Lenovo

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

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.

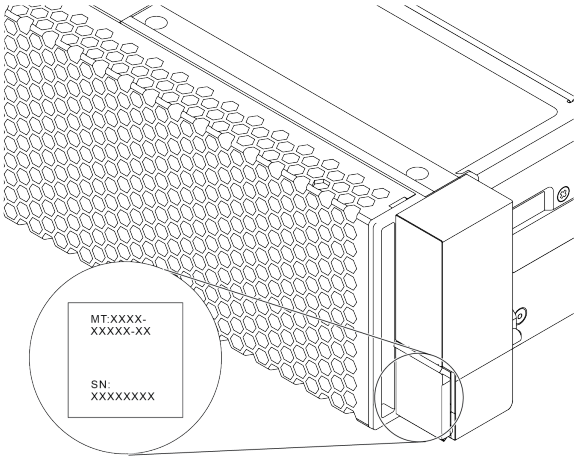

Figure 1. Location of the ID label

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 15

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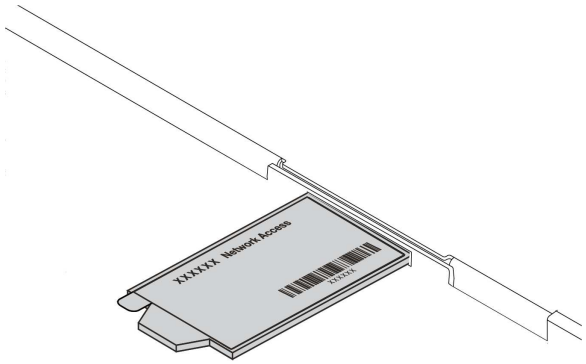


Figure 2. Location of the XClarity Controller network access label

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.

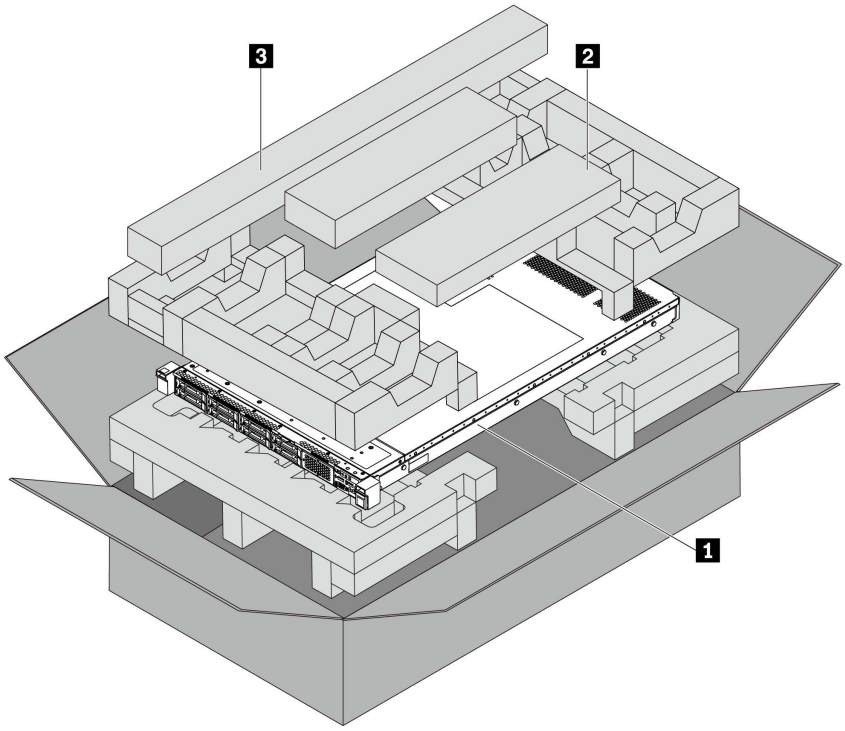
The following illustration shows the QR code: https://datacentersupport.lenovo.com/products/servers/thinksystem/sr645/7d2x

Figure 3. QR code

Server package contents

When you receive your server, verify that the shipment contains everything that you expected to receive.

