



# ThinkSystem SR645 Setup Guide



**Machine Types:** 7D2X and 7D2Y

**Note**

Before using this information and the product it supports, be sure to read and understand the safety information and the safety instructions, which are available at:

[http://thinksystem.lenovofiles.com/help/topic/safety\\_documentation/pdf\\_files.html](http://thinksystem.lenovofiles.com/help/topic/safety_documentation/pdf_files.html)

In addition, be sure that you are familiar with the terms and conditions of the Lenovo warranty for your server, which can be found at:

<http://datacentersupport.lenovo.com/warrantylookup>

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## Chapter 1. Introduction

The ThinkSystem™ SR645 server is a 2-socket 1U server that features the new AMD® EPYC™ 7002 family of processors. The server offers a broad selection of drive and slot configurations and offers high performance and expansion for various IT workloads. Combining performance and flexibility, the server is a great choice for enterprises of all sizes.

Performance, ease of use, reliability, and expansion capabilities were key considerations in the design of the server. These design features make it possible for you to customize the system hardware to meet your needs today and provide flexible expansion capabilities for the future.

The server comes with a limited warranty. For details about the warranty, see:

<https://support.lenovo.com/us/en/solutions/ht503310>

For details about your specific warranty, see:

<http://datacentersupport.lenovo.com/warrantylookup>

### Identifying your server

When you contact Lenovo for help, the machine type and serial number information helps support technicians to identify your server and provide faster service.

The machine type and serial number are on the ID label on the right rack latch in the front of the server.

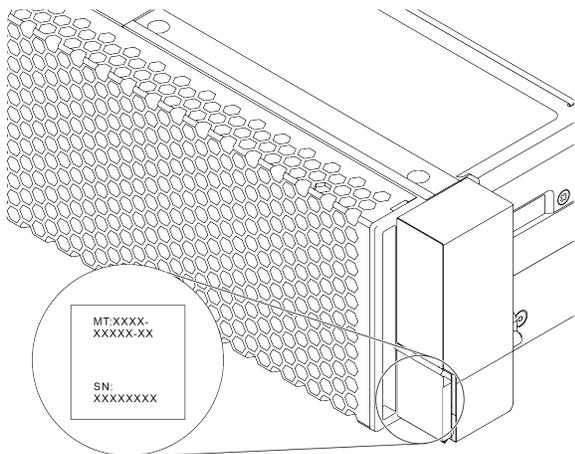


Figure 1. Location of the ID label

## XClarity Controller network access label

The XClarity® Controller network access label is attached on the top side of the pull-out information tab as shown. After you get the server, peel the XClarity Controller network access label away and store it in a safe place for future use.

**Note:** The pull-out information tab is located on the right bottom of the front side of your server. For detailed information, see “Front view” on page 49.

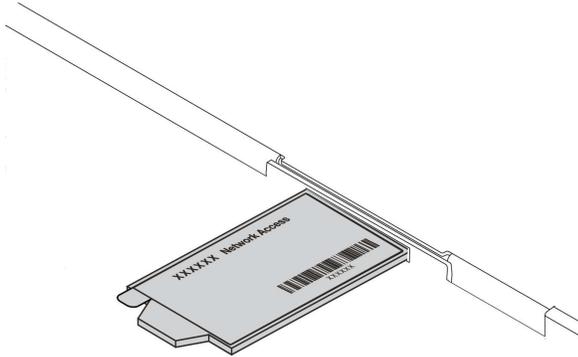


Figure 2. Location of the XClarity Controller network access label

## Quick response code

The system service label, which is on the top cover, provides a quick response (QR) code for mobile access to service information. Scan the QR code with a mobile device and a QR code reader application to get quick access to the Lenovo Service Web site for this server. The Lenovo Service Information Web site provides additional information for parts installation and replacement videos, and error codes for server support.

The following illustration shows the QR code: <https://datacentersupport.lenovo.com/products/servers/thinksystem/sr645/7d2x>



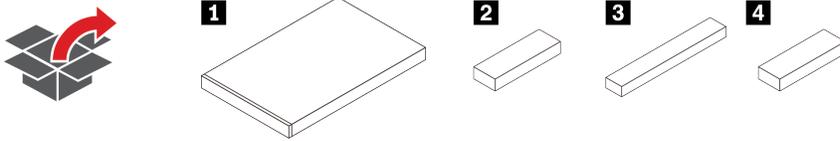
Figure 3. QR code

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## Package contents

This section provides server package contents list.

The server package includes the following items:



**Note:** Items marked with asterisk (\*) are available on some models.

- ❶ Server
- ❷ Material box, including items such as accessory kit, power cords\*, and documentation.
- ❸ Rail kit box\*, including the rail kit and documentation.
- ❹ CMA box\*, including the cable management arm.

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## Features

Performance, ease of use, reliability, and expansion capabilities were key considerations in the design of your server. These design features make it possible for you to customize the system hardware to meet your needs today and provide flexible expansion capabilities for the future.

Your server implements the following features and technologies:

- **Features on Demand**

If a Features on Demand feature is integrated in the server or in an optional device that is installed in the server, you can purchase an activation key to activate the feature. For information about Features on Demand, see:

<https://fod.lenovo.com/lkms>

- **Flexible network support**

The server has an Open Compute Project (OCP) 3.0 slot for an OCP 3.0 Ethernet adapter, which provides one to four network connectors for network support.

- **Integrated Trusted Platform Module (TPM)**

This integrated security chip performs cryptographic functions and stores private and public secure keys. It provides the hardware support for the Trusted Computing Group (TCG) specification. You can download the software to support the TCG specification. For more information on TPM configurations, see “Configure security settings” in *Maintenance Manual*.

TPM version	Type	Outside Chinese Mainland		Chinese Mainland	
		7002 CPU	7003 CPU	7002 CPU	7003 CPU
TPM 1.2	Onboard chip	√			
TPM 2.0	Onboard chip	√	√		
NationZ TPM 2.0	Daughter card			√	√

- **Large system-memory capacity**

The server supports up to 32 TruDDR4 registered DIMMs (RDIMMs), performance+ RDIMMS, or three-dimensional stacking registered DIMMs (3DS RDIMMs). For more about the specific types and maximum amount of memory, see “[Technical specifications](#)” on page 7.

- **Large data-storage capacity and hot-swap capability**

Depending on different models, the server supports up to four 3.5-inch or ten 2.5-inch SAS/SATA/NVMe on the front, up to two M.2 drives, and up to two 2.5-inch SAS/SATA/NVMe or two 7mm drives on the rear.

With the hot-swap feature, you can add, remove, or replace hard disk drives without turning off the server.

- **System management tool offerings**

The server supports the following tools to enable easier and more efficient server management process.

- Lenovo XClarity Controller

**Important:** Lenovo XClarity Controller (XCC) supported version varies by product. All versions of Lenovo XClarity Controller are referred to as Lenovo XClarity Controller and XCC in this document, unless specified otherwise. To see the XCC version supported by your server, go to [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html).

- Lenovo XClarity Administrator

- Lenovo XClarity Essentials toolset
- Lenovo XClarity Provisioning Manager

**Important:** Lenovo XClarity Provisioning Manager (LXPM) supported version varies by product. All versions of Lenovo XClarity Provisioning Manager are referred to as Lenovo XClarity Provisioning Manager and LXPM in this document, unless specified otherwise. To see the LXPM version supported by your server, go to [https://sysmgt.lenovofiles.com/help/topic/lxpm\\_frontend/lxpm\\_product\\_page.html](https://sysmgt.lenovofiles.com/help/topic/lxpm_frontend/lxpm_product_page.html).

- Lenovo XClarity Integrator
- Lenovo XClarity Energy Manager
- Lenovo Capacity Planner

For more information about each tool, see “Management options” on page 25.

- **Light path diagnostics**

Light path diagnostics provides LEDs to help you diagnose problems and an integrated LCD diagnostics panel or external diagnostics handset can provide additional diagnostic information. For more information about the light path diagnostics, see the following:

- “Drive LEDs” on page 59
- “Rear view LEDs” on page 77
- “Diagnostics panel” on page 61
- “LCD diagnostics panel/handset” on page 63

- **Mobile access to Lenovo Service Information website**

The server provides a QR code on the system service label, which is on the cover of the server, that you can scan using a QR code reader and scanner with a mobile device to get quick access to the Lenovo Service Information website. The Lenovo Service Information website provides additional information for parts installation, replacement videos, and error codes for server support.

- **Redundant networking connection**

The Lenovo XClarity Controller provides failover capability to a redundant Ethernet connection with the applicable application installed. If a problem occurs with the primary Ethernet connection, all Ethernet traffic that is associated with the primary connection is automatically switched to the optional redundant Ethernet connection. If the applicable device drivers are installed, this switching occurs without data loss and without user intervention.

- **Redundant cooling and optional power capabilities**

The server supports a maximum of eight hot-swap power supplies, which provide redundancy for a typical configuration. The redundant cooling by the fans in the server enables continued operation if one of the fans fails.

- **ThinkSystem RAID support**

The ThinkSystem RAID adapter provides hardware redundant array of independent disks (RAID) support to create configurations. The standard RAID adapter provides RAID levels 0 and 1. An optional RAID adapter is available for purchase.

- **UEFI-compliant server firmware**

Lenovo ThinkSystem firmware is Unified Extensible Firmware Interface (UEFI) 2.5 compliant. UEFI replaces BIOS and defines a standard interface between the operating system, platform firmware, and external devices.

Lenovo ThinkSystem servers are capable of booting UEFI-compliant operating systems, BIOS-based operating systems, and BIOS-based adapters as well as UEFI-compliant adapters.

**Note:** The server does not support DOS (Disk Operating System).

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## Specifications

This section provides technical and environment specifications of the server.

- [“Technical specifications” on page 7](#)
- [“Environment specifications” on page 29](#)

## Technical specifications

The section provides technical specifications of the server. Depending on the model, some features might not be available, or some specifications might not apply.

**Note:** For technical rules of each component, see [“Technical rules” on page 36](#).

- [“Dimensions” on page 8](#)
- [“CPU” on page 9](#)
- [“Heat sink” on page 12](#)
- [“Memory” on page 13](#)
- [“Fan” on page 14](#)
- [“Operating systems” on page 15](#)
- [“Input/Output \(I/O\)” on page 16](#)
- [“Internal drives” on page 17](#)
- [“Expansion slots” on page 18](#)
- [“Storage controllers” on page 19](#)
- [“Network” on page 21](#)
- [“GPU” on page 23](#)
- [“Power supplies” on page 24](#)
- [“Management options” on page 25](#)
- [“Minimum configuration for debugging” on page 28](#)

## Dimensions

Form factor	Height	Depth	Width	Package weight
1U	43.0 mm (1.69 inches)	771.8 mm (30.39 inches)	<ul style="list-style-type: none"><li>• With rack latches: 481.7 mm (18.96 inches)</li><li>• Without rack latches: 445 mm (17.52 inches)</li></ul>	Up to 35.4 kg (78.0 lb)

**Note:** The depth is measured with rack latches installed, but without security bezel installed.

## **CPU**

- Up to two AMD® EPYC™ 7002 or 7003 series CPUs
- Scalable up to 64 cores per socket, 128 cores in total
- 7nm process technologies
- Designed for Land Grid Array (LGA) 4094 (SP3) socket
- Supports 3200 MHz DDR4 frequency
- TDP ratings up to 280 watts

### **Notes:**

- 7002 series CPU and 7003 series CPU cannot be mixed within a server.
- CPUs with a P suffix (for example 7232P) are single-socket capable only.
- Check [“CPU, heat sink, and fan combinations” on page 36](#) for selecting the correct heat sinks and fans under different CPU and hardware configurations.

## 7002 series CPUs

Model	Core/threads	Base Freq.	Default TDP	Group
7232P	8/16	3.1 GHz	120 W	C
7252	8/16	3.1 GHz	120 W	
7272	12/24	2.9 GHz	120 W	
7282	16/32	2.8 GHz	120 W	
7262	8/16	3.2 GHz	155 W	B
7302	16/32	3.0 GHz	155 W	
7302P	16/32	3.0 GHz	155 W	
7352	24/48	2.3 GHz	155 W	
7452	32/64	2.35 GHz	155 W	A
7F32	8/16	3.7 GHz	180 W	
7402	24/48	2.8 GHz	180 W	
7402P	24/48	2.8 GHz	180 W	
7502	32/64	2.5 GHz	180 W	
7502P	32/64	2.5 GHz	180 W	
7532	32/64	2.4 GHz	200 W	
7552	48/96	2.2 GHz	200 W	
7702	64/128	2.0 GHz	200 W	
7702P	64/128	2.0 GHz	200 W	
7542	32/64	2.9 GHz	225 W	D
7642	48/96	2.3 GHz	225 W	
7742	64/128	2.25 GHz	225 W	
7662	64/128	2.0 GHz	225 W	
7F72	24/48	3.2 GHz	240 W	
7F52	16/32	3.5GHz	240 W	
7H12	64/128	2.6 GHz	280 W	Z

## 7003 series CPUs

Model	Core/threads	Base Freq.	Default TDP	Group
7313	16/32	3.0 GHz	155 W	B
7313P	16/32	3.0 GHz	155 W	
72F3	8/16	3.7 GHz	180 W	D
7413	24/48	2.65 GHz	180 W	
7343	16/32	3.2 GHz	190 W	
7443	24/48	2.85 GHz	200 W	
7443P	24/48	2.85 GHz	200 W	
7513	32/64	2.6 GHz	200 W	

7453	28/56	2.8 GHz	225 W	A
7543	32/64	2.8 GHz	225 W	
7543P	32/64	2.8 GHz	225 W	
7643	48/96	2.3 GHz	225 W	
7663	56/112	2.3 GHz	225 W	
7713	64/128	2.0 GHz	225 W	
7713P	64/128	2.0 GHz	225 W	
73F3	16/32	3.5 GHz	240 W	
74F3	24/48	3.2 GHz	240 W	
75F3	32/64	2.95 GHz	280 W	Z
7763	64/128	2.45 GHz	280 W	

## Heat sink

- 1U standard heat sink
- 1U Aluminum heat sink
- 1U performance heat sink (T-shape)

**Note:** Performance heat sinks include 2 satellite heat sinks that connect to the main heat sink via liquid-filled copper tubes.

## Memory

- 16 independent channels with interleaved feature
- 8 channels per CPU, 2 DIMM per channel(DPC)
  - Slot 1–16: CPU 1
  - Slot 17–32: CPU 2

Parameter	RDIMM	Performance+ RDIMM	3DS RDIMM
Generation	TruDDR4	TruDDR4	TruDDR4
Rank	2R	2R	2S2R/2S4R
Speed	3200 MHz	3200 MHz	3200 MHz/2933 MHz
Voltage	1.2 V	1.2 V	1.2 V
DRAM data width	x4/x8	x4/x8	x4
DRAM density	8 Gbit/16 Gbit	16 Gbit	16 Gbit
DIMM capacity	16 GB/32 GB/64 GB	32 GB/64 GB	128 GB/256 GB
Maximum memory	<ul style="list-style-type: none"> <li>• 1 CPU: 1 TB</li> <li>• 2 CPUs: 2 TB</li> </ul>	<ul style="list-style-type: none"> <li>• 1 CPU: 512 GB</li> <li>• 2 CPUs: 2 TB</li> </ul>	<ul style="list-style-type: none"> <li>• 1 CPU: 4 TB</li> <li>• 2 CPUs: 8 TB</li> </ul>
Minimum memory	<ul style="list-style-type: none"> <li>• 1 CPU: 16 GB</li> <li>• 2 CPUs: 32 GB</li> </ul>	<ul style="list-style-type: none"> <li>• 1 CPU: 32 GB</li> <li>• 2 CPUs: 64 GB</li> </ul>	<ul style="list-style-type: none"> <li>• 1 CPU: 128 GB</li> <li>• 2 CPUs: 256 GB</li> </ul>

**Note:** The operating speed and total memory capacity depend on the processor model and UEFI settings.

## Fan

Up to 8 hot-swap fans (including 2 redundant fans)

Form factor	Rotor	Type	Speed
4056	dual	Standard	21K RPM
4056	dual	Performance	28K RPM

## Operating systems

Supported and certified operating systems:

- Microsoft Windows Server
- VMware ESXi
- Red Hat Enterprise Linux
- SUSE Linux Enterprise Server

References:

- Complete list of available operating systems: <https://lenovopress.com/osig>.
- OS deployment instructions: [Deploy the operating system](#).

## Input/Output (I/O)

Front:

- One VGA connector (optional)
- One USB 2.0 connector
- One USB 3.1 Gen 1 connector
- One external diagnostics connector
- One diagnostics panel (optional)
- One LCD diagnostics panel (optional)

Rear:

- One VGA connector
- Three USB 3.1 Gen 1 connectors
- Ethernet connectors on OCP 3.0 Ethernet adapter (optional)
- One XClarity Controller network connector
- One serial port (optional)

For detailed information about each component, see [“Front view” on page 49](#) and [“Rear view” on page 70](#).

## Internal drives

Front drive bays:

- 4 x 2.5" SAS/SATA
- 8 x 2.5" SAS/SATA
- 10 x 2.5" SAS/SATA
- 10 x 2.5" AnyBay(SAS/SATA/U.2 NVMe/U.3 NVMe)
- 10 x 2.5" U.2 NVMe
- 8 x 2.5" AnyBay(SAS/SATA/U.3 NVMe) + 2 x 2.5" U.2 NVMe
- 6 x 2.5" SAS/SATA + 4 x 2.5" AnyBay(SAS/SATA/U.2 NVMe/U.3 NVMe)
- 6 x 2.5" SAS/SATA + 4 x 2.5" U.2 NVMe
- 6 x 2.5" SAS/SATA + 2 x 2.5" AnyBay(SAS/SATA/U.2 NVMe/U.3 NVMe) + 2 x 2.5" U.2 NVMe
- 4 x 3.5" SAS/SATA
- 4 x 3.5" AnyBay(SAS/SATA/U.2 NVMe/U.3 NVMe)

Inside chassis:

- 2 x M.2 SATA/NVMe

Rear drive bays:

- 2 x 2.5" SAS/SATA/U.2 NVMe
- 2 x 7mm SATA/U.2 NVMe

### Notes:

- For supported internal storage configurations, see <https://lenovopress.com/lp1280-thinksystem-sr645-server#internal-storage>.
- For supported external storage systems, see <https://lenovopress.com/lp1280-thinksystem-sr645-server#external-storage-systems>
- For backplane-less models, field upgrades to other models are available. For details, see <https://lenovopress.com/lp1280-thinksystem-sr645-server#field-upgrades>.

## Expansion slots

Depending on the model, your server supports up to three PCIe slots in the rear.

- Your server supports up to three PCIe slots in the rear:
  - PCIe x16, low-profile
  - PCIe x16/x16, low-profile + low profile
  - PCIe x16/x16, low profile + full-height
- Your server supports up to one slot for OCP 3.0 Ethernet adapter

For locations of the PCIe slots, see [“Rear view” on page 70](#).

## Storage controllers

Support for JBOD mode and RAID level 0, 1, 10:

- 530-16i PCIe 12Gb SFF RAID adapter (Gen3)
- 540-8i PCIe 12Gb SFF RAID adapter (Gen4)
- 540-16i PCIe 12Gb SFF RAID adapter (Gen4)

Support for JBOD mode and RAID level 0, 1, 5, 10:

- 5350-8i PCIe 12Gb SFF RAID adapter (Gen3)

Support for JBOD mode and RAID level 0, 1, 5, 10, 50:

- 530-8i PCIe 12Gb SFF RAID adapter (Gen3)

Support for JBOD mode and RAID level 0, 1, 5, 6, 10, 50, 60:

- 930-8i 2 GB Flash 12Gb Internal SFF RAID adapter (Gen3)
- 930-16i 4 GB Flash 12Gb Internal SFF RAID adapter (Gen 3)
- 9350-8i 2GB Flash 12Gb Internal SFF RAID adapter (Gen 3)
- 9350-16i 4GB Flash 12Gb Internal SFF RAID adapter (Gen 3)
- 940-8i 4 GB Flash 12Gb Internal SFF RAID adapter (Gen4)
- 940-8i 8 GB Flash 12Gb Internal SFF RAID adapter (Gen4)
- 940-16i 4 GB Flash 12Gb Internal SFF RAID Adapter (Gen4)
- 940-16i 8 GB Flash 12Gb Internal SFF RAID adapter (Gen4)
- 940-8i 4 GB Flash 12Gb Internal SFF RAID adapter (Gen4, support Tri-Mode)
- 940-8i 8 GB Flash 12Gb Internal SFF RAID adapter (Gen4, support Tri-Mode)
- 940-16i 8 GB Flash 12Gb Internal CFF RAID adapter (Gen4, support Tri-Mode)
- 930-8e 4 GB Flash 12Gb External SFF RAID adapter (Gen3)

Support the following HBA adapter:

- 430-8i SAS/SATA 12Gb Internal SFF HBA adapter (Gen3)
- 430-16i SAS/SATA 12Gb Internal SFF HBA adapter (Gen3)
- 4350-8i SAS/SATA 12Gb Internal SFF HBA adapter (Gen3)
- 4350-16i SAS/SATA 12Gb Internal SFF HBA adapter (Gen3)
- 440-8i SAS/SATA 12Gb Internal SFF HBA adapter (Gen4)
- 440-16i SAS/SATA 12Gb Internal SFF HBA adapter (Gen4)
- 440-16i SAS/SATA 12Gb Internal CFF HBA adapter (Gen4)
- 430-8e SAS/SATA 12Gb External SFF HBA adapter (Gen3)
- 430-16e SAS/SATA 12Gb External SFF HBA adapter (Gen3)
- 440-16e SAS/SATA 12Gb External SFF HBA adapter (Gen4)

Support the following Fibre Channel HBA:

- Emulex 16Gb Gen6 1-port Fibre Channel Adapter(Gen3)
- Emulex 16Gb Gen6 2-port Fibre Channel Adapter (Gen3)
- Emulex LPe35000 32Gb 1-port Fibre Channel Adapter (Gen4)
- Emulex LPe35002 32Gb 2-port Fibre Channel Adapter (Gen4)

- QLogic 16Gb Enhanced Gen5 1-port Fibre Channel Adapter(Gen3)
- QLogic 16Gb Enhanced Gen5 2-port Fibre Channel Adapter(Gen3)
- QLogic QLE2772 32Gb 2-Port Fibre Channel Adapter(Gen4)
- QLogic QLE2770 32Gb 1-Port Fibre Channel Adapter(Gen4)

Support the following controller for NVMe configuration:

- NVMe Retimer card (Gen 4)

**Notes:**

- **SFF:** Standard Form Factor. This type of RAID/HBA adapter is installed in the PCIe expansion slots.
- **CFF:** Custom Form Factor. This type of RAID/HBA adapter is installed between fans and front backplanes.
- **Tri-Mode:** This type of controllers are hardware RAID designed with Tri-Mode SerDes technology. Once the Tri-Mode setting is enabled, the controllers support any combinations of NVMe, SAS, and SATA devices.
- CM5 and CM6 NVMe drives are not supported when a system is configured with NVMe Retimer cards.
- The following adapters are only supported on server models with 7003 series processors:
  - 5350-8i, 9350-8i, and 9350-16i RAID adapters
  - 4350-8i and 4350-16i HBA adapters

## Network

- Up to 1 OCP 3.0 Ethernet adapter

Manufacturer	Name	Port	Speed	I/O	PCIe Lane
Broadcom	5719	4	1 GbE	RJ45	x4
	57454	4	10 GbE	10GBASE-T	x16
	57454	4	10/25 GbE	SFP28	x16
	57414	2	10/25 GbE	SFP28	x8
	57416	2	1 GbE	10GBASE-T	x8
Mellanox	ConnectX-6 Lx	2	10/25GbE	SFP28	x8
	ConnectX-4 Lx	2	10/25 GbE	SFP28	x8
Intel	I350	4	1 GbE	RJ45	x4
	X710-T2L	2	10 GbE	10GBASE-T	x8
	E810-D2	2	10/25GbE	SFP28	x8
Marvell	QL41232	2	10/25 GbE	SFP28	x8
	QL41232	2	10/25 GbE	10GBASE-T	x8

- Up to 2 or 3 Ethernet adapters in the PCIe slots

Manufacturer	Name	Port	Speed	I/O	PCIe Lane
Broadcom	NetXtreme	2	1 GbE	RJ45	x4
	NetXtreme	2	10 GbE	Base-T	x8
	5719	4	1 GbE	RJ45	x4
	57454	4	10 GbE	10GBASE-T	x16
	57454	4	10/25 GbE	SFP28	x16
	57454 V2	4	10/25 GbE	SFP28	x16
	57414	2	10/25 GbE	SFP28	x8
	57508	2	100 GbE	QSFP56	x16
Mellanox	ConnectX-6 Lx	2	10/25GbE	SFP28	x8
	ConnectX-4 Lx	2	10/25 GbE	SFP28	x8
	ConnectX-6 Dx	2	100GbE	QSFP56	x16
	ConnectX-6 HDR100	1	100GbE	QSFP56	x16
	ConnectX-6 HDR	1	200GbE	QSFP56	x16
	ConnectX-6 HDR100	2	100GbE	QSFP56	x16
Intel	I350-T2	2	1 GbE	RJ45	x4
	I350-T4	4	1 GbE	RJ45	x4
	I350-F1	1	1 GbE	SFP	x4
	X550-T2	2	10 GbE	10GBASE-T	x4
	X710-DA2	2	10 GbE	SFP+	x8

	E810-DA2	2	10/25 GbE	SFP28	x8
Xilinx	Alveo U25	2	25GbE	SFP28	x8
	Alveo U50	2	25GbE	SFP28	x8
	SolarflareX2522-Plus	2	10/25GbE	SFP28	x8
QLogic	QL41232	2	10/25 GbE	SFP28	x8
	QL41134	4	10GbE	Base-T	x8

## GPU

Your server supports the following GPU adapters:

Manufacturer	Form factor	Name	GPU power	Cooling	Max Qty.	PCIe Lane
NVIDIA	Single-wide, Half-length, Low profile	Tesla T4	75 W	Passive	3	x16
		A2	60 W	Passive	3	x8
		Quadro P620	40 W	Active	3	x16
	Double-wide, Half-length, Full-height	Quadro P2200	75 W	Passive	1	x16

**Note:** The above are all low-voltage GPU adapters, they can be powered directly by the riser slots.

## Power supplies

The server supports up to two power supplies for redundancy.

The server does not support setting the redundancy mode manually. The BMC of the server can automatically set it based on the installed power supply unit quantity.

- When only 1 power supply unit is installed, the power policy is set to “Non-redundant mode”.
- When 2 power supply units are installed, the redundancy mode is set to “Redundant N+N”. If one of the power supply units fails or has been removed, the BMC will report an event and set the redundancy mode to “Non-redundant mode” automatically.

Power supply	100–127 V AC	200–240 V AC	240 V DC (Chinese Mainland only)	-48 V dc
500-watt 80 PLUS Platinum	✓	✓	✓	
750-watt 80 PLUS Platinum	✓	✓	✓	
750-watt 80 PLUS Titanium		✓	✓	
1100-watt 80 PLUS Platinum	✓	✓	✓	
1100-watt 80 PLUS Platinum				✓
1800-watt 80 PLUS Platinum		✓	✓	

### CAUTION:

- **Use Lenovo Capacity Planner to calculate the required power capacity for what is configured for your server. More information about Lenovo Capacity Planner is available at: [Lenovo Capacity Planner website](#)**
- **Ensure that the power supply units that you are installing are supported. For a list of supported power supply units for the server, go to: <https://static.lenovo.com/us/en/serverproven/index.shtml>**
- **240 V dc input (input range: 180-300 V dc) is supported in Chinese Mainland ONLY.**

## Management options

### Overview

The XClarity portfolio and other system management offerings described in this section are available to help you manage the servers more conveniently and efficiently.

Options	Description
Lenovo XClarity Controller	<p>Baseboard management controller.</p> <p>Consolidates the service processor functionality, Super I/O, video controller, and remote presence capabilities into a single chip on the server system board.</p> <p><b>Interface</b></p> <ul style="list-style-type: none"> <li>• CLI application</li> <li>• Mobile application</li> <li>• Web interface</li> <li>• REST API</li> </ul> <p><b>Usage and downloads</b></p> <p><a href="https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html">https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html</a></p>
Lenovo XClarity Administrator	<p>Centralized GUI tool for multi-server management.</p> <p><b>Interface</b></p> <ul style="list-style-type: none"> <li>• GUI application</li> <li>• Mobile application</li> <li>• Web GUI interface</li> <li>• REST API</li> </ul> <p><b>Usage and downloads</b></p> <p><a href="http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/aug_product_page.html">http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/aug_product_page.html</a></p>
Lenovo XClarity Essentials toolset	<p>Portable and light toolset for server configuration, data collection, and firmware updates. Suitable both for single-server or multi-server management contexts.</p> <p><b>Interface</b></p> <ul style="list-style-type: none"> <li>• <b>OneCLI</b>: CLI application</li> <li>• <b>Bootable Media Creator</b>: CLI application, GUI application</li> <li>• <b>UpdateXpress</b>: GUI application</li> </ul> <p><b>Usage and downloads</b></p> <p><a href="http://sysmgt.lenovofiles.com/help/topic/xclarity_essentials/overview.html">http://sysmgt.lenovofiles.com/help/topic/xclarity_essentials/overview.html</a></p>
Lenovo XClarity Provisioning Manager	<p>UEFI-based GUI tool on a single server that can simplify management tasks.</p> <p><b>Interface</b></p> <ul style="list-style-type: none"> <li>• Web GUI interface (BMC remote access)</li> </ul> <p><b>Usage and downloads</b></p> <p><a href="https://sysmgt.lenovofiles.com/help/topic/lxpm_frontend/lxpm_product_page.html">https://sysmgt.lenovofiles.com/help/topic/lxpm_frontend/lxpm_product_page.html</a></p>

Lenovo XClarity Integrator	<p>Series of applications that can integrate management features of Lenovo XClarity Administrator and your server with software used in a certain deployment infrastructure, such as VMware vCenter, Microsoft Admin Center, or Microsoft System Center.</p> <p><b>Interface</b></p> <p>GUI application</p> <p><b>Usage and downloads</b></p> <p><a href="https://sysmgt.lenovofiles.com/help/topic/lxce_frontend/overview.html">https://sysmgt.lenovofiles.com/help/topic/lxce_frontend/overview.html</a></p>
Lenovo XClarity Energy Manager	<p>Application that can manage and monitor server power and temperature.</p> <p><b>Interface</b></p> <ul style="list-style-type: none"> <li>• Web GUI Interface</li> </ul> <p><b>Usage and downloads</b></p> <p><a href="https://datacentersupport.lenovo.com/solutions/Invo-lxem">https://datacentersupport.lenovo.com/solutions/Invo-lxem</a></p>
Lenovo Capacity Planner	<p>Application that supports power consumption planning for a server or rack.</p> <p><b>Interface</b></p> <ul style="list-style-type: none"> <li>• Web GUI Interface</li> </ul> <p><b>Usage and downloads</b></p> <p><a href="https://datacentersupport.lenovo.com/solutions/Invo-lcp">https://datacentersupport.lenovo.com/solutions/Invo-lcp</a></p>

## Functions

Options		Functions							
		Multi-system mgmt	OS deployment	System configuration	Firmware updates <sup>1</sup>	Event/alert monitoring	Inventory/logs	Power mgmt	Power planning
Lenovo XClarity Controller				√	√ <sup>2</sup>	√	√		
Lenovo XClarity Administrator		√	√	√	√ <sup>2</sup>	√	√ <sup>4</sup>		
Lenovo XClarity Essentials toolset	OneCLI	√		√	√ <sup>2</sup>	√	√		
	Bootable Media Creator			√	√		√		
	UpdateXpress			√	√				
Lenovo XClarity Provisioning Manager			√	√	√ <sup>3</sup>		√ <sup>5</sup>		
Lenovo XClarity Integrator		√	√ <sup>6</sup>	√	√	√	√	√ <sup>7</sup>	
Lenovo XClarity Energy Manager		√				√		√	
Lenovo Capacity Planner									√ <sup>8</sup>

### Notes:

1. Most options can be updated through the Lenovo tools. Some options, such as GPU firmware or Omni-Path firmware, require the use of vendor tools.
2. The server UEFI settings for option ROM must be set to **Auto** or **UEFI** to update firmware using Lenovo XClarity Administrator, Lenovo XClarity Controller, or Lenovo XClarity Essentials.
3. Firmware updates are limited to Lenovo XClarity Provisioning Manager, BMC firmware, and UEFI updates only. Firmware updates for optional devices, such as adapters, are not supported.
4. The server UEFI settings for option ROM must be set to **Auto** or **UEFI** for detailed adapter card information, such as model name and firmware levels, to be displayed in Lenovo XClarity Administrator, Lenovo XClarity Controller, or Lenovo XClarity Essentials.
5. Limited inventory.
6. Lenovo XClarity Integrator supports Windows operating system deployment with the Microsoft System Center Configuration Manager (SCCM) deployment pack.
7. Power management function is supported by Lenovo XClarity Integrator for VMware vCenter.
8. It's highly recommended that you check the power summary data for your server using Lenovo Capacity Planner before purchasing any new parts.

## **Minimum configuration for debugging**

- One processor in processor socket 1
- One memory module in slot 14
- One power supply
- One HDD/SSD drive, one M.2 drive, or one 7mm drive (if OS is needed for debugging)
- Six system fans (with one CPU)

## Environment specifications

The section provides environmental specifications of the server.

- [“Ambient temperature/Humidity/Altitude” on page 30](#)
- [“Vibration” on page 31](#)
- [“Shock” on page 32](#)
- [“Heat output” on page 33](#)
- [“Acoustical noise emissions” on page 34](#)
- [“Particulate contamination” on page 34](#)

## Ambient temperature/Humidity/Altitude

Server is operating:

Specification	Description
Ambient temperature	<p>The temperature range is measured at sea level altitude. The maximum ambient temperature decreases by 1°C for every 300 m (984 ft) increase in altitude above 900 m (2,953 ft).</p> <ul style="list-style-type: none"><li>• ASHRAE class A2: 10°C – 35°C (50°F – 95°F)</li><li>• ASHRAE class A3: 5°C –40°C (41°F – 104°F)</li><li>• ASHRAE class A4: 5°C – 45°C (41°F – 113°F)</li></ul>
Relative humidity (non-condensing)	<ul style="list-style-type: none"><li>• ASHRAE class A2: 20%–80%; maximum dew point: 21°C (70°F)</li><li>• ASHRAE class A3: 8%–85%; maximum dew point: 24°C (75°F)</li><li>• ASHRAE class A4: 8%–90%; maximum dew point: 24°C (75°F)</li></ul>
Maximum altitude	3050 m (10 000 ft)

Server is not operating:

Specification	Description
Ambient temperature	<ul style="list-style-type: none"><li>• Server off: -10°C – 60°C (14°F – 140°F)</li><li>• Shipment/storage: -40°C – 70°C (-40°F – 158°F)</li></ul>
Relative humidity (non-condensing)	8%–90%
Maximum altitude	3050 m (10 000 ft)

## **Vibration**

- Server is operating:  
0.21 G rms at 5 Hz to 500 Hz for 15 minutes across 3 axes
- Server is not operating:  
1.04 G rms at 2 Hz to 200 Hz for 15 minutes across 6 surfaces

## **Shock**

- Server is operating:
  - 15 G for 3 milliseconds in each direction (positive and negative X, Y, and Z axes)
- Server is not operating:
  - 12 kg - 22 kg: 50 G for 152 in./sec velocity change across 6 surfaces

## Heat output

- Minimum configuration: 900 BTU/hr, 264 W
- Maximum configuration: 2924 BTU/hr, 857 W

## Acoustical noise emissions

These sound levels were measured in controlled acoustical environments according to procedures specified by ISO7779 and are reported in accordance with ISO 9296.

	Typical	Storage rich	GPU rich
Sound power levels ( $L_{WA,m}$ )			
Idling	6.0 Bel	7.0 Bel	7.5 Bel
Operating	6.5 Bel	7.6 Bel	7.5 Bel
Sound pressure level ( $L_{pA,m}$ )			
Idling	43 dBA	53 dBA	59 dBA
Operating	49 dBA	59 dBA	59 dBA

The declared acoustic noise levels are based on below configurations, which may change depending on configurations and conditions:

Config.	Typical	Storage rich	GPU rich
CPU	2 x 155 W	1 x 155 W	1 x 155 W
DIMM	32 x 32 GB RDIMM	32 x 64 GB RDIMM	32 x 64 GB RDIMM
Ethernet	1 x SFP28 2-port OCP	1 x SFP28 2-port OCP	1 x SFP28 2-port OCP
PSU	2 x 750 W	2 x 750 W	2 x 1100 W
RAID	930-8i RAID	930-16i RAID	930-16i RAID
Drive	10 x 2.5" HDD	12 x 2.5" HDD	10 x 2.5" HDD
GPU	NA	NA	2 x T4/A2 GPU

**Note:** Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room; the noise levels from other equipment; the room ambient temperature, and employee's location in relation to the equipment. Further, compliance with such government regulations depends on a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. Lenovo recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

## Particulate contamination

**Attention:** Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the device that is described in this document.

Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the device to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If Lenovo determines that the levels of particulates or gases in your environment have

caused damage to the device, Lenovo may condition provision of repair or replacement of devices or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 1. Limits for particulates and gases

Contaminant	Limits
Reactive gases	<p>Severity level G1 as per ANSI/ISA 71.04-1985<sup>1</sup>:</p> <ul style="list-style-type: none"> <li>• The copper reactivity level shall be less than 300 Å/month (around 0.0039 µg/cm<sup>2</sup>-hour weight gain).<sup>2</sup></li> <li>• The silver reactivity level shall be less than 200 Å/month (around 0.0035 µg/cm<sup>2</sup>-hour weight gain).<sup>3</sup></li> <li>• The reactive monitoring of gaseous corrosivity must be conducted approximately 5 cm (2 in.) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.</li> </ul>
Airborne particulates	<p>Data centers must meet the cleanliness level of ISO 14644-1 class 8.</p> <p>For data centers without airside economizer, the ISO 14644-1 class 8 cleanliness might be met by choosing one of the following filtration methods:</p> <ul style="list-style-type: none"> <li>• The room air might be continuously filtered with MERV 8 filters.</li> <li>• Air entering a data center might be filtered with MERV 11 or preferably MERV 13 filters.</li> </ul> <p>For data centers with airside economizers, the choice of filters to achieve ISO class 8 cleanliness depends on the specific conditions present at that data center.</p> <ul style="list-style-type: none"> <li>• The deliquescent relative humidity of the particulate contamination should be more than 60% RH.<sup>4</sup></li> <li>• Data centers must be free of zinc whiskers.<sup>5</sup></li> </ul>
<p><sup>1</sup> ANSI/ISA-71.04-1985. <i>Environmental conditions for process measurement and control systems: Airborne contaminants</i>. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.</p> <p><sup>2</sup> The derivation of the equivalence between the rate of copper corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Cu<sub>2</sub>S and Cu<sub>2</sub>O grow in equal proportions.</p> <p><sup>3</sup> The derivation of the equivalence between the rate of silver corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Ag<sub>2</sub>S is the only corrosion product.</p> <p><sup>4</sup> The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.</p> <p><sup>5</sup> Surface debris is randomly collected from 10 areas of the data center on a 1.5 cm diameter disk of sticky electrically conductive tape on a metal stub. If examination of the sticky tape in a scanning electron microscope reveals no zinc whiskers, the data center is considered free of zinc whiskers.</p>	

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## Technical rules

This section provides technical rules for the server.

- [“CPU, heat sink, and fan combinations” on page 36](#)
- [“DIMM population rules” on page 37](#)
- [“PCIe slots and configurations” on page 43](#)
- [“Thermal rules” on page 46](#)

### CPU, heat sink, and fan combinations

#### 4 x 2.5" models

CPU group	Config.	Heat sink	Fan
Z	All configurations	Performance	Performance

#### 8 x 2.5"/4 x 3.5" models

CPU group	Config.	Heat sink	Fan
C	Non Mellanox ConnectX-6 NIC	Aluminum	Standard
	All other configurations	Aluminum	Performance
B	Non Mellanox ConnectX-6 NIC	Aluminum	Standard
	All other configurations	Aluminum	Performance
A	All configurations	Standard	Performance
D	All configurations	Performance	Performance

#### 10 x 2.5" models

CPU group	Config.	Heat sink	Fan
C	Non Mellanox ConnectX-6 NIC	Aluminum	Standard
	All other configurations	Aluminum	Performance
B	All configurations	Aluminum	Performance
A	All configurations	Standard	Performance
D	All configurations	Performance	Performance

#### Notes:

- One CPU requires 6 fans (slot 1–6) and 2 fan dummies(7–8); two CPUs require 8 fans(slot 1–8).
- If there is an OCP 3.0 Ethernet adapter installed, when the system is powered off but still plugged in to AC power, fans 5 and fan 6 will continue to spin at a much lower speed. This is the system design to provide proper cooling for the OCP 3.0 Ethernet adapter.

## DIMM population rules

### General mixing rules:

DIMMs	Coexist in a channel	Coexist in a system
RDIMMs and Performance+ RDIMMs		
3DS RDIMMs and other DIMM types		
128 GB 3DS RDIMMs and 256 GB 3DS RDIMMs		
DIMMs of different DRAM density (8Gbit and 16 Gbit)	√ <sup>1</sup>	√ <sup>1</sup>
DIMMs of different DRAM data width (x4 and x8)		√
DIMMs of different rank	√ <sup>2</sup>	√ <sup>2</sup>
DIMMs manufactured by different vendors	√	√
DIMMs of different voltage <sup>3</sup>		
ECC and Non-ECC DIMMs <sup>4</sup>		
<ol style="list-style-type: none"> <li>1. Install the one with the higher density first.</li> <li>2. Install the one with the higher rank first.</li> <li>3. Only support 1.2 V.</li> <li>4. Only support ECC DIMMs.</li> </ol>		

### DIMM compatibility (based on general mixing rules)

Type	Option	Capacity	DRAM data width	DRAM density
RDIMM	1	16 GB	x8	8 Gbit
	2	32 GB	x4	8 Gbit
	3	32 GB	x8	16 Gbit
	4	64 GB	x4	16 Gbit
Performance+ RDIMM	5	32 GB	x8	16 Gbit
	6	64 GB	x4	16 Gbit
3DS RDIMM	7	128 GB	x4	16 Gbit
	8	256 GB	x4	16 Gbit
Support mixing within a channel: <ul style="list-style-type: none"><li>• Options 1 and 3</li><li>• Options 2 and 4</li></ul> Support mixing within a system: <ul style="list-style-type: none"><li>• Options 1 to 4 (Install the one with higher DRAM density first.)</li><li>• Options 5 and 6 (Install the one with higher capacity first.)</li></ul>				

**Alternatively, for balancing memory and for better performance, consider below rules:**

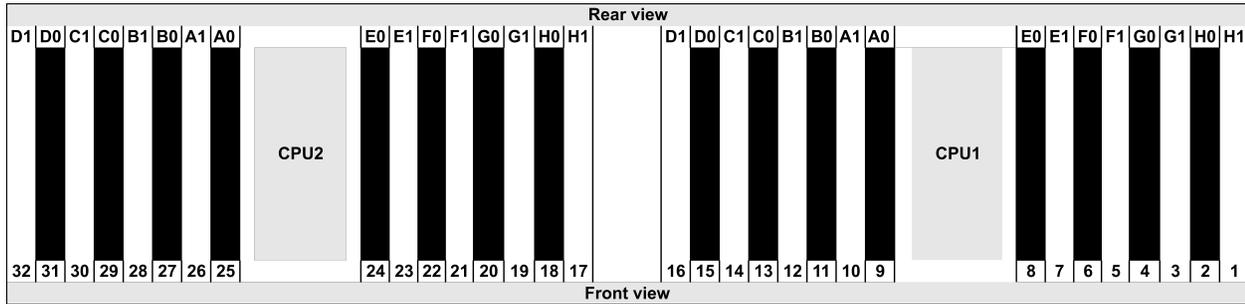
- Balance memory capacity per channel pair on a given CPU.
- Balance memory capacity per CPU socket when 2 CPUs are installed.
- In cases of using Performance+ RDIMMs to maximize memory operating speed, ensure that Performance + RDIMMs with the same capacity are populated on 2DPC. Otherwise, there will be no performance gain.
- When only one DIMM is to be populated in a given channel, it must be populated in DIMM slot 1 (physically farthest away from the CPU).
- The server supports single DIMM as a minimum configuration, however, full memory bandwidth requires one DIMM per channel (A–H) be populated. For best performance, populate all 8 channels per socket, with every channel having the same capacity.

**Note:** Detailed instructions for balancing memory configurations for your server can be found at:

[Balanced Memory Configurations with Second-or-Third-Generation AMD EPYC Processors](#)

**Recommended population order (based on general rules)**

**1 CPU installed:**



Qty.	DIMM population order															
1 DIMM	14															
2 DIMMs	14	16														
3 DIMMs	14	16	3													
4 DIMMs	14	16	3	1												
5 DIMMs	14	16	3	1	10											
6 DIMMs	14	16	3	1	10	12										
7 DIMMs	14	16	3	1	10	12	7									
8 DIMMs	14	16	3	1	10	12	7	5								
9 DIMMs	14	16	3	1	10	12	7	5	13							
10 DIMMs	14	16	3	1	10	12	7	5	13	15						
11 DIMMs	14	16	3	1	10	12	7	5	13	15	4					
12 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2				
13 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9			
14 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9	11		
15 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9	11	8	
16 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9	11	8	6



**Note:** There are performance-optimized 6-DIMM and 12-DIMM configurations for server models with one 7003 series CPU and 12-DIMM and 24-DIMM configurations for server models with two 7003 series CPUs. For details, see the table below.

<b>CPU Qty.</b>	<b>DIMM Qty.</b>	<b>Performance-optimized DIMM population order</b>
<b>1</b>	<b>6</b>	<b>1, 3, 7, 10, 14, 16</b>
	<b>12</b>	<b>1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 16</b>
<b>2</b>	<b>12</b>	<b>1, 3, 7, 10, 14, 16, 17, 19, 23, 26, 30, 32</b>
	<b>24</b>	<b>1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24, 25, 26, 29, 30, 31, 32</b>

## PCIe slots and configurations

- [Slot configurations](#)
- [Quantities and slot priority](#)
- [RAID rules](#)

### Slot configurations

The server supports up to 3 PCIe slots on the rear. The PCIe slot configurations vary by server model.

**Notes:** The slots defined in the UEFI setting are slightly different from the physical slots. For information about slots defined in the UEFI setting, refer to:

- For AMD EPYC 7002 series processors: [https://thinksystem.lenovofiles.com/help/topic/uefi\\_amd\\_2p/onboard\\_device.html](https://thinksystem.lenovofiles.com/help/topic/uefi_amd_2p/onboard_device.html)
- For AMD EPYC 7003 series processors: [https://thinksystem.lenovofiles.com/help/topic/uefi\\_amd\\_2p\\_milan/onboard\\_device.html](https://thinksystem.lenovofiles.com/help/topic/uefi_amd_2p_milan/onboard_device.html)

Models	Configurations
3 PCIe slots(no rear bays)	<ul style="list-style-type: none"> <li>• Slot 1: PCIe x16 (x8, x4, x1), low-profile</li> <li>• Slot 2: PCIe x16 (x8, x4, x1), full-height</li> <li>• Slot 3: PCIe x16 (x8, x4, x1), low-profile</li> </ul>
2 PCIe slots(no rear bays)	<ul style="list-style-type: none"> <li>• Slot 1: PCIe x16 (x8, x4, x1), low-profile</li> <li>• Slot 2: PCIe x16 (x8, x4, x1), full-height</li> </ul> <p><b>Note:</b> One rearwall bracket must be installed next to the two PCIe slots.</p>
2 PCIe slots(7mm rear bay)	<ul style="list-style-type: none"> <li>• Slot 1: PCIe x16 (x8, x4, x1), low-profile</li> <li>• Slot 2: PCIe x16 (x8, x4, x1), low-profile</li> </ul>
1 PCIe slot(2.5" rear bay)	<ul style="list-style-type: none"> <li>• Slot 1: PCIe x16 (x8, x4, x1), low-profile</li> </ul>

### Quantities and slot priority

PCIe adapters		Max qty.	Slot priority
GPU	Tesla T4/A2/Quadro P620	3	<ul style="list-style-type: none"> <li>• 1 CPU: slot 1---&gt; 2</li> <li>• 2 CPU: slot 1---&gt; 3---&gt; 2</li> </ul>
	Quadro P2200	1	Slot 2
NIC	Xilinx Alveo U25	2	<ul style="list-style-type: none"> <li>• 1 CPU: slot 1</li> <li>• 2 CPU: slot 1---&gt; 3</li> </ul> <p><b>Note:</b> When the Alveo U50 is installed, fan redundancy is not supported and the ambient temperature must be limited to 30°C or lower.</p>
	Xilinx Alveo U50		

	Others	3	<ul style="list-style-type: none"> <li>• 1 CPU: slot 1---&gt; 2</li> <li>• 2 CPU: slot 1---&gt; 3---&gt; 2</li> </ul> <p><b>Notes:</b> The following adapters require a full-height bracket and must be installed in a full-height slot:</p> <ul style="list-style-type: none"> <li>• ThinkSystem Broadcom 57454 10/25GbE SFP28 4-port PCIe Ethernet Adapter</li> <li>• ThinkSystem Broadcom 57454 10/25GbE SFP28 4-port PCIe Ethernet Adapter_Refresh (V2)</li> </ul>
Internal SFF RAID/HBA		1	Slot 1
Internal CFF RAID/HBA		1	Front chassis
External RAID/HBA		3	NA
FC HBA		3	<ul style="list-style-type: none"> <li>• 1 CPU: slot 1---&gt; 2</li> <li>• 2 CPU: slot 1---&gt; 3---&gt; 2</li> </ul>
PCIe SSD		3	<ul style="list-style-type: none"> <li>• 1 CPU: slot 1---&gt; 2</li> <li>• 2 CPU: slot 1---&gt; 3---&gt; 2</li> </ul>
COM cable		1	Slot 3
OCP 3.0		1	OCP slot

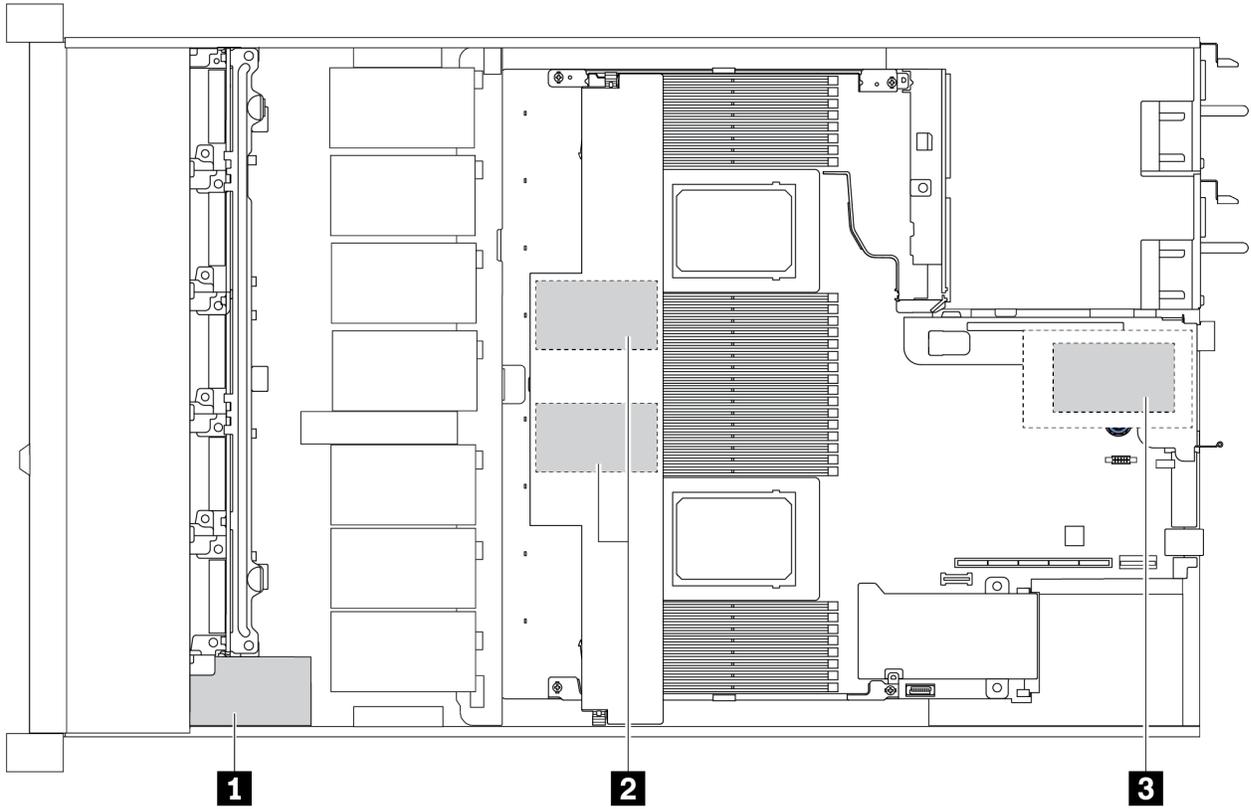
## RAID rules

- Gen3 and Gen4 cannot be installed together on one riser card.
- RAID controllers of the same PCIe generation group can be installed on one riser card.
- RAID and HBA controllers can be installed on one riser card.
- RAID/HBA 4350/5350/9350 adapters cannot be mixed with the following adapters in the same system:
  - RAID/HBA 430/530/930 adapters
  - RAID/HBA 440/540/940 adapters
  - Expander adapters
- PCIe SSD does not support RAID function.
- Below 3 controllers support Tri-mode function, once Tri-Mode is enabled, the controllers support any combinations of NVMe, SAS, and SATA devices.
  - 940-8i 4 GB Flash 12Gb Internal SFF RAID adapter (Gen4)
  - 940-8i 8 GB Flash 12Gb Internal SFF RAID adapter (Gen4)
  - 940-16i 8 GB Flash 12Gb Internal CFF RAID adapter (Gen4)
- Internal HBAs do not support SED (Self-Encrypting Drives) HDDs/SSDs.
- RAID arrays do not support SED or FIPS HDDs/SSDs.

**Note:** FIPS (Federal Information Processing Standard) 140-2 is a U.S. government standard that describes the encryption and related security requirements for sensitive but unclassified (SBU) information technology (IT) products. FIPS 140-2 defines four levels of security, SEDs are FIPS 140-2 Level 2 validated drives.

- 930/9350/940 RAID controllers require a super capacitor.

Locations and quantities of RAID super capacitors vary by models:



	2.5" chassis		3.5" chassis		Installation priority	Location
	STD heat sink	Perf. heat sink	STD heat sink	Perf. heat sink		
<b>1</b>	Super cap 1	Super cap 1	NA	NA	Super cap 1---> 2--->3	Front chassis
<b>2</b>	Super cap 2, 3	NA	Super cap 1, 2	NA		Air baffle
<b>3</b>	NA	NA	NA	Super cap 1		Riser cage

## Thermal rules

This topic lists the thermal rules for the server to comply with “ASHRAE class A2, A3, or A4 specifications” on page 30.

### ASHARE class A2 environment

The following table lists the ambient temperature requirement for the server depending on the hardware configuration.

Model	Default TDP	Configuration	Max. Ambient Temp.
All models		<ul style="list-style-type: none"> <li>Mellanox ConnectX-6 &lt; 100 GbE</li> <li>Xilinx Alveo U25</li> <li>NVIDIA Quadro P620/P2200 GPU</li> <li>Broadcom 57454 OCP 3.0</li> </ul>	35°C
		Mellanox ConnectX-6 100 GbE/200GbE with AOC	30°C
4 x 2.5" models	280 W	Non-Mellanox ConnectX-6 NIC	35°C
		2 Tesla T4/A2 GPUs	30°C
8 x 2.5"/4 x 3.5" models	120 W / 155 W	2 x 2.5" SSD	35°C
	180W / 190 W / 200 W	3 Tesla T4/A2 GPUs	35°C
		2 x 2.5" SSD	30°C
	225 W /240 W	<ul style="list-style-type: none"> <li>3 Non-Mellanox ConnectX-6 NIC</li> <li>2 Tesla T4/A2 GPUs</li> <li>2 x 7mm SSD</li> </ul>	35°C
10 x 2.5" models	120 W / 155 W	<ul style="list-style-type: none"> <li>3 Tesla T4/A2 GPUs</li> <li>2 x 2.5" SSD</li> </ul>	35°C
	180W / 190 W / 200 W	<ul style="list-style-type: none"> <li>Non-Mellanox ConnectX-6 NIC</li> <li>2 Tesla T4/A2 GPUs</li> <li>2 x 7mm SSD</li> </ul>	35°C
		3 Tesla T4/A2 GPUs	30°C
	225 W /240 W	<ul style="list-style-type: none"> <li>Non-Mellanox ConnectX-6 NIC</li> <li>2 Tesla T4/A2 GPUs</li> <li>2 x 7mm SSD</li> </ul>	35°C

### ASHARE class A3/A4 environment

To comply with ASHARE class A3/A4 specifications, the server must NOT be configured with below components:

- CPU (TDP ≥ 170W)
- 3DS RDIMMs
- GPUs
- Mellanox ConnectX-6 100 GbE/200GbE with AOC
- Xilinx Alveo U25 FPGA

- Broadcom 57454 OCP 3.0
- NVMe AIC switches
- 2 x 7mm SSDs
- 2 x 2.5" SSDs



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## Chapter 2. Server components

This section provides details of all components available on the server.

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### Front view

The front view of the server varies by model. Depending on the model, your server might look slightly different from the illustrations in this topic.

Refer to the following front view for different server models:

- [“Server models with four 2.5-inch front drive bays” on page 50](#)
- [“Server models with eight 2.5-inch front drive bays” on page 51](#)
- [“Server models with ten 2.5-inch front drive bays” on page 52](#)
- [“Server models with four 3.5-inch front drive bays” on page 53](#)
- [“Server models with four 2.5-inch front drive bays \(backplane-less\)” on page 54](#)
- [“Server models with eight 2.5-inch front drive bays \(backplane-less\)” on page 55](#)
- [“Server models with ten 2.5-inch front drive bays \(backplane-less\)” on page 56](#)
- [“Server models with four 3.5-inch front drive bays \(backplane-less\)” on page 57](#)
- [“Server models with eight 2.5-inch front drive bays \(with LCD diagnostics panel\)” on page 58](#)

## Server model with four 2.5-inch drive bays

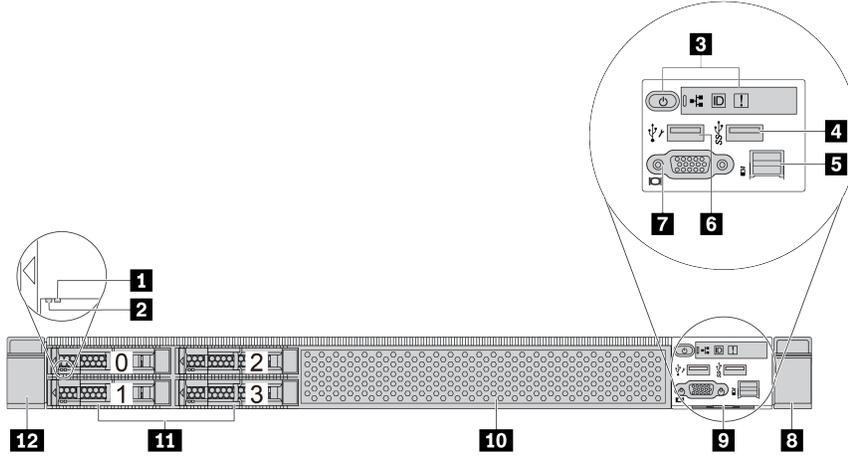


Table 2. Components on the front of the server

Callout	Callout
<b>1</b> Drive status LED	<b>2</b> Drive activity LED
<b>3</b> Diagnostics panel	<b>4</b> USB 3.1 Gen 1 connector
<b>5</b> External diagnostics connector	<b>6</b> XClarity Controller USB connector
<b>7</b> VGA connector (optional)	<b>8</b> Rack latch (right)
<b>9</b> Pull-out information tab	<b>10</b> Drive bay filler (1)
<b>11</b> Drive bays (4)	<b>12</b> Rack latch (left)

**Note:** For more information about each component, see [“Front components overview”](#) on page 59.

## Server model with eight 2.5-inch drive bays

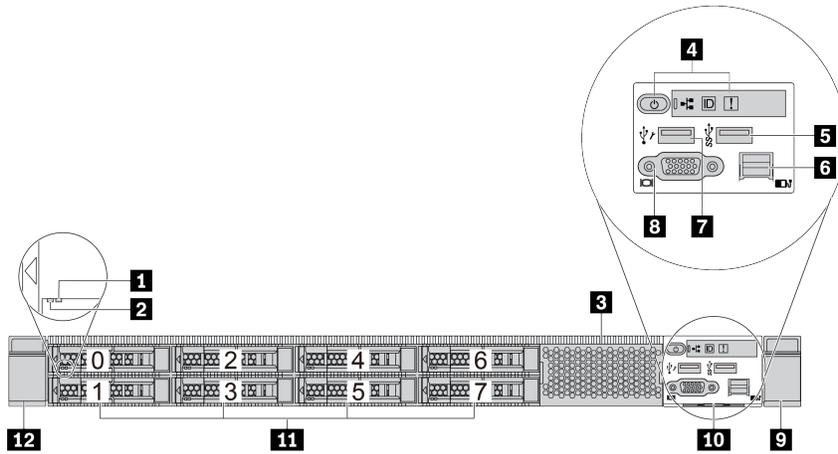


Table 3. Components on the front of the server

Callout	Callout
<b>1</b> Drive status LED	<b>2</b> Drive activity LED
<b>3</b> Drive bay filler (1)	<b>4</b> Diagnostics panel
<b>5</b> USB 3.1 Gen 1 connector	<b>6</b> External diagnostics connector
<b>7</b> XClarity Controller USB connector	<b>8</b> VGA connector (optional)
<b>9</b> Rack latch (right)	<b>10</b> Pull-out information tab
<b>11</b> Drive bays (8)	<b>12</b> Rack latch (left)

**Note:** For more information about each component, see [“Front components overview” on page 59](#).

## Server model with ten 2.5-inch drive bays

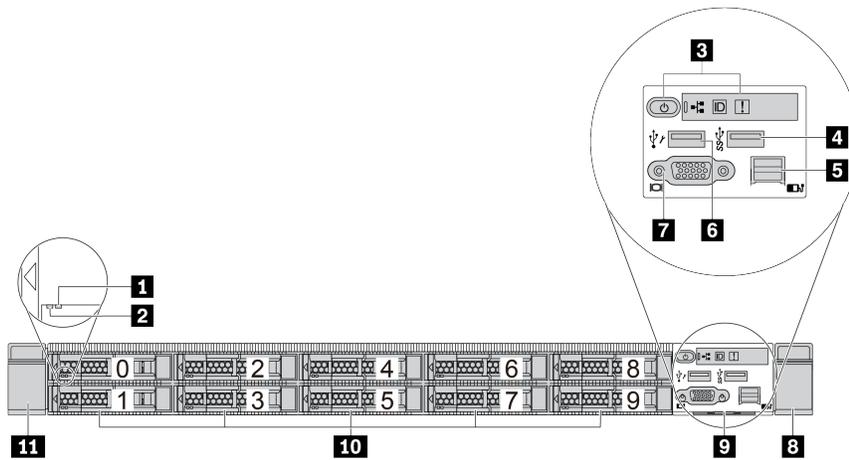


Table 4. Components on the front of the server

Callout	Callout
<b>1</b> Drive status LED	<b>2</b> Drive activity LED
<b>3</b> Diagnostics panel	<b>4</b> USB 3.1 Gen 1 connector
<b>5</b> External diagnostics connector	<b>6</b> XClarity Controller USB connector
<b>7</b> VGA connector (optional)	<b>8</b> Rack latch (right)
<b>9</b> Pull-out information tab	<b>10</b> Drive bays (10)
<b>11</b> Rack latch (left)	

**Note:** For more information about each component, see [“Front components overview” on page 59](#).

**Server model with four 3.5-inch drive bays**

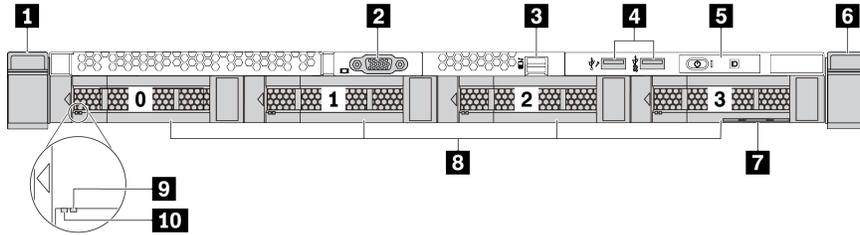


Table 5. Components on the front of the server

Callout	Callout
<b>1</b> Rack latch (right)	<b>2</b> VGA connector (optional)
<b>3</b> External diagnostics connector	<b>4</b> XClarity Controller USB connector and USB 3.1 Gen 1 connector
<b>5</b> Diagnostics panel	<b>6</b> Rack latch (left)
<b>7</b> Pull-out information tab	<b>8</b> Drive bays (4)
<b>9</b> Drive status LED	<b>10</b> Drive activity LED

**Note:** For more information about each component, see [“Front components overview”](#) on page 59.

**Server model with four 2.5-inch drive bays (backplane-less)**

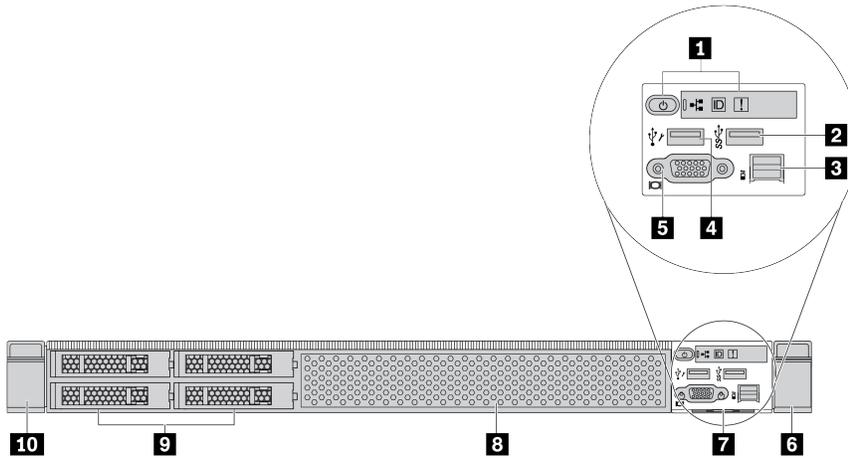


Table 6. Components on the front of the server

Callout	Callout
<b>1</b> Diagnostics panel	<b>2</b> USB 3.1 Gen 1 connector
<b>3</b> External diagnostics connector	<b>4</b> XClarity Controller USB connector
<b>5</b> VGA connector (optional)	<b>6</b> Rack latch (right)
<b>7</b> Pull-out information tab	<b>8</b> Drive bay filler (1)
<b>9</b> Drive bay fillers (4)	<b>10</b> Rack latch (left)

**Note:** For more information about each component, see [“Front components overview”](#) on page 59.

**Server model with eight 2.5-inch drive bays (backplane-less)**

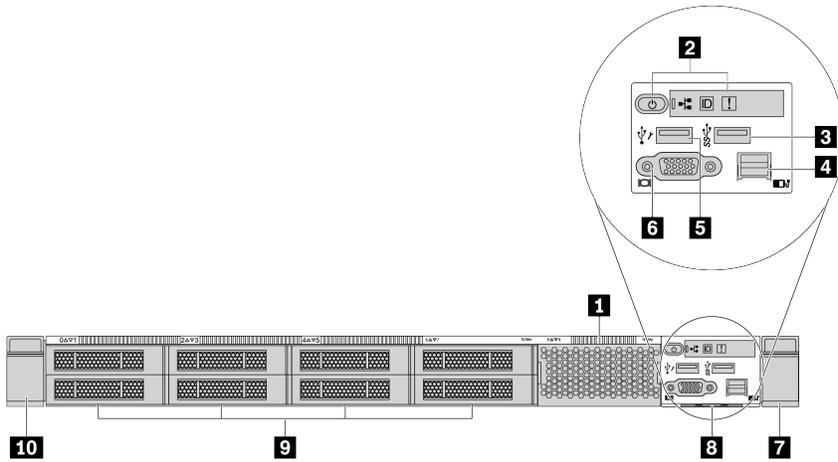


Table 7. Components on the front of the server

Callout	Callout
<b>1</b> Drive bay filler (1)	<b>2</b> Diagnostics panel
<b>3</b> USB 3.1 Gen 1 connector	<b>4</b> External diagnostics connector
<b>5</b> XClarity Controller USB connector	<b>6</b> VGA connector (optional)
<b>7</b> Rack latch (right)	<b>8</b> Pull-out information tab
<b>9</b> Drive bay filler (8)	<b>10</b> Rack latch (left)

**Note:** For more information about each component, see [“Front components overview” on page 59](#).

**Server model with ten 2.5-inch drive bays (backplane-less)**

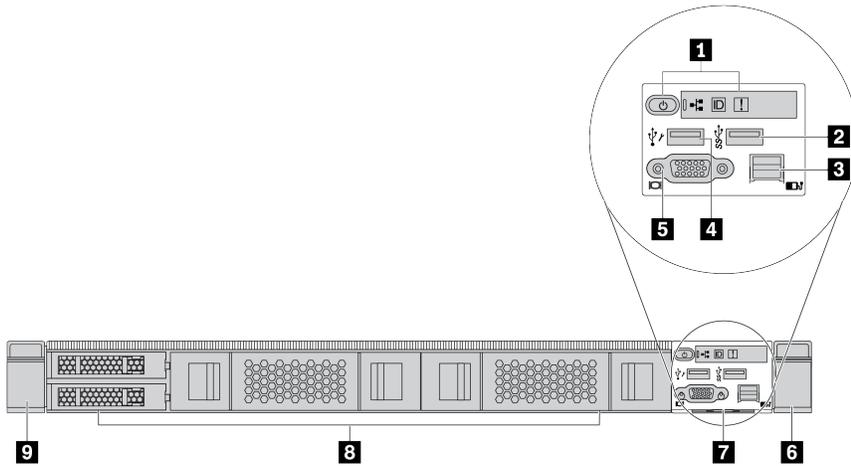


Table 8. Components on the front of the server

Callout	Callout
<b>1</b> Diagnostics panel	<b>2</b> USB 3.1 Gen 1 connector
<b>3</b> External diagnostics connector (Reserved)	<b>4</b> XClarity Controller USB connector
<b>5</b> VGA connector (optional)	<b>6</b> Rack latch (right)
<b>7</b> Pull-out information tab	<b>8</b> Drive bay fillers (4)
<b>9</b> Rack latch (left)	

**Note:** For more information about each component, see [“Front components overview”](#) on page 59.

**Server model with four 3.5-inch drive bays (backplane-less)**

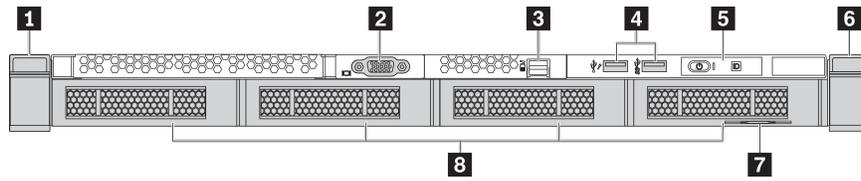


Table 9. Components on the front of the server

Callout	Callout
<b>1</b> Rack latch (left)	<b>2</b> VGA connector (optional)
<b>3</b> External diagnostics connector	<b>4</b> XClarity Controller USB connector and USB 3.1 Gen 1 connector
<b>5</b> Diagnostics panel	<b>6</b> Rack latch (right)
<b>7</b> Pull-out information tab	<b>8</b> Drive bay fillers (4)

**Note:** For more information about each component, see [“Front components overview” on page 59](#).

**Server model with eight 2.5-inch drive bays (with LCD diagnostics panel assembly)**

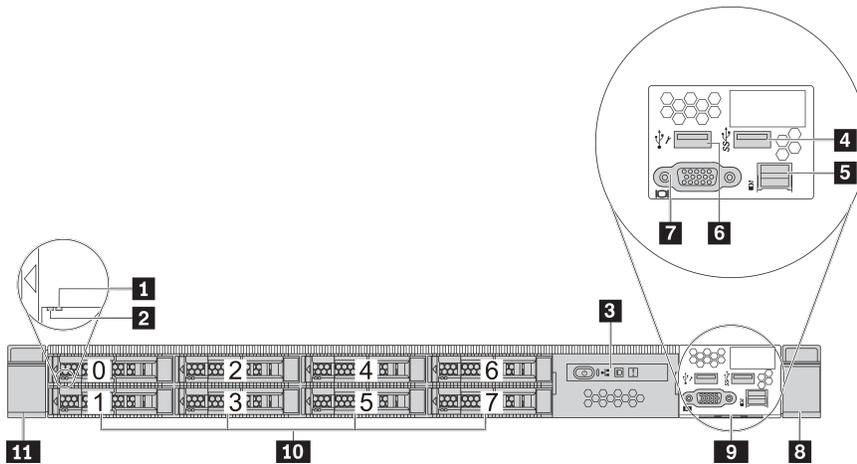


Table 10. Components on the front of the server

Callout	Callout
<b>1</b> Drive status LED	<b>2</b> Drive activity LED
<b>3</b> LCD diagnostics panel assembly	<b>4</b> USB 3.1 Gen 1 connector
<b>5</b> External diagnostics connector	<b>6</b> XClarity Controller USB connector
<b>7</b> VGA connector (optional)	<b>8</b> Rack latch (right)
<b>9</b> Pull-out information tab	<b>10</b> Drive bays (8)
<b>11</b> Rack latch (left)	

**Note:** For more information about each component, see [“Front components overview”](#) on page 59.

## Front components overview

### Diagnostics panel

The diagnostics panel is integrated in front I/O assembly on some models. For information about the controls and status LEDs on the diagnostics panel, see [“Diagnostics panel” on page 61](#).

### Drive LEDs

Each hot-swap drive comes with an activity LED and status LED and the signals are controlled by the backplanes. Different colors and speeds indicate different activities or status of the drive. The following illustration shows the LEDs on a Hard disk drive or solid-state drive.

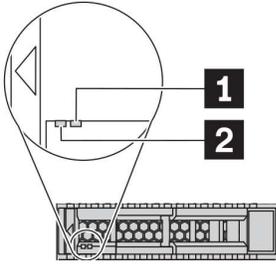


Figure 4. Drive LEDs

Drive LED	Status	Description
1 Drive status LED (right)	Solid yellow	The drive has an error.
	Blinking yellow (blinking slowly, about one flash per second)	The drive is being rebuilt.
	Blinking yellow (blinking rapidly, about four flashes per second)	The RAID adapter is locating the drive.
2 Drive activity LED (left)	Solid green	The drive is powered but not active.
	Blinking green	The drive is active.

### External diagnostics port

The connector is for connecting an external diagnostics handset. For more about its functions, see [“LCD diagnostics panel/handset” on page 63](#).

### Hot-swap drives and drive bays

The drive bays on the front and rear of your server are designed for hot-swap drives. The number of the installed drives in your server varies by model. When you install drives, follow the order of the drive bay numbers.

The EMI integrity and cooling of the server are protected by having all drive bays occupied. Vacant drive bays must be occupied by drive fillers.

### LCD diagnostics panel assembly

The assembly comes with an integrated LCD diagnostics panel that can be used to quickly obtain system status, firmware levels, network information, and health information about the system. For more about the panel functions, see [“LCD diagnostics panel/handset” on page 63](#).

### **Pull-out information tab**

The Lenovo XClarity Controller network access label is attached on the pull-out information tab. The default Lenovo XClarity Controller hostname and the IPv6 Link Local Address (LLA) are provided on the tab.

For more information, see “[Set the network connection for the Lenovo XClarity Controller](#)” on page 195.

### **Rack latches**

If your server is installed in a rack, you can use the rack latches to help you slide the server out of the rack. You also can use the rack latches and screws to secure the server in the rack so that the server cannot slide out, especially in vibration-prone areas. For more information, refer to the *Rack Installation Guide* that comes with your rail kit.

### **USB 3.1 Gen 1 connectors**

The USB 3.1 Gen 1 connectors can be used to attach a USB-compatible device, such as a USB keyboard, USB mouse, or USB storage device.

### **VGA connector**

The VGA connectors on the front and rear of the server can be used to attach a high-performance monitor, a direct-drive monitor, or other devices that use a VGA connector.

### **XClarity Controller USB connector**

The XClarity Controller USB connector can function as a regular USB 2.0 connector to the host OS. In addition, it can also be used to connect the server to an android or iOS device, where you can then install and launch the Lenovo XClarity Mobile app to manage the system using XClarity Controller.

For details about using the Lenovo XClarity Mobile app, refer to [http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/lxca\\_usemobileapp.html](http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/lxca_usemobileapp.html).

## Diagnostics panel

The diagnostics panel provides controls, connectors, and LEDs.

**Note:** Diagnostics panel with an LCD display is available for some models. For details, see [“LCD diagnostics panel/handset” on page 63](#).

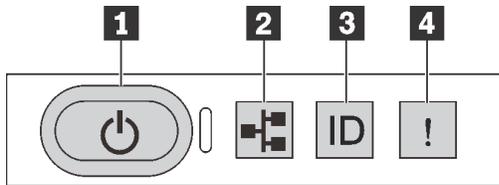


Figure 5. Diagnostics panel

### 1 Power button with power status LED

You can press the power button to power on the server when you finish setting up the server. You also can hold the power button for several seconds to power off the server if you cannot shut down the server from the operating system. The power status LED helps you determine the current power status.

Status	Color	Description
Solid on	Green	The server is on and running.
Slow blinking (about one flash per second)	Green	The server is off and is ready to be powered on (standby state).
Fast blinking (about four flashes per second)	Green	The server is off, but the XClarity Controller is initializing, and the server is not ready to be powered on.
Off	None	There is no ac power applied to the server.

### 2 Network activity LED

Compatibility of the NIC adapter and the network activity LED

NIC adapter	Network activity LED
OCP 3.0 Ethernet adapter	Support
PCIe NIC adapter	Not support

When an OCP 3.0 Ethernet adapter is installed, the network activity LED on the front I/O assembly helps you identify the network connectivity and activity. If no OCP 3.0 Ethernet adapter is installed, this LED is off.

Status	Color	Description
On	Green	The server is connected to a network.
Blinking	Green	The network is connected and active.
Off	None	The server is disconnected from the network. <b>Note:</b> If the network activity LED is off when an OCP 3.0 Ethernet adapter is installed, check the network ports in the rear of your server to determine which port is disconnected.

## 3 System ID button with system ID LED

Use this system ID button and the blue system ID LED to visually locate the server. A system ID LED is also located on the rear of the server. Each time you press the system ID button, the state of both the system ID LEDs changes. The LEDs can be changed to on, blinking, or off. You can also use the Lenovo XClarity Controller or a remote management program to change the state of the system ID LEDs to assist in visually locating the server among other servers.

If the XClarity Controller USB connector is set to have both the USB 2.0 function and XClarity Controller management function, you can press the system ID button for three seconds to switch between the two functions.

## 4 System error LED

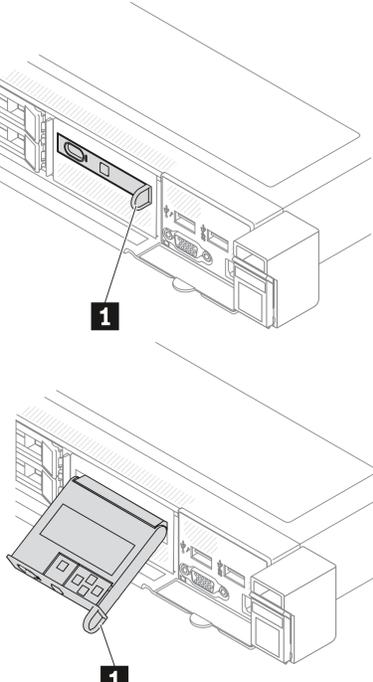
The system error LED helps you determine if there are any system errors.

Status	Color	Description	Action
On	Yellow	<p>An error has been detected on the server. Causes might include but are not limited to the following errors:</p> <ul style="list-style-type: none"><li>• The temperature of the server reached the non-critical temperature threshold.</li><li>• The voltage of the server reached the non-critical voltage threshold.</li><li>• A fan has been detected to be running at low speed.</li><li>• A hot-swap fan has been removed.</li><li>• The power supply has a critical error.</li><li>• The power supply is not connected to the power.</li></ul>	<p>Check the event log to determine the exact cause of the error. Alternatively, follow the light path diagnostics to determine if additional LEDs are lit that will direct you to identify the cause of the error.</p>
Off	None	<p>The server is off or the server is on and is working correctly.</p>	<p>None.</p>

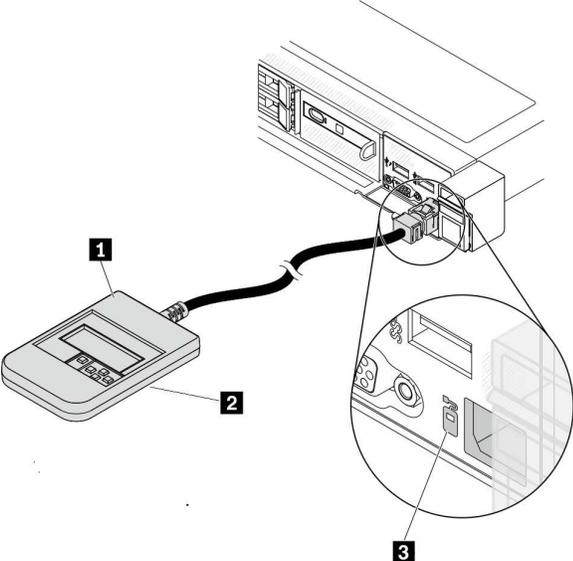
## LCD diagnostics panel/handset

The LCD diagnostics panel is a component attached to the front of the server, the external LCD diagnostics handset is an external device that can be connected to the server with a cable. Functions of the integrated component and the external device are the same, both of them can be used to quickly access system information such as active errors, system status, firmware, network information, and health information.

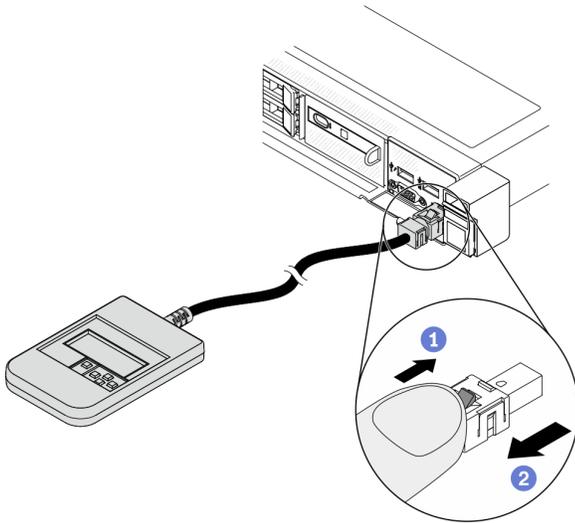
### Where to find the LCD diagnostics panel

Location	Callout
<p>The LCD diagnostics panel is attached to the front of the server.</p> 	<p><b>1</b> The handle with which the panel can be pulled out and inserted into the rack.</p> <p><b>Notes:</b></p> <ul style="list-style-type: none"><li>• The panel can be inserted or pulled out regardless of the system status.</li><li>• When pulling out the panel, carefully hold it by the handle and avoid any hard pulling.</li></ul>

## Where to find the external LCD diagnostics handset

Location	Callout
<p>The external LCD diagnostics handset is connected to the server with an external cable.</p>  <p>The diagram shows a server rack with an external LCD diagnostics handset connected via a cable. Callout 1 points to the handset, callout 2 points to the magnetic bottom, and callout 3 points to the external diagnostics connector on the server.</p>	<p><b>1</b> The LCD diagnostics handset that can be connected to the server with an external cable. <b>2</b> The magnetic bottom with which the device can be attached to the top or side of the rack. This is helpful and can free up both hands for certain service tasks. <b>3</b> The external diagnostics connector on the front of the server that can be used to connect an external LCD diagnostics handset.</p>

**Note:** Pay attention to the following steps when unplugging the external handset:

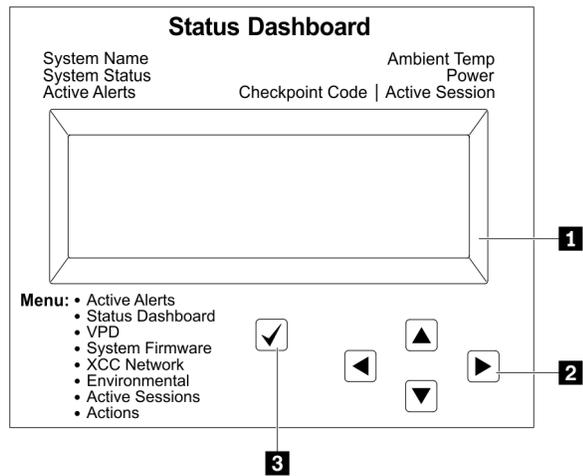


Step 1. Press the plastic clip on the plug in the shown direction.

Step 2. Gently pull out the cable from the connector while keeping the clip pressed down.

## Display panel overview

Both the integrated panel and the external handset consist of an LCD display and 5 navigation buttons.



**1** LCD display

**2** Scroll buttons (up/down/left/right).

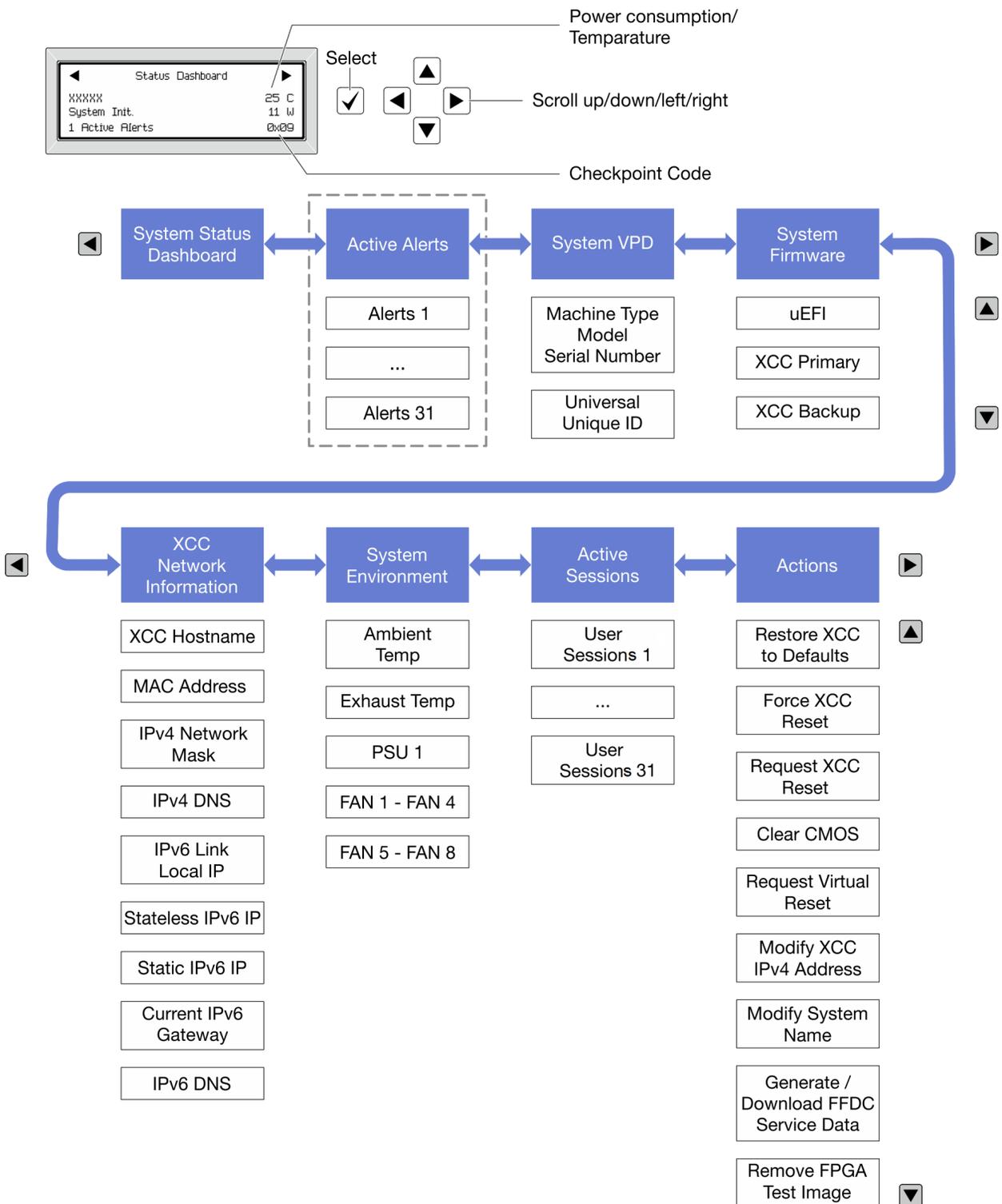
Press the scroll buttons to locate and select system information.

**3** Select button.

Press the select button to select from the menu options.