The server package includes the following items:



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

- 1 Server
- 2 Material boxes, including items such as cable management arm*, accessory kit, power cords* and documentation
- 3 Rail kit*. Detailed instructions for installing the rail kit are provided in the package with the rail kit.

  –

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:

- **Active Energy Manager**

  Lenovo XClarity Energy Manager is a power and temperature management solution for data centers. Using Lenovo XClarity Energy Manager, you can monitor and manage the power consumption and temperature to improve energy efficiency.

- **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 two or 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.

  Trusted Platform Module (TPM) of version 2.0 is supported.

  For more information on TPM configurations, see "Enable TPM" in the *Maintenance Manual*.

  Note: For customers in Chinese Mainland, a Lenovo-qualified TPM 2.0 adapter (sometimes called a daughter card) may be pre-installed.

- **Large system-memory capacity**

  The server supports up to 32 TruDDR4 registered DIMMs (RDIMMs) or three-dimensional stacking registered DIMMs (3DS RDIMMs). For more about the specific types and maximum amount of memory, see "Specifications" on page 5.

- **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.

- **Lenovo XClarity Controller (XCC)**

  The Lenovo XClarity Controller is the common management controller for Lenovo ThinkSystem server hardware. It consolidates multiple management functions in a single chip on the server system board.

  Some of the features that are unique to the Lenovo XClarity Controller are enhanced performance, higher-resolution remote video, and expanded security options. For additional information about the Lenovo XClarity Controller, see:

  http://sysmgt.lenovofiles.com/help/topic/com.lenovo.systems.management.xcc.doc/product_page.html

- **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 25
  - "Rear view LEDs" on page 43
  - "Diagnostics panel" on page 27
  - "LCD diagnostics panel/handset" on page 29

- **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 two 1100-watt hot-swap power supplies and two dual-motor non hot-swap fans, 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).

Specifications

The following information is a summary of the features and specifications of the server. Depending on the model, some features might not be available, or some specifications might not apply.

Table 1. Server specifications

Specification	Description
Dimension	• 1U • Height: 43.0 mm (1.69 inches) • Width: – With rack latches: 481.7mm (18.96 inches) – Without rack latches: 445 mm (17.52 inches) • Depth: 771.8 mm (30.39 inches) **Note:** The depth is measured with rack latches installed, but without security bezel installed.
Package weight	Up to 20.23 kg (44.56 lb)
Processor	• Up to two AMD® EPYC™ processors • Designed for Land Grid Array (LGA) 4094 (SP3) socket • Scalable up to 128 cores • Thermal Design Power (TDP): up to 280 watts For a list of supported processors, see: https://static.lenovo.com/us/en/serverproven/index.shtml For technical rules for processors and heat sinks, see “Technical rules for processors and heat sinks” on page 96.

Table 1. Server specifications (continued)

Specification	Description
Heat sink	• Standard heat sink • High-performance heat sink (T-shape) For technical rules for processors and heatsinks, see "Technical rules for processors and heat sinks" on page 96.
Memory	• Slots: 32 memory module slots • Supported memory module type: – TruDDR4 3200, dual-rank, 16 GB/32 GB/64 GB RDIMM – TruDDR4 3200, dual-rank, 128 GB 3DS RDIMM • Minimum memory: – 16 GB using RDIMMs – 128 GB using 3DS RDIMMs • Maximum memory: – 2 TB using RDIMMs – 4 TB using 3DS RDIMMs **Note:** The operating speed and total memory capacity depend on the processor model and UEFI settings. For a list of supported memory, see the Lenovo ServerProven Web site: https://static.lenovo.com/us/en/serverproven/index.shtml. For technical rules for memory modules, see "Technical rules for DIMMs" on page 99.
Internal drives	Front: • Up to ten 2.5-inch hot-swap SAS/SATA/U.2 drives • Up to four 3.5-inch hot-swap SAS/SATA/NVMe drives Inside: • Up to two internal SATA/NVMe M.2 drives Rear: • Up to two 2.5-inch hot-swap SAS drives • Up to two 7mm hot-swap SATA/NVMe drives For technical rules for drives, see "Drive bay configurations and requirements" on page 97.
Expansion slots	Depending on the model, 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 For locations and technical rules for PCIe slots, see "Rear view" on page 36 and "Technical rules for PCIe adapters" on page 101.