## Options flow diagram

The LCD diagnostics panel/handset shows various system information. Navigate through the options with the scroll keys.



## Full menu list

Following is the list of options available on the LCD diagnostics panel/handset. Switch between an option and the subordinate information entries with the select button, and switch among options or information entries with the scroll buttons.

### Home Menu (System Status Dashboard)

Home Menu	Example
<ul style="list-style-type: none"> <li>1 System name</li> <li>2 System status</li> <li>3 Active alert quantity</li> <li>4 Temperature</li> <li>5 Power consumption</li> <li>6 Checkpoint code</li> </ul>	<p>The screenshot shows a 'Status Dashboard' screen with the following items: 'xxxxxx' (1), 'System Init.' (2), '1 Active Alerts' (3), '25 C' (4), '11 W' (5), and '0x09' (6). Navigation arrows are visible at the top.</p>

### Active Alerts

Sub Menu	Example
Home screen: Active error quantity <b>Note:</b> The "Active Alerts" menu displays only the quantity of active errors. If no errors occur, the "Active Alerts" menu will not be available during navigation.	1 Active Alerts
Details screen: <ul style="list-style-type: none"> <li>• Error message ID (Type: Error/Warning/Information)</li> <li>• Occurrence time</li> <li>• Possible sources of the error</li> </ul>	Active Alerts: 1 Press ▼ to view alert details FQXSPPU009N (Error) 04/07/2020 02:37:39 PM CPU 1 Status: Configuration Error

### System VPD Information

Sub Menu	Example
<ul style="list-style-type: none"> <li>• Machine type and serial number</li> <li>• Universal Unique ID (UUID)</li> </ul>	Machine Type: xxxx Serial Num: xxxxxx Universal Unique ID: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

## System Firmware

Sub Menu	Example
UEFI <ul style="list-style-type: none"> <li>Firmware level (status)</li> <li>Build ID</li> <li>Version number</li> <li>Release date</li> </ul>	UEFI (Inactive) Build: D0E101P Version: 1.00 Date: 2019-12-26
XCC Primary <ul style="list-style-type: none"> <li>Firmware level (status)</li> <li>Build ID</li> <li>Version number</li> <li>Release date</li> </ul>	XCC Primary (Active) Build: DVI399T Version: 4.07 Date: 2020-04-07
XCC Backup <ul style="list-style-type: none"> <li>Firmware level (status)</li> <li>Build ID</li> <li>Version number</li> <li>Release date</li> </ul>	XCC Backup (Active) Build: D8BT05I Version: 1.00 Date: 2019-12-30

## XCC Network Information

Sub Menu	Example
<ul style="list-style-type: none"> <li>XCC hostname</li> <li>MAC address</li> <li>IPv4 Network Mask</li> <li>IPv4 DNS</li> <li>IPv6 Link Local IP</li> <li>Stateless IPv6 IP</li> <li>Static IPv6 IP</li> <li>Current IPv6 Gateway</li> <li>IPv6 DNS</li> </ul> <p><b>Note:</b> Only the MAC address that is currently in use is displayed (extension or shared).</p>	XCC Network Information XCC Hostname: XCC- xxxx-SN  MAC Address: xx:xx:xx:xx:xx:xx IPv4 IP: xx.xx.xx.xx  IPv4 Network Mask :x.x.x.x IPv4 Default Gateway : x.x.x.x

## System Environmental Information

Sub Menu	Example
<ul style="list-style-type: none"> <li>Ambient temperature</li> <li>Exhaust temperature</li> <li>PSU status</li> <li>Spinning speed of fans by RPM</li> </ul>	Ambient Temp: 24 C Exhaust Temp: 30 C PSU1: Vin= 213 w Inlet= 26 C FAN1 Front: 21000 RPM FAN2 Front: 21000 RPM FAN3 Front: 21000 RPM FAN4 Front: 21000 RPM

## Active Sessions

Sub Menu	Example
Quantity of active sessions	Active User Sessions: 1

## Actions

Sub Menu	Example
Several quick actions supported for users <ul style="list-style-type: none"> <li>Restore XCC to Defaults</li> <li>Force XCC Reset</li> <li>Request XCC Reset</li> <li>Clear CMOS</li> <li>Request Virtual Reseat</li> <li>Modify XCC Static IPv4 Address/Net mask/Gateway</li> <li>Modify System Name</li> <li>Generate/Download FFDC Service Data</li> <li>Remove FPGA Test Image</li> </ul>	Request XCC Reset? This will request the BMC to reboot itself. Hold <input checked="" type="checkbox"/> for 3 seconds

---

## Rear view

The rear view of the server varies by model. Depending on the model, your server might look slightly different from the illustrations in this topic.

Refer to the following rear view for different server models:

- [“Server model with three PCIe slots” on page 71](#)
- [“Server model with two PCIe slots” on page 72](#)
- [“Server model with two hot-swap 2.5-inch rear drive bays and one PCIe slot” on page 73](#)
- [“Server model with two hot-swap 7mm rear drive bays and two PCIe slots” on page 74](#)

### Server model with three PCIe slots

The following illustration shows the rear view of server model with three PCIe slots. Depending on the model, your server might look slightly different from the illustration below.

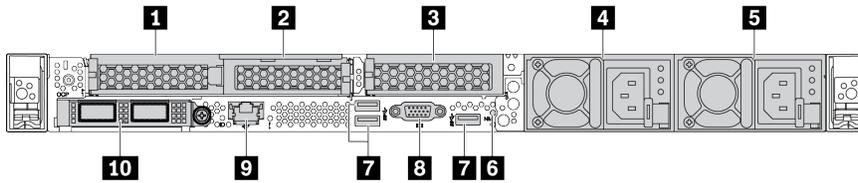


Table 11. Components on the rear of the server

Callout	Callout
<b>1</b> PCIe slot 1 on riser 1 assembly	<b>2</b> PCIe slot 2 on riser 1 assembly
<b>3</b> PCIe slot 3 on riser 2 assembly	<b>4</b> Power supply 2 (optional)
<b>5</b> Power supply 1	<b>6</b> NMI button
<b>7</b> USB 3.1 Gen 1 connectors (3)	<b>8</b> VGA connector
<b>9</b> XClarity Controller network connector	<b>10</b> Ethernet connectors on OCP 3.0 Ethernet adapter (optional)

**Note:** For more information about each component, see [“Rear components overview”](#) on page 75.

### Server model with two PCIe slots

The following illustration shows the rear view of the server model with two PCIe slots. Depending on the model, your server might look slightly different from the illustration below.

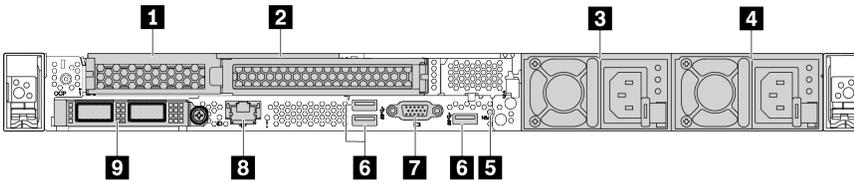


Table 12. Components on the rear of the server

Callout	Callout
<b>1</b> PCIe slot 1 on riser 1 assembly	<b>2</b> PCIe slot 2 on riser 1 assembly
<b>3</b> Power supply 2 (optional)	<b>4</b> Power supply 1
<b>5</b> NMI button	<b>6</b> USB 3.1 Gen 1 connectors (3)
<b>7</b> VGA connector	<b>8</b> XClarity Controller network connector
<b>9</b> Ethernet connectors on OCP 3.0 Ethernet adapter (optional)	

**Note:** For more information about each component, see [“Rear components overview”](#) on page 75.

### Server model with two 2.5-inch hot-swap rear drive bays and one PCIe slot

The following illustration shows the rear view of the server model with two hot-swap drive bays and one PCIe slot. Depending on the model, your server might look slightly different from the illustration below.

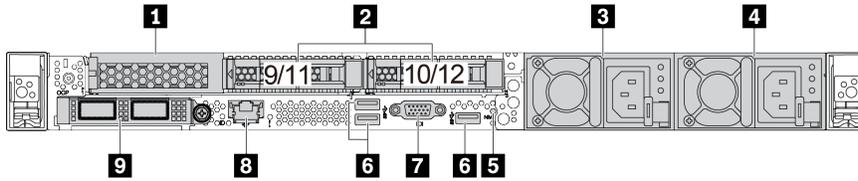


Table 13. Components on the rear of the server

<b>1</b> PCIe slot 1 on riser 1 assembly	<b>2</b> Rear 2.5-inch drive bays (2)
<b>3</b> Power supply 2 (optional)	<b>4</b> Power supply 1
<b>5</b> NMI button	<b>6</b> USB 3.1 Gen 1 connectors (3)
<b>7</b> VGA connector	<b>8</b> XClarity Controller network connector
<b>9</b> Ethernet connectors on OCP 3.0 Ethernet adapter (optional)	

**Note:** For more information about each component, see [“Rear components overview”](#) on page 75.

### Server model with two 7mm hot-swap rear drive bays and two PCIe slots

The following illustration shows the rear view of the server model with two 7mm hot-swap rear drive bays and two PCIe slots. Depending on the model, your server might look slightly different from the illustration below.

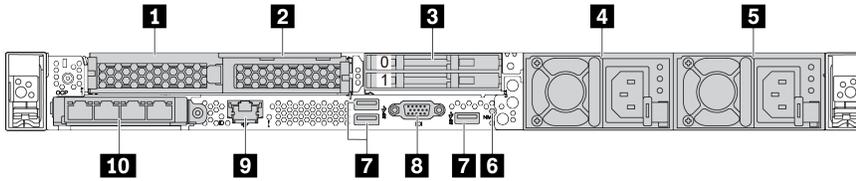


Table 14. Components on the rear of the server

<b>1</b> PCIe slot 1 on riser 1 assembly	<b>2</b> PCIe slot 2 on riser 1 assembly
<b>3</b> Rear 7mm drive bays (2)	<b>4</b> Power supply 2 (optional)
<b>5</b> Power supply 1	<b>6</b> NMI button
<b>7</b> USB 3.1 Gen 1 connectors ((3 DCIs)	<b>8</b> VGA connector
<b>9</b> XClarity Controller network connector	<b>10</b> Ethernet connectors on OCP 3.0 Ethernet adapter (optional, two or four connectors may be available)

**Note:** For more information about each component, see [“Rear components overview” on page 75](#).

## Rear components overview

### Drive LEDs

Each hot-swap drive comes with an activity LED and status LED and the signals are controlled by the backplanes. Different colors and speeds indicate different activities or status of the drive. The following illustration shows the LEDs on a Hard disk drive or solid-state drive.

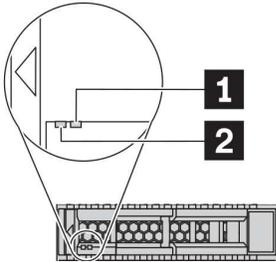


Figure 6. Drive LEDs

Drive LED	Status	Description
1 Drive status LED (right)	Solid yellow	The drive has an error.
	Blinking yellow (blinking slowly, about one flash per second)	The drive is being rebuilt.
	Blinking yellow (blinking rapidly, about four flashes per second)	The RAID adapter is locating the drive.
2 Drive activity LED (left)	Solid green	The drive is powered but not active.
	Blinking green	The drive is active.

### Ethernet connectors



Figure 7. OCP 3.0 Ethernet adapter (two connectors, seen from the rear)

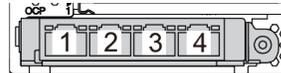


Figure 8. OCP 3.0 Ethernet adapter (four connectors, seen from the rear)

The OCP 3.0 Ethernet adapter provides two or four extra Ethernet connectors for network connections.

By default, Ethernet connector 1 (the first port starting from the left in the rear server view) on the OCP 3.0 Ethernet adapter can also function as a management connector using the shared management capacity. If the shared management connector fails, traffic can automatically switch over to another connector on the adapter.

### Hot-swap drives and drive bays

The drive bays on the front and rear of your server are designed for hot-swap drives. The number of the installed drives in your server varies by model. When you install drives, follow the order of the drive bay numbers.

The EMI integrity and cooling of the server are protected by having all drive bays occupied. Vacant drive bays must be occupied by drive fillers.

### **NMI button**

Press this button to force a nonmaskable interrupt (NMI) to the processor. By this way, you can make the operating system halt (such as Windows Blue Screen of Death) and take a memory dump. You might have to use a pen or the end of a straightened paper clip to press the button.

### **PCIe slots**

The PCIe slots are on the rear of the server and your server supports up to three PCIe slots on riser 1 and 2 assemblies.

### **Power supply units**

The hot-swap redundant power supply helps you avoid significant interruption to the operation of the system when a power supply fails. You can purchase a power supply option from Lenovo and install the power supply to provide power redundancy without turning off the server.

On each power supply, there are three status LEDs near the power cord connector. For information about the LEDs, see [“Rear view LEDs” on page 77](#).

### **USB 3.1 Gen 1 connectors**

The USB 3.1 Gen 1 connectors can be used to attach a USB-compatible device, such as a USB keyboard, USB mouse, or USB storage device.

### **VGA connector**

The VGA connectors on the front and rear of the server can be used to attach a high-performance monitor, a direct-drive monitor, or other devices that use a VGA connector.

### **XClarity Controller network connector**

The XClarity Controller network connector can be used to attach an Ethernet cable to manage the baseboard management controller (BMC).

## Rear view LEDs

The rear of the server provides system ID LED, system error LED, Ethernet LEDs, and power supply LEDs.

### Server rear view LEDs

The following illustration shows the LEDs on the rear view of server model with two PCIe slots. The LEDs on the rear view of other server models are the same.

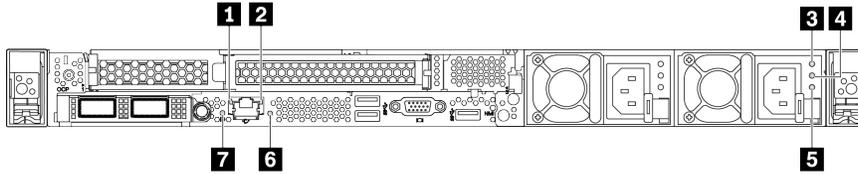


Figure 9. Rear view LEDs

Table 15. LEDs on the rear view of the server

<b>1</b> Ethernet link LED	<b>2</b> Ethernet activity LED
<b>3</b> Power input LED	<b>4</b> Power output LED
<b>5</b> Power supply error LED	<b>6</b> System error LED
<b>7</b> System ID LED	

### **1** Ethernet link LED **2** Ethernet activity LED

The BMC network connector has two status LEDs.

Ethernet status LED	Color	Status	Description
<b>1</b> Ethernet link LED	Green	On	Network link is established.
	None	Off	Network link is disconnected.
<b>2</b> Ethernet activity LED	Green	Blinking	Network link is connected and active.
	None	Off	The server is disconnected from a LAN.

### 3 4 5 Power supply LEDs

Each hot-swap power supply has three status LEDs.

LED	Description
3 Power input LED	<ul style="list-style-type: none"><li>• Green: The power supply is connected to the ac power source.</li><li>• Off: The power supply is disconnected from the ac power source or a power problem occurs.</li></ul>
4 Power output LED	<ul style="list-style-type: none"><li>• Green: The server is on and the power supply is working normally.</li><li>• Blinking green: The power supply is in the zero-output mode (standby). When the server power load is low, one of the installed power supplies enters into the standby state while the other one delivers the entire load. When the power load increases, the standby power supply will switch to active state to provide sufficient power to the system.  To disable zero-output mode, start the Setup utility, go to <b>Advanced → Power → Zero Output</b>, and select <b>Disable</b>. If you disable the zero-out mode, both power supplies will be in the active state.</li><li>• Off: The server is powered off, or the power supply is not working properly. If the server is powered on but the LED is off, replace the power supply.</li></ul>
5 Power supply error LED	<ul style="list-style-type: none"><li>• Yellow: The power supply has failed. To resolve the issue, replace the power supply.</li><li>• Off: The power supply is working normally.</li></ul>

### 6 System ID LED

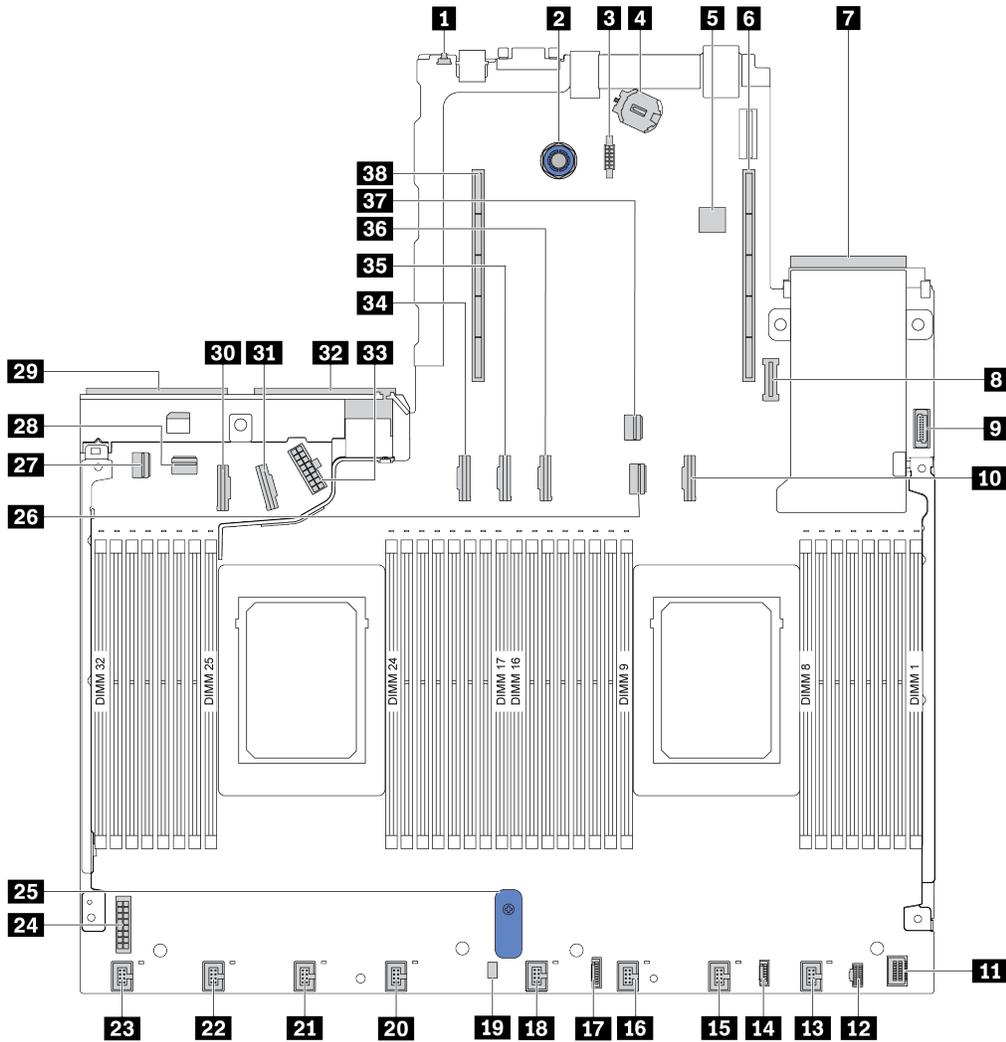
The blue system ID LED helps you visually locate the server. A system ID LED is also located on the front of the server. Each time you press the system ID button, the state of both the system ID LEDs changes. The LEDs can be changed to on, blinking, or off. You can also use the Lenovo XClarity Controller or a remote management program to change the state of the system ID LEDs to assist in visually locating the server among other servers.

### 7 System error LED

The system error LED helps you determine if there are any system errors. For details, see [“Diagnostics panel” on page 61](#).

## System board

The illustration in this section shows the component locations on the system board.



<b>1</b> NMI Button	<b>2</b> System Board Release Pin
<b>3</b> Serial Port Module Connector	<b>4</b> CMOS Battery (CR2032)
<b>5</b> Internal USB Connector	<b>6</b> Riser 1 slot
<b>7</b> OCP 3.0 Network Card Connector	<b>8</b> TPM Module Connector
<b>9</b> Front USB Connector	<b>10</b> PCIe Connector 3
<b>11</b> Front VGA Connector	<b>12</b> M.2 Power Connector
<b>13</b> Fan 1 connector	<b>14</b> Connector for external diagnostics panel
<b>15</b> Fan 2 connector	<b>16</b> Fan 3 connector
<b>17</b> Diagnostics panel connector	<b>18</b> Fan 4 connector
<b>19</b> Intrusion Switch cable Connector	<b>20</b> Fan 5 connector

<b>21</b> Fan 6 connector	<b>22</b> Fan 7 connector
<b>23</b> Fan 8 connector	<b>24</b> Backplane Power Connector
<b>25</b> System Board Lift Handle	<b>26</b> PCIe Connector 1
<b>27</b> PCIe Connector 4	<b>28</b> PCIe Connector 5
<b>29</b> Power Supply 1 Connector	<b>30</b> PCIe Connector 7
<b>31</b> PCIe Connector 8	<b>32</b> Power Supply 2 Connector
<b>33</b> Internal Raid Power Connector	<b>34</b> PCIe Connector 6
<b>35</b> PCIe Connector 9	<b>36</b> PCIe Connector 10 (Reserved)
<b>37</b> PCIe Connector 2	<b>38</b> Riser 2 slot

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## Parts list

Use the parts list to identify each of the components that are available for your server.

The parts are identified as one of the following:

- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If Lenovo installs a Tier 1 CRU at your request with no service agreement, you will be charged for the installation.
- **Tier 2 customer replaceable unit (CRU):** You may install a Tier 2 CRU yourself or request Lenovo to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.
- **Consumable and Structural parts:** Purchase and replacement of consumable and structural parts is your responsibility. If Lenovo acquires or installs a structural component at your request, you will be charged for the service.

**Note:** Depending on the model, your server might look slightly different from the illustration. Some parts are available only on some models. For more information about ordering the parts, go to: <https://datacentersupport.lenovo.com/products/servers/thinksystem/sr645/7d2x/parts>

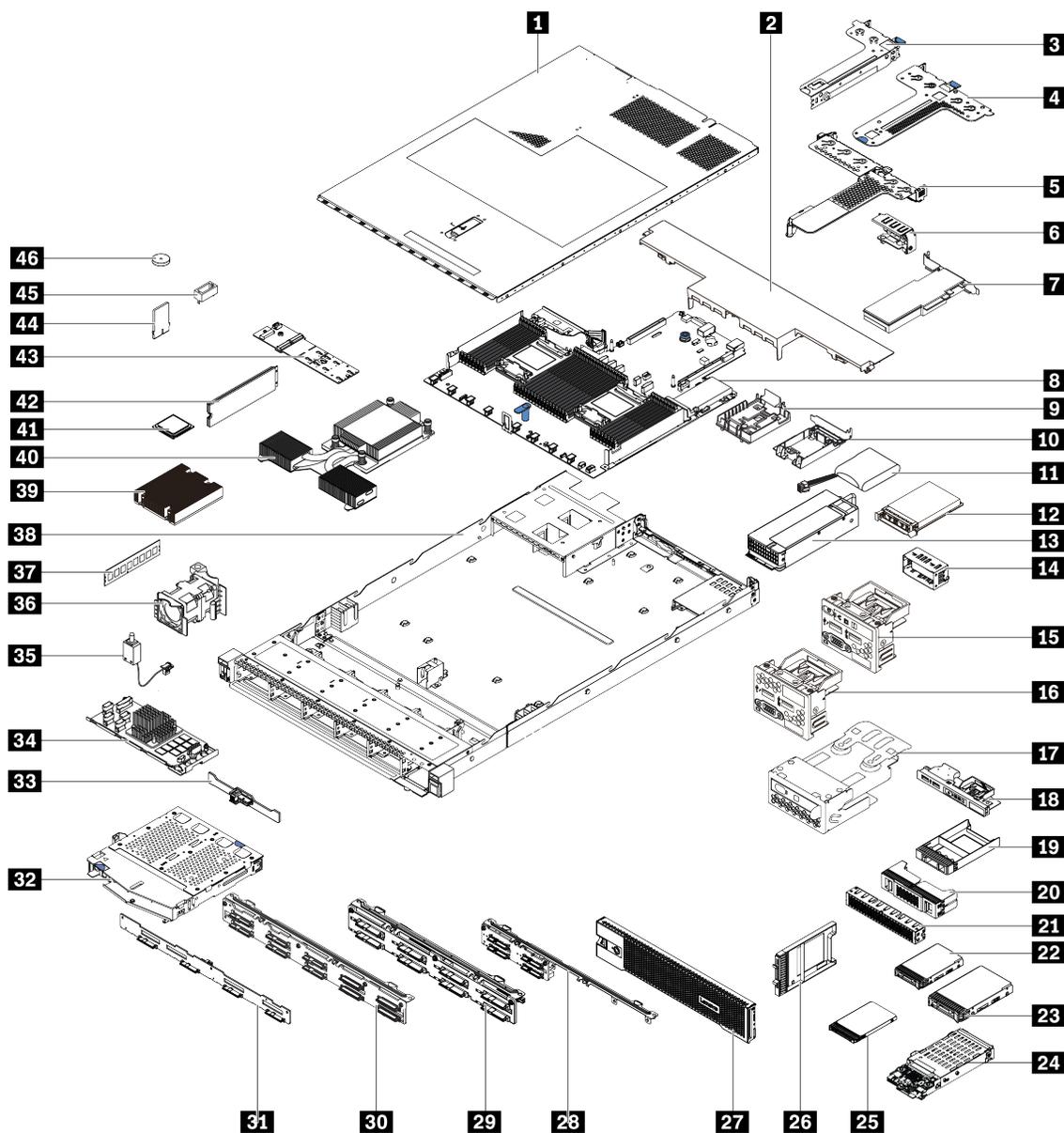


Table 16. Parts list

Index	Description	Tier 1 CRU	Tier 2 CRU	FRU	Consumable and Structural parts
<b>1</b>	Top cover	✓			
<b>2</b>	Standard air baffle				✓
<b>3</b>	Riser assembly (LP)	✓			
<b>4</b>	Riser assembly (LP+LP)	✓			
<b>5</b>	Riser assembly (LP+FH)	✓			
<b>6</b>	Rearwall bracket				✓

Table 16. Parts list (continued)

Index	Description	Tier 1 CRU	Tier 2 CRU	FRU	Consumable and Structural parts
7	PCIe adapter	√			
8	System board			√	
9	RAID super capacitor holder (on chassis)				√
10	RAID super capacitor holder (in riser cage)				√
11	RAID super capacitor	√			
12	OCP 3.0 Ethernet adapter	√			
13	Power supply unit	√			
14	Power supply unit filler				√
15	Front I/O assembly with diagnostics panel (right)	√			
16	Front I/O assembly	√			
17	LCD diagnostics panel assembly	√			
18	Front I/O assembly with diagnostics panel (top)	√			
19	1 x 2.5-inch drive bay filler				√
20	2 x 2 2.5-inch drive bay filler				√
21	2 x 32.5-inch drive bay filler				√
22	2.5-inch drive	√			
23	3.5-inch drive	√			
24	7 mm drive assembly (cage +backplanes)	√			
25	7mm drive	√			
26	7mm drive bay filler				√
27	Security bezel	√			
28	4 x 2.5-inch front drive backplane	√			
29	8 x 2.5-inch front drive backplane	√			
30	10 x 2.5-inch front drive backplane	√			
31	4 x 3.5-inch front drive backplane	√			
32	2 x 2.5-inch rear drive cage	√			
33	2 x 2.5-inch rear drive backplane	√			
34	Internal RAID module	√			
35	Intrusion switch cable	√			

Table 16. Parts list (continued)

Index	Description	Tier 1 CRU	Tier 2 CRU	FRU	Consumable and Structural parts
36	Fan module	√			
37	Memory module	√			
38	Chassis			√	
39	Standard heat sink			√	
40	Performance heat sink (T-shape)			√	
41	Processor			√	
42	M.2 drive	√			
43	M.2 adapter	√			
44	M.2 retainer clip	√			
45	TPM adapter (for Chinese Mainland only)			√	
46	CMOS battery (CR2032)				√

## Power cords

Several power cords are available, depending on the country and region where the server is installed.

To view the power cords that are available for the server:

1. Go to: <http://dcsc.lenovo.com/#/>
2. Click **Preconfigured Model** or **Configure to order**.
3. Enter the machine type and model for your server to display the configurator page.
4. Click **Power** → **Power Cables** to see all line cords.

### Notes:

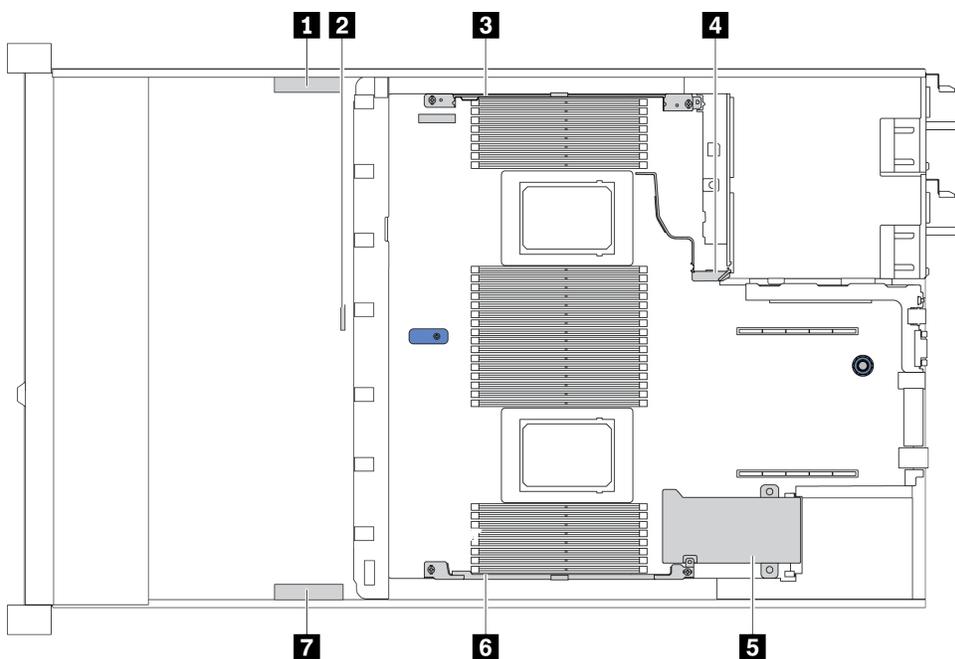
- For your safety, a power cord with a grounded attachment plug is provided to use with this product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.
- Power cords for this product that are used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).
- For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum of 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.
- For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum of 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.
- For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.
- Power cords for a specific country or region are usually available only in that country or region.

## Chapter 3. Internal cable routing

This section provides internal cable routing information for the server.

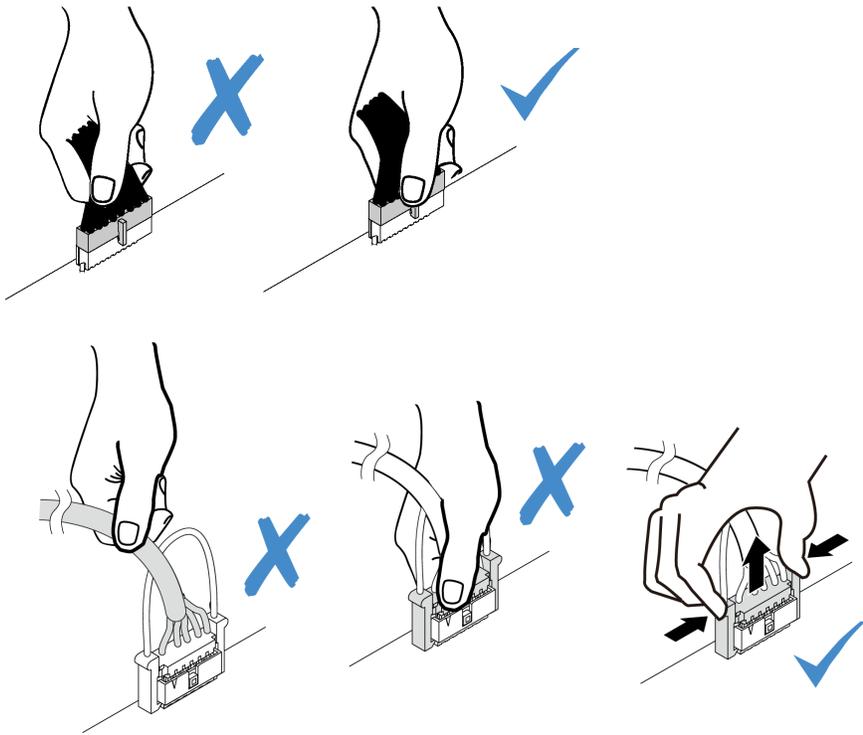
**Attention:** Some of the components in the server have internal cables and cable connectors. Read the following guidelines carefully before you connect any cables:

- Power off the server before you connect or disconnect any internal cables.
- See the documentation that comes with any external devices for additional cabling instructions. It might be easier for you to route cables before you connect the devices to the server.
- Cable identifiers of some cables are printed on the cables that come with the server and optional devices. Use these identifiers to connect the cables to the correct connectors.
- Ensure that the relevant cables pass through the cable clips.



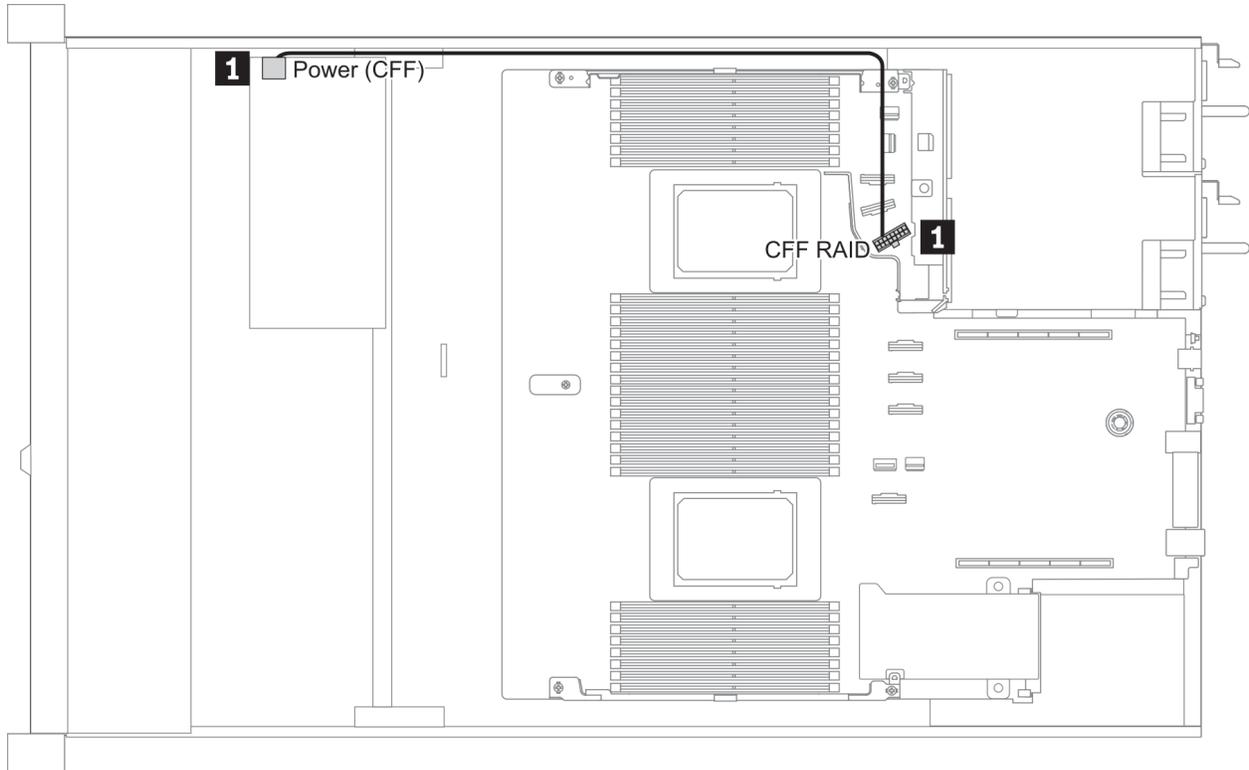
Cable holder	Route
<b>1 3 4</b>	Route to BP Pwr connector, Raid Pwr connector, and PCIe connectors (4, 5, 7, 8)
<b>2</b>	Route to intrusion switch cable
<b>5 6 7</b>	Route to FIO connector, LCD external connector, M.2 Pwr connector, VGA 2 connector, Front USB connector, PCIe connectors (1-3, 6, 9, 10), and Raid/HBA connectors

**Note:** Disengage all latches, release tabs, or locks on cable connectors when you disconnect cables from the system board. Failing to release them before removing the cables will damage the cable sockets on the system board, which are fragile. Any damage to the cable sockets might require replacing the system board.



## CFF RAIR/HBA adapter cable routing

**Note:** The illustration only involves power cable routing, for signal cable routing of CFF RAID/HBA adapters, see [“2.5-inch/3.5-inch drive backplane cable routing \(signal\)”](#) on page 95



From	To
1 Power connector on the CFF RAID/HBA adapter	CFF RAID connector on the system board

## FIO cable routing

**Note:** The illustration shows the cabling scenario for server models with four 3.5-inch front drive bays. Location of each connector on the front of the server varies by models. For detailed location of front I/O components for different models, see “[Front view](#)” on page 49.

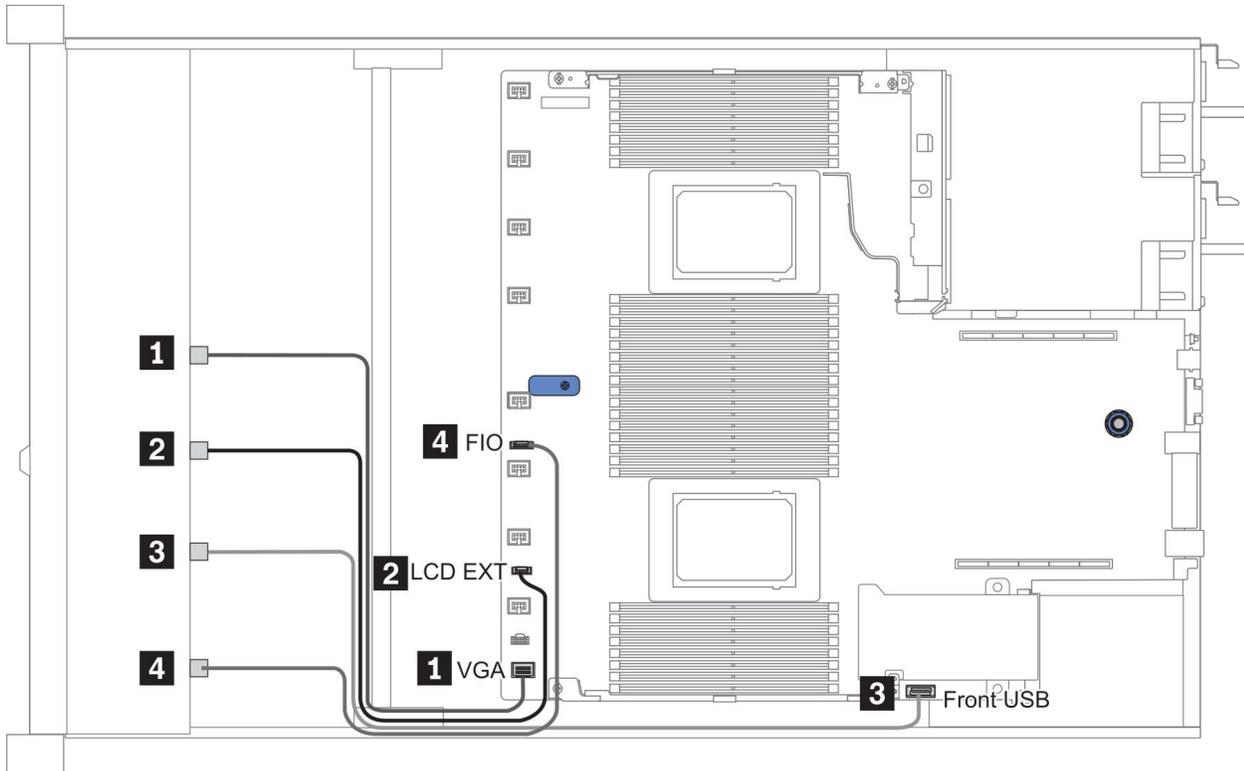


Figure 10. FIO cable routing

From	To
<b>1</b> VGA cable	VGA connector on the system board
<b>2</b> LCD external diagnostics handset cable	LCD EXT connector on the system board
<b>3</b> USB cable	Front USB connector on the system board
<b>4</b> Front diagnostic panel cable	FIO connector on the system board

## Intrusion switch cable routing

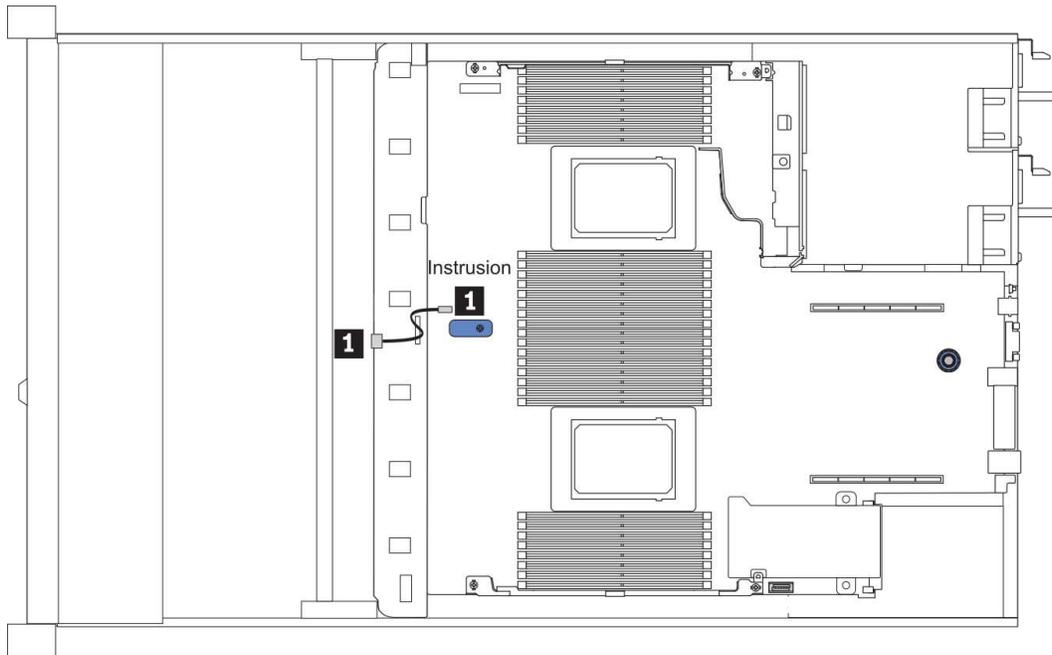
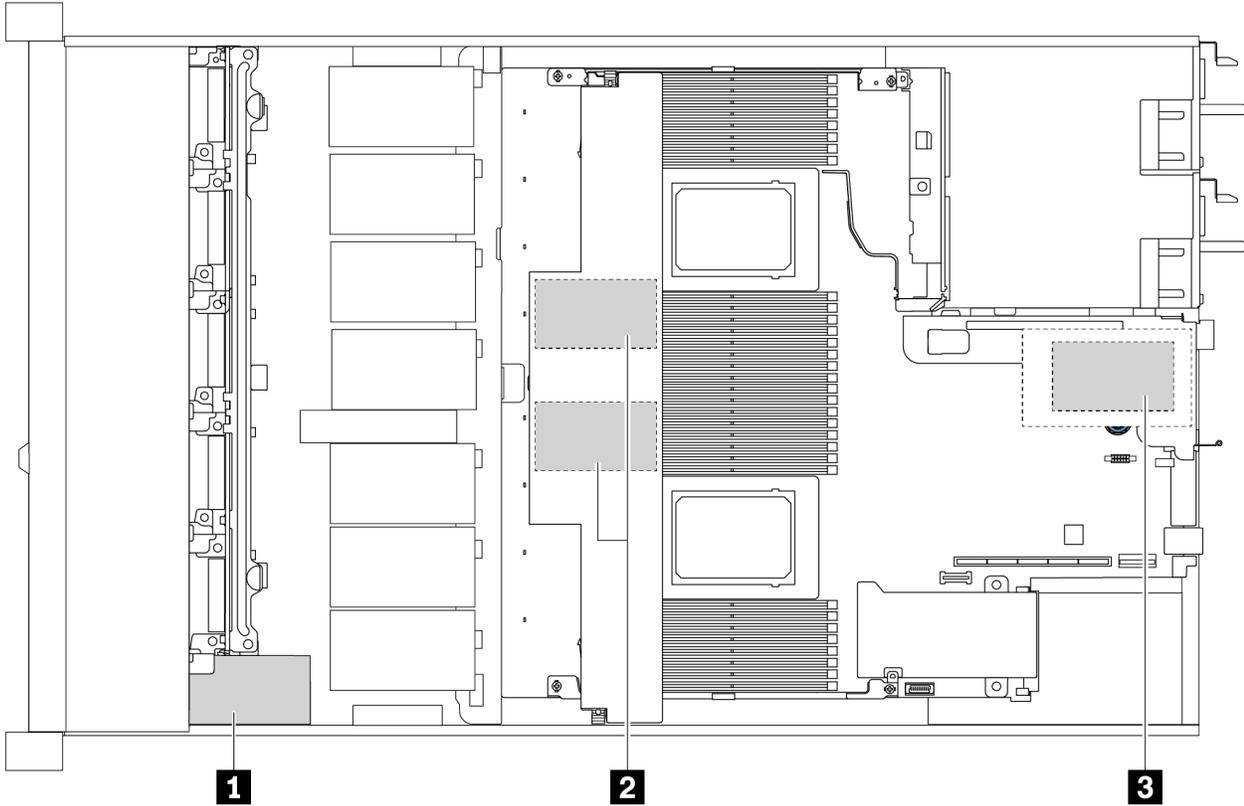


Figure 11. Intrusion switch cable routing

From	To
1 Intrusion switch cable on the fan cage	Intrusion switch connector on the system board

## Super capacitor cable routing

### RAID super capacitor module location



<b>1</b>	Super capacitor on the chassis
<b>2</b>	Super capacitors in the air baffle
<b>3</b>	Super capacitors in riser 3 assembly

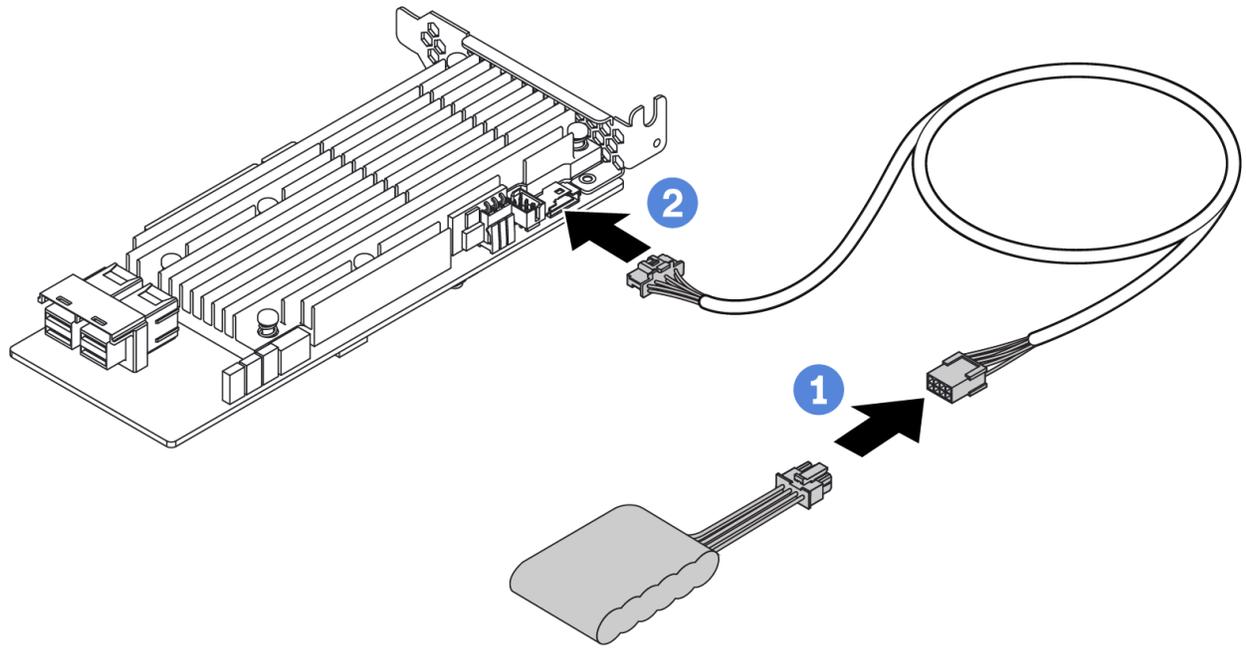


Figure 12. Super capacitor cable routing

## 7mm drive backplane cable routing (power & signal)

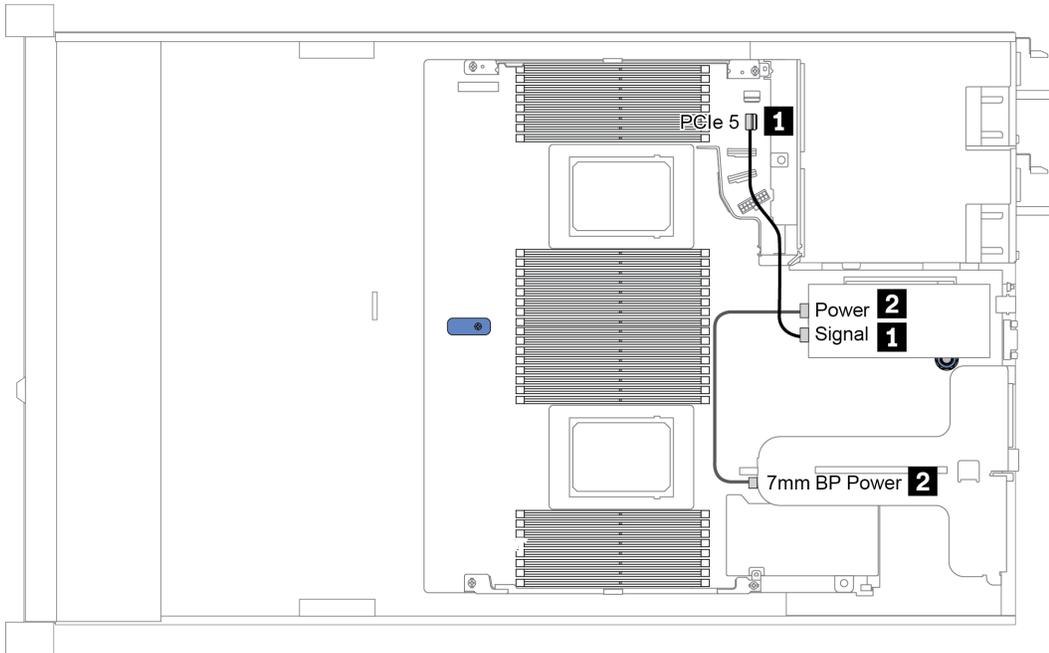


Figure 13. 7mm cable routing

From	To
<b>1</b> 7mm signal cable	PCIe connector 5 on the system board
<b>2</b> Power cable	7mm power connector on riser 1 assembly

## M.2 drive backplane cable routing (power & signal)

### Notes:

- M.2 drives can be installed on the chassis (scenario 1) or 3.5-inch front drive cage (scenario 2). The figure illustrates cable connections in scenario 1. The cable connections for the other scenario is the same.
- M.2 signal cable can be connected to both PCIe connector 1 or PCIe connector 4 on the system board. The illustration shows the general scenario, the signal cable needs to be connected to PCIe connector 4 only when your server is configured with one of the following front drive backplanes:
  - 10 x 2.5" (10 AnyBay)
  - 10 x 2.5" (10 NVMe)
  - 10 x 2.5" (8AnyBay+2NVMe)

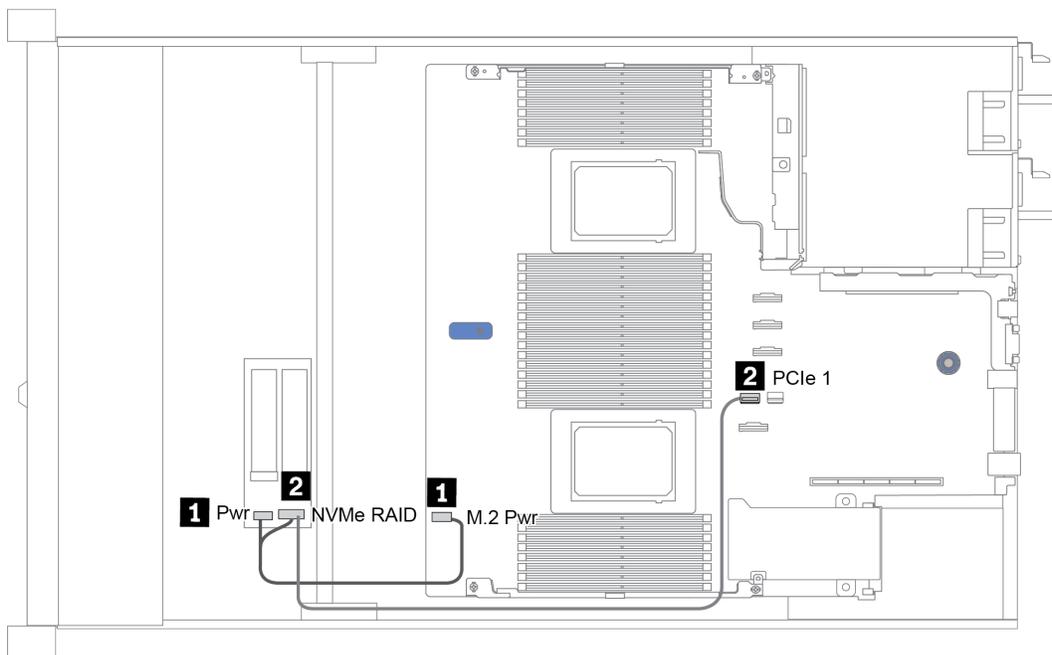
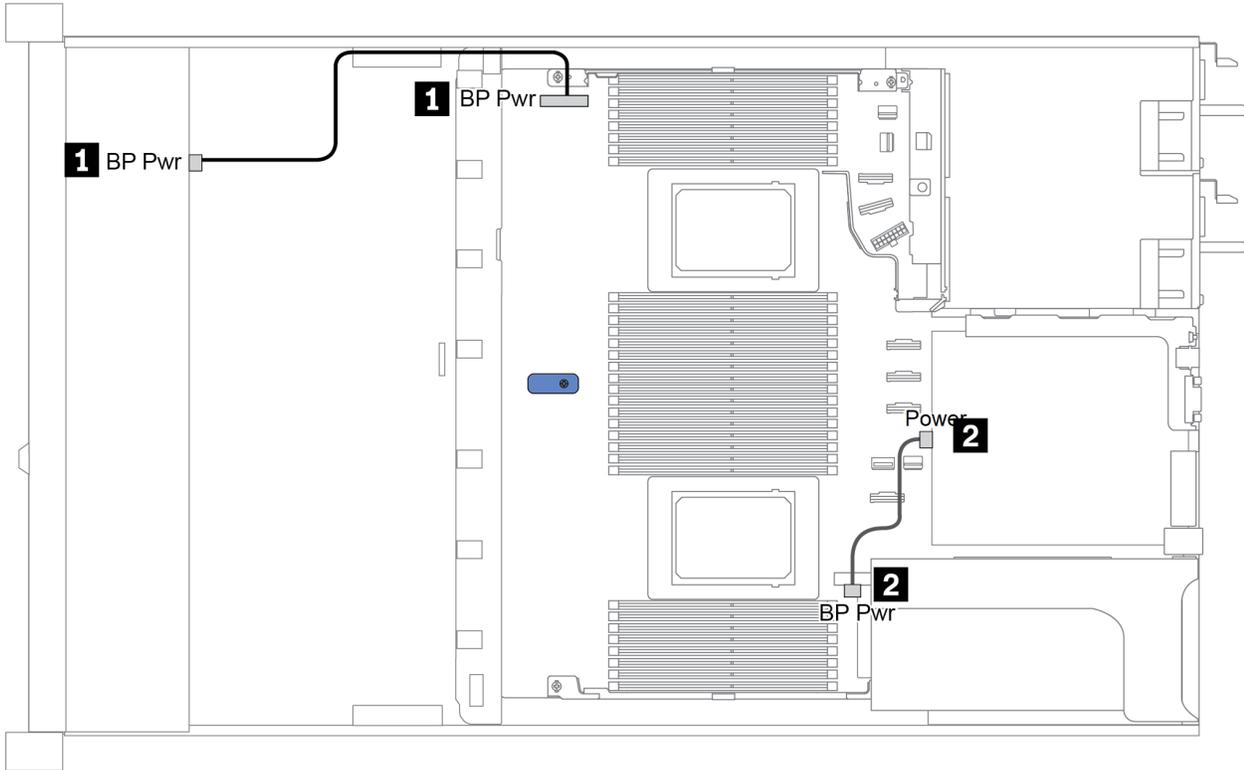


Figure 14. M.2 cable routing

From	To
<b>1</b> Power cable	M.2 power connector on the system board
<b>2</b> M.2 signal cable	PCIe connector 1 on the system board

## 2.5-inch/3.5-inch drive backplane cable routing (power)

Power cable routing for 2.5-inch or 3.5-inch drive backplanes



From	To
<b>1</b> Power connector on the front drive backplane	BP power connector on the system board
<b>2</b> Power connector on the rear drive backplane	Power connector on riser card on riser 1 assembly

---

## 2.5-inch/3.5-inch drive backplane cable routing (signal)

**Note:** The cable routing figures in the following sections illustrate only PCIe Gen 4 adapters, the routing is similar for Gen 3 adapters.

- [“2.5-inch\(4 SAS/SATA\)” on page 96](#)
- [“2.5-inch \(8 SAS/SATA\)” on page 97](#)
- [“3.5-inch\(4 SAS/SATA\)” on page 119](#)
- [“3.5-inch\(4 AnyBay\)” on page 123](#)
- [“2.5-inch\(10 AnyBay\)” on page 102](#)
- [“2.5-inch \(10 NVMe\)” on page 106](#)
- [“2.5-inch \(10 SAS/SATA\)” on page 100](#)
- [“2.5-inch\(8 AnyBay + 2 NVMe\)” on page 110](#)
- [“2.5-inch \(6 SAS/SATA + 4 AnyBay\)” on page 112](#)
- [“2.5-inch \(6 SAS/SATA + 4 NVMe\)” on page 116](#)
- [“2.5-inch \(6 SAS/SATA + 2 AnyBay + 2 NVMe\)” on page 117](#)

## 2.5-inch(4 SAS/SATA)

Configuration	Storage controller	
	Qty.	Type
Config. 1		
Config. 2	1	SFF 8i RAID/HBA

Depending on your server configurations, refer to one of the following sections for cable routing information.

### Configuration 1, 2:

Front BP: 4 x 2.5" SAS/SATA BP

Config.	Front BP	System board	Storage controller
			SFF 8i RAID/HBA
1	SAS 0	PCIe 2	
2	SAS 0, SAS 1		Gen 4: C 0 Gen 3: C 0, C 1

### Example

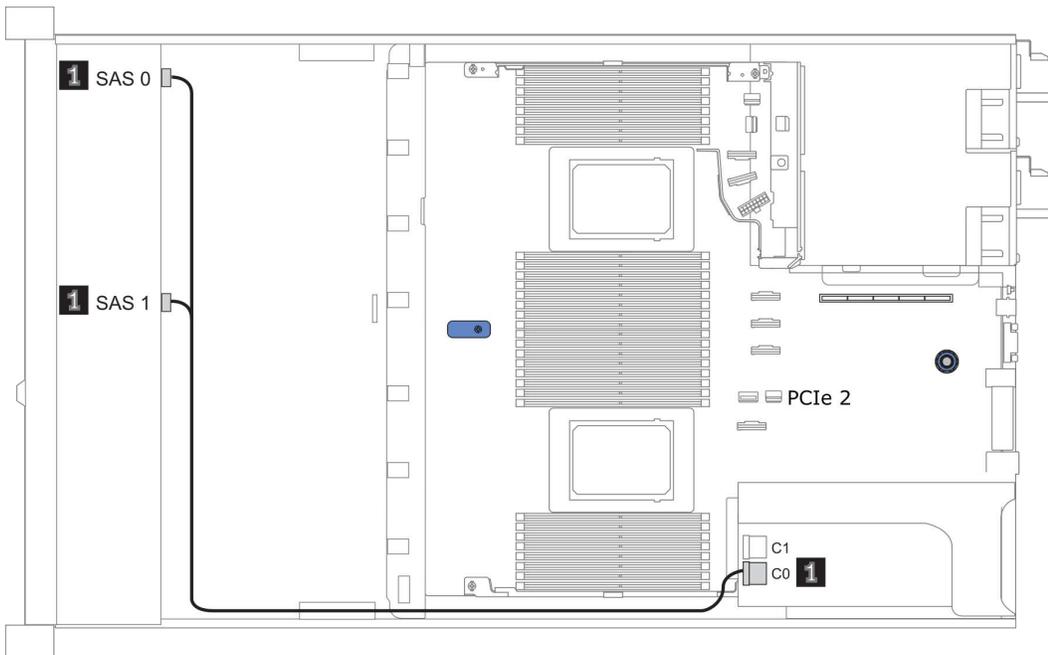


Figure 15. Configuration 2

## 2.5-inch (8 SAS/SATA)

Configuration	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1				
Config. 2			1	SFF 8i RAID/HBA
Config. 3			1	CFF 16i RAID/HBA
Config. 4	1	2 x 2.5" SAS/SATA		
Config. 5	1	2 x 2.5" SAS/SATA	1	SFF 8i RAID
Config. 6	1	2 x 2.5" SAS/SATA	1	CFF 16i RAID/HBA

Depending on your server configurations, refer to one of the following sections for cable routing information.

- [“Configuration 1 – 3: front BP” on page 98](#)
- [“Configuration 4 – 6: front BP + rear BP” on page 99](#)

**Configuration 1 – 3:**

Front BP: 8 x 2.5" SAS/SATA BP

Con-fig.	Front BP	System board	Storage controller	
			SFF 8i RAID/HBA	CFF 16i RAID/HBA
1	SAS 0	PCIe 2		
	SAS 1	PCIe 4		
2	SAS 0, SAS 1		Gen 4: C 0 Gen 3: C 0, C 1	
3	SAS 0			C 0
	SAS 1			C 1
		PCIe 8		MB

**Example**

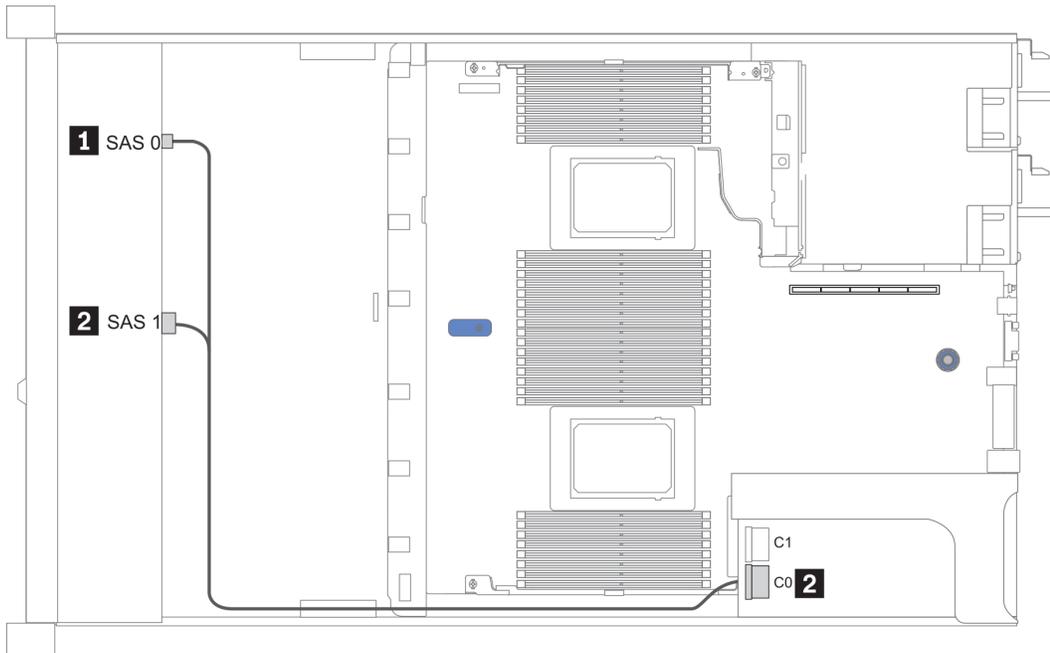


Figure 16. Configuration 2

**Configuration 4 – 6:**

Front BP: 8 x 2.5" SAS/SATA BP

Rear BP: 2 x 2.5" SAS/SATA BP

Con-fig.	Front BP	Rear BP	System board	Storage controller	
				SFF 8i RAID	CFF 16i RAID/HBA
4	SAS 0		PCIe 2		
	SAS 1		PCIe 4		
		SAS	PCIe 5		
5	SAS 0, SAS 1			Gen 4: C 0 Gen 3: C 0, C 1	
		SAS	PCIe 5		
6	SAS 0				C 0
	SAS 1				C 1
			PCIe 8		MB
		SAS			C 3

**Example**

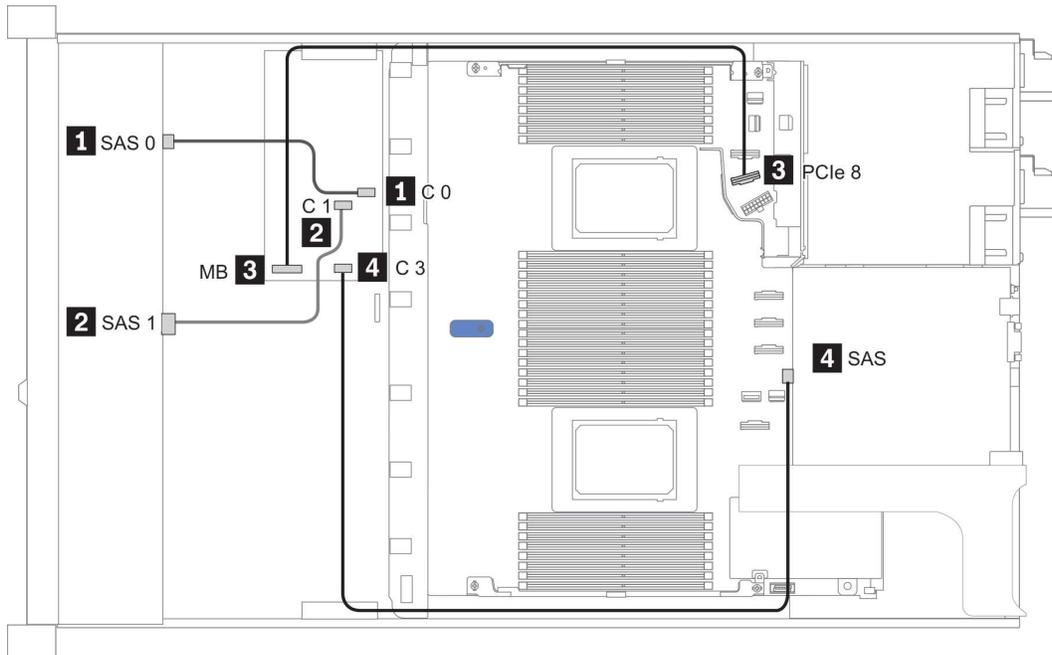


Figure 17. Configuration 6

## 2.5-inch (10 SAS/SATA)

Configuration	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1			1	SFF 16i RAID/HBA
Config. 2	1	2 x 2.5" SAS/SATA		
Config. 3	1	2 x 2.5" SAS/SATA	1	SFF 16i RAID/HBA

### Configuration 1:

Front BP: [6 x 2.5" SAS/SATA + 4 x 2.5" Anybay] BP used as pure SAS/SATA BP

Table 17. Cable routing information for configuration 1

Config.	Front BP	Storage controller
		SFF 16i RAID/HBA
1	SAS 0, SAS 1	Gen 4: C 0 Gen 3: C 0, C 1
	SAS 2	Gen 4: C 1 Gen 3: C 2

### Example

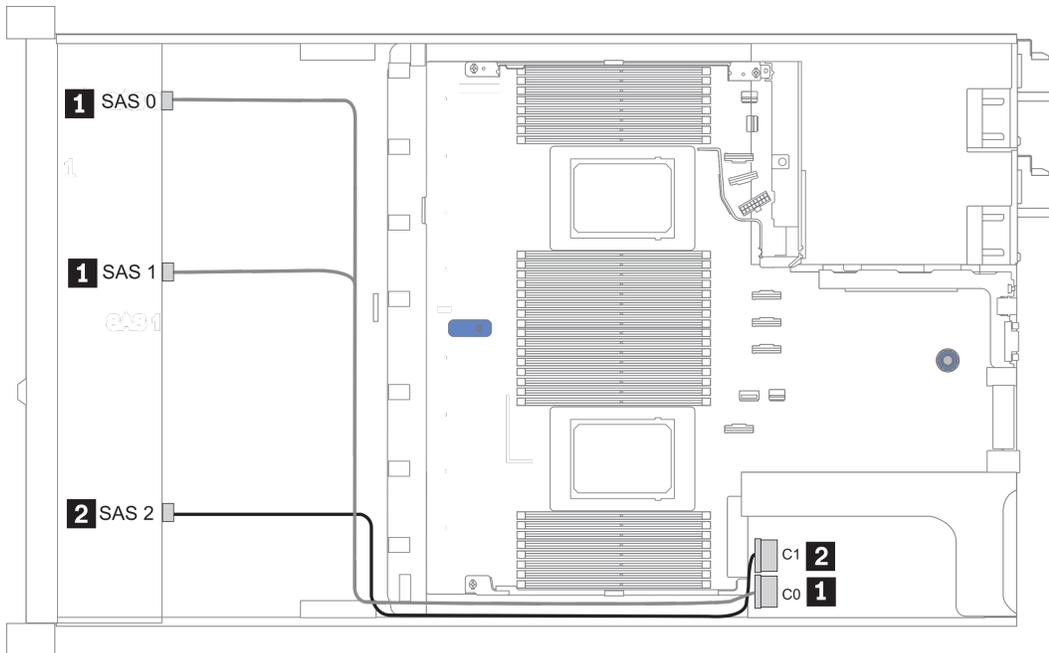


Figure 18. Configuration 1

### Configurations 2-3:

Front BP: [6 x 2.5" SAS/SATA + 4 x 2.5" Anybay] BP used as pure SAS/SATA BP

Rear BP: 2 x 2.5" SAS/SATA BP

Table 18. Configurations 2-3

Config.	Front BP	Rear BP	System board	Storage controller
				SFF 16i RAID/HBA
2	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS 0		PCIe 2	
	SAS 1		PCIe 4	
	SAS 2	SAS	PCIe 5	
3	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS 0, SAS 1			Gen 4: C 0 Gen 3: C 0, C 1
	SAS 2	SAS		Gen 4: C 1 Gen 3: C 2, C 3

**Example**

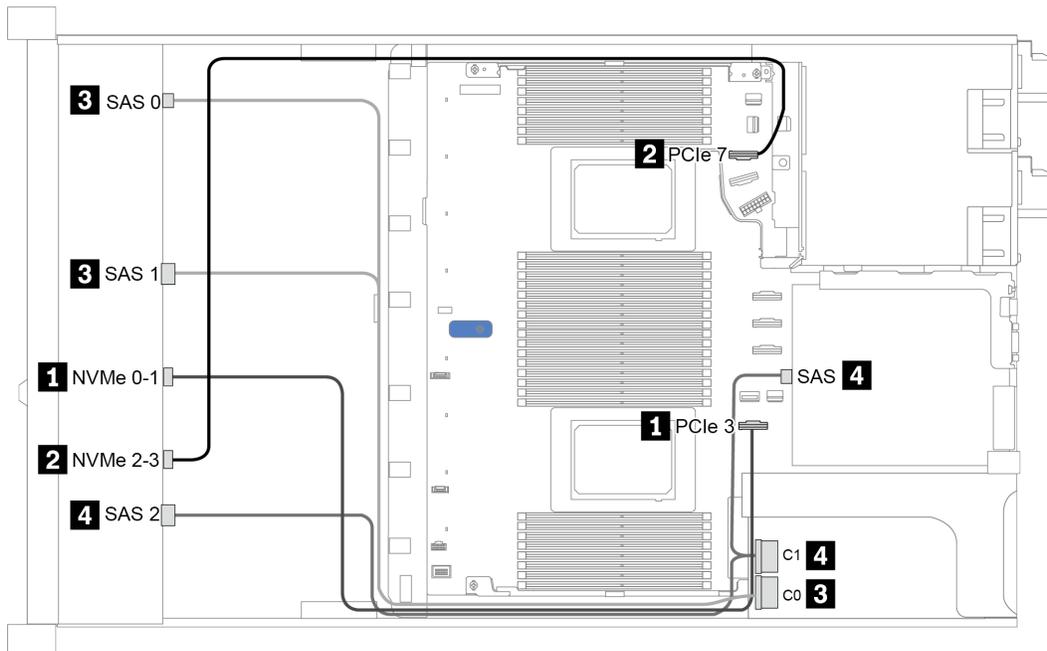


Figure 19. Configuration 3

## 2.5-inch(10 AnyBay)

Configuration	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1			1	SFF 16i RAID/HBA
Config. 2			1	SFF 16i RAID(Tri-mode)
Config. 3	1	2 x 2.5" SAS/SATA	1	SFF 16i RAID/HBA
Config. 4	1	2 x 2.5" NVMe	1	SFF 16i RAID/HBA

Depending on your server configurations, refer to one of the following sections for cable routing information.

- [“Configuration 1 – 2: front BP” on page 103](#)
- [“Configuration 3 – 4: front BP + rear BP” on page 104](#)

**Configuration 1:**

Front BP: 10 x 2.5" AnyBay BP

**Note:** Connectors marked with asterisk (\*) are NOT needed for single CPU configuration.

Con-fig.	Front BP	System board	Storage controller	
			SFF 16i RAID/HBA	SFF 16i RAID(Tri-mode)
1	NVMe 0-1	PCIe 1, PCIe 2		
	NVMe 2-3	PCIe 3		
	*NVMe 4-5	*PCIe 7		
	*NVMe 6-7	*PCIe 8		
	*NVMe 8-9	*PCIe 6		
	SAS 0, SAS 1		Gen 4: C 0 Gen 3: C 0, C 1	
	SAS 2		Gen 3: C 2	
2	SAS 0, SAS 1			Gen 4: C 0
	SAS 2			Gen 4: C 1

**Example**

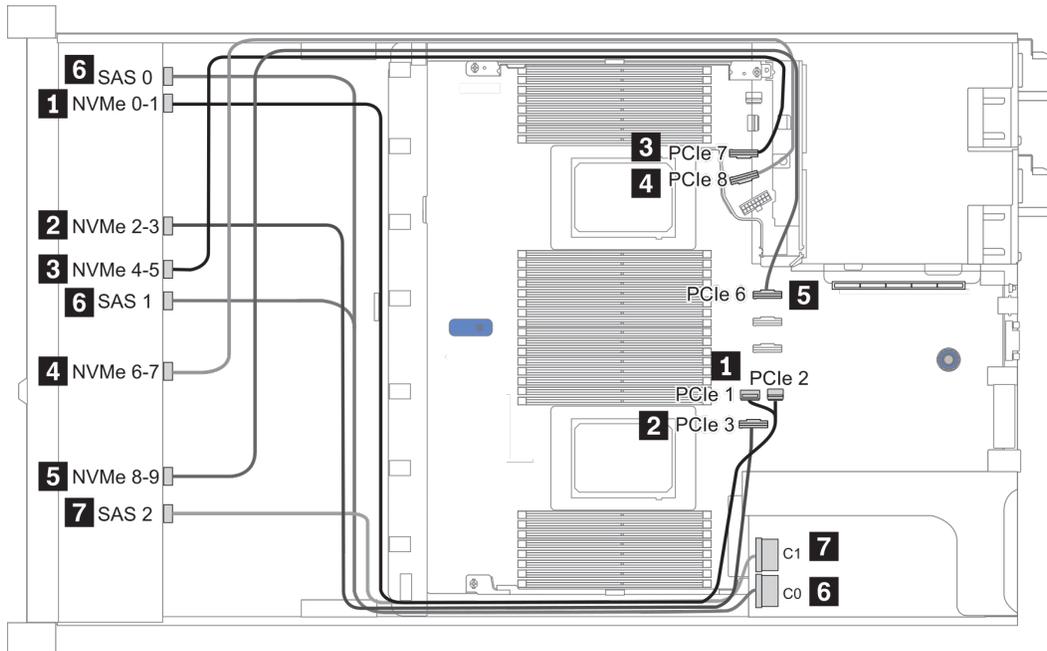


Figure 20. Configuration 1

**Configuration 2 – 3:**

Front BP: 10 x 2.5" AnyBay BP

Rear BP: 2 x 2.5" NVMe BP/ 2 x 2.5" SAS/SATA BP

Con-fig.	Front BP	Rear BP	System board	Storage controller
				SFF 16i RAID/HBA
3	NVMe 0-1		PCIe 1, PCIe 2	
	NVMe 2-3		PCIe 3	
	NVMe 4-5		PCIe 7	
	NVMe 6-7		PCIe 8	
	NVMe 8-9		PCIe 6	
	SAS 0, SAS 1			Gen 4: C 0 Gen 3: C 0, C 1
	SAS 2	SAS		Gen 4: C 1 Gen 3: C 2, C 3
4	NVMe 0-1		PCIe 1, PCIe 2	
	NVMe 2-3		PCIe 3	
	NVMe 4-5		PCIe 7	
	NVMe 6-7		PCIe 8	
	NVMe 8-9		PCIe 6	
	SAS 0, SAS 1			Gen 4: C 0 Gen 3: C 0, C 1
	SAS 2			Gen 4: C 1 Gen 3: C 2
		NVMe 0, NVMe 1	PCIe 9	

## Example

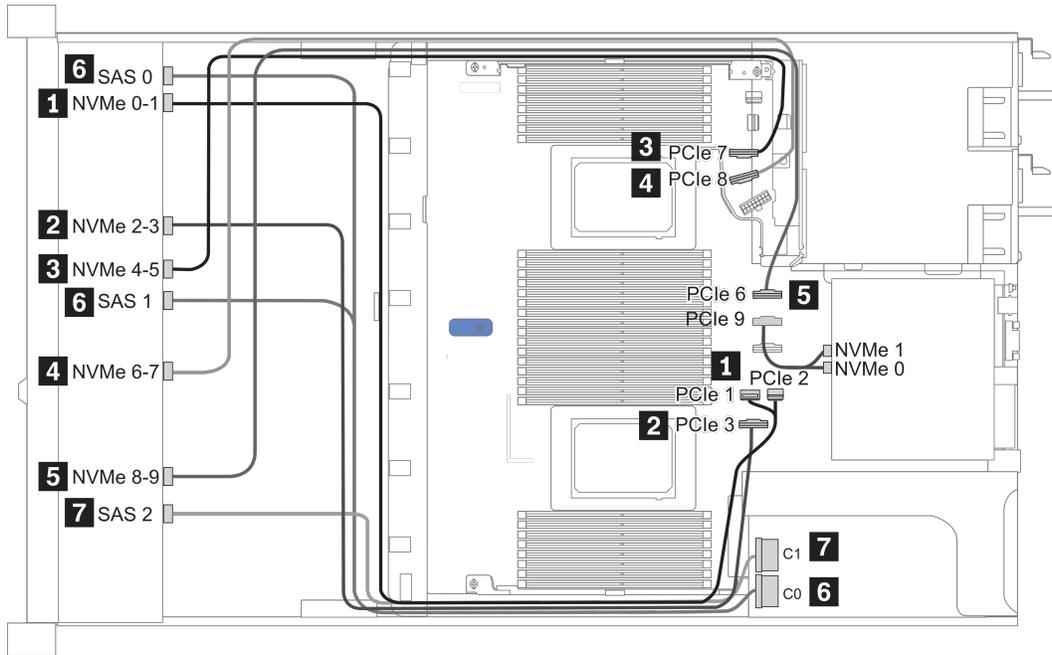


Figure 21. Configuration 3

## 2.5-inch (10 NVMe)

Configuration	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1				
Config. 2			2	NVMe Retimer card
Config. 3	1	2 x 2.5" NVMe		
Config. 4	1	2 x 2.5" SAS/SATA		

Depending on your server configurations, refer to one of the following sections for cable routing information.

- [“Configuration 1: front BP \(onboard connectors\)” on page 107](#)
- [“Configuration 2: front BP \(retimer card\)” on page 107](#)
- [“Configuration 3 – 4: front BP + rear BP” on page 109](#)

**Configuration 1:**

Front BP: 10 x 2.5" Anybay BP used as pure NVMe BP

Table 19. Cable routing information for configuration 1

Config.	Front BP	System board
1	NVMe 0-1	PCIe 1, PCIe 2
	NVMe 2-3	PCIe 3
	NVMe 4-5	PCIe 7
	NVMe 6-7	PCIe 8
	NVMe 8-9	PCIe 6

**Example**

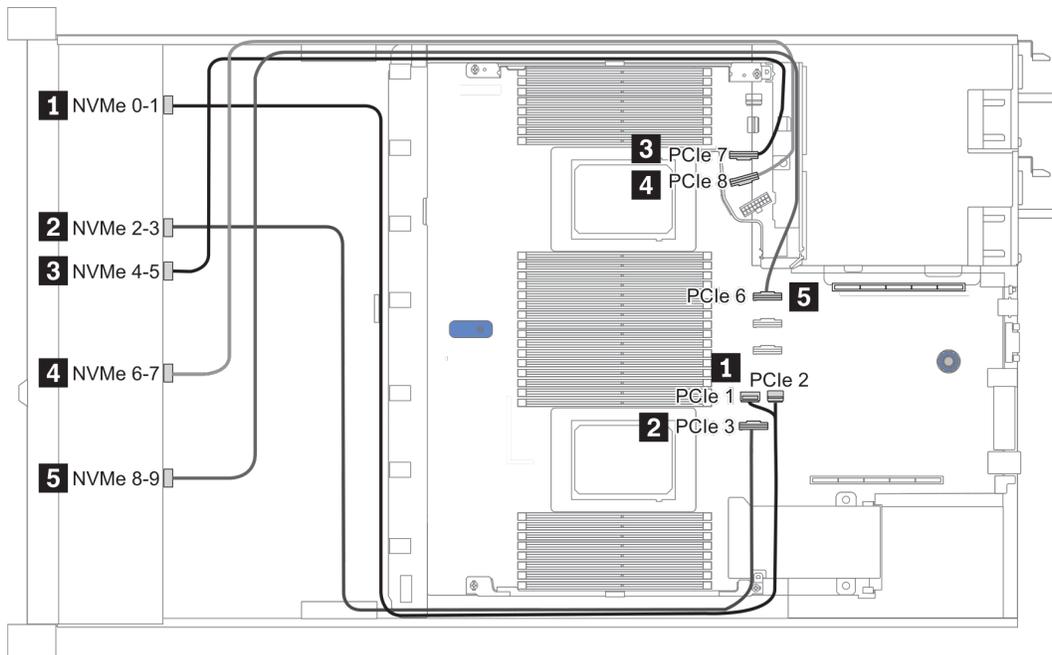


Figure 22. Configuration 1

**Configuration 2:**

Table 20. Cable routing information for configuration 2

Con-fig.	Front BP	System board	Retimer card	
			Slot 1	Slot 2
2	NVMe 0-1	PCIe 3		
	NVMe 2-3		C0	
	NVMe 4-5		C1	
	NVMe 6-7			C0
	NVMe 8-9			C1

**Example**

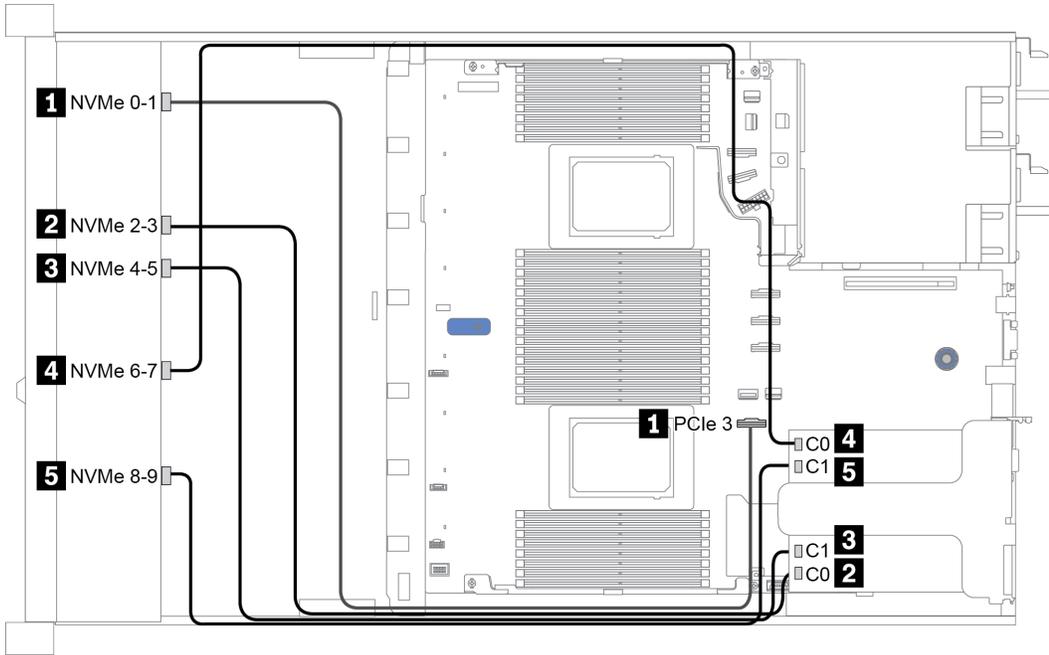


Figure 23. Configuration 2

**Configuration 3 – 4:**

Front BP: 10 x 2.5" Anybay BP used as pure NVMe BP

Rear BP: 2 x 2.5" NVMe BP/ 2 x 2.5" SAS/SATA BP

Config.	Front BP	Rear BP	System board
3	NVMe 0-1		PCIe 1, PCIe 2
	NVMe 2-3		PCIe 3
	NVMe 4-5		PCIe 7
	NVMe 6-7		PCIe 8
	NVMe 8-9		PCIe 6
			NVMe 0, NVMe 1
4	NVMe 0-1		PCIe 1, PCIe 2
	NVMe 2-3		PCIe 3
	NVMe 4-5		PCIe 7
	NVMe 6-7		PCIe 8
	NVMe 8-9		PCIe 6
			SAS

**Example**

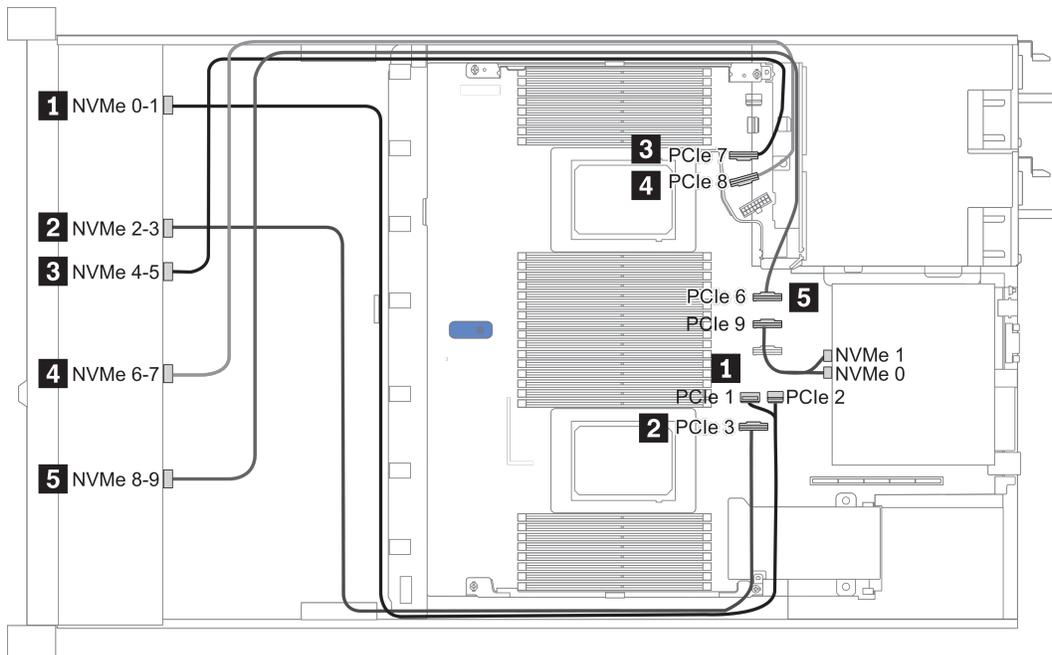


Figure 24. Configuration 3

## 2.5-inch(8 AnyBay + 2 NVMe)

Configuration	Storage controller	
	Qty.	Type
Config. 1		
Config. 2	1	SFF 8i RAID/HBA

### Configuration 1 – 2:

Front BP: 10 x 2.5" Anybay BP used as [8 x 2.5"AnyBay + 2 x 2.5"NVMe] BP

Config.	Front BP	System board	Storage controller
			SFF 8i RAID/HBA
1	NVMe 0-1	PCIe 1, PCIe 2	
	NVMe 2-3	PCIe 3	
	NVMe 4-5	PCIe 7	
	NVMe 6-7	PCIe 8	
	NVMe 8-9	PCIe 6	
	SAS 0	PCIe 4	
	SAS 1	PCIe 5	
2	NVMe 0-1	PCIe 1, PCIe 2	
	NVMe 2-3	PCIe 3	
	NVMe 4-5	PCIe 7	
	NVMe 6-7	PCIe 8	
	NVMe 8-9	PCIe 6	
	SAS 0, SAS 1		Gen 4: C 0 Gen 3: C 0, C 1

## Example

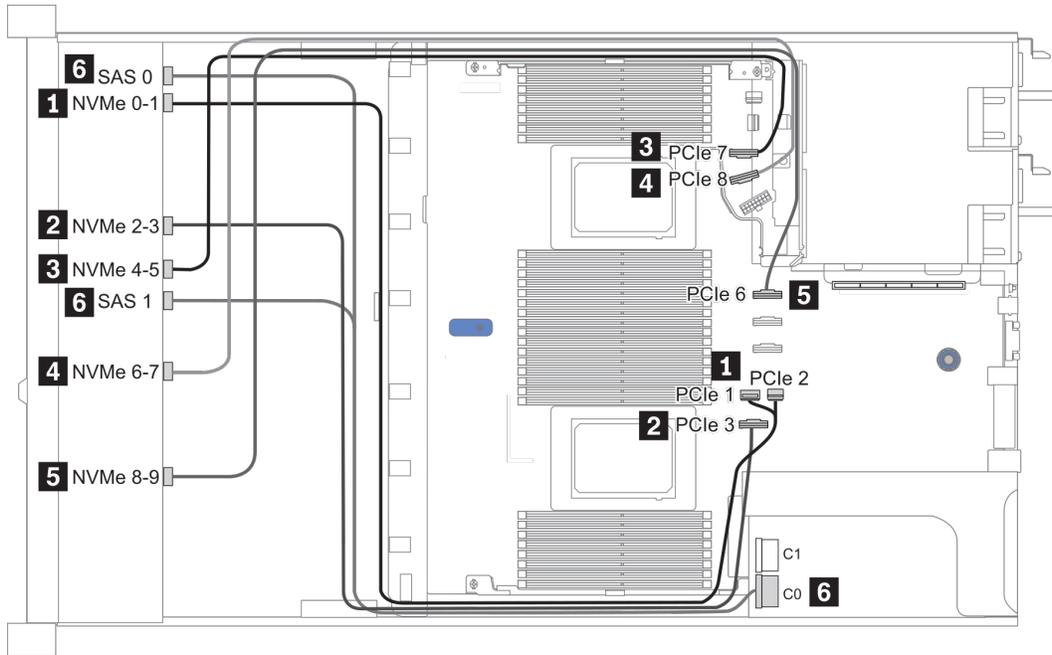


Figure 25. Configuration 1

## 2.5-inch (6 SAS/SATA + 4 AnyBay)

Configuration	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1				
Config. 2			1	SFF 16i RAID/HBA
Config. 3			1	CFF 16i RAID/HBA
Config. 4	1	2 x 2.5" SAS/SATA		
Config. 5	1	2 x 2.5" SAS/SATA	1	CFF 16i RAID/HBA

Depending on your server configurations, refer to one of the following sections for cable routing information.