Table 1. Server specifications (continued)

Specification	Description
Graphics processing unit (GPU)	Your server supports the following GPUs: • Low-profile, half-length, single-wide: NVIDIA® Quadro® P620, NVIDIA® Tesla® T4 • Full-height, half-length, single-wide: NVIDIA® Quadro® P2200 For technical rules for GPU, see “Technical rules for GPU adapters” on page 103.
Input/Output (I/O) features	• 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 15 and “Rear view” on page 36.

Table 1. Server specifications (continued)

Specification	Description
HBA/RAID adapters (depending on the model)	Support for JBOD mode and RAID level 0, 1, 10: • 530-16i 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 PCIe 12Gb SFF RAID adapter (Gen3) • 930-16i 4 GB Flash PCIe 12Gb SFF RAID adapter (Gen 3) • 940-8i 4 GB Flash PCIe 12Gb SFF RAID adapter (Gen4) • 940-8i 8 GB Flash PCIe 12Gb SFF RAID adapter (Gen4) • 940-16i 8 GB Flash PCIe 12Gb SFF RAID adapter (Gen4) • 930-8e 4 GB Flash PCIe 12Gb SFF RAID adapter (Gen3) • 940-16i 8 GB Flash PCIe 12Gb Internal CFF RAID adapter (Gen4) Support the following HBA adapter: • 430-8i SAS/SATA 12Gb SFF HBA adapter (Gen3) • 430-16i SAS/SATA 12Gb SFF HBA adapter (Gen3) • 430-8e SAS/SATA 12Gb SFF HBA adapter (Gen3) • 430-16e SAS/SATA 12Gb SFF HBA adapter (Gen3) • 440-16i SAS/SATA PCIe Gen4 12Gb Internal CFF HBA adapter (Gen4) **Notes:** • **SFF**: Standard Form Factor. This type of RAID/HBA adapter is installed in the PCIe slots on the rear of the server. • **CFF**: Custom Form Factor. This type of RAID/HBA adapter is installed on the chassis between fans and front backplane. For technical rules for storage controller adapters, see “Technical rules for PCIe adapters” on page 101.
System fans	Up to eight dual-rotor hot-swap fans (including two redundant fans) • Standard fan 4056 (21000 RPM) • Performance fan 4056 (24000 RPM) For technical rules for system fans, see “Technical rules for system fans” on page 103.
Minimal 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 processor)

Table 1. Server specifications (continued)

<table>
<tr><th>Specification</th><th>Description</th></tr>
<tr><td>Acoustical noise emissions</td><td>

Sound power levels, idle

6.0 bels, typical
6.9 bels, maximum

Sound power levels, operating

6.5 bels, typical
6.9 bels, maximum

Notes:

These sound power levels are measured in controlled acoustical environments according to procedures specified by ISO 7779 and are reported in accordance with ISO 9296.
The declared acoustic noise levels are based on specified configurations, which may change slightly depending on configuration/conditions.

</td></tr>
<tr><td>Electrical input</td><td>
One or two hot-swap power supplies for redundancy support:

Table 2. Electrical input for power supplies
<table>
<tr><th>Power supply</th><th>100–127 V ac</th><th>200–240 V ac</th><th>240 V dc</th><th>-48 V dc</th></tr>
<tr><td>500-watt 80 PLUS Platinum</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>750-watt 80 PLUS Platinum</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>750-watt 80 PLUS Titanium</td><td></td><td>√</td><td>√</td><td></td></tr>
<tr><td>1100-watt 80 PLUS Platinum</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>1100-watt 80 PLUS Platinum</td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>1800-watt 80 PLUS Platinum</td><td></td><td>√</td><td>√</td><td></td></tr>
</table>
CAUTION:

240 V dc input (input range: 180-300 V dc) is supported in Chinese Mainland ONLY.
Power supply with 240 V dc input cannot support hot plugging power cord function. Before removing the power supply with dc input, please turn off server or disconnect dc power sources at the breaker panel or by turning off the power source. Then, remove the power cord.