- [“Configuration 1 – 3: front BP” on page 113](#)
- [“Configuration 4 – 5: front BP + rear BP” on page 115](#)

**Configuration 1 – 3:**

Front BP: [6 x 2.5" SAS/SATA + 4 x 2.5" Anybay] BP

Co- nfig.	Front BP	System board	Storage controller	
			SFF 16i RAID/HBA	CFF 16i RAID/HBA
1	NVMe 0-1	PCIe 3		
	NVMe 2-3	PCIe 7		
	SAS 0	PCIe 2		
	SAS 1	PCIe 4		
	SAS 2	PCIe 5		
2	NVMe 0-1	2 CPUs installed: PCIe 3 1 CPU installed: PCIe 1, PCIe 2		
	NVMe 2-3	2 CPUs installed: PCIe 7 1 CPU installed: PCIe 3		
	SAS 0, SAS 1		Gen 4: C 0 Gen 3: C 0, C 1	
	SAS 2		Gen 4: C 1 Gen 3: C 2	
3	NVMe 0-1	PCIe 3		
	NVMe 2-3	PCIe 7		
	SAS 0			C 0
	SAS 1			C 1
	SAS 2			C 2
		PCIe 8		MB

**Example**

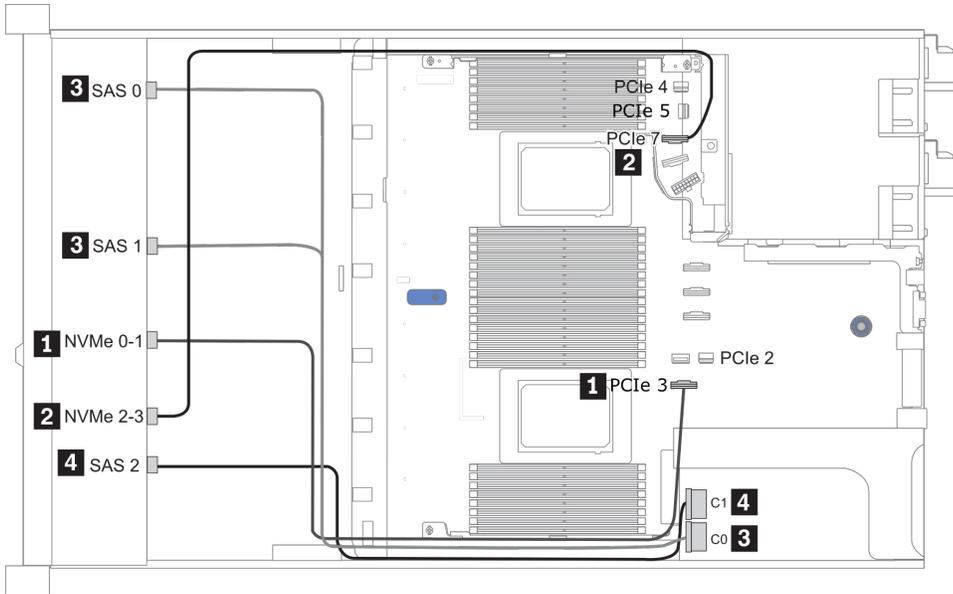


Figure 26. Configuration 2 (2 CPU installed)

**Configurations 4 – 5:**

Front BP: [6 x 2.5" SAS/SATA + 4 x 2.5" Anybay] BP

Rear BP: 2 x 2.5" SAS/SATA BP

Config.	Front BP	Rear BP	System board	Storage controller
				CFF 16i RAID/HBA
4	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS 0		PCIe 2	
	SAS 1		PCIe 4	
	SAS 2	SAS	PCIe 5	
5	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS 0			C 0
	SAS 1			C 1
	SAS 2			C 2
		SAS		C 3
			PCIe 8	MB

**Example**

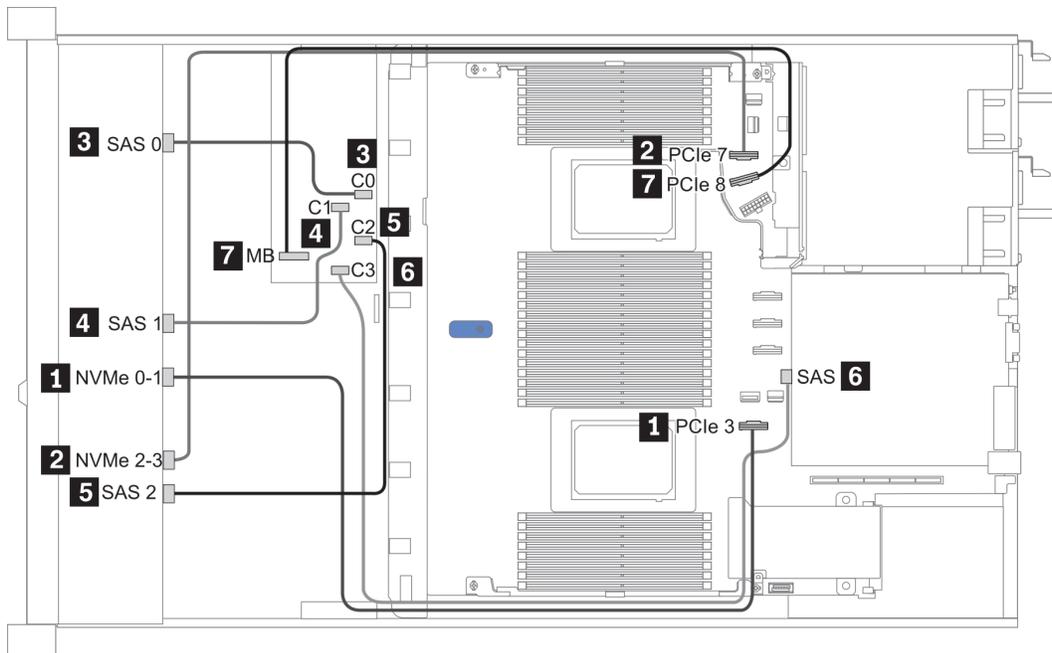


Figure 27. Configuration 5

## 2.5-inch (6 SAS/SATA + 4 NVMe)

Configuration	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1	1	2 x 2.5" SAS/SATA		

### Configuration 1

Front BP: [6 x 2.5" SAS/SATA + 4 x 2.5" Anybay] BP used as [6 x 2.5" SAS/SATA + 4 x 2.5" NVMe] BP

Config.	Front BP	Rear BP	System board
1	NVMe 0-1		PCIe 3
	NVMe 2-3		PCIe 7
	SAS 0		PCIe 2
	SAS 1		PCIe 4
			SAS

### Example

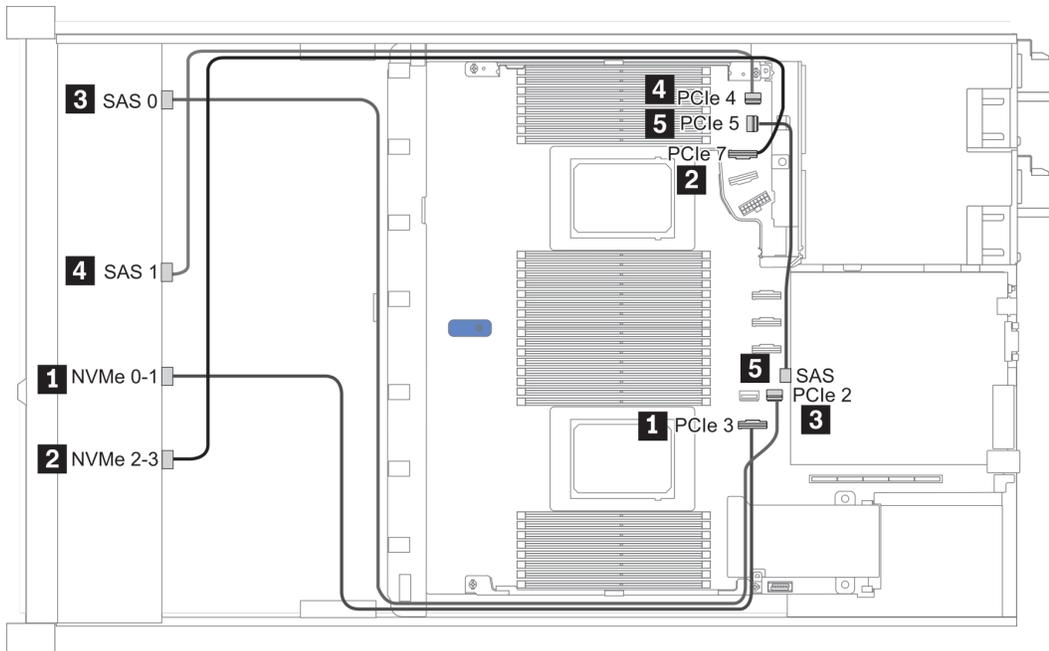


Figure 28. Configuration 1

## 2.5-inch (6 SAS/SATA + 2 AnyBay + 2 NVMe)

Configuration	Storage controller	
	Qty.	Type
Config. 1		
Config. 2	1	SFF 8i RAID/HBA
Config. 3	1	CFF 16i RAID/HBA

### Configuration 1 – 3

Front BP: [6 x 2.5" SAS/SATA + 4 x 2.5" Anybay] BP used as [6 x 2.5" SAS/SATA + 2 x 2.5" AnyBay + 2 x 2.5" NVMe] BP

Con-fig.	Front BP	System board	Storage controller	
			SFF 8i RAID/HBA	CFF 16i RAID/HBA
1	NVMe 0–1	PCIe 3		
	NVMe 2–3	PCIe 7		
	SAS 0	PCIe 2		
	SAS 1	PCIe 4		
2	NVMe 0–1	PCIe 3		
	NVMe 2–3	PCIe 7		
	SAS 0, SAS 1		Gen 4: C 0 Gen 3: C 0, C 1	
3	NVMe 0–1	PCIe 3		
	NVMe 2–3	PCIe 7		
	SAS 0			C 0
	SAS 1			C 1
		PCIe 8		MB

## Example

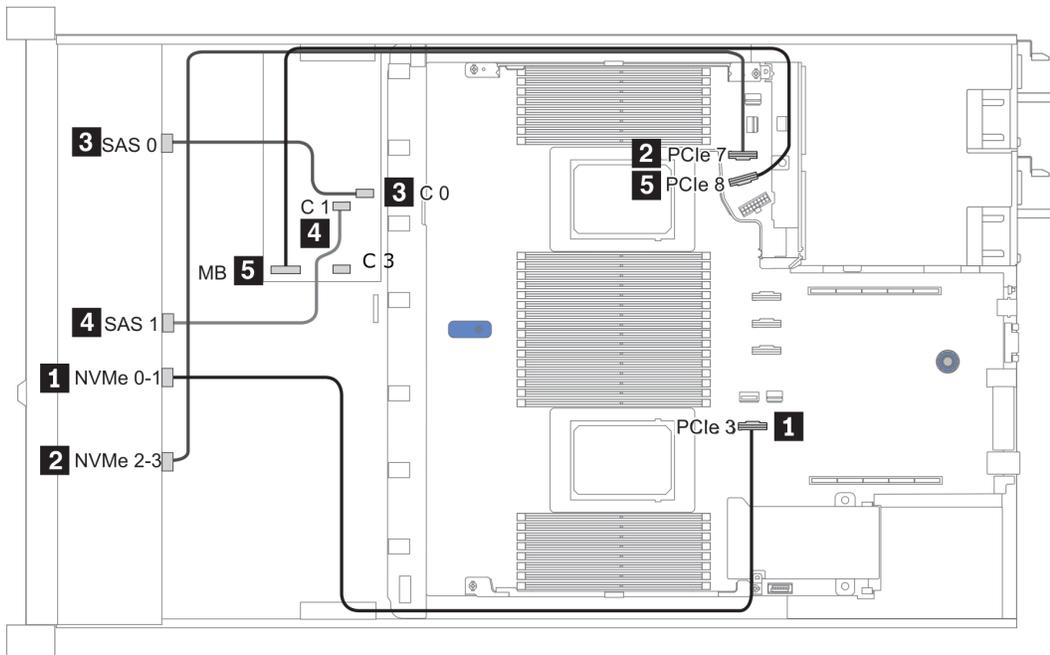


Figure 29. Configuration 3

### 3.5-inch(4 SAS/SATA)

Configuration option	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1				
Config. 2			1	SFF 8i RAID/HBA
Config. 3	1	2 x 2.5" SAS/SATA		
Config. 4	1	2 x 2.5" SAS/SATA	1	SFF 8i RAID/HBA
Config. 5	1	2 x 2.5" NVMe		
Config. 6	1	2 x 2.5" NVMe	1	SFF 8i RAID/HBA

Depending on your server configurations, refer to one of the following sections for cable routing information.

- [“Configuration 1, 2: front BP” on page 120](#)
- [“Configuration 3 – 6: front BP + rear BP” on page 121](#)

**Configuration 1, 2:**

Front BP: 4 x 3.5" SAS/SATA BP

Config.	Front BP	System board	Storage controller
			SFF 8i RAID/HBA
1	SAS	PCIe 2	
2	SAS		Gen 4: C 0 Gen 3: C 0, C 1

**Example**

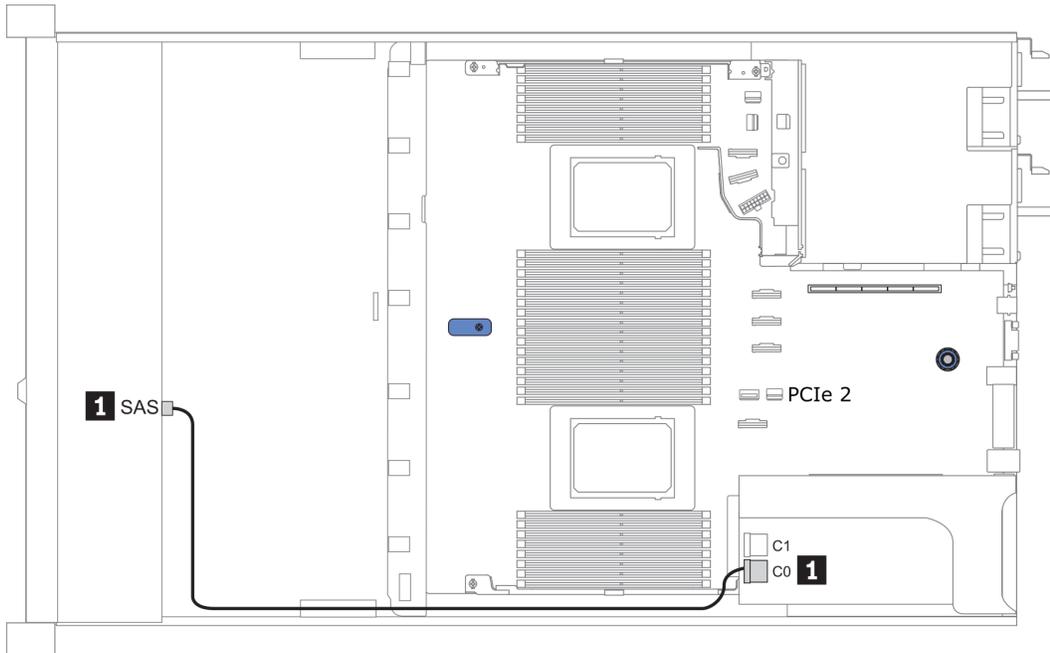


Figure 30. Configuration 2

**Configuration 3 – 6:**

Front BP: 4 x 3.5" SAS/SATA BP

Rear BP: 2 x 2.5" SAS/SATA BP

Config.	Front BP	Rear BP	System board	Storage controller
				SFF 8i RAID/HBA
3	SAS		PCle 2	
		SAS	PCle 5	
4	SAS	SAS		Gen 4: C 0 Gen 3: C 0, C 1

**Example**

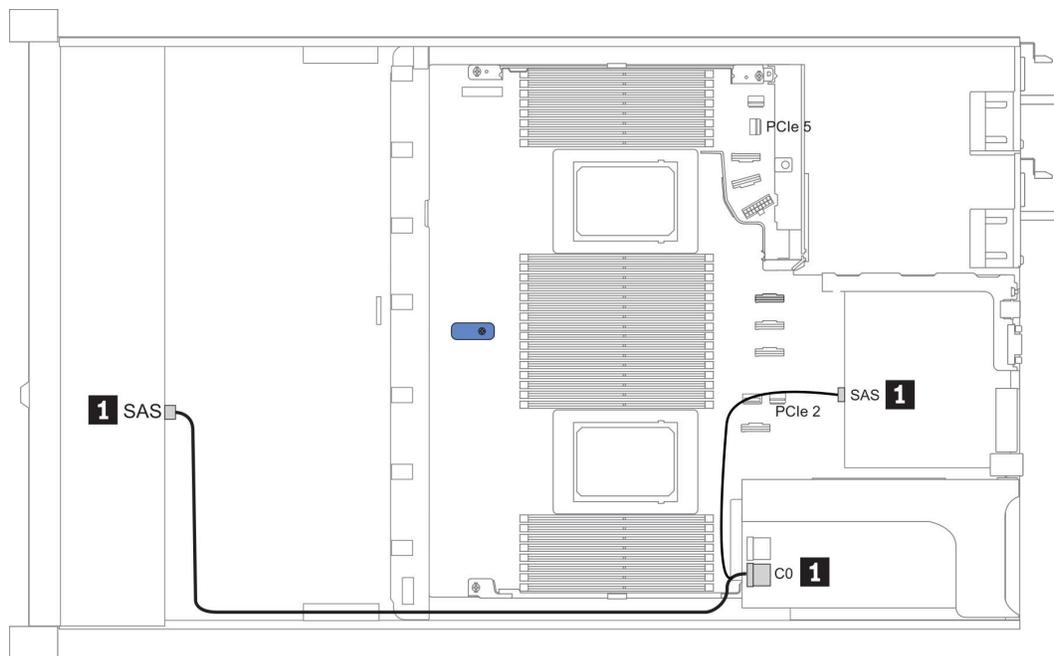


Figure 31. Configuration 4

Front BP: 4 x 3.5" SAS/SATA BP

Rear BP: 2 x 2.5" NVMe BP

Con-fig.	Front BP	Rear BP	System board	Storage controller
				SFF 8i RAID/HBA
5	SAS		PCIe 2	
		NVMe 0, NVMe 1	PCIe 6	
6	SAS			Gen 4: C 0 Gen 3: C 0, C 1
		NVMe 0, NVMe 1	PCIe 6	

**Example**

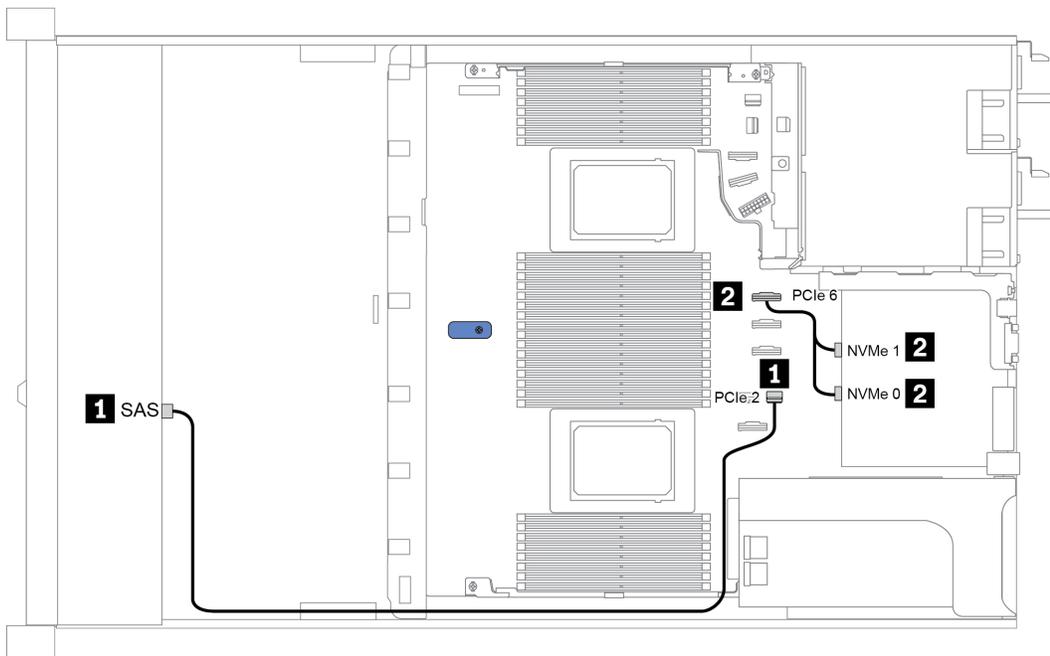


Figure 32. Configuration 5

### 3.5-inch(4 AnyBay)

Configuration	Rear BP		Storage controller	
	Qty.	Type	Qty.	Type
Config. 1				
Config. 2			1	SFF 8i RAID/HBA
Config. 3			1	SFF 16i RAID(Tri-mode)
Config. 4	1	2 x 2.5" SAS/SATA		
Config. 5	1	2 x 2.5" SAS/SATA	1	SFF 8i RAID/HBA
Config. 6	1	2 x 2.5" NVMe		
Config. 7	1	2 x 2.5" NVMe	1	SFF 8i RAID/HBA

Depending on your server configurations, refer to one of the following sections for cable routing information.

- [“Configuration 1 – 3: front BP” on page 124](#)
- [“Configuration 4 – 7: front BP + rear BP” on page 125](#)

**Configuration 1 – 3:**

Front BP: 4 x 3.5" AnyBay BP

Con-fig.	Front BP	System board	Storage controller	
			SFF 8i RAID/HBA	SFF 16i RAID(Tri-mode)
1	NVMe 0-1	PCIe 3		
	NVMe 2-3	PCIe 7		
	SAS	PCIe 2		
2	NVMe 0-1	PCIe 3		
	NVMe 2-3	PCIe 7		
	SAS		Gen 4: C 0 Gen 3: C 0, C 1	
3	SAS			Gen 4: C 0

**Example**

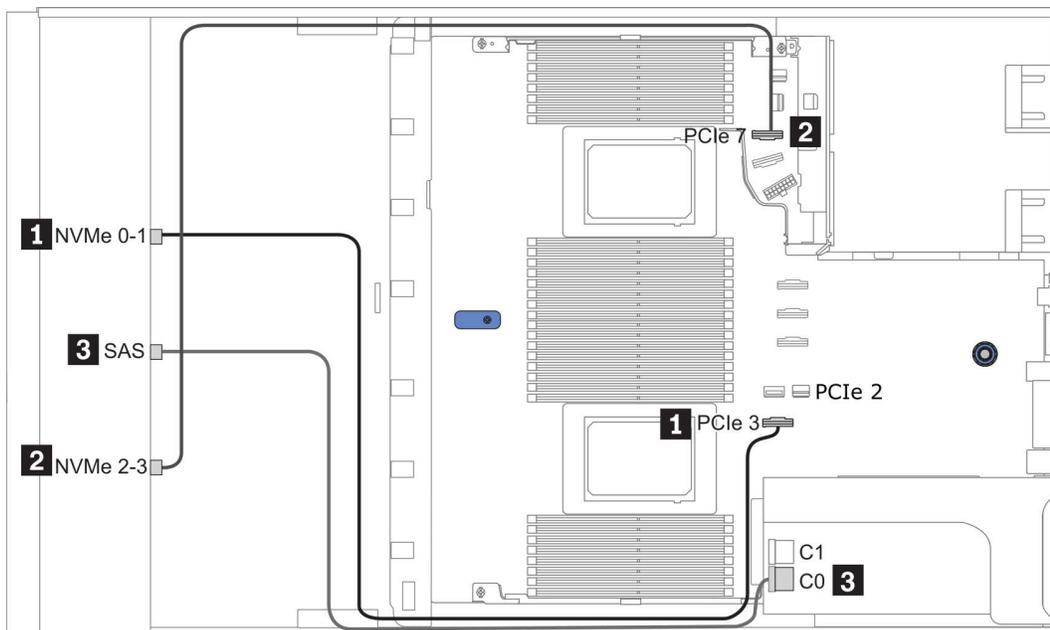


Figure 33. Configuration 2

**Configuration 4 – 7:**

Front BP: 4 x 3.5" AnyBay BP

Rear BP: 2 x 2.5" SAS/SATA BP

Con-fig.	Front BP	Rear BP	System board	Storage controller
				SFF 8i RAID/HBA
4	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS		PCIe 2	
		SAS	PCIe 5	
5	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS	SAS		Gen 4: C 0 Gen 3: C 0, C 1

**Example**

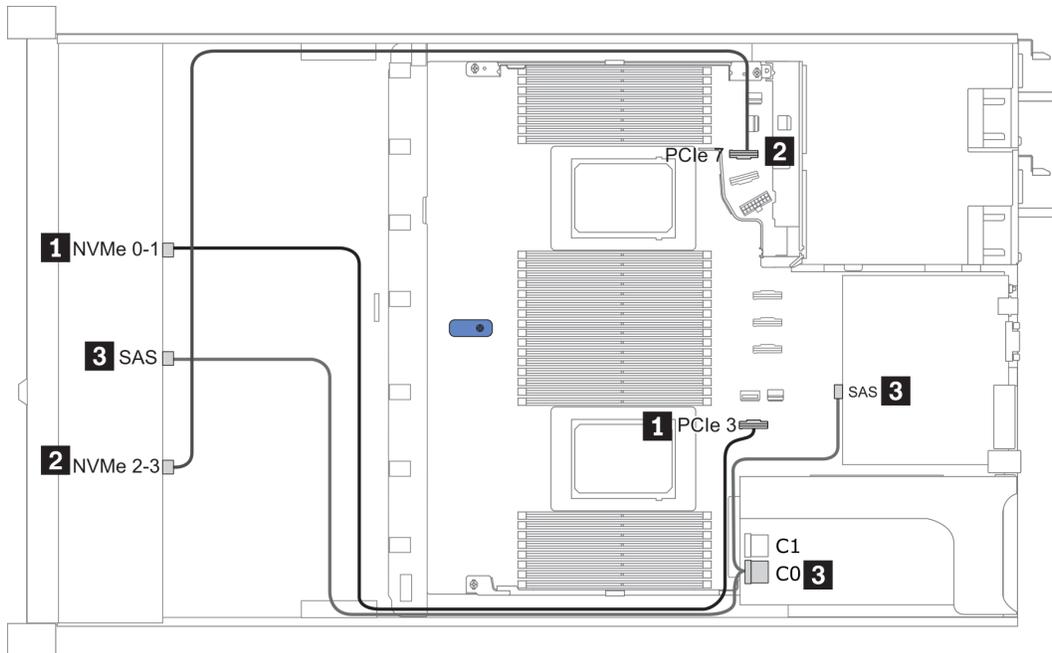


Figure 34. Configuration 5

Front BP: 4 x 3.5" AnyBay BP

Rear BP: 2 x 2.5" NVMe BP

Con-fig.	Front BP	Rear BP	System board	Storage controller
				SFF 8i RAID/HBA
6	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS		PCIe 2	
		NVMe 0, NVMe 1	PCIe 6	
7	NVMe 0-1		PCIe 3	
	NVMe 2-3		PCIe 7	
	SAS			Gen 4: C 0 Gen 3: C 0, C 1
		NVMe 0, NVMe 1	PCIe 6	

**Example**

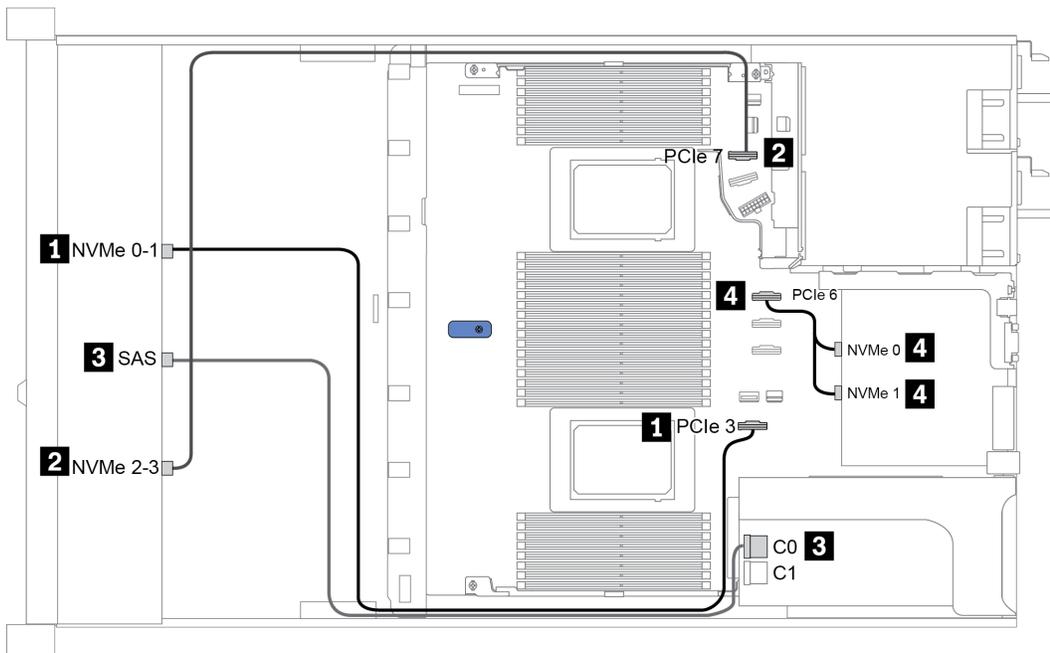


Figure 35. Configuration 7

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## Chapter 4. Server hardware setup

To set up the server, install any options that have been purchased, cable the server, configure and update the firmware, and install the operating system.

---

### Installation guidelines

Use the installation guidelines to install components in your server.

Before installing optional devices, read the following notices carefully:

**Attention:** Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

- Read the safety information and guidelines to ensure your safety at work:  
[http://thinksystem.lenovofiles.com/help/topic/safety\\_documentation/pdf\\_files.html](http://thinksystem.lenovofiles.com/help/topic/safety_documentation/pdf_files.html)
- When you install a new server, download and apply the latest firmware. This will help ensure that any known issues are addressed, and that your server is ready to work with optimal performance. Go to [ThinkSystem SR645 Drivers and Software](#) to download firmware updates for your server.

**Important:** Some cluster solutions require specific code levels or coordinated code updates. If the component is part of a cluster solution, verify that the latest level of code is supported for the cluster solution before you update the code.

- It is good practice to make sure that the server is working correctly before you install an optional component.
- Keep the working area clean, and place removed components on a flat and smooth surface that does not shake or tilt.
- Do not attempt to lift an object that might be too heavy for you. If you have to lift a heavy object, read the following precautions carefully:
  - Make sure that you can stand steadily without slipping.
  - Distribute the weight of the object equally between your feet.
  - Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
  - To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Back up all important data before you make changes related to the disk drives.
- Have a small flat-blade screwdriver, a small Phillips screwdriver, and a T8 torx screwdriver available.
- To view the error LEDs on the system board and internal components, leave the power on.
- You do not have to turn off the server to remove or install hot-swap power supplies, hot-swap fans, or hot-plug USB devices. However, you must turn off the server before you perform any steps that involve removing or installing adapter cables, and you must disconnect the power source from the server before you perform any steps that involve removing or installing a riser card, memory, and processor.
- Blue on a component indicates touch points, where you can grip to remove a component from or install it in the server, open or close a latch, and so on.
- The Red strip on the drives, adjacent to the release latch, indicates that the drive can be hot-swapped if the server and operating system support hot-swap capability. This means that you can remove or install the drive while the server is still running.

**Note:** See the system specific instructions for removing or installing a hot-swap drive for any additional procedures that you might need to perform before you remove or install the drive.

- After finishing working on the server, make sure you reinstall all safety shields, guards, labels, and ground wires.

## Safety inspection checklist

Use the information in this section to identify potentially unsafe conditions with your server. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury.

### Notes:

1. The product is not suitable for use at visual display workplaces according to §2 of the Workplace Regulations.
2. The set-up of the server is made in the server room only.

### CAUTION:

**This equipment must be installed or serviced by trained personnel, as defined by the NEC, IEC 62368-1 & IEC 60950-1, the standard for Safety of Electronic Equipment within the Field of Audio/Video, Information Technology and Communication Technology. Lenovo assumes you are qualified in the servicing of equipment and trained in recognizing hazards energy levels in products. Access to the equipment is by the use of a tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.**

**Important:** Electrical grounding of the server is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Use the following checklist to verify that there are no potentially unsafe conditions:

1. Make sure that the power is off and the power cord is disconnected.
2. Check the power cord.
  - Make sure that the third-wire ground connector is in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
  - Make sure that the power cord is the correct type.

To view the power cords that are available for the server:

  - a. Go to:  
<http://dcsc.lenovo.com/#/>
  - b. In the Customize a Model pane:
    - 1) Click **Select Options/Parts for a Model**.
    - 2) Enter the machine type and model for your server.
  - c. Click the Power tab to see all line cords.
  - Make sure that the insulation is not frayed or worn.
3. Check for any obvious non-Lenovo alterations. Use good judgment as to the safety of any non-Lenovo alterations.
4. Check inside the server for any obvious unsafe conditions, such as metal filings, contamination, water or other liquid, or signs of fire or smoke damage.
5. Check for worn, frayed, or pinched cables.
6. Make sure that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

## System reliability guidelines

Review the system reliability guidelines to ensure proper system cooling and reliability.

Make sure the following requirements are met:

- When the server comes with redundant power, a power supply must be installed in each power-supply bay.
- Adequate space around the server must be spared to allow server cooling system to work properly. Leave approximately 50 mm (2.0 in.) of open space around the front and rear of the server. Do not place any object in front of the fans.
- For proper cooling and airflow, refit the server cover before you turn the power on. Do not operate the server for more than 30 minutes with the server cover removed, for it might damage server components.
- Cabling instructions that come with optional components must be followed.
- A failed fan must be replaced within 48 hours after malfunction.
- A removed hot-swap fan must be replaced within 30 seconds after removal.
- A removed hot-swap drive must be replaced within two minutes after removal.
- A removed hot-swap power supply must be replaced within two minutes after removal.
- Every air baffle that comes with the server must be installed when the server starts (some servers might come with more than one air baffle). Operating the server with a missing air baffle might damage the processor.
- All processor sockets must contain either a socket cover or a processor with heat sink.
- When more than one processor is installed, fan population rules for each server must be strictly followed.

## Working inside the server with the power on

Guidelines to work inside the server with the power on.

**Attention:** The server might stop and data loss might occur when internal server components are exposed to static electricity. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding systems when working inside the server with the power on.

- Avoid loose-fitting clothing, particularly around your forearms. Button or roll up long sleeves before working inside the server.
- Prevent your necktie, scarf, badge rope, or hair from dangling into the server.
- Remove jewelry, such as bracelets, necklaces, rings, cuff links, and wrist watches.
- Remove items from your shirt pocket, such as pens and pencils, in case they fall into the server as you lean over it.
- Avoid dropping any metallic objects, such as paper clips, hairpins, and screws, into the server.

## Handling static-sensitive devices

Use this information to handle static-sensitive devices.

**Attention:** Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

- Limit your movement to prevent building up static electricity around you.
- Take additional care when handling devices during cold weather, for heating would reduce indoor humidity and increase static electricity.
- Always use an electrostatic-discharge wrist strap or other grounding system, particularly when working inside the server with the power on.
- While the device is still in its static-protective package, touch it to an unpainted metal surface on the outside of the server for at least two seconds. This drains static electricity from the package and from your body.
- Remove the device from the package and install it directly into the server without putting it down. If it is necessary to put the device down, put it back into the static-protective package. Never place the device on the server or on any metal surface.
- When handling a device, carefully hold it by the edges or the frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Keep the device from others' reach to prevent possible damages.



## Memory module installation rules and order

Memory modules must be installed in a specific order based on the memory configuration that you implement on your server.

### General mixing rules:

DIMMs	Coexist in a channel	Coexist in a system
RDIMMs and Performance+ RDIMMs		
3DS RDIMMs and other DIMM types		
128 GB 3DS RDIMMs and 256 GB 3DS RDIMMs		
DIMMs of different DRAM density (8Gbit and 16 Gbit)	√ <sup>1</sup>	√ <sup>1</sup>
DIMMs of different DRAM data width (x4 and x8)		√
DIMMs of different rank	√ <sup>2</sup>	√ <sup>2</sup>
DIMMs manufactured by different vendors	√	√
DIMMs of different voltage <sup>3</sup>		
ECC and Non-ECC DIMMs <sup>4</sup>		
<ol style="list-style-type: none"><li>1. Install the one with the higher density first.</li><li>2. Install the one with the higher rank first.</li><li>3. Only support 1.2 V.</li><li>4. Only support ECC DIMMs.</li></ol>		

**DIMM compatibility (based on general mixing rules)**

Type	Option	Capacity	DRAM data width	DRAM density
RDIMM	1	16 GB	x8	8 Gbit
	2	32 GB	x4	8 Gbit
	3	32 GB	x8	16 Gbit
	4	64 GB	x4	16 Gbit
Performance+ RDIMM	5	32 GB	x8	16 Gbit
	6	64 GB	x4	16 Gbit
3DS RDIMM	7	128 GB	x4	16 Gbit
	8	256 GB	x4	16 Gbit
Support mixing within a channel: <ul style="list-style-type: none"><li>• Options 1 and 3</li><li>• Options 2 and 4</li></ul> Support mixing within a system: <ul style="list-style-type: none"><li>• Options 1 to 4 (Install the one with higher DRAM density first.)</li><li>• Options 5 and 6 (Install the one with higher capacity first.)</li></ul>				

**Alternatively, for balancing memory and for better performance, consider below rules:**

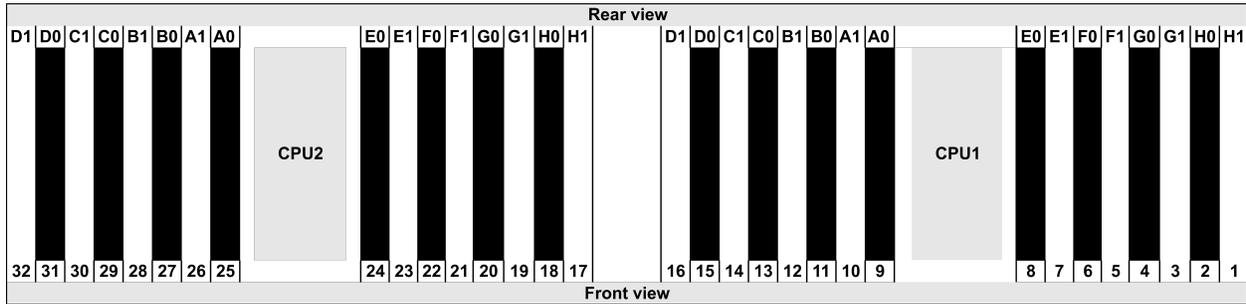
- Balance memory capacity per channel pair on a given CPU.
- Balance memory capacity per CPU socket when 2 CPUs are installed.
- In cases of using Performance+ RDIMMs to maximize memory operating speed, ensure that Performance + RDIMMs with the same capacity are populated on 2DPC. Otherwise, there will be no performance gain.
- When only one DIMM is to be populated in a given channel, it must be populated in DIMM slot 1 (physically farthest away from the CPU).
- The server supports single DIMM as a minimum configuration, however, full memory bandwidth requires one DIMM per channel (A–H) be populated. For best performance, populate all 8 channels per socket, with every channel having the same capacity.

**Note:** Detailed instructions for balancing memory configurations for your server can be found at:

[Balanced Memory Configurations with Second-or-Third-Generation AMD EPYC Processors](#)

**Recommended population order (based on general rules)**

**1 CPU installed:**



Qty.	DIMM population order															
1 DIMM	14															
2 DIMMs	14	16														
3 DIMMs	14	16	3													
4 DIMMs	14	16	3	1												
5 DIMMs	14	16	3	1	10											
6 DIMMs	14	16	3	1	10	12										
7 DIMMs	14	16	3	1	10	12	7									
8 DIMMs	14	16	3	1	10	12	7	5								
9 DIMMs	14	16	3	1	10	12	7	5	13							
10 DIMMs	14	16	3	1	10	12	7	5	13	15						
11 DIMMs	14	16	3	1	10	12	7	5	13	15	4					
12 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2				
13 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9			
14 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9	11		
15 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9	11	8	
16 DIMMs	14	16	3	1	10	12	7	5	13	15	4	2	9	11	8	6



**Note:** There are performance-optimized 6-DIMM and 12-DIMM configurations for server models with one 7003 series CPU and 12-DIMM and 24-DIMM configurations for server models with two 7003 series CPUs. For details, see the table below.

CPU Qty.	DIMM Qty.	Performance-optimized DIMM population order
1	6	1, 3, 7, 10, 14, 16
	12	1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 16
2	12	1, 3, 7, 10, 14, 16, 17, 19, 23, 26, 30, 32
	24	1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24, 25, 26, 29, 30, 31, 32

---

## Install server hardware options

This section includes instructions for performing initial installation of optional hardware. Each component installation procedure references any tasks that need to be performed to gain access to the component being replaced.

Installation procedures are presented in the optimum sequence to minimize work.

**Attention:** To ensure the components you install work correctly without problems, read the following precautions carefully.

- Always download and apply the latest firmware. This will help ensure that any known issues are addressed, and that your server is ready to work with optimal performance. Go to [ThinkSystem SR645 Drivers and Software](#) to download firmware updates for your server.
- It is good practice to make sure that the server is working correctly before you install an optional component.
- Follow the installation procedures in this section and use appropriate tools. Incorrectly installed components can cause system failure from damaged pins, damaged connectors, loose cabling, or loose components.

## Remove the security bezel

Use this information to remove the security bezel.

### About this task

**Attention:** Read “Installation guidelines” on page 127 to ensure that you work safely.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

Step 1. Use the key to unlock the security bezel.

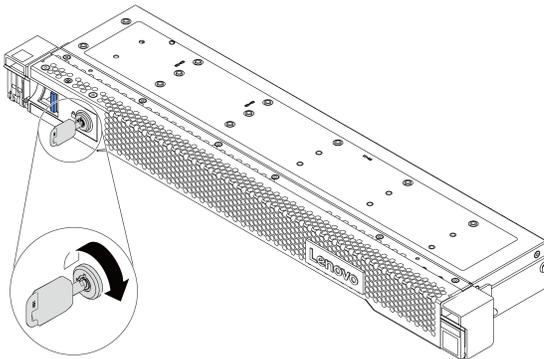


Figure 36. Unlocking the security bezel

Step 2. Press the release latch **1** and rotate the security bezel outward to remove it from the chassis.

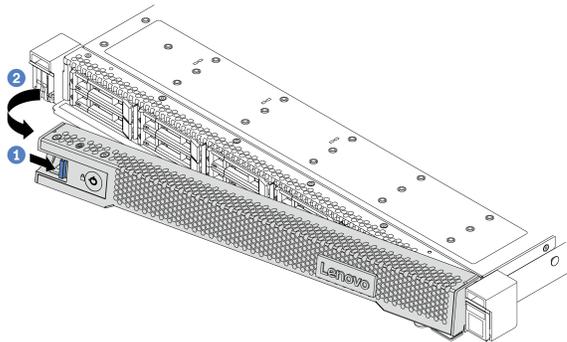


Figure 37. Security bezel removal

**Attention:** Before you ship the rack with the server installed, reinstall and lock the security bezel into place.

## Remove the top cover

Use this information to remove the top cover.

### About this task

#### S033



#### **CAUTION:**

**Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.**

#### S014



#### **CAUTION:**

**Hazardous voltage, current, and energy levels might be present. Only a qualified service technician is authorized to remove the covers where the label is attached.**

#### **Attention:**

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. If the server is installed in a rack, remove the server from the rack. See the Rack Installation Guide that comes with the rail kit for your server.

Step 2. Remove the top cover.

**Attention:** Handle the top cover carefully. Dropping the top cover with the cover latch open might damage the cover latch.

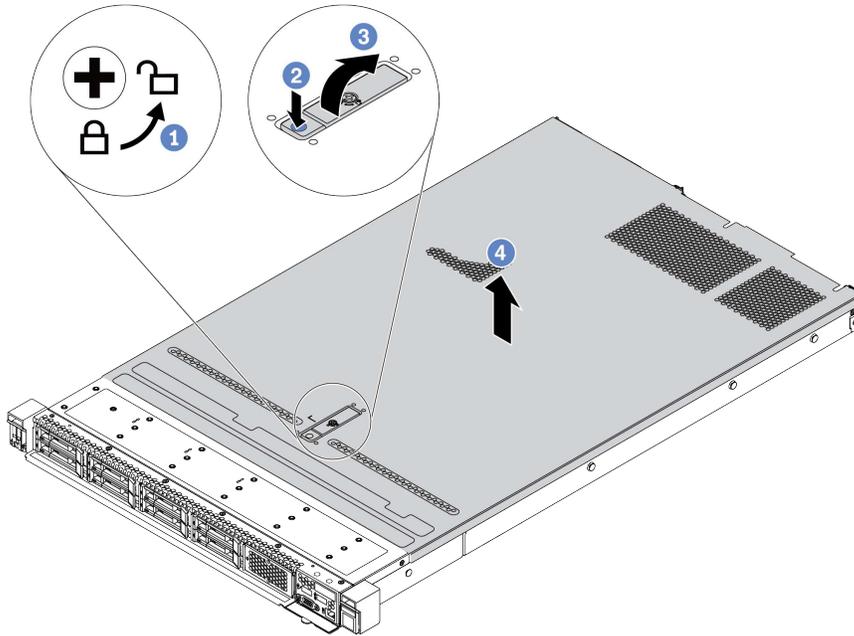


Figure 38. Top cover removal

- Use a screwdriver to turn the cover lock to the unlocked position as shown.
- Press the release button on the cover latch. The cover latch then gets released to some extent.
- Fully open the cover latch as shown.
- Slide the top cover to the rear until it is disengaged from the chassis. Then, lift the top cover off the chassis and place the top cover on a flat clean surface.

## After you finish

Install any options you want to install.

## Remove the air baffle

Use this information to remove the air baffle.

### About this task

Depending on the model, your server might not have an air baffle installed. The air baffle you want to remove might be different from the following illustrations, but the removal method is the same.

#### S033



#### **CAUTION:**

**Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.**

#### S017



#### **CAUTION:**

**Hazardous moving fan blades nearby. Keep fingers and other body parts away.**

#### **Attention:**

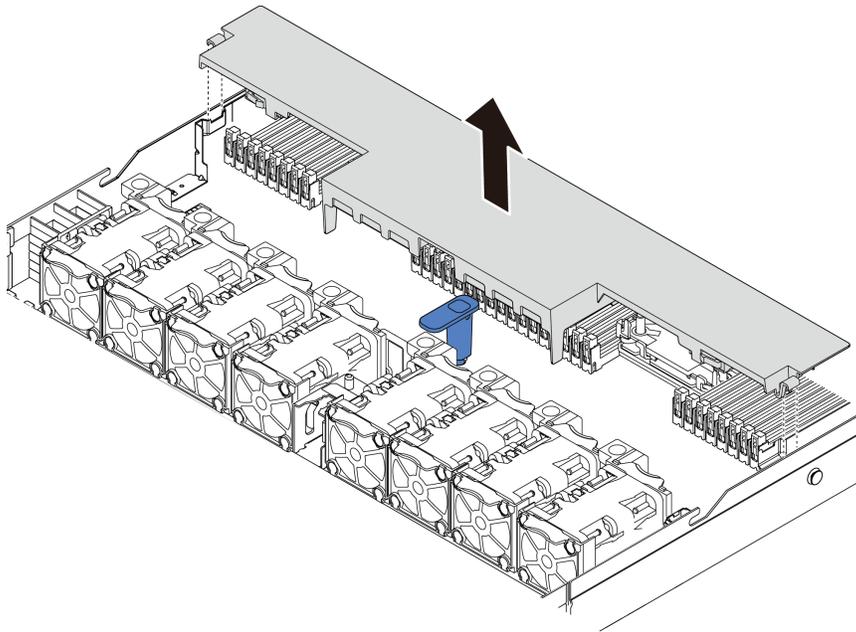
- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. If there is a RAID super capacitor module installed on the bottom of the air baffle, disconnect the RAID super capacitor module cable first.

Step 2. Grasp the air baffle and carefully lift it out of the server.



*Figure 39. Air baffle removal*

**Attention:** For proper cooling and airflow, install the air baffle before you power on the server. Operating the server with the air baffle removed might damage server components.

### **After you finish**

Install any options that you have purchased.

## Remove a riser assembly

Use this information to remove a riser assembly.

### About this task

The riser assembly you want to remove might be different from the following illustrations, but the removal method is the same. The following takes the LP-FH riser assembly as an example.

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Remove the top cover. See “[Remove the top cover](#)” on [page 141](#).
- Step 2. If there is any PCIe adapter installed on the riser assembly, record the cable connections first. Then, disconnect all cables from the PCIe adapter.
- Step 3. Grasp the riser assembly by its edges and carefully lift it out of the chassis.

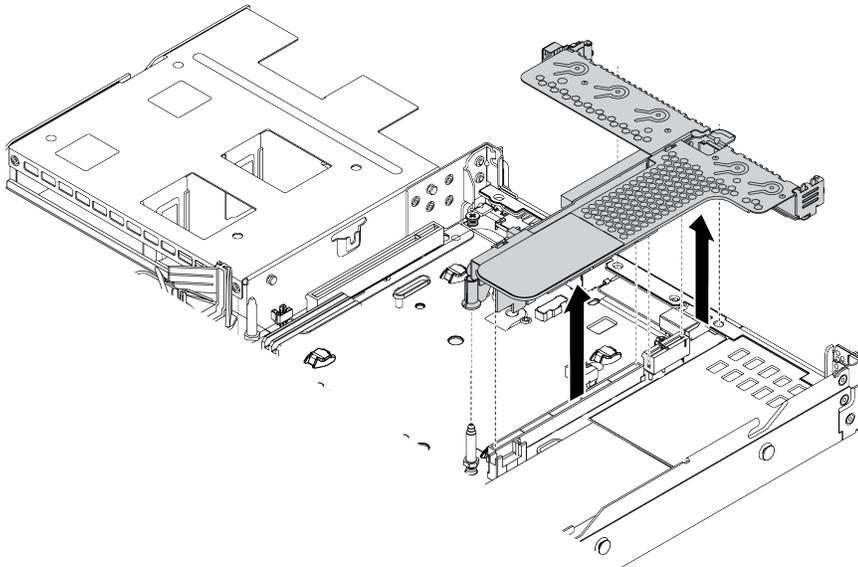


Figure 40. Riser assembly removal

- Step 4. Remove the PCIe adapters that are installed on the riser assembly.

Step 5. Remove the riser card from the bracket.

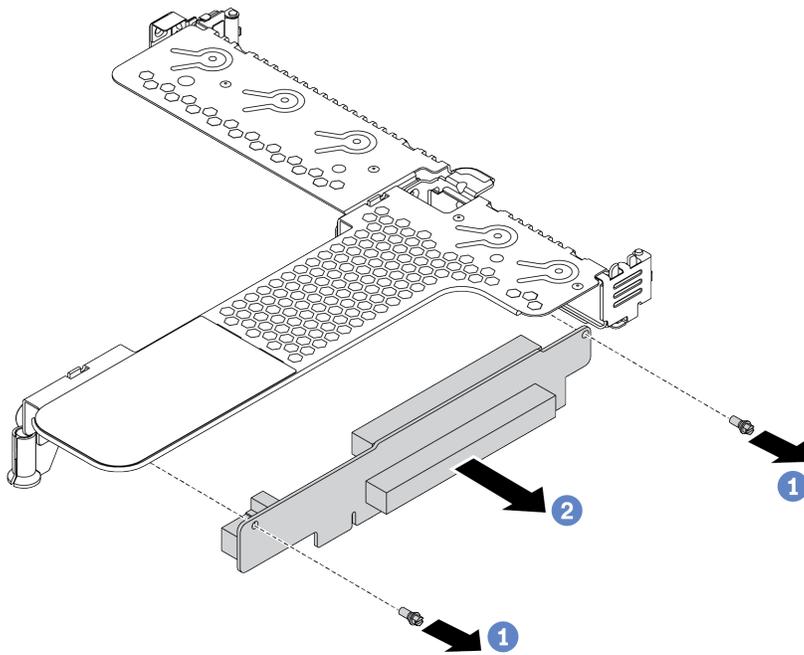


Figure 41. riser card removal

- a. Remove the two screws that secure the riser assembly to the bracket.
- b. Remove the riser assembly.

### After you finish

1. If you are instructed to return the old riser assembly, follow all packaging instructions and use any packaging materials that are provided.
2. Remove the rear wall bracket if you would like to install a non-LP-FH riser assembly.

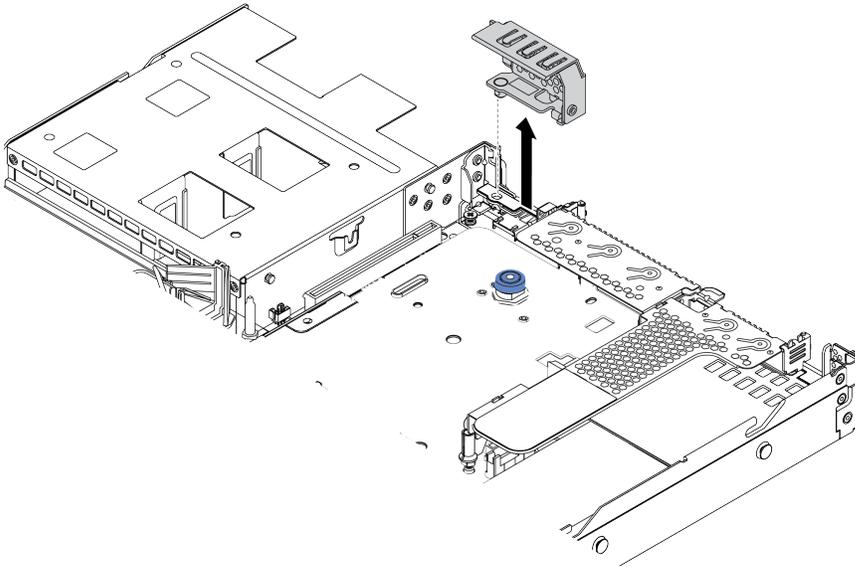


Figure 42. Rear wall bracket removal

## Install a processor and heat sink

Standard and T-shaped heat sinks are available for your server. This task has instructions for replacing a standard heat sink, which requires a Torx #T20 screwdriver. The instructions for replacing a T-shaped heat sink are similar.

### About this task

#### CAUTION:

The processor and heat sink replacement can only be performed by trained service technicians.

#### CAUTION:

Make sure that all server power cords are disconnected from their power sources before performing this procedure.

#### Attention:

- Read “[Installation guidelines](#)” on page 127 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- See <https://static.lenovo.com/us/en/serverproven/index.shtml> for a list of processors supported for your server. All processors on the system board must have the same speed, number of cores, and frequency.
- Before you install a new processor, update your system firmware to the latest level. See “[Update the firmware](#)” on page 196.
- Optional devices available for your system might have specific processor requirements. See “[Thermal rules](#)” on page 46.
- The heat sink is necessary to maintain proper thermal conditions for the processor. Do not power on the server with the heat sink removed.
- Do not touch the processor socket or processor contacts. Processor-socket contacts are very fragile and easily damaged. Contaminants on the processor contacts, such as oil from your skin, can cause connection failures.

- Do not allow the thermal grease on the processor or heat sink to come in contact with anything. Contact with any surface can compromise the thermal grease, rendering it ineffective. Thermal grease can damage components, such as electrical connectors in the processor socket. Do not remove the grease cover from a heat sink until you are instructed to do so.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

## Procedure

Step 1. Install the processors.

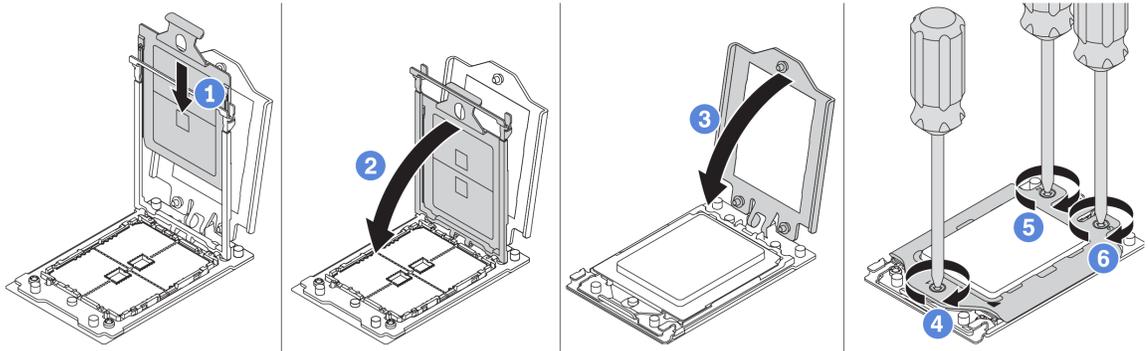


Figure 43. Processor installation

- a. Slide the processor carrier into the rail frame.
- b. Push the rail frame down until the blue latches lock into place.
- c. Close the force frame.
- d. Tighten the screws in the *installation sequence* shown on the force frame.

**Note:** Use an ESD safe screwdriver and set the maximum torque value to  $14.0 \pm 0.5$  inch-pounds.

Step 2. Install the standard or performance heat sinks.

**Note:** For a new heat sink, the thermal grease is pre-applied to the heat sink. Remove the protective cover and install the heat sink.

- a. Orient the heat sink with the screw holes on the processor plate. The captive screws on the heat sink should align with the screw holes on the processor plate.
- b. Tighten all the captive screws in the *installation sequence* shown on the heat-sink label.
- c. (Optional) Tighten the two screws located in the front of the performance heat sink.

**Note:** Use an ESD safe screwdriver and set the maximum torque value to  $14.0 \pm 0.5$  inch-pounds.

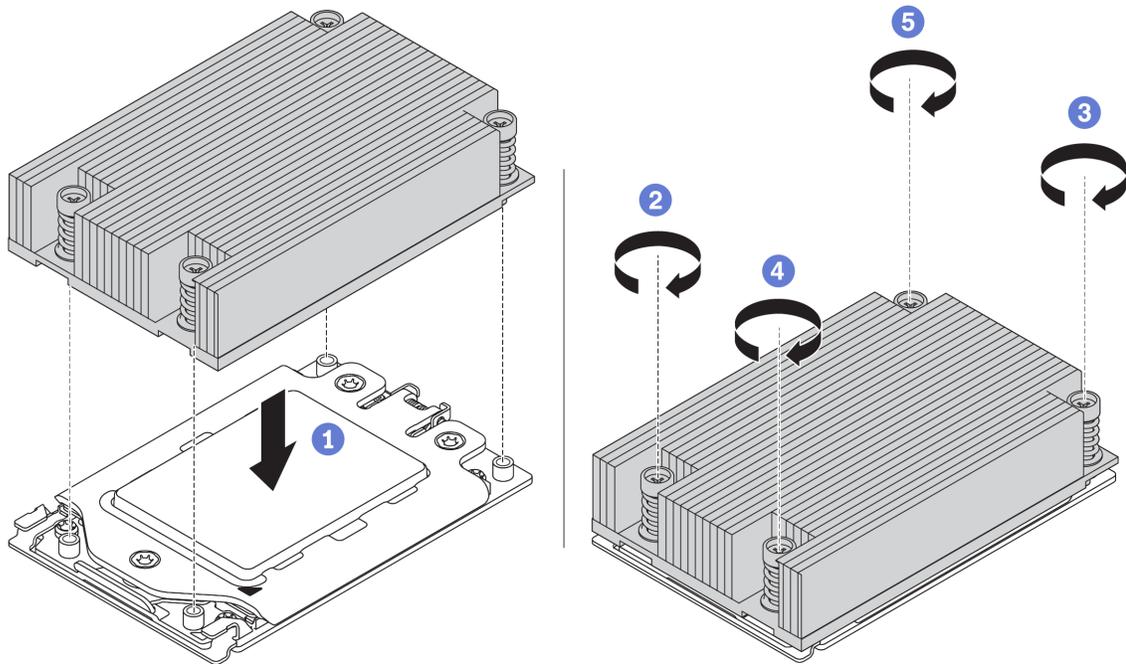


Figure 44. Standard heat sink installation

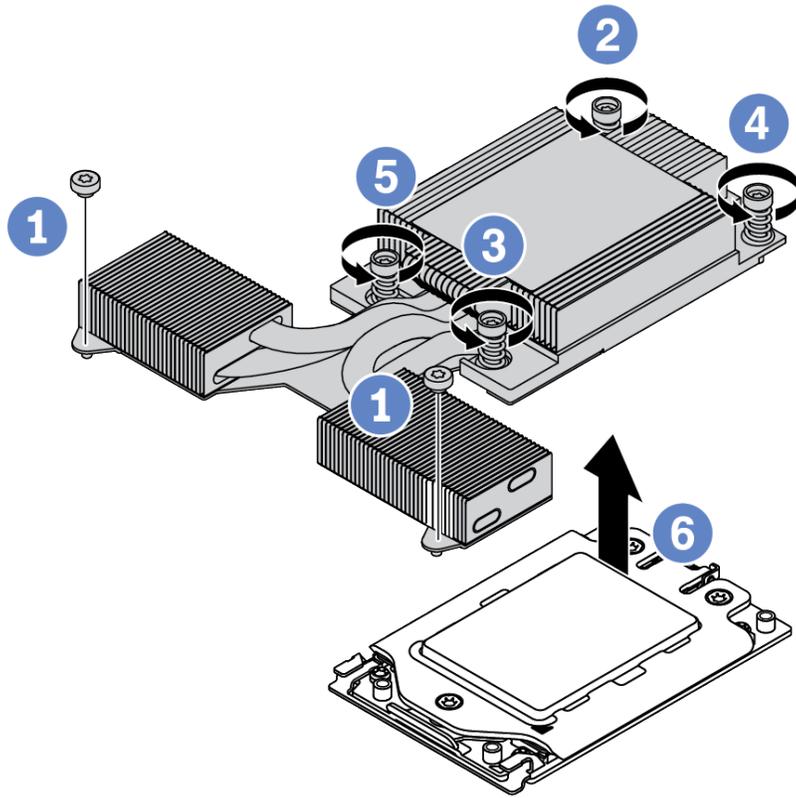


Figure 45. Performance heat sink installation

## After you finish

1. If there are memory modules to install, install them. See [“Install a memory module” on page 152](#).
2. Install other options you want to install.

## Install a memory module

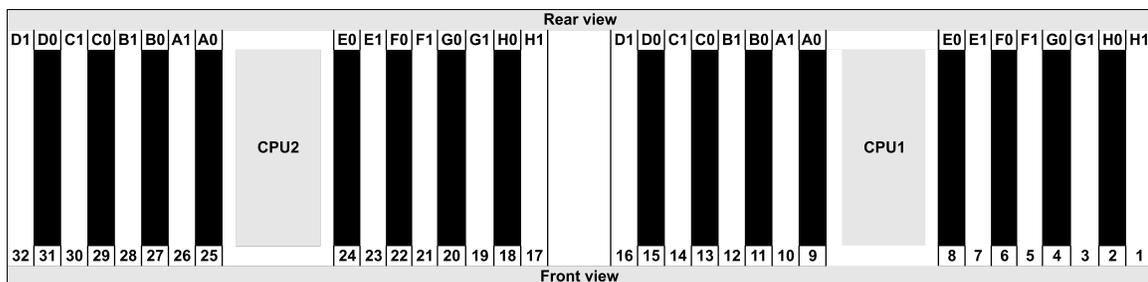
Use this information to install a memory module.

### Attention:

- Read [“Installation guidelines” on page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Memory modules are sensitive to static discharge and require special handling. Refer to the standard guidelines for [“Handling static-sensitive devices” on page 132](#):
  - Always wear an electrostatic-discharge strap when removing or installing memory modules. Electrostatic-discharge gloves can also be used.
  - Never hold two or more memory modules together so that they do not touch each other. Do not stack memory modules directly on top of each other during storage.
  - Never touch the gold memory module connector contacts or allow these contacts to touch the outside of the memory module connector housing.
  - Handle memory modules with care: never bend, twist, or drop a memory module.
  - Do not use any metal tools (such as jigs or clamps) to handle the memory modules, because the rigid metals may damage the memory modules.
  - Do not insert memory modules while holding packages or passive components, which can cause package cracks or detachment of passive components by the high insertion force.

## Procedure

- Step 1. Touch the static-protective package that contains the memory module to any unpainted surface on the outside of the server. Then, take the memory module out of the package and place it on a static-protective surface.
- Step 2. Check the technical rules and make sure you have selected the correct memory modules. See [“DIMM population rules” on page 37](#).
- Step 3. Locate the channels and slots on the system board.



- Step 4. Install the memory module into the slot.

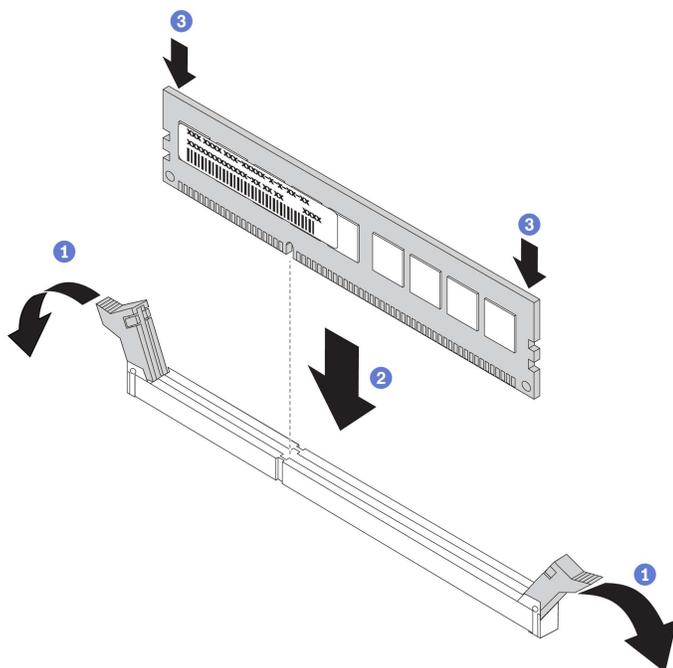


Figure 46. Memory module installation

- a. Open the retaining clip on each end of the memory module slot.

**Attention:** To avoid breaking the retaining clips or damaging the memory module slots, open and close the clips gently.

- b. Align the memory module with the slot, and gently place the memory module on the slot with both hands.
- c. Firmly press both ends of the memory module straight down into the slot until the retaining clips snap into the locked position.

**Note:** If there is a gap between the memory module and the retaining clips, the memory module has not been correctly inserted. In this case, open the retaining clips, remove the memory module, and then reinsert it.

## Install the front 2.5-inch-drive backplane

### About this task

The following describes how to install the backplane for ten 2.5-inch hot-swap drives. You can install the backplane for eight 2.5-inch hot-swap drives in the same way.

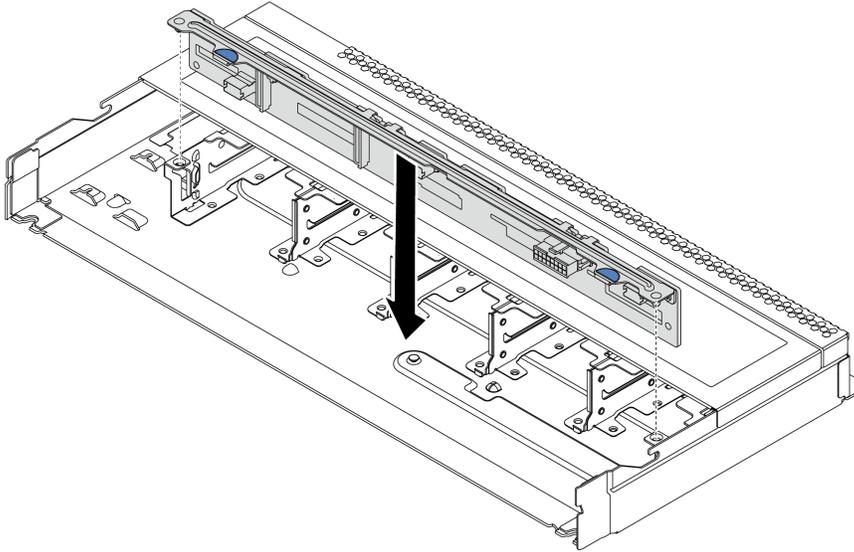
#### Attention:

- Read “[Installation guidelines](#)” on page 127 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

## Procedure

- Step 1. Touch the static-protective package that contains the backplane to any unpainted surface on the outside of the server. Then, take the backplane out of the package and place it on a static-protective surface.
- Step 2. Connect the cables to the backplane. See [“2.5-inch/3.5-inch drive backplane cable routing \(power\)”](#) on page 94 and [“2.5-inch/3.5-inch drive backplane cable routing \(signal\)”](#) on page 95.
- Step 3. Align the two pins on the backplane with the corresponding holes in the chassis.



*Figure 47. Installation of backplane for ten 2.5-inch hot-swap drives*

- Step 4. Lower the backplane into the chassis. Ensure that the pins pass through the holes and the backplane is fully seated in place.

## Install the front 3.5-inch-drive backplane

Use this information to install the front 3.5-inch-drive backplane.

### About this task

The following describes how to install the backplane for four 3.5-inch hot-swap drives.

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the backplane to any unpainted surface on the outside of the server. Then, take the backplane out of the package and place it on a static-protective surface.
- Step 2. Connect the cables to the system board or expansion slots. See “[2.5-inch/3.5-inch drive backplane cable routing \(power\)](#)” on [page 94](#) and “[2.5-inch/3.5-inch drive backplane cable routing \(signal\)](#)” on [page 95](#).

Step 3. Put the backplane down into place.

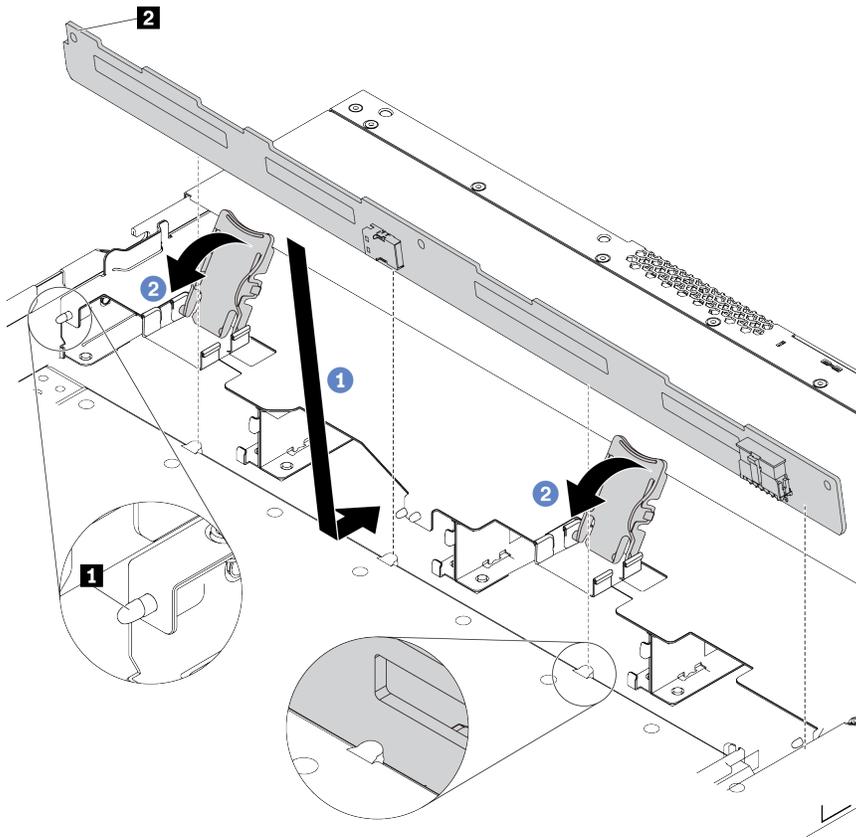


Figure 48. Installation of backplane for four 3.5-inch hot-swap drives

- a. Put the backplane under the front I/O assembly cables, align it with the chassis, and lower it into the chassis. Put the backplane into place with it leaning backward slightly so that the three pins **1** on the chassis pass through the three holes **2** in the backplane.
- b. Close the release latches to secure the backplane in place.

Step 4. Connect the cables to the system board or expansion slots. See [“2.5-inch/3.5-inch drive backplane cable routing \(power\)” on page 94](#) and [“2.5-inch/3.5-inch drive backplane cable routing \(signal\)” on page 95](#).

## After you finish

Reinstall all the drives and drive fillers into the drive bays. See [“Install a hot-swap drive” on page 164](#).

## Install the 7mm drive backplanes

Use this information to install the 7mm drive backplanes.

## About this task

### Attention:

- Read [“Installation guidelines” on page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

## Procedure

- Step 1. Touch the static-protective package that contains the new backplane to any unpainted surface on the outside of the server. Then, take the new backplane out of the package and place it on a static-protective surface.
- Step 2. Install the 7mm drive backplane at the bottom.

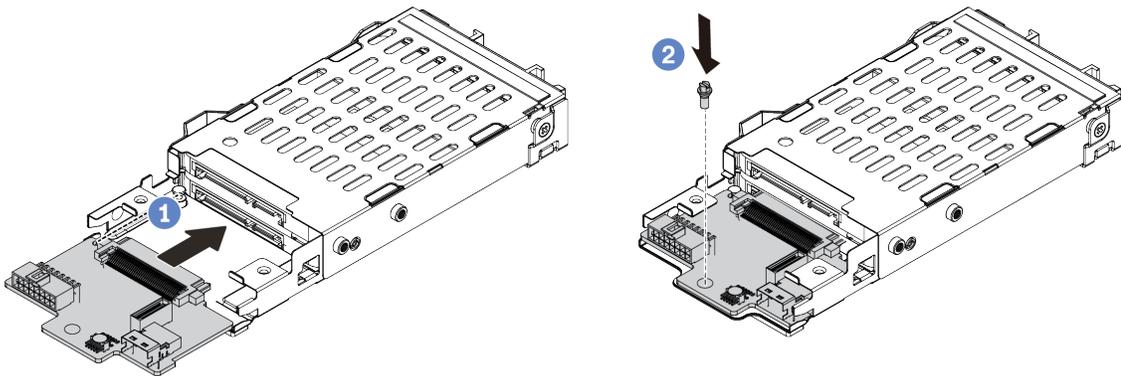


Figure 49. 7mm drive backplane installation (bottom)

- a. Align the pin on the cage and slightly slide the backplane into the cage until it is fully seated.
  - b. Install the screw as shown.
- Step 3. Install the 7mm drive backplane on the top.

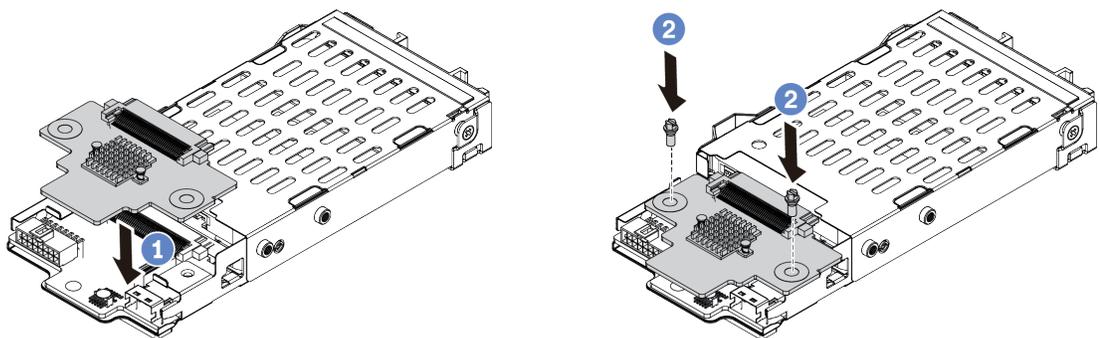


Figure 50. 7mm drive backplane installation (top)

- a. Put the backplane down on the cage as shown.
- b. Install the two screws to secure the backplane in place

Step 4. Connect the cables from the backplanes to the system board and riser slot. See “7mm drive backplane cable routing (power & signal)” on page 92.

### After you finish

1. Install the 7mm drive cage assembly on the rear chassis. See “Install the rear hot-swap drive assembly” on page 166
2. Reinstall all the drives and fillers (if any) into the drive bays.

## Install the rear 2.5-inch drive backplane

Use this information to install the rear 2.5-inch drive backplane.

### About this task

#### Attention:

- Read “Installation guidelines” on page 127 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the rear hot-swap drive cage to any unpainted surface on the outside of the server. Then, take the rear hot-swap drive cage out of the package and place it on a static-protective surface.
- Step 2. Gently press and hold the tab on the rear hot-swap drive cage as shown and remove the air baffle from the rear hot-swap drive cage.

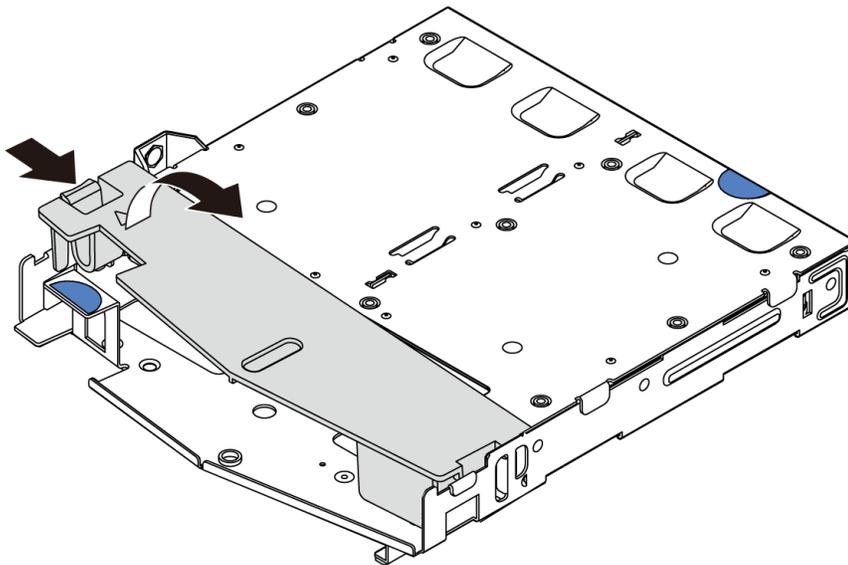


Figure 51. Air baffle removal

Step 3. Align the rear backplane with the rear hot-swap drive cage and lower it into the rear hot-swap drive cage.

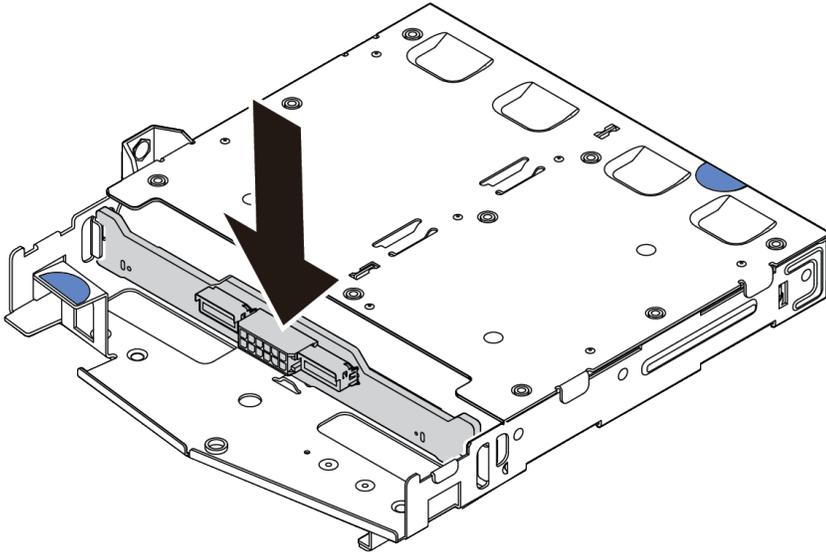


Figure 52. Rear backplane installation

Step 4. Connect the signal cable and the power cable on the rear backplane.

Step 5. Install the air baffle into the rear hot-swap drive cage as shown.

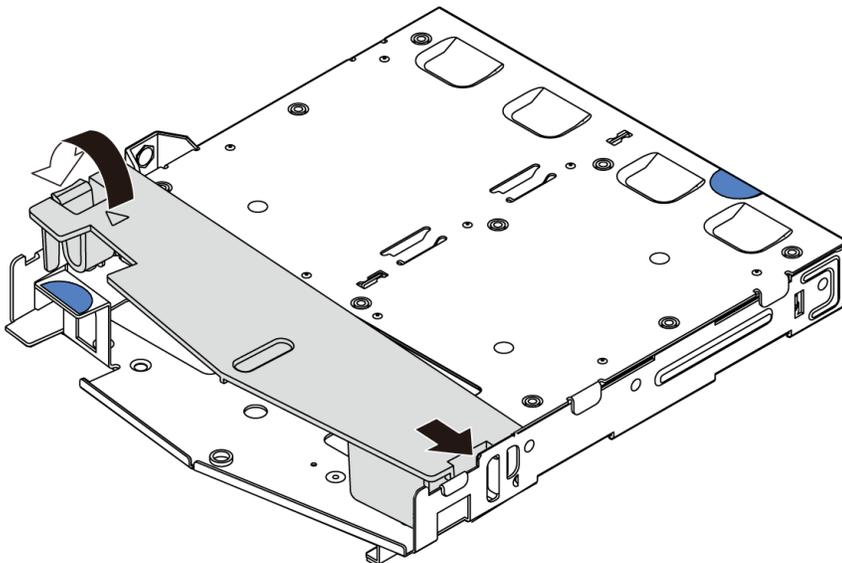


Figure 53. Air baffle installation

### After you finish

1. Install the rear 2.5-inch drive assembly onto the chassis. See [“Install the rear hot-swap drive assembly” on page 166.](#)
2. Install the drives or drive fillers into the rear hot-swap drive assembly. See [“Install a hot-swap drive” on page 164.](#)



## Install the M.2 adapter and M.2 drive

Use this information to install the M.2 adapter and M.2 drive.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

Step 1. Touch the static-protective package that contains the M.2 adapter and M.2 drive to any unpainted surface on the outside of the server. Then, take the M.2 adapter and M.2 drive out of the package and place them on a static-protective surface.

#### Notes:

- The M.2 adapter module is shipped with a loose screw, but the screw is not necessarily used for the installation.
- The M.2 adapter you want to install might be different from the following illustrations, but the installation method is the same.

Step 2. Adjust the retainer on the M.2 adapter to accommodate the particular size of the M.2 drive you wish to install. See “[Adjust the retainer on the M.2 adapter](#)” on [page 163](#).

Step 3. Locate the M.2 drive slot on the M.2 adapter.

**Note:** For some M.2 adapters that support two identical M.2 drives, install the M.2 drive in slot 0 first.

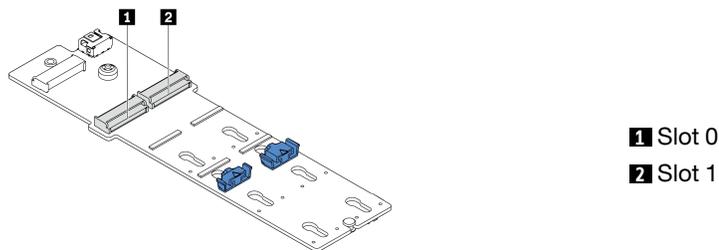


Figure 54. M.2 drive slot

Step 4. Install the M.2 adapter onto the chassis.

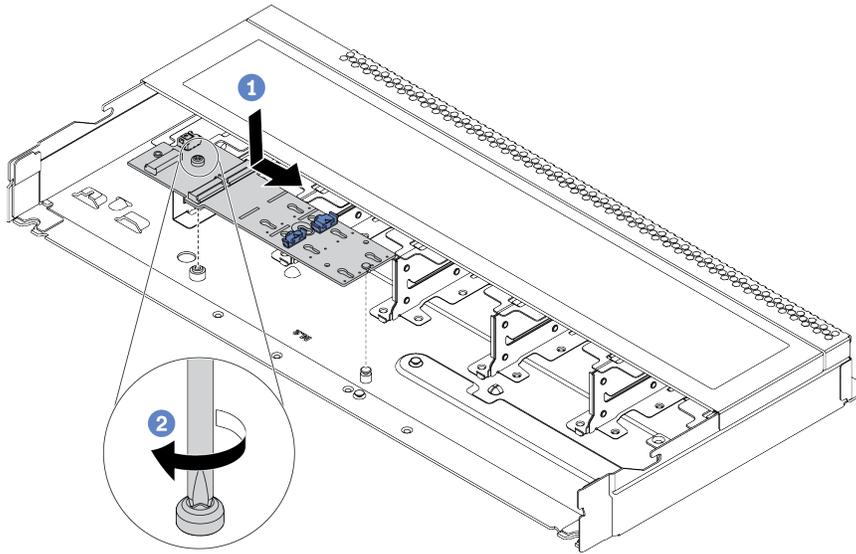


Figure 55. M.2 adapter installation

- a. Align the notch of the M.2 adapter with the pin on the chassis, and then place down the M.2 adapter.
- b. Tighten the screw to secure the M.2 adapter.

Step 5. Install the M.2 drive on the M.2 adapter.

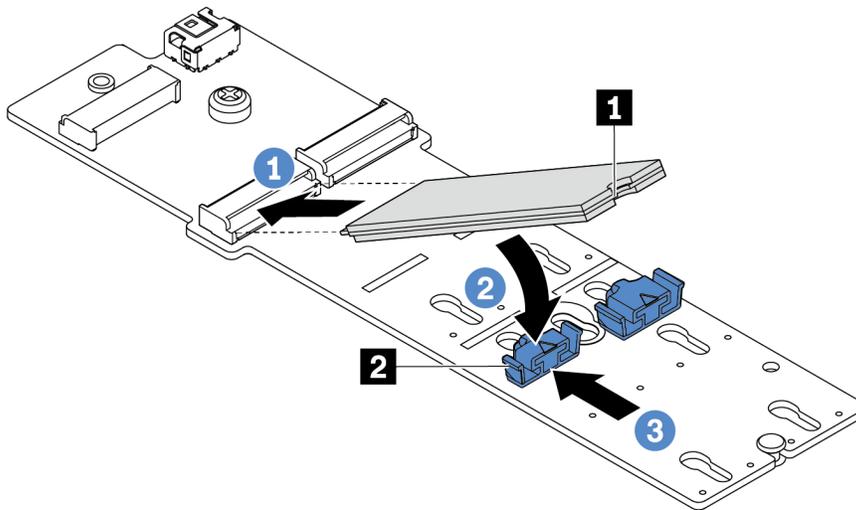


Figure 56. M.2 drive installation

- a. Insert the M.2 drive at an angle of approximately 30 degrees into the connector.
- b. Rotate the M.2 drive down until the notch **1** catches on the lip of the retainer **2**.
- c. Slide the retainer forward (toward the connector) to secure the M.2 drive into place.

## After you finish

Use the Lenovo XClarity Provisioning Manager to configure the RAID. For more information, see the “RAID Setup” section in the LXPM documentation compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxpm\\_frontend/lxpm\\_product\\_page.html](https://sysmgt.lenovofiles.com/help/topic/lxpm_frontend/lxpm_product_page.html).

## Adjust the retainer on the M.2 adapter

Use this information to adjust the retainer on the M.2 adapter.

### About this task

#### Attention:

- Read “Installation guidelines” on page 127 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

**Note:** The M.2 adapter you want to adjust might be different from the following illustrations, but the adjustment method is the same.

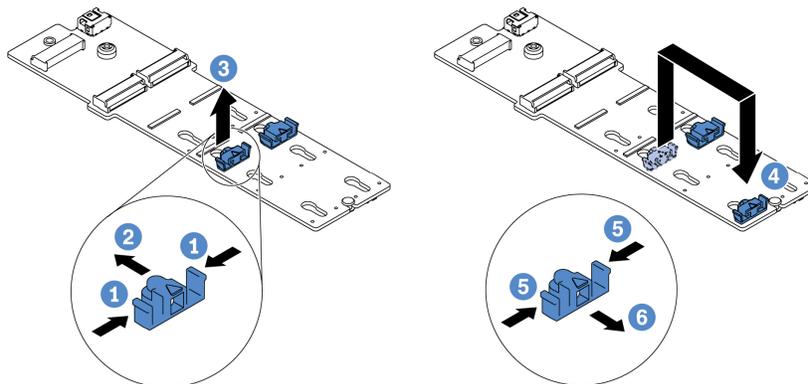


Figure 57. M.2 retainer adjustment

- Step 1. Press both sides of the retainers.
- Step 2. Move the retainer forward until it is in the large opening of the keyhole.
- Step 3. Take the retainer out of the keyhole.
- Step 4. Insert the retainer into the correct keyhole into which the retainer should be installed to accommodate the particular size of the M.2 drive you wish to install.
- Step 5. Press both sides of the retainer.
- Step 6. Slide the retainer backwards until it is seated in place.

## Install a hot-swap drive

Use this information to install a hot-swap drive.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

Step 1. Touch the static-protective package that contains the drive to any unpainted surface on the outside of the server. Then, take the drive out of the package and place it on a static-protective surface.

**Note:** Ensure that drive installation meets “[Technical rules](#)” on [page 36](#).

Step 2. Remove the drive filler from the drive bay and keep the drive filler in a safe place.

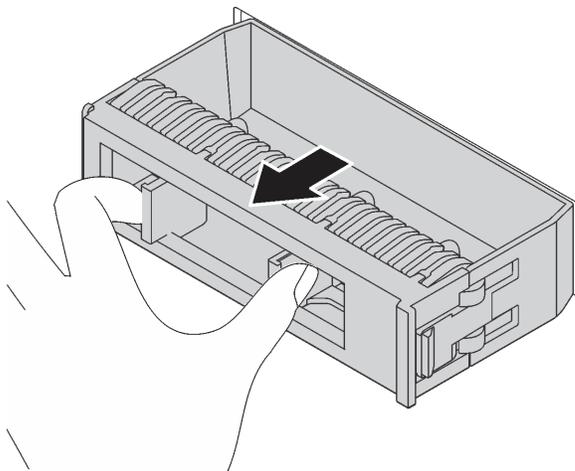


Figure 58. Drive filler removal

Step 3. Install the drive in the drive bay.

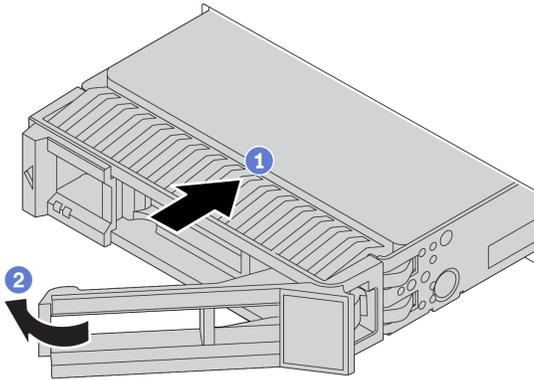


Figure 59. Hot-swap drive installation

- a. Ensure that the drive tray handle is in the open position. Slide the drive into the drive bay until it snaps into position.
- b. Close the drive tray handle to lock the drive in place.

Step 4. Check the drive LEDs to verify that the drive is operating correctly. For details, see [“Drive LEDs” on page 59](#).

Step 5. Continue to install additional hot-swap drives if necessary.

## Install the rear hot-swap drive assembly

Use this information to install the rear hot-swap drive assembly.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the rear hot-swap drive cage to any unpainted surface on the outside of the server. Then, take the rear hot-swap drive cage out of the package and place it on a static-protective surface.
- Step 2. Gently press and hold the tab on the rear hot-swap drive cage as shown and remove the air baffle from the rear hot-swap drive cage.

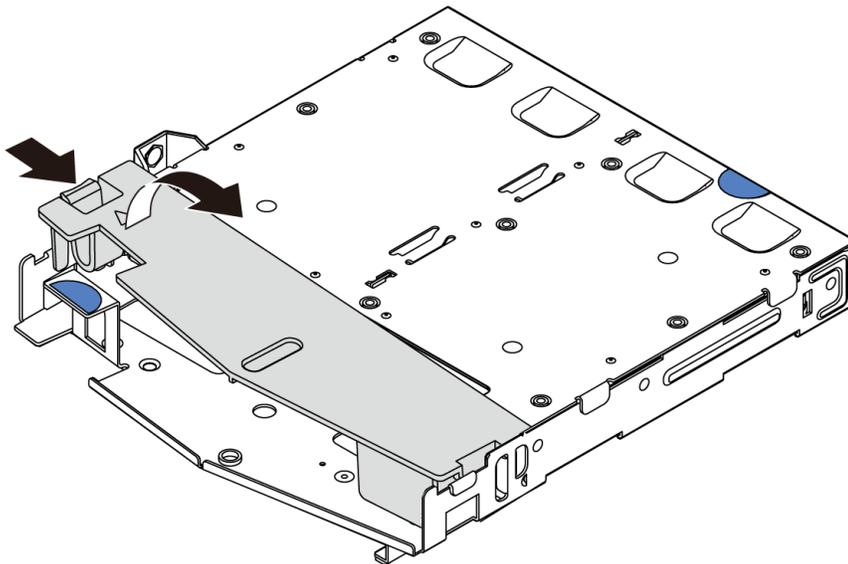
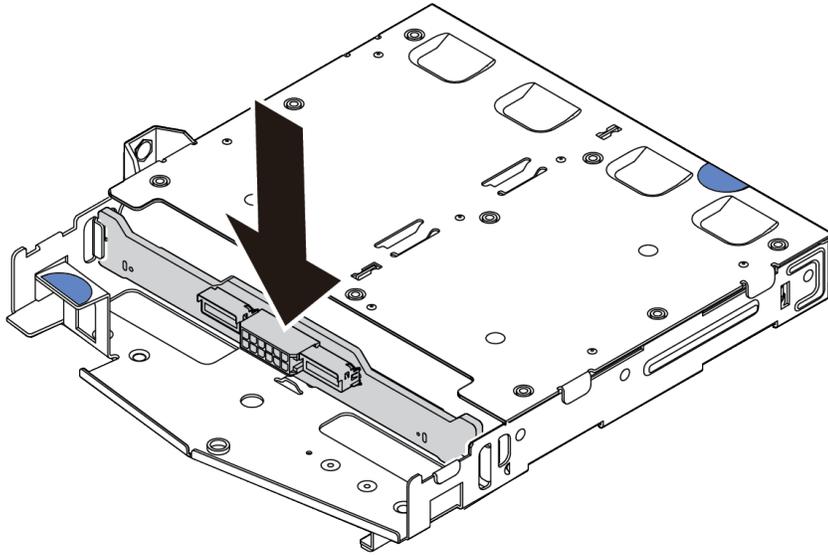


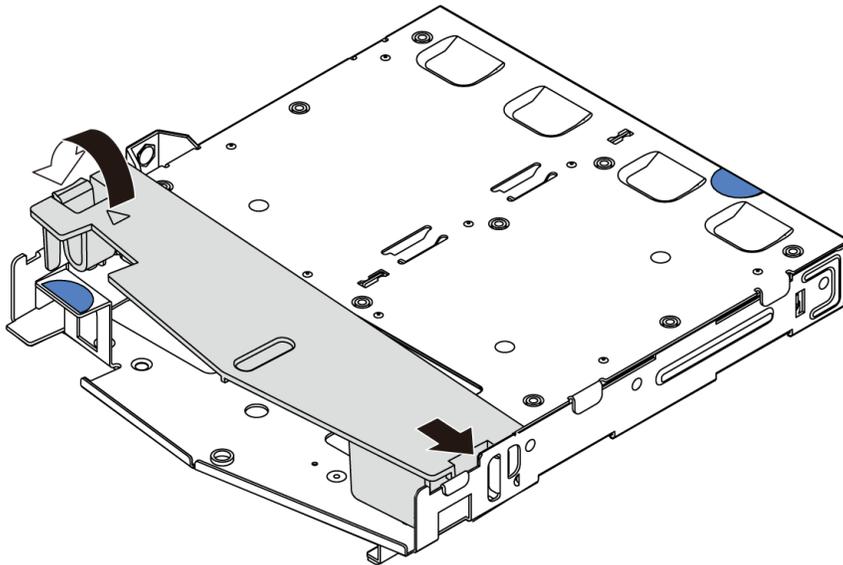
Figure 60. Air baffle removal

- Step 3. Align the rear backplane with the rear hot-swap drive cage and lower it into the rear hot-swap drive cage.



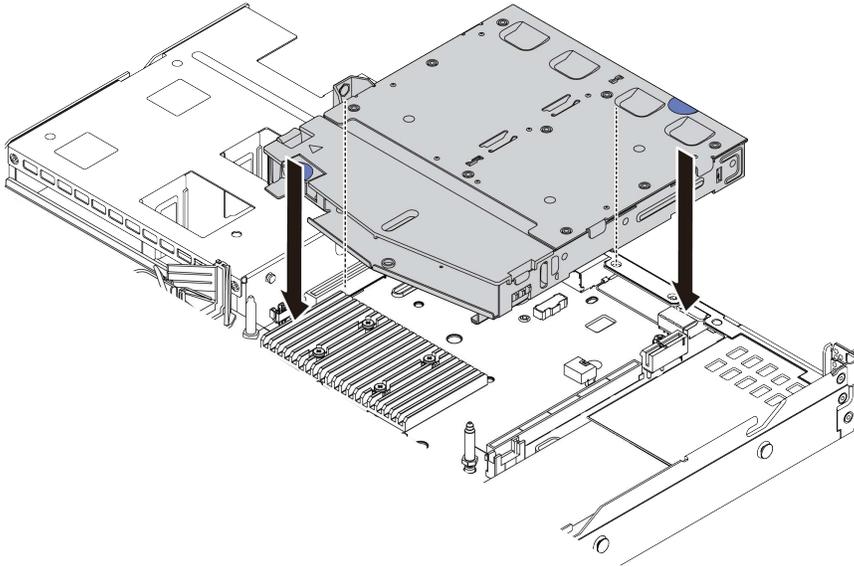
*Figure 61. Rear backplane installation*

- Step 4. Connect the signal cable and the power cable on the rear backplane.
- Step 5. Install the air baffle into the rear hot-swap drive cage as shown.



*Figure 62. Air baffle installation*

Step 6. Align the pins on the rear hot-swap drive cage with the corresponding hole and slot in the chassis. Then, lower the rear hot-swap drive cage into the chassis until it is fully seated.



*Figure 63. Rear hot-swap drive cage installation*

Step 7. Connect the signal cable and connect the power cable to the system board.

### **After you finish**

Install the drives or drive fillers into the rear hot-swap drive assembly. See [“Install a hot-swap drive” on page 164](#).

## Install a PCIe adapter and riser assembly

Use this information to install a PCIe adapter and riser assembly.

### About this task

There are different types of riser assembly configurations. The procedure for installing the riser card and PCIe adapter is similar for all types of riser assembly. The following takes the LPFH riser assembly as an example.

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the PCIe adapter to any unpainted surface on the outside of the server. Then, take the PCIe adapter out of the package and place it on a static-protective surface.
- Step 2. Locate the correct PCIe slot for the PCIe adapter. For information about the PCIe slots and supported PCIe adapters, see “[Rear view](#)” on [page 70](#) and “[PCIe slots and configurations](#)” on [page 43](#).
- Step 3. Remove the PCIe slot filler if there is a filler installed.
- Step 4. Install the PCIe adapter and secure it to the riser assembly.

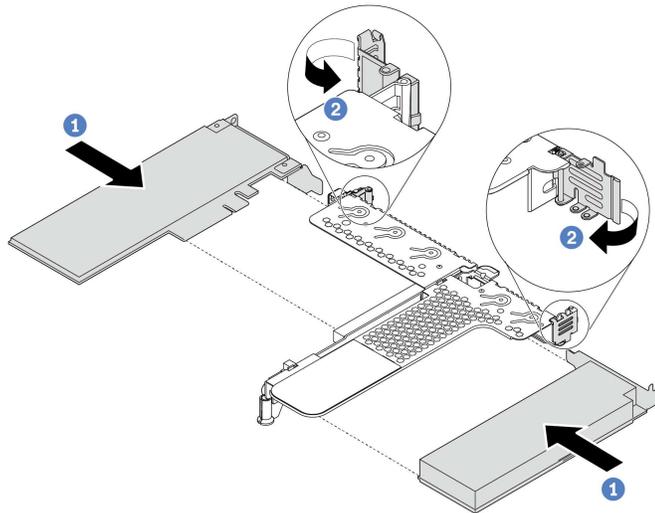
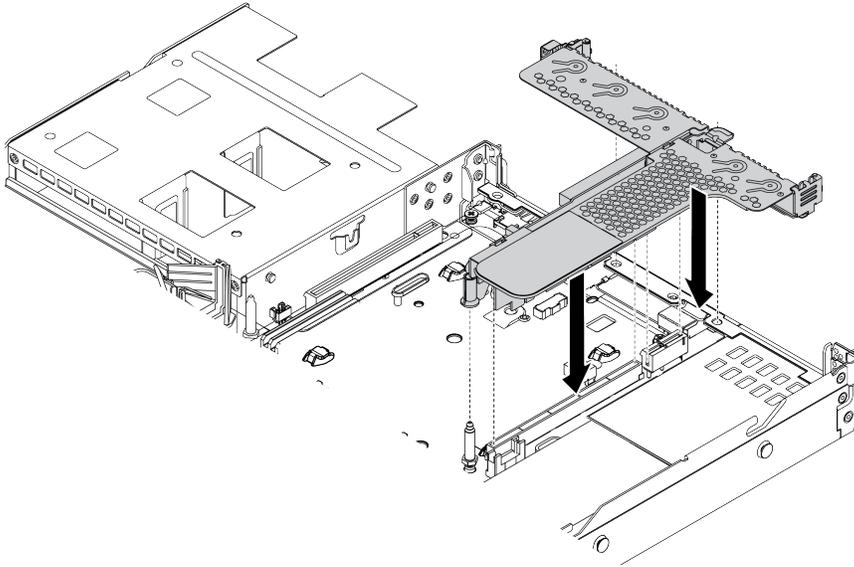


Figure 64. PCIe adapter installation into the LPFH riser assembly

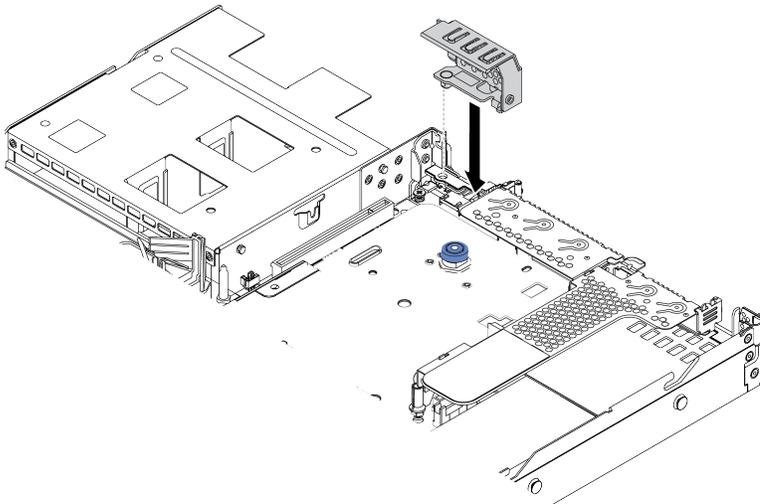
- a. Align the PCIe adapter with the PCIe slot on the riser card. Then, carefully press the PCIe adapter straight into the slot until it is securely seated and its bracket also is secured.
- b. Pivot the latch on the riser bracket to the closed position.

- Step 5. Connect cables to the PCIe adapter in the riser assembly.
- Step 6. Position the riser assembly on the chassis. Align the plastic clip and two pins on the bracket with the guide pin and two holes in the chassis and align the riser card with the riser slot on the system board. Then, carefully press the riser assembly straight down into the slot until it is fully seated.



*Figure 65. Riser assembly installation*

- Step 7. For the LPFH riser assembly, you need to install the rear wall bracket.



*Figure 66. Rear wall bracket installation*

## Install the serial port module

Use this information to install the serial port module.

### About this task

#### Attention:

- Read [“Installation guidelines” on page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

### Procedure

- Step 1. Touch the static-protective package that contains the system fan to any unpainted surface on the outside of the server. Then, take the system fan out of the package and place it on a static-protective surface.
- Step 2. Use a 5 mm wrench to install the serial port cable into the bracket.

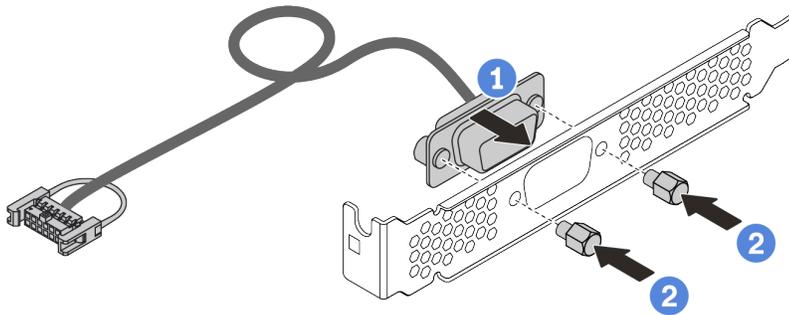


Figure 67. Serial port module installation

- Step 3. Remove the needed riser bracket from the system board. See [“Remove a riser assembly” on page 145](#).
- Step 4. Install the serial port assembly to the riser bracket.
- Step 5. Install the riser assembly back to the server. See [“Install a PCIe adapter and riser assembly” on page 169](#).
- Step 6. Connect the cable of the serial port module to the serial-port-module connector on the system board. For the location of the serial-port-module connector, refer to [“System board” on page 79](#).

After installing the serial port module, do one of the following to enable it according to the installed operating system:

- For Linux operating system:

Open the ipmitool and enter the following command to disable the Serial over LAN (SOL) feature:

```
-I lanplus -H IP -U USERID -P PASSWORD sol deactivate
```

- For Microsoft Windows operating system:
  1. Open the ipmitool and enter the following command to disable the SOL feature:  
`-I lanplus -H IP -U USERID -P PASSWORD sol deactivate`
  2. Open Windows PowerShell and enter the following command to disable the Emergency Management Services (EMS) feature:  
`Bcdedit /ems no`
  3. Restart the server to ensure that the EMS setting takes effect.

## Install the internal RAID adapter

Use this information to install the internal RAID adapter.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the internal RAID adapter to any unpainted surface on the outside of the server. Then, take the internal RAID adapter out of the package and place it on a static-protective surface.
- Step 2. Remove any components that may impede installation of the internal RAID adapter.

Step 3. Align the notches on the tray with the pins on the chassis, place down the internal RAID adapter, and slightly slide it as shown to secure it on the chassis.

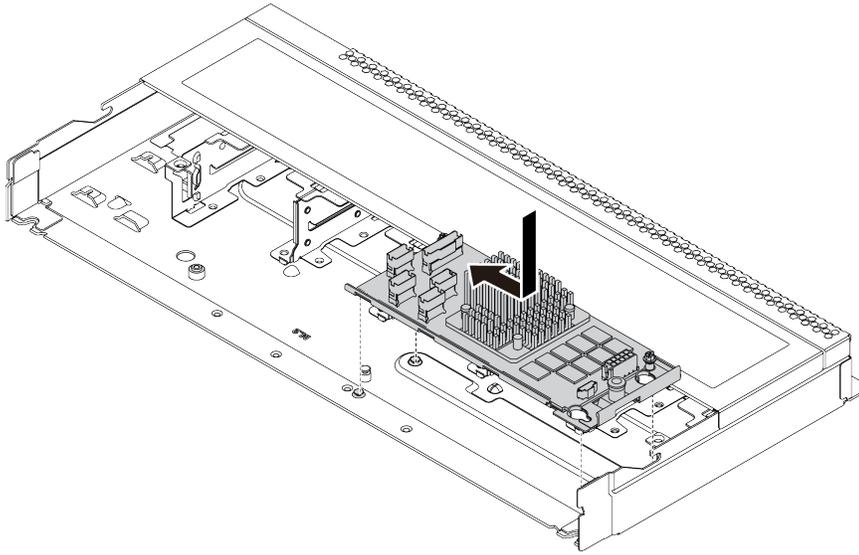


Figure 68. Internal RAID adapter installation

Step 4. Connect cables to the internal CFF RAID/HBA adapter. See [“CFF RAIR/HBA adapter cable routing” on page 87](#) and [“2.5-inch/3.5-inch drive backplane cable routing \(signal\)” on page 95](#).

## After you finish

Reinstall the components that you have been removed for installing the internal RAID adapter.

## Install the RAID super capacitor module

Use this information to install the RAID super capacitor module.

### About this task

#### Attention:

- Read [“Installation guidelines” on page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

**Note:** The following illustrates the locations for super capacitor modules.

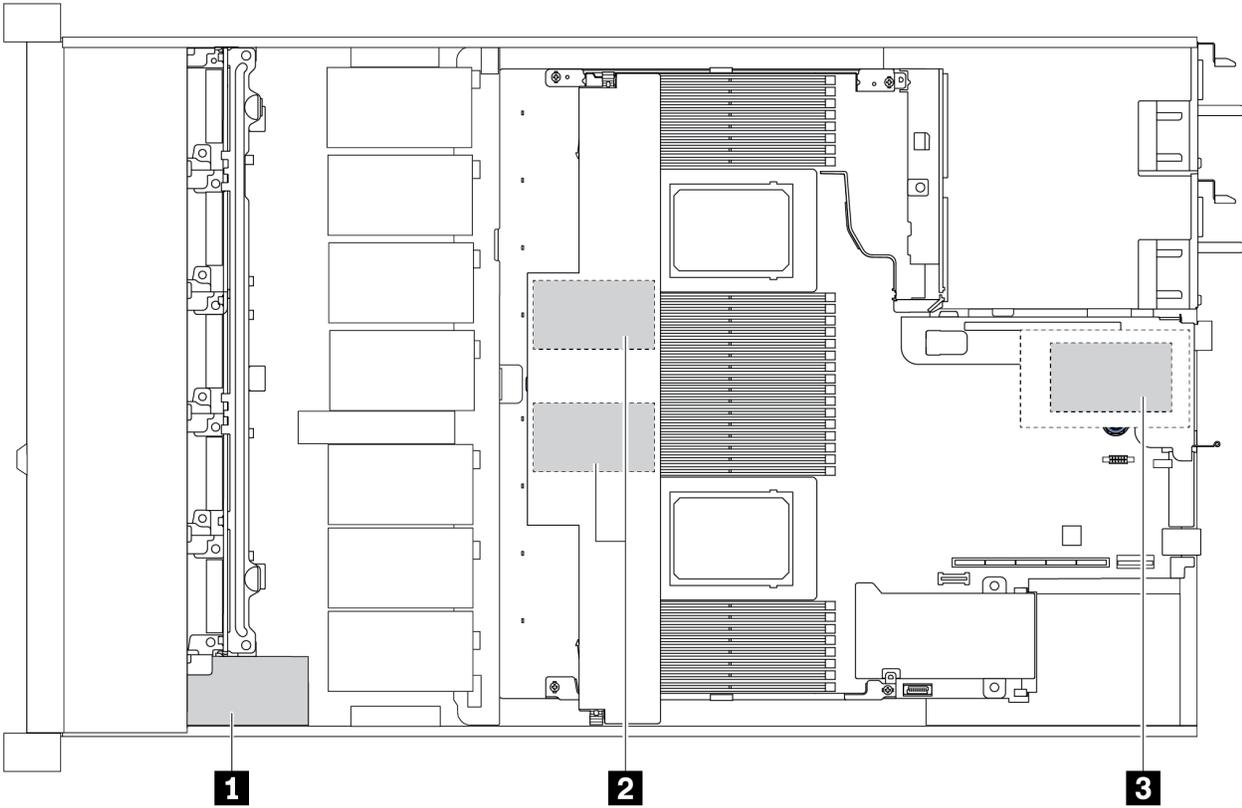


Figure 69. RAID super capacitor module location

## Install the RAID super capacitor module on the riser

Use this information to install the RAID super capacitor module on the riser.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on page 127 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the RAID super capacitor module to any unpainted surface on the outside of the server. Then, take the RAID super capacitor module out of the package and place it on a static-protective surface.
- Step 2. Check the installation rules for super capacitors. See “[PCIe slots and configurations](#)” on page 43.
- Step 3. Install the RAID super capacitor module on the riser.

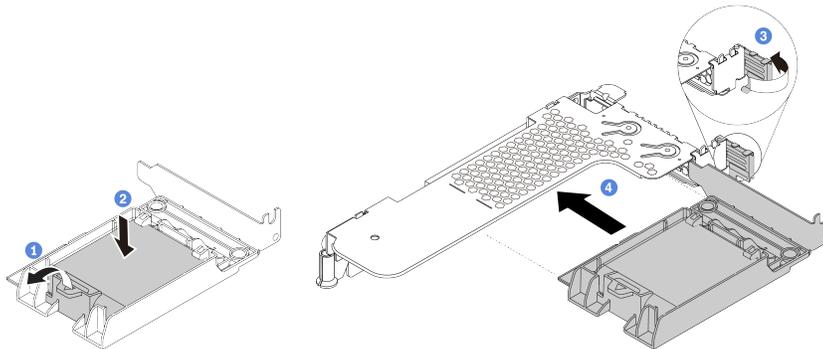


Figure 70. Installation of the RAID super capacitor module on the riser

- a. Open the retention clip on the holder.
- b. Put the RAID super capacitor module into the holder and press it down to secure it into the holder.
- c. Pivot the latch on the riser bracket to the open position.
- d. Align the RAID super capacitor assembly with the slot on the riser card. Then, carefully press the RAID super capacitor assembly straight into the slot until it is securely seated and its bracket also is secured.

### After you finish

1. Install the riser assembly on the chassis. See “[Install a PCIe adapter and riser assembly](#)” on page 169.

2. Connect the super capacitor module to an adapter with the extension cable that comes with the super capacitor module.

## Install the RAID super capacitor module on the air baffle

Use this information to install the RAID super capacitor module on the air baffle.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on page 127 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the RAID super capacitor module to any unpainted surface on the outside of the server. Then, take the RAID super capacitor module out of the package and place it on a static-protective surface.
- Step 2. Check the installation rules for super capacitors. See “[PCIe slots and configurations](#)” on page 43.
- Step 3. Install the RAID super capacitor module on the air baffle.

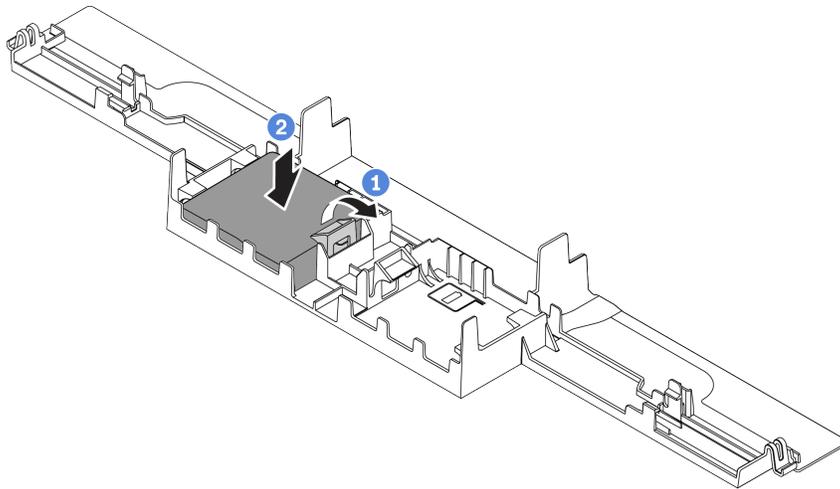


Figure 71. Installation of the RAID super capacitor module on the air baffle

- a. Open the retention clip on the holder.
- b. Put the RAID super capacitor module into the air baffle and press it down to secure it into the air baffle.

### After you finish

1. Install the air baffle on the chassis. See “[Install the air baffle](#)” on page 184.

2. Connect the super capacitor module to an adapter with the extension cable that comes with the super capacitor module.

## Install the RAID super capacitor module on the chassis

Use this information to install the RAID super capacitor module on the chassis.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on page 127 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the RAID super capacitor module to any unpainted surface on the outside of the server. Then, take the RAID super capacitor module out of the package and place it on a static-protective surface.
- Step 2. Check the installation rules for super capacitors. See “[PCIe slots and configurations](#)” on page 43.
- Step 3. If the server comes with a tray that covers the place of the RAID super capacitor module on the chassis, remove it first.

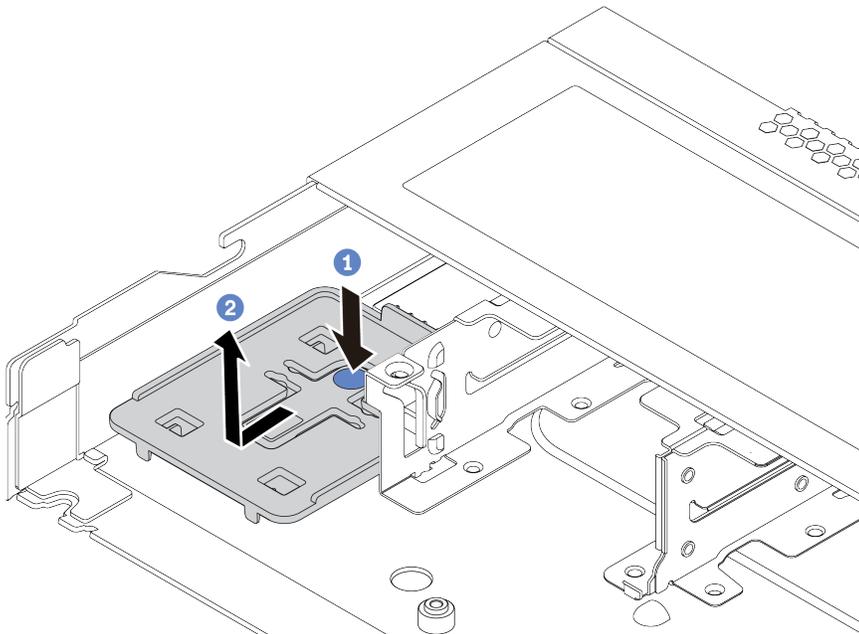


Figure 72. Tray removal

- Step 4. If the server does not have a RAID super capacitor module holder on the chassis, install one first.

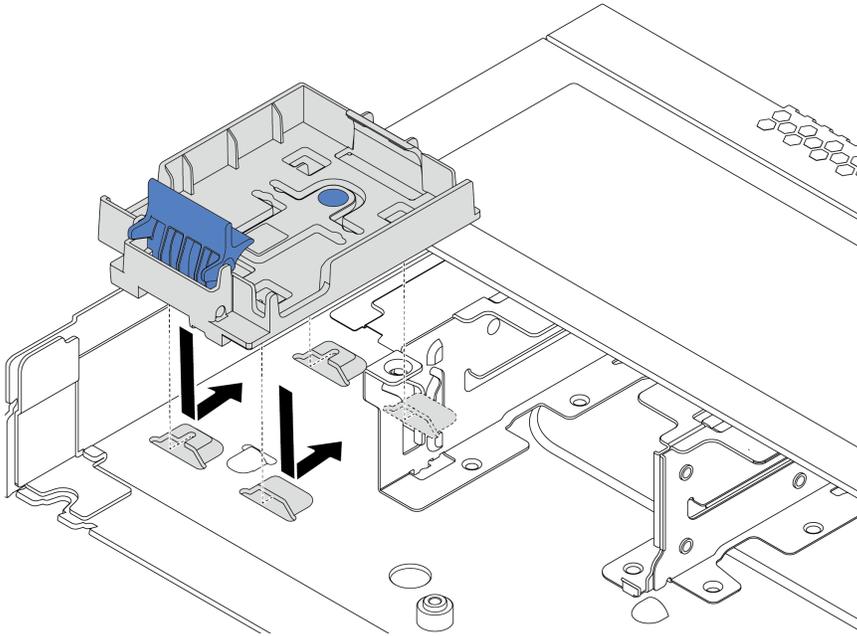


Figure 73. RAID super capacitor module holder installation

Step 5. Install the RAID super capacitor module on the chassis.

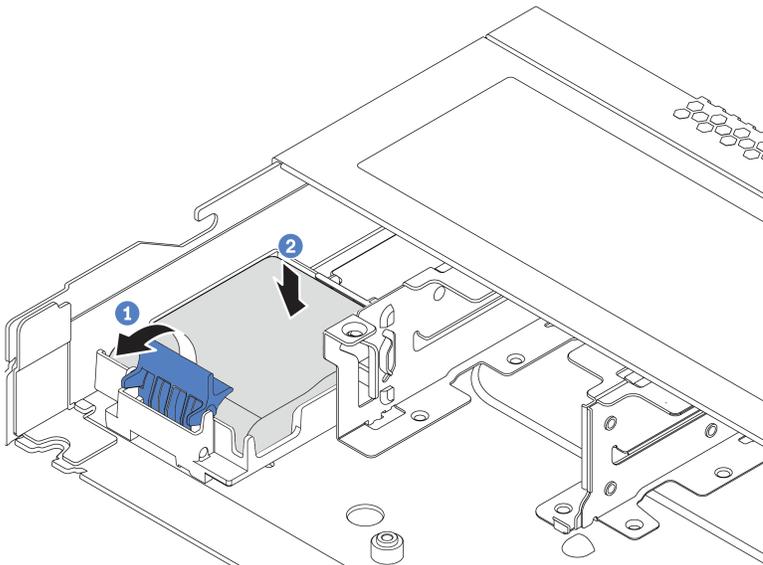


Figure 74. Installation of the RAID super capacitor module on the chassis

- a. Open the retention clip on the holder.
- b. Put the RAID super capacitor module into the holder and press it down to secure it into the holder.

## Install the OCP 3.0 Ethernet adapter

Use this information to install the OCP 3.0 Ethernet adapter.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the OCP 3.0 Ethernet adapter to any unpainted surface on the outside of the server. Then, take the OCP 3.0 Ethernet adapter out of the package and place it on a static-protective surface.
- Step 2. Remove the OCP bay filler if there is a filler installed.
- Step 3. Attach the OCP 3.0 Ethernet adapter label that comes with this option on the rear of the server.

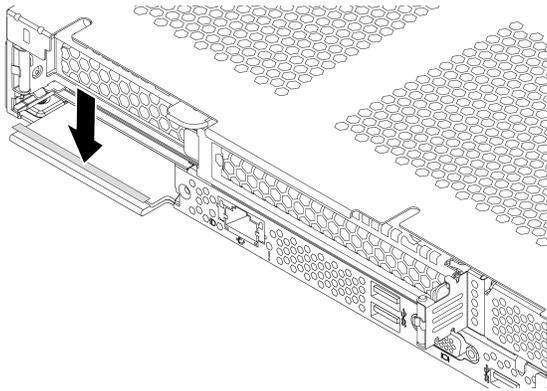


Figure 75. OCP 3.0 Ethernet adapter label installation

Step 4. Install the OCP 3.0 Ethernet adapter.

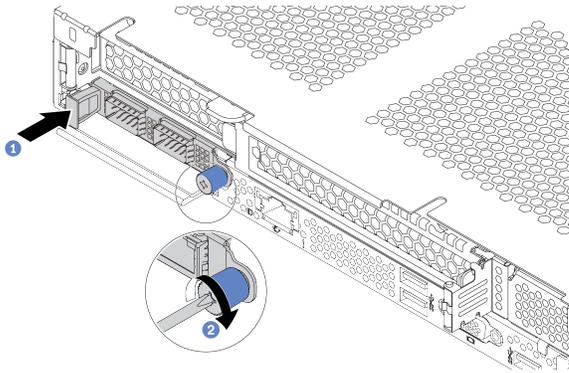


Figure 76. OCP 3.0 Ethernet adapter installation

- a. Push the OCP 3.0 Ethernet adapter as shown to insert it into the connector on the system board.
- b. Tighten the thumbscrew to secure the adapter.

**Notes:**

- Ensure that the thumbscrew is securely tightened. Otherwise, the OCP 3.0 Ethernet adapter will not get full connection and may not function.
- If there is an OCP 3.0 Ethernet adapter installed, when the system is powered off but still plugged in to AC power, system fans will continue to spin at a much lower speed. This is the system design to provide proper cooling for the OCP 3.0 Ethernet adapter.

## Install a system fan

Use this information to install a system fan. You can install a hot-swap fan without powering off the server, which helps you avoid significant interruption to the operation of the system.

### About this task

#### S033



#### **CAUTION:**

**Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.**

#### S017



#### **CAUTION:**

**Hazardous moving fan blades nearby. Keep fingers and other body parts away.**

#### **Attention:**

- Read “[Installation guidelines](#)” on page 127 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. If there is a fan filler installed, remove it.
- Step 2. Touch the static-protective package that contains the system fan to any unpainted surface on the outside of the server. Then, take the system fan out of the package and place it on a static-protective surface.

**Note:** Ensure that fan installation meets “[Technical rules](#)” on page 36.

Step 3. Place the system fan down in the slot and then press the point on its edge to secure it in place. Ensure that the fan connector is installed correctly to the connector on the system board.

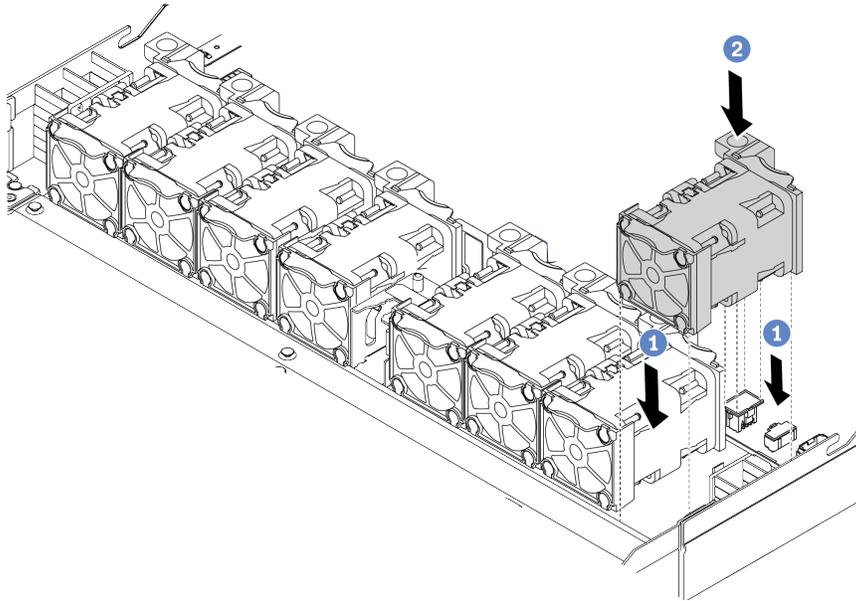


Figure 77. System fan installation

## Install an intrusion switch

Use this information to install an intrusion switch.

### About this task

#### Attention:

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. Touch the static-protective package that contains the intrusion switch to any unpainted surface on the outside of the server. Then, take the intrusion switch out of the package and place them on a static-protective surface.
- Step 2. Insert the intrusion switch and push it in the direction as shown until it is fully seated.

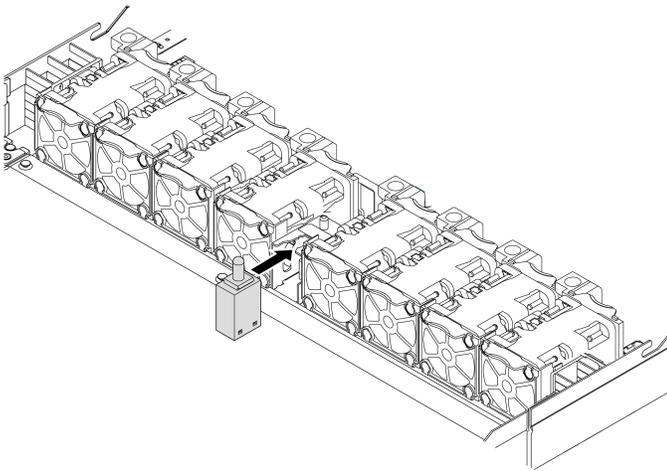


Figure 78. Intrusion switch installation

- Step 3. Connect the cable of the intrusion switch to the intrusion switch connector on the system board. For the location of the intrusion switch connector, refer to “[System board](#)” on [page 79](#).

## Install the air baffle

Use this information to install the air baffle.

### About this task

Depending on the model, your server might not have an air baffle installed. The air baffle you want to install might be different from the following illustrations, but the removal method is the same.

#### S033



#### **CAUTION:**

**Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.**

#### S017



#### **CAUTION:**

**Hazardous moving fan blades nearby. Keep fingers and other body parts away.**

#### **Attention:**

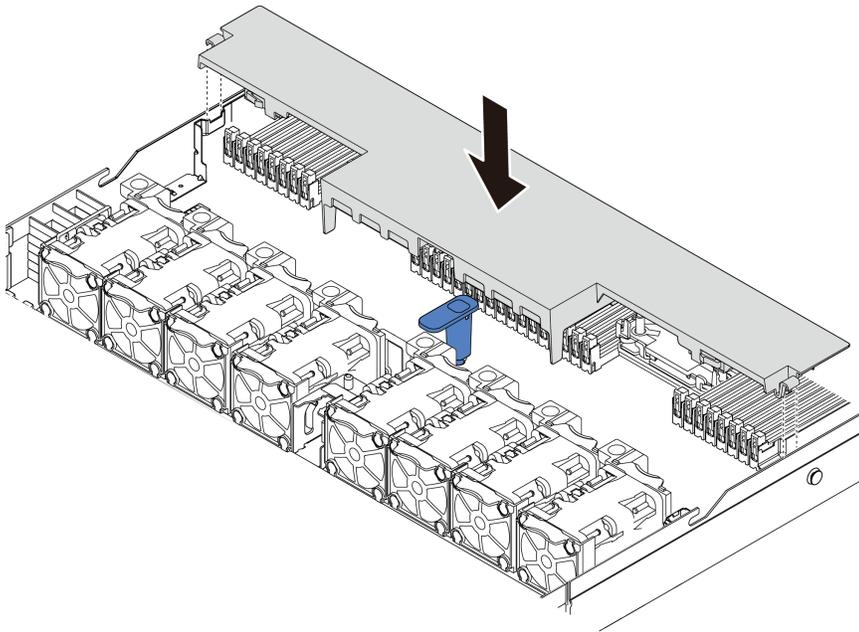
- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

### Procedure

- Step 1. If you need to install a RAID super capacitor module on the bottom of the air baffle, install it first. See “[Install the RAID super capacitor module on the air baffle](#)” on [page 176](#).

Step 2. Align the direction of the air baffle according to indications on it.



*Figure 79. Air baffle installation*

Step 3. Lower the air baffle into the chassis and press the air baffle down until it is securely seated.

### **After you finish**

If there is a RAID super capacitor module installed on the bottom of the air baffle, connect it to the RAID adapter with the extension cable that comes with the RAID super capacitor module.

## Install the top cover

Use this information to install the top cover.

### **S033**



#### **CAUTION:**

**Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.**

### **S014**



#### **CAUTION:**

**Hazardous voltage, current, and energy levels might be present. Only a qualified service technician is authorized to remove the covers where the label is attached.**

#### **Attention:**

- Read “[Installation guidelines](#)” on [page 127](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Operating the server with the top cover removed might damage server components. For proper cooling and airflow, install the top cover before you turn on the server.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

## **Procedure**

Step 1. Check your server and ensure that:

- All cables, adapters, and other components are installed and seated correctly and that you have not left loose tools or parts inside the server.
- All internal cables are connected and routed correctly. See [Chapter 3 “Internal cable routing” on page 85](#).

Step 2. Install the top cover to your server.

**Attention:** Handle the top cover carefully. Dropping the top cover with the cover latch open might damage the cover latch.

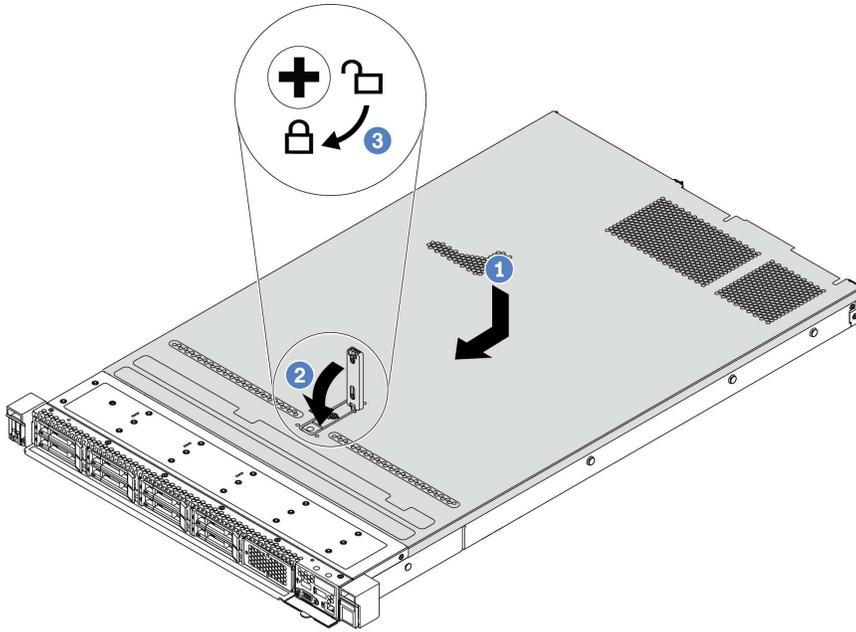


Figure 80. Top cover installation

- a. Ensure that the cover latch is in the open position. Lower the top cover onto the chassis until both sides of the top cover engage the guides on both sides of the chassis. Then, slide the top cover to the front of the chassis.

**Note:** Before you slide the top cover forward, ensure that all the tabs on the top cover engage the chassis correctly.

- b. Press down the cover latch and ensure that the cover latch is completely closed.
- c. Use a screwdriver to turn the cover lock to the locked position.

## Install a hot-swap power supply

Use this information to install a hot-swap power supply.

### About this task

- The server is shipped with only one power supply by default. In this case, the power supply is non-hot-swap and before removing it, you must turn off the server first. To support redundancy mode or hot-swap, install an additional hot-swap power supply.
- The server does not support setting the redundancy mode manually. The BMC of the server can automatically set it based on the installed power supply unit quantity.
  - When only 1 power supply unit is installed, the redundancy mode is set to “Non-redundant mode”.
  - When 2 power supply units are installed, the redundancy mode is set to “Redundant (N+N)”. If one of the power supply units fails or has been removed, the BMC will report an event and set the redundancy mode to “Non-redundant mode” automatically.
- If you are replacing the existing power supply with a new power supply:
  - Use Lenovo Capacity Planner to calculate the required power capacity for what is configured for your server. For details, see:  
<https://datacentersupport.lenovo.com/solutions/Invo-lcp>
  - Ensure that the devices that you are installing are supported. For details, see:  
<https://static.lenovo.com/us/en/serverproven/index.shtml>
  - Attach the label coming with this option onto the existing label near the power supply.



Figure 81. Example label

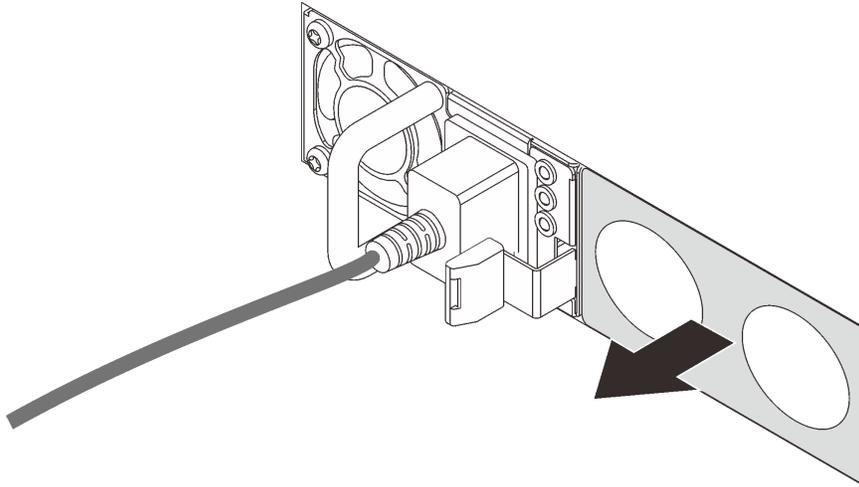
### Attention:

- Read “[Installation guidelines](#)” on page 127 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

A video for this task is available at YouTube: <https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDIoAwuBQHR0>.

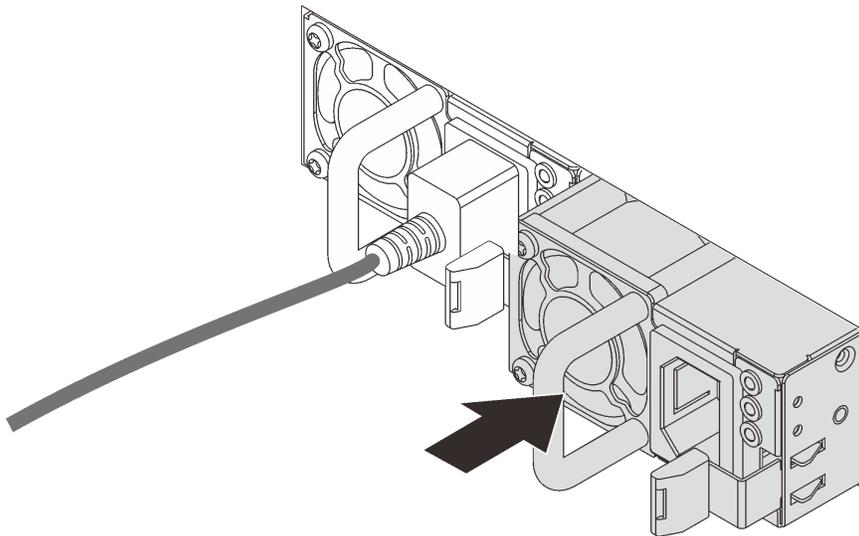
### Procedure

- Step 1. Take the new part out of the package and place it on a static-protective surface.
- Step 2. If there is a power-supply filler installed, remove it.



*Figure 82. Hot-swap power supply filler removal*

Step 3. Slide the new hot-swap power supply into the bay until it snaps into position.



*Figure 83. Hot-swap power supply installation*

Step 4. Connect the power supply unit to a properly grounded electrical outlet.

- For 240 V DC power supply units:
  1. Turn off the server.
  2. Connect one end of the power cord to the power connector on the power supply unit.
  3. Connect the other end of the power cord to a properly grounded electrical outlet.
- For AC power supply units:
  1. Connect one end of the power cord to the power connector on the power supply unit.
  2. Connect the other end of the power cord to a properly grounded electrical outlet.
- For -48V DC power supply units:

1. Use a slotted screwdriver to loosen the 3 captive screws on the power supply terminal block.
2. Check the type label on the power supply block and each power cord.

Type	PSU terminal block	Power cord
Input	-Vin	-Vin
Ground		GND
Output	RTN	RTN

3. Face the groove side of each power cord pin upwards, and then plug the pins into corresponding holes on the power block. Use the table above for guidance to ensure that the pins find correct slots.
4. Tighten the captive screws on the power block. Ensure that the screws and cord pins are secured in place and no bare metal parts are shown.
5. Connect the other end of the cables to a properly grounded electrical outlet. Ensure that the cable ends find correct outlets.

## Safety precautions

Understand and apply the safety precautions before removing or installing a power supply unit.

### AC power supply units

#### S001



 **DANGER**

**Electrical current from power, telephone, and communication cables is hazardous.**

**To avoid a shock hazard:**

- **Connect all power cords to a properly wired and grounded electrical outlet/source.**
- **Connect any equipment that will be attached to this product to properly wired outlets/sources.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **The device might have more than one power cord, to remove all electrical current from the device, ensure that all power cords are disconnected from the power source.**

## S002



### **CAUTION:**

The power-control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

## S035



### **CAUTION:**

Never remove the cover on a power supply or any part that has this label attached. Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

## **DC power supply units**

### **CAUTION:**



240 V DC input (input range: 180-300 V) is supported in Chinese Mainland ONLY.

Perform the following steps to safely remove the power cord of one 240 V DC power supply unit. Otherwise, there can be data loss and other damages to the equipment. Damages and losses resulting from inappropriate operations will not be covered by the manufacturer's warranty.

1. Turn off the server.
2. Disconnect the power cord from the power source.
3. Disconnect the power cord from the power supply unit.

## S035



### **CAUTION:**

Never remove the cover on a power supply or any part that has this label attached. Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

## S019



### CAUTION:

The power-control button on the device does not turn off the electrical current supplied to the device. The device also might have more than one connection to dc power. To remove all electrical current from the device, ensure that all connections to dc power are disconnected at the dc power input terminals.

## S029



For -48V dc power supply, electrical current from power cables is hazardous.

To avoid a shock hazard:

- To connect or disconnect -48V dc power cables when you need to remove/install redundancy power supply unit(s).

### To Connect:

1. Turn OFF subject dc power source(s) and equipment (s) that are attached to this product.
2. Install the power supply unit(s) into the system housing.
3. Attach dc power cable(s) to the product.
  - Ensure correct polarity of -48 V dc connections: RTN is + and -Vin (typical -48 V) dc is -. Earth ground should use a two-hole lug for safety.
4. Connect dc power cable(s) to subject power source (s).
5. Turn ON all the power source(s).

### To Disconnect:

1. Disconnect or turn off the subject dc power source(s) (at the breaker panel) before removing the power supply unit(s).
2. Remove the subject dc cable(s).
3. Unplug the subject power supply unit(s) from the system housing.

---

## Install the server in a rack

To install the server in a rack, follow the instructions that are provided in the Rail Installation Kit for the rails on which the server will be installed.

---

## Connect external cables

Attach all external cables to the server. Typically, you will need to connect the server to a power source, to the data network, and to storage. In addition, you will need to connect the server to the management network.

Connect the server to power.

Connect the server to the network.

Connect the server to any storage devices.

---

## Power on the server

After the server performs a short self-test (power status LED flashes quickly) when connected to input power, it enters a standby state (power status LED flashes once per second).

The server can be turned on (power LED on) in any of the following ways:

- You can press the power button.
- The server can respond to remote power-on requests sent to Lenovo XClarity Controller via Lenovo XClarity Essentials OneCLI, IPMItool, or SSH CLI.

For example, run the following command on Lenovo XClarity Essentials OneCLI to power on your server: `OneCli.exe ospower turnon --bmc USERID:PASSWORD@host`

For more information about running the `ospower` command, see [https://sysmgt.lenovofiles.com/help/topic/toolstr\\_cli\\_lenovo/onecli\\_r\\_ospower\\_command.html](https://sysmgt.lenovofiles.com/help/topic/toolstr_cli_lenovo/onecli_r_ospower_command.html).

If the system UEFI power policy is set to “always on”, the system will be powered on automatically when an AC source is plugged in.

For information about powering off the server, see “[Power off the server](#)” on page 193.

---

## Validate server setup

After powering up the server, make sure that the LEDs are lit and that they are green.

---

## Power off the server

The server remains in a standby state when it is connected to a power source, allowing the BMC to respond to remote power-on requests. To remove all power from the server (power status LED off), you must disconnect all power cables.

To place the server in a standby state (power status LED flashes once per second):

**Note:** The Lenovo XClarity Controller can place the server in a standby state as an automatic response to a critical system failure.

- Start an orderly shutdown using the operating system (if supported by your operating system).
- Press the power button to start an orderly shutdown (if supported by your operating system).
- Press and hold the power button for more than 4 seconds to force a shutdown.
- Send remote power-off commands to Lenovo XClarity Controller via Lenovo XClarity Essentials OneCLI, IPMItool, or SSH CLI.

When in a standby state, the server can respond to remote power-on requests sent to the Lenovo XClarity Controller. For information about powering on the server, see “[Power on the server](#)” on page 193.



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## Chapter 5. System configuration

Complete these procedures to configure your system.

---

### Set the network connection for the Lenovo XClarity Controller

Before you can access the Lenovo XClarity Controller over your network, you need to specify how Lenovo XClarity Controller will connect to the network. Depending on how the network connection is implemented, you might need to specify a static IP address as well.

The following methods are available to set the network connection for the Lenovo XClarity Controller if you are not using DHCP:

- If a monitor is attached to the server, you can use Lenovo XClarity Controller to set the network connection.

Complete the following steps to connect the Lenovo XClarity Controller to the network using the Lenovo XClarity Provisioning Manager.

Step 1. Start the server.

Step 2. When you see <F1> Setup, press F1.

Step 3. On the top right corner of the Lenovo XClarity Provisioning Manager main interface, click , and then specify how the Lenovo XClarity Controller will connect to the network in the Network Settings window.

- If you choose a static IP connection, make sure that you specify an IPv4 or IPv6 address that is available on the network.
- If you choose a DHCP connection, make sure that the MAC address for the server has been configured in the DHCP server.

Step 4. Click **OK** to continue starting the server.

---

## Update the firmware

Several options are available to update the firmware for the server.

You can use the tools listed here to update the most current firmware for your server and the devices that are installed in the server.

**Note:** Lenovo typically releases firmware in bundles called UpdateXpress System Packs (UXSPs). To ensure that all of the firmware updates are compatible, you should update all firmware at the same time. If you are updating firmware for both the Lenovo XClarity Controller and UEFI, update the firmware for Lenovo XClarity Controller first.

Best practices related to updating firmware are available at the following location:

<http://lenovopress.com/LP0656>

### Important terminology

- **In-band update.** The installation or update is performed using a tool or application within an operating system that is executing on the server's core CPU.
- **Out-of-band update.** The installation or update is performed by the Lenovo XClarity Controller collecting the update and then directing the update to the target subsystem or device. Out-of-band updates have no dependency on an operating system executing on the core CPU. However, most out-of-band operations do require the server to be in the S0 (Working) power state.
- **On-Target update.** The installation or update is initiated from an Operating System executing on the server's operating system.
- **Off-Target update.** The installation or update is initiated from a computing device interacting directly with the server's Lenovo XClarity Controller.
- **UpdateXpress System Packs (UXSPs).** UXSPs are bundled updates designed and tested to provide the interdependent level of functionality, performance, and compatibility. UXSPs are server machine-type specific and are built (with firmware and device driver updates) to support specific Windows Server, Red Hat Enterprise Linux (RHEL) and SUSE Linux Enterprise Server (SLES) operating system distributions. Machine-type-specific firmware-only UXSPs are also available.

See the following table to determine the best Lenovo tool to use for installing and setting up the firmware:

**Note:** The server UEFI settings for option ROM must be set to **Auto** or **UEFI** to update firmware using Lenovo XClarity Administrator or Lenovo XClarity Essentials. For more information, see the following Tech Tip:

<https://datacentersupport.lenovo.com/us/en/solutions/ht506118>

Tool	In-band update	Out-of-band update	On-target update	Off-target update	Graphical user interface	Command-line interface	Supports UXSPs
<b>Lenovo XClarity Provisioning Manager</b> Limited to core system firmware only	√ <sup>2</sup>			√	√		√
<b>Lenovo XClarity Controller</b> Supports core system firmware and most advanced I/O option firmware updates		√		√	√	√	
<b>Lenovo XClarity Essentials OneCLI</b> Supports all core system firmware, I/O firmware, and installed operating system driver updates	√	√	√	√		√	√
<b>Lenovo XClarity Essentials UpdateXpress</b> Supports all core system firmware, I/O firmware, and installed operating system driver updates	√	√	√	√	√		√
<b>Lenovo XClarity Essentials Bootable Media Creator</b> Supports core system firmware and I/O firmware updates. You can update the Microsoft® Windows® operating system, but device drivers are not included on the bootable image	√	√		√	√	√	√
<b>Lenovo XClarity Administrator</b> Supports core system firmware and I/O firmware updates	√ <sup>1</sup>	√ <sup>2</sup>		√	√		
<b>Lenovo XClarity Integrator for VMware vCenter</b> Supports all core system firmware, I/O firmware, and installed operating system driver updates		√		√	√		√

Tool	In-band update	Out-of-band update	On-target update	Off-target update	Graphical user interface	Command-line interface	Supports UXSPs
<b>Lenovo XClarity Integrator for Microsoft Windows Admin Center</b> Supports all core system firmware, I/O firmware, and installed operating system driver updates	✓	✓	✓	✓	✓		
<b>Lenovo XClarity Integrator for Microsoft System Center Configuration Manager</b> Supports all core system firmware, I/O firmware, and installed operating system driver updates	✓		✓		✓		✓
<b>Notes:</b> <ol style="list-style-type: none"> <li>1. For I/O firmware updates.</li> <li>2. For BMC and UEFI firmware updates.</li> </ol>							

The latest firmware can be found at the following site:

<https://datacentersupport.lenovo.com/us/en/products/servers/thinksystem/sr645/7d2x/downloads/driver-list>

- **Lenovo XClarity Provisioning Manager**

From Lenovo XClarity Provisioning Manager, you can update the Lenovo XClarity Controller firmware, the UEFI firmware, and the Lenovo XClarity Provisioning Manager software.

**Note:** By default, the Lenovo XClarity Provisioning Manager Graphical User Interface is displayed when you press F1. If you have changed that default to be the text-based system setup, you can bring up the Graphical User Interface from the text-based system setup interface.

For additional information about using Lenovo XClarity Provisioning Manager to update firmware, see:

“Firmware Update” section in the LXPM documentation compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxpm\\_frontend/lxpm\\_product\\_page.html](https://sysmgt.lenovofiles.com/help/topic/lxpm_frontend/lxpm_product_page.html).

- **Lenovo XClarity Controller**

If you need to install a specific update, you can use the Lenovo XClarity Controller interface for a specific server.

**Notes:**

- To perform an in-band update through Windows or Linux, the operating system driver must be installed and the Ethernet-over-USB (sometimes called LAN over USB) interface must be enabled.

For additional information about configuring Ethernet over USB, see:

“Configuring Ethernet over USB” section in the XCC documentation version compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html)

- If you update firmware through the Lenovo XClarity Controller, make sure that you have downloaded and installed the latest device drivers for the operating system that is running on the server.

For specific details about updating firmware using Lenovo XClarity Controller, see:

“Updating Server Firmware” section in the XCC documentation compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html)

- **Lenovo XClarity Essentials OneCLI**

Lenovo XClarity Essentials OneCLI is a collection of command line applications that can be used to manage Lenovo servers. Its update application can be used to update firmware and device drivers for your servers. The update can be performed within the host operating system of the server (in-band) or remotely through the BMC of the server (out-of-band).

For specific details about updating firmware using Lenovo XClarity Essentials OneCLI, see:

[http://sysmgt.lenovofiles.com/help/topic/toolsctr\\_cli\\_lenovo/onecli\\_c\\_update.html](http://sysmgt.lenovofiles.com/help/topic/toolsctr_cli_lenovo/onecli_c_update.html)

- **Lenovo XClarity Essentials UpdateXpress**

Lenovo XClarity Essentials UpdateXpress provides most of OneCLI update functions through a graphical user interface (GUI). It can be used to acquire and deploy UpdateXpress System Pack (UXSP) update packages and individual updates. UpdateXpress System Packs contain firmware and device driver updates for Microsoft Windows and for Linux.

You can obtain Lenovo XClarity Essentials UpdateXpress from the following location:

<https://datacentersupport.lenovo.com/solutions/Invo-xpress>

- **Lenovo XClarity Essentials Bootable Media Creator**

You can use Lenovo XClarity Essentials Bootable Media Creator to create bootable media that is suitable for firmware updates, VPD updates, inventory and FFDC collection, advanced system configuration, FoD Keys management, secure erase, RAID configuration, and diagnostics on supported servers.

You can obtain Lenovo XClarity Essentials BoMC from the following location:

<https://datacentersupport.lenovo.com/solutions/Invo-bomc>

- **Lenovo XClarity Administrator**

If you are managing multiple servers using the Lenovo XClarity Administrator, you can update firmware for all managed servers through that interface. Firmware management is simplified by assigning firmware-compliance policies to managed endpoints. When you create and assign a compliance policy to managed endpoints, Lenovo XClarity Administrator monitors changes to the inventory for those endpoints and flags any endpoints that are out of compliance.

For specific details about updating firmware using Lenovo XClarity Administrator, see:

[http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/update\\_fw.html](http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/update_fw.html)

- **Lenovo XClarity Integrator offerings**

Lenovo XClarity Integrator offerings can integrate management features of Lenovo XClarity Administrator and your server with software used in a certain deployment infrastructure, such as VMware vCenter, Microsoft Admin Center, or Microsoft System Center.

For specific details about updating firmware using Lenovo XClarity Integrator offerings, see:

[https://sysmgt.lenovofiles.com/help/topic/lxce\\_frontend/overview.html](https://sysmgt.lenovofiles.com/help/topic/lxce_frontend/overview.html)

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## Configure the firmware

Several options are available to install and set up the firmware for the server.

**Important:** Do not configure option ROMs to be set to **Legacy** unless directed to do so by Lenovo Support. This setting prevents UEFI drivers for the slot devices from loading, which can cause negative side effects for Lenovo software, such as Lenovo XClarity Essentials OneCLI, and to the Lenovo XClarity Controller. The side effects include the inability to determine adapter card details, such as model name and firmware levels. When adapter card information is not available, generic information for the model name, such as "Adapter 06:00:00" instead of the actual model name, such as "ThinkSystem RAID 930-16i 4GB Flash." In some cases, the UEFI boot process might also hang.

- “Configuring the Server” section in the XCC documentation compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html)

- **Lenovo XClarity Provisioning Manager**

From Lenovo XClarity Provisioning Manager, you can configure the UEFI settings for your server.

**Note:** The Lenovo XClarity Provisioning Manager provides a Graphical User Interface to configure a server. The text-based interface to system configuration (the Setup Utility) is also available. From Lenovo XClarity Provisioning Manager, you can choose to restart the server and access the text-based interface. In addition, you can choose to make the text-based interface the default interface that is displayed when you press F1.

- **Lenovo XClarity Essentials OneCLI**

You can use the configuration application and commands to view the current system configuration settings and make changes to Lenovo XClarity Controller and UEFI. The saved configuration information can be used to replicate or restore other systems.

For information about configuring the server using Lenovo XClarity Essentials OneCLI, see:

[http://sysmgt.lenovofiles.com/help/topic/toolsctr\\_cli\\_lenovo/onecli\\_c\\_settings\\_info\\_commands.html](http://sysmgt.lenovofiles.com/help/topic/toolsctr_cli_lenovo/onecli_c_settings_info_commands.html)

- **Lenovo XClarity Controller**

You can configure the management processor for the server through the Lenovo XClarity Controller Web interface or through the command-line interface.

For information about configuring the server using Lenovo XClarity Controller, see:

“Configuring the Server” section in the XCC documentation compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html).

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## Configure the memory

Memory performance depends on several variables, such as memory mode, memory speed, memory ranks, memory population and processor.

More information about optimizing memory performance and configuring memory is available at the Lenovo Press Web site:

<https://lenovopress.com/servers/options/memory>

In addition, you can take advantage of a memory configurator, which is available at the following site:

[http://1config.lenovo.com/#/memory\\_configuration](http://1config.lenovo.com/#/memory_configuration)

For specific information about the required installation order of memory modules in your server based on the system configuration and memory mode that you are implementing, see “[DIMM population rules](#)” on page 37.

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## Configure the RAID arrays

Using a Redundant Array of Independent Disks (RAID) to store data remains one of the most common and cost-efficient methods to increase server's storage performance, availability, and capacity.

RAID increases performance by allowing multiple drives to process I/O requests simultaneously. RAID can also prevent data loss in case of a drive failure by reconstructing (or rebuilding) the missing data from the failed drive using the data from the remaining drives.

RAID array (also known as RAID drive group) is a group of multiple physical drives that uses a certain common method to distribute data across the drives. A virtual drive (also known as virtual disk or logical drive) is a partition in the drive group that is made up of contiguous data segments on the drives. Virtual drive is presented up to the host operating system as a physical disk that can be partitioned to create OS logical drives or volumes.

An introduction to RAID is available at the following Lenovo Press Web site:

<https://lenovopress.com/lp0578-lenovo-raid-introduction>

Detailed information about RAID management tools and resources is available at the following Lenovo Press Web site:

<https://lenovopress.com/lp0579-lenovo-raid-management-tools-and-resources>



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## Deploy the operating system

Several options are available to deploy an operating system on one or more servers.

### Tool-based deployment

- **Multi-server context**

Available tools:

- Lenovo XClarity Administrator

[http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/compute\\_node\\_image\\_deployment.html](http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/compute_node_image_deployment.html)

- Lenovo XClarity Essentials OneCLI

[http://sysmgt.lenovofiles.com/help/topic/toolstr\\_cli\\_lenovo/onecli\\_r\\_uxspi\\_proxy\\_tool.html](http://sysmgt.lenovofiles.com/help/topic/toolstr_cli_lenovo/onecli_r_uxspi_proxy_tool.html)

- **Single-server context**

Available tools:

- Lenovo XClarity Provisioning Manager

“OS Installation” section in the LXPM documentation compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxpm\\_frontend/lxpm\\_product\\_page.html](https://sysmgt.lenovofiles.com/help/topic/lxpm_frontend/lxpm_product_page.html)

- Lenovo XClarity Essentials OneCLI

[http://sysmgt.lenovofiles.com/help/topic/toolstr\\_cli\\_lenovo/onecli\\_r\\_uxspi\\_proxy\\_tool.html](http://sysmgt.lenovofiles.com/help/topic/toolstr_cli_lenovo/onecli_r_uxspi_proxy_tool.html)

### Manual deployment

If you cannot access the above tools, follow the instructions below, download the corresponding OS *Installation Guide*, and deploy the operating system manually by referring to the guide.

1. Go to <https://datacentersupport.lenovo.com/solutions/server-os>.
2. Select an operating system from the navigation pane and click **Resources**.
3. Locate the “OS Install Guides” area and click the installation instructions. Then, follow the instructions to complete the operation system deployment task.

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## Back up the server configuration

After setting up the server or making changes to the configuration, it is a good practice to make a complete backup of the server configuration.

Make sure that you create backups for the following server components:

- **Management processor**

You can back up the management processor configuration through the Lenovo XClarity Controller interface. For details about backing up the management processor configuration, see:

“Backing up the BMC configuration” section in the XCC documentation compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html).

Alternatively, you can use the `save` command from Lenovo XClarity Essentials OneCLI to create a backup of all configuration settings. For more information about the `save` command, see:

[http://sysmgt.lenovofiles.com/help/topic/toolstr\\_cli\\_lenovo/onecli\\_r\\_save\\_command.html](http://sysmgt.lenovofiles.com/help/topic/toolstr_cli_lenovo/onecli_r_save_command.html)

- **Operating system**

Use your backup methods to back up the operating system and user data for the server.





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## Chapter 6. Resolving installation issues

Use this information to resolve issues that you might have when setting up your system.

Use the information in this section to diagnose and resolve problems that you might encounter during the initial installation and setup of your server.

- [“Server does not power on” on page 207](#)
- [“The server immediately displays the POST Event Viewer when it is turned on” on page 207](#)
- [“Embedded hypervisor is not in the boot list” on page 208](#)
- [“Server cannot recognize a hard drive” on page 208](#)
- [“Displayed system memory is less than installed physical memory” on page 209](#)
- [“A Lenovo optional device that was just installed does not work.” on page 209](#)
- [“Voltage planar fault is displayed in the event log” on page 210](#)

### Server does not power on

Complete the following steps until the problem is resolved:

1. Check the event log for any events related to the server not powering on.
2. Check for any LEDs that are flashing amber.
3. Check the power LED on the system board.
4. Check if AC power LED is lit on or the amber LED is lit on at the PSU rear side.
5. AC cycle the system.
6. Remove the CMOS battery for at least ten seconds, then, reinstall the CMOS battery.
7. Try to power on the system by IPMI command through XCC or by the power button.
8. Implement the minimum configuration (one processor, one DIMM and one PSU without any adapter and any drive installed).
9. Reseat all power supplies and make sure that AC LEDs on the PSU rear side are lit.
10. Replace the each power supply and check the power button function after installing the each one.
11. If the issue cannot be resolved by above actions, please call service to review the issue symptom and see whether the system board replacement is necessary.

### The server immediately displays the POST Event Viewer when it is turned on

Complete the following steps until the problem is solved.

1. Correct any errors that are indicated by the light path diagnostics LEDs.
2. Make sure that the server supports all the processors and that the processors match in speed and cache size.

You can view processor details from system setup.

To determine if the processor is supported for the server, see <https://static.lenovo.com/us/en/serverproven/index.shtml>.

3. (Trained technician only) Make sure that processor 1 is seated correctly
4. (Trained technician only) Remove processor 2 and restart the server.
5. Replace the following components one at a time, in the order shown, restarting the server each time:
  - a. (Trained technician only) Processor

- b. (Trained technician only) System board

### Embedded hypervisor is not in the boot list

Complete the following steps until the problem is solved.

1. If the server has been installed, moved, or serviced recently, or if this is the first time the embedded hypervisor is being used, make sure that the device is connected properly and that there is no physical damage to the connectors.
2. See the documentation that comes with the optional embedded hypervisor flash device for setup and configuration information.
3. Check <https://static.lenovo.com/us/en/serverproven/index.shtml> to validate that the embedded hypervisor device is supported for the server.
4. Make sure that the embedded hypervisor device is listed in the list of available boot options. From the management controller user interface, click **Server Configuration → Boot Options**.

For information about accessing the management controller user interface, see the “Opening and Using the XClarity Controller Web Interface” section in the XCC documentation version compatible with your server at [https://sysmgmt.lenovofiles.com/help/topic/ixcc\\_frontend/ixcc\\_overview.html](https://sysmgmt.lenovofiles.com/help/topic/ixcc_frontend/ixcc_overview.html).

5. Check <http://datacentersupport.lenovo.com> for any tech tips (service bulletins) related to the embedded hypervisor and the server.
6. Make sure that other software works on the server to ensure that it is working properly.

### Server cannot recognize a hard drive

Complete the following steps until the problem is solved.

1. Observe the associated yellow hard disk drive status LED. If the LED is lit, it indicates a drive fault.
2. If the status LED is lit, remove the drive from the bay, wait 45 seconds, and reinsert the drive, making sure that the drive assembly connects to the hard disk drive backplane.
3. Observe the associated green hard disk drive activity LED and the yellow status LED and perform corresponding operations in different situations:
  - If the green activity LED is flashing and the yellow status LED is not lit, the drive is recognized by the controller and is working correctly. Run the diagnostics tests for the hard disk drives. When you start a server and press F1, the Lenovo XClarity Provisioning Manager interface is displayed by default. You can perform hard drive diagnostics from this interface. From the Diagnostic page, click **Run Diagnostic → HDD test**.
  - If the green activity LED is flashing and the yellow status LED is flashing slowly, the drive is recognized by the controller and is rebuilding.
  - If neither LED is lit or flashing, check whether the hard disk drive backplane is correctly seated. For details, go to step 4.
  - If the green activity LED is flashing and the yellow status LED is lit, replace the drive. If the activity of the LEDs remains the same, go to step Hard disk drive problems. If the activity of the LEDs changes, return to step 1.
4. Make sure that the hard disk drive backplane is correctly seated. When it is correctly seated, the drive assemblies correctly connect to the backplane without bowing or causing movement of the backplane.
5. Reseat the backplane power cable and repeat steps 1 through 3.
6. Reseat the backplane signal cable and repeat steps 1 through 3.
7. Suspect the backplane signal cable or the backplane:
  - Replace the affected backplane signal cable.
  - Replace the affected backplane.

8. Run the diagnostics tests for the hard disk drives. When you start a server and press F1, the Lenovo XClarity Provisioning Manager interface is displayed by default. You can perform hard drive diagnostics from this interface. From the Diagnostic page, click **Run Diagnostic → HDD test**.

Based on those tests:

- If the backplane passes the test but the drives are not recognized, replace the backplane signal cable and run the tests again.
- Replace the backplane.
- If the adapter fails the test, disconnect the backplane signal cable from the adapter and run the tests again.
- If the adapter fails the test, replace the adapter.

### **Displayed system memory is less than installed physical memory**

Complete the following steps until the problem is resolved.

**Note:** Each time you install or remove a DIMM, you must disconnect the server from the power source; then, wait 10 seconds before restarting the server.

1. Make sure that:
  - Memory modules from different vendors are not in the same channel.
  - No error LEDs are lit on the operator information panel.
  - No DIMM error LEDs are lit on the system board.
  - Memory mirrored channel does not account for the discrepancy.
  - The memory modules are seated correctly.
  - You have installed the correct type of memory.
  - If you changed the memory, you updated the memory configuration in the Setup utility.
  - All banks of memory are enabled. The server might have automatically disabled a memory bank when it detected a problem, or a memory bank might have been manually disabled.
  - There is no memory mismatch when the server is at the minimum memory configuration.
2. Reseat the DIMMs and then restart the server.
3. Run the memory module diagnostics. When you start a server and press F1, the Lenovo XClarity Provisioning Manager interface is displayed by default. You can perform memory diagnostics from this interface. From the Diagnostic page, click **Run Diagnostic → Memory test**.
4. Check the POST error log:
  - If a DIMM was disabled by a systems-management interrupt (SMI), replace the DIMM.
  - If a DIMM was disabled by the user or by POST, reseat the DIMM; then, run the Setup utility and enable the DIMM.
5. Reseat the DIMM.
6. Restart the server.

### **A Lenovo optional device that was just installed does not work.**

1. Make sure that:
  - The device is supported for the server (see <https://static.lenovo.com/us/en/serverproven/index.shtml>).
  - You followed the installation instructions that came with the device and the device is installed correctly.
  - You have not loosened any other installed devices or cables.

- You updated the configuration information in system setup. When you start a server and press F1 to display the Setup Utility. Whenever memory or any other device is changed, you must update the configuration.
2. Reseat the device that you have just installed.
  3. Replace the device that you have just installed.
  4. Reseat the cable connection and check there is no physical damage to the cable.
  5. If there is any cable damages, then replace the cable.

### **Voltage planar fault is displayed in the event log**

Complete the following steps until the problem is solved.

1. Revert the system to the minimum configuration. See [“Minimum configuration for debugging” on page 28](#) for the minimally required number of processors and DIMMs.
2. Restart the system.
  - If the system restarts, add each of the removed items one at a time and restart the system each time until the error occurs. Replace the item for which the error occurs.
  - If the system does not restart, suspect the system board.

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## Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about Lenovo products, you will find a wide variety of sources available from Lenovo to assist you.

On the World Wide Web, up-to-date information about Lenovo systems, optional devices, services, and support are available at:

<http://datacentersupport.lenovo.com>

**Note:** This section includes references to IBM Web sites and information about obtaining service. IBM is Lenovo's preferred service provider for ThinkSystem.

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### Tech Tips

Lenovo continually updates the support website with the latest tips and techniques that you can use to solve issues that your server might encounter. These Tech Tips (also called retain tips or service bulletins) provide procedures to work around issues or solve problems related to the operation of your server.

To find the Tech Tips available for your server:

1. Go to <http://datacentersupport.lenovo.com> and navigate to the support page for your server.
2. Click on the documentation icon  from the navigation pane.
3. Click **Documentation Type** → **Solution** from the drop-down menu.

Follow the on-screen instructions to choose the category for the problem that you are having.

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### Security advisories

Lenovo is committed to developing products and services that adhere to the highest security standards in order to protect our customers and their data. When potential vulnerabilities are reported, it is the responsibility of the Lenovo Product Security Incident Response Team (PSIRT) to investigate and provide information to our customers so they may put mitigation plans in place as we work toward providing solutions.

The list of current advisories is available at the following location:

[https://datacentersupport.lenovo.com/product\\_security/home](https://datacentersupport.lenovo.com/product_security/home)

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## Before you call

Before you call, there are several steps that you can take to try and solve the problem yourself. If you decide that you do need to call for assistance, gather the information that will be needed by the service technician to more quickly resolve your problem.

### Attempt to resolve the problem yourself

You can solve many problems without outside assistance by following the troubleshooting procedures that Lenovo provides in the online help or in the Lenovo product documentation. The Lenovo product documentation also describes the diagnostic tests that you can perform. The documentation for most systems, operating systems, and programs contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

You can find the product documentation for your ThinkSystem products at the following location:

<http://thinksystem.lenovofiles.com/help/index.jsp>

You can take these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Check for updated software, firmware, and operating-system device drivers for your Lenovo product. The Lenovo Warranty terms and conditions state that you, the owner of the Lenovo product, are responsible for maintaining and updating all software and firmware for the product (unless it is covered by an additional maintenance contract). Your service technician will request that you upgrade your software and firmware if the problem has a documented solution within a software upgrade.
- If you have installed new hardware or software in your environment, check <https://static.lenovo.com/us/en/serverproven/index.shtml> to make sure that the hardware and software are supported by your product.
- Go to <http://datacentersupport.lenovo.com> and check for information to help you solve the problem.
  - Check the Lenovo forums at [https://forums.lenovo.com/t5/Datacenter-Systems/ct-p/sv\\_eg](https://forums.lenovo.com/t5/Datacenter-Systems/ct-p/sv_eg) to see if someone else has encountered a similar problem.

### Gathering information needed to call Support

If you require warranty service for your Lenovo product, the service technicians will be able to assist you more efficiently if you prepare the appropriate information before you call. You can also go to <http://datacentersupport.lenovo.com/warrantylookup> for more information about your product warranty.

Gather the following information to provide to the service technician. This data will help the service technician quickly provide a solution to your problem and ensure that you receive the level of service for which you might have contracted.

- Hardware and Software Maintenance agreement contract numbers, if applicable
- Machine type number (Lenovo 4-digit machine identifier)
- Model number
- Serial number
- Current system UEFI and firmware levels
- Other pertinent information such as error messages and logs

As an alternative to calling Lenovo Support, you can go to <https://support.lenovo.com/servicerequest> to submit an Electronic Service Request. Submitting an Electronic Service Request will start the process of

determining a solution to your problem by making the pertinent information available to the service technicians. The Lenovo service technicians can start working on your solution as soon as you have completed and submitted an Electronic Service Request.

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## Collecting service data

To clearly identify the root cause of a server issue or at the request of Lenovo Support, you might need collect service data that can be used for further analysis. Service data includes information such as event logs and hardware inventory.

Service data can be collected through the following tools:

- **Lenovo XClarity Provisioning Manager**

Use the Collect Service Data function of Lenovo XClarity Provisioning Manager to collect system service data. You can collect existing system log data or run a new diagnostic to collect new data.

- **Lenovo XClarity Controller**

You can use the Lenovo XClarity Controller web interface or the CLI to collect service data for the server. The file can be saved and sent to Lenovo Support.

- For more information about using the web interface to collect service data, see the “Downloading service data” section in the XCC documentation version compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html).
- For more information about using the CLI to collect service data, see the “ffdc command” section in the XCC documentation version compatible with your server at [https://sysmgt.lenovofiles.com/help/topic/lxcc\\_frontend/lxcc\\_overview.html](https://sysmgt.lenovofiles.com/help/topic/lxcc_frontend/lxcc_overview.html).

- **Lenovo XClarity Administrator**

Lenovo XClarity Administrator can be set up to collect and send diagnostic files automatically to Lenovo Support when certain serviceable events occur in Lenovo XClarity Administrator and the managed endpoints. You can choose to send diagnostic files to Lenovo Support using Call Home or to another service provider using SFTP. You can also manually collect diagnostic files, open a problem record, and send diagnostic files to the Lenovo Support Center.

You can find more information about setting up automatic problem notification within the Lenovo XClarity Administrator at [http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/admin\\_setupcallhome.html](http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/admin_setupcallhome.html).

- **Lenovo XClarity Essentials OneCLI**

Lenovo XClarity Essentials OneCLI has inventory application to collect service data. It can run both in-band and out-of-band. When running in-band within the host operating system on the server, OneCLI can collect information about the operating system, such as the operating system event log, in addition to the hardware service data.

To obtain service data, you can run the `getinfor` command. For more information about running the `getinfor`, see [http://sysmgt.lenovofiles.com/help/topic/toolsctr\\_cli\\_lenovo/onecli\\_r\\_getinfor\\_command.html](http://sysmgt.lenovofiles.com/help/topic/toolsctr_cli_lenovo/onecli_r_getinfor_command.html).

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## Contacting Support

You can contact Support to obtain help for your issue.

You can receive hardware service through a Lenovo Authorized Service Provider. To locate a service provider authorized by Lenovo to provide warranty service, go to <https://datacentersupport.lenovo.com/serviceprovider> and use filter searching for different countries. For Lenovo support telephone numbers, see <https://datacentersupport.lenovo.com/supportphonenumber> for your region support details.



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## Appendix B. Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area.

Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service.

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*Lenovo (United States), Inc.  
8001 Development Drive  
Morrisville, NC 27560  
U.S.A.  
Attention: Lenovo Director of Licensing*

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## Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1 024 bytes, MB stands for 1 048 576 bytes, and GB stands for 1 073 741 824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity can vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard-disk-drive bays with the largest currently supported drives that are available from Lenovo.

Maximum memory might require replacement of the standard memory with an optional memory module.

Each solid-state memory cell has an intrinsic, finite number of write cycles that the cell can incur. Therefore, a solid-state device has a maximum number of write cycles that it can be subjected to, expressed as total bytes written (TBW). A device that has exceeded this limit might fail to respond to system-generated commands or might be incapable of being written to. Lenovo is not responsible for replacement of a device that has exceeded its maximum guaranteed number of program/erase cycles, as documented in the Official Published Specifications for the device.

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Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

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## Telecommunication regulatory statement

This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Contact a Lenovo representative or reseller for any questions.

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## Electronic emission notices

When you attach a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices that are supplied with the monitor.

Additional electronic emissions notices are available at:

<http://thinksystem.lenovofiles.com/help/index.jsp>

## Taiwan BSMI RoHS declaration

單元 Unit	限用物質及其化學符號 Restricted substances and its chemical symbols					
	鉛Lead (Pb)	汞Mercury (Hg)	鎘Cadmium (Cd)	六價鉻 Hexavalent chromium (Cr <sup>+6</sup> )	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
機架	○	○	○	○	○	○
外部蓋板	○	○	○	○	○	○
機械組零件	-	○	○	○	○	○
空氣傳動設備	-	○	○	○	○	○
冷卻組零件	-	○	○	○	○	○
內存模組	-	○	○	○	○	○
處理器模組	-	○	○	○	○	○
電纜組零件	-	○	○	○	○	○
電源供應器	-	○	○	○	○	○
儲備設備	-	○	○	○	○	○
電路卡	-	○	○	○	○	○
光碟機	-	○	○	○	○	○
<p>備考1. “超出0.1 wt %” 及 “超出0.01 wt %” 係指限用物質之百分比含量超出百分比含量基準值。            Note1 : “exceeding 0.1wt%” and “exceeding 0.01 wt%” indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition.</p> <p>備考2. “○” 係指該項限用物質之百分比含量未超出百分比含量基準值。            Note2 : “○” indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.</p> <p>備考3. “-” 係指該項限用物質為排除項目。            Note3 : The “-” indicates that the restricted substance corresponds to the exemption.</p>						

## Taiwan import and export contact information

Contacts are available for Taiwan import and export information.

委製商/進口商名稱: 台灣聯想環球科技股份有限公司  
 進口商地址: 台北市南港區三重路 66 號 8 樓  
 進口商電話: 0800-000-702



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