</td></tr>
<tr><td>Environment</td><td>Your server complies with ASHRAE class A2 specifications. Depending on the hardware configuration, some server models comply with ASHRAE class A3 and class A4 specifications, see “” on page .</td></tr>
</table>

Management options

Several management interfaces are available for managing your server. The management options described in this section are provided to support the direct management of Lenovo servers.

Function	Lenovo XClarity Administrator	Lenovo XClarity Energy Manager	Lenovo XClarity Provisioning Manager V3	Lenovo XClarity Essentials[1]	Lenovo XClarity Integrator[2]	Lenovo Capacity Planner
Multiple systems management	√	√		√	√	
Operating system deployment			√			
Firmware updates[1]			√[3]	√[5]	√	
System configuration			√	√	√	
Events / alerts	√	√			√	
Inventory/ log	√[4]			√[6]	√	
Power management		√				
Data center planning						√

Notes:

1. Lenovo XClarity Essentials includes Lenovo XClarity Essentials OneCLI, Lenovo XClarity Essentials Bootable Media Creator, and Lenovo XClarity Essentials UpdateXpress.
2. Lenovo XClarity Integrator includes Lenovo XClarity Integrator for Redhat, Lenovo XClarity Integrator for Microsoft, and Lenovo XClarity Integrator for VMware.
3. 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.
4. Firmware updates are limited to Lenovo XClarity Provisioning Manager V3, BMC firmware, and UEFI updates only. Firmware updates for optional devices, such as adapters, are not supported.
5. The server UEFI settings for option ROM must be set to **UEFI** to update firmware using Lenovo XClarity Essentials Bootable Media Creator.
6. The server UEFI settings for option ROM must be set to **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 OneCLI.

Lenovo XClarity Energy Manager

Lenovo XClarity Energy Manager is a web-based power and temperature management solution designed for data center administrators. It monitors and manages the power consumption and temperature of servers, such as Converged, NeXtScale, System x, ThinkServer, and ThinkSystem servers, using the out-of-band method. Lenovo XClarity Energy Manager models data center physical hierarchy and monitors power and temperature at the server/group level. By analyzing monitored power and temperature data, Lenovo XClarity Energy Manager greatly improves business continuity and energy efficiency.

With Lenovo XClarity Energy Manager, administrators can take control of power usage through improved data analysis and lower the TCO (total cost of ownership). The tool optimizes data center efficiency by allowing administrators to:

- Track platform power consumption, inlet temperature, and component-level power consumption, such as CPU and memory power consumption.
- Visually check the layout of room, row and rack via 2D thermal map.
- Show events and send e-mail or SNMP trap notifications when certain faults occur or certain thresholds are reached.
- Optimize energy efficiency by identifying hotspot or over-cooling servers to optimize cooling efficiency and identifying low-usage servers to save energy.

For more information about downloading, installation, and usage, see:

https://datacentersupport.lenovo.com/solutions/lnvo-lxem

Lenovo XClarity Administrator

Note: The following functions may be not fully available for your server model.

Lenovo XClarity Administrator is a centralized, resource-management solution that simplifies infrastructure management, speeds responses, and enhances the availability of Lenovo server systems and solutions. It runs as a virtual appliance that automates discovery, inventory, tracking, monitoring, and provisioning for server, network, and storage hardware in a secure environment.

Lenovo XClarity Administrator provides a central interface to perform the following functions for all managed endpoints:

- **Manage and monitor hardware**. Lenovo XClarity Administrator provides agent-free hardware management. It can automatically discover manageable endpoints, including server, network, and storage hardware. Inventory data is collected for managed endpoints for an at-a-glance view of the managed hardware inventory and status.
- **Service and support**. Lenovo XClarity Administrator can be set up to collect and send diagnostic files automatically to your preferred service provider 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.

Lenovo XClarity Administrator can be integrated into external, higher-level management and automation platforms through open REST application programming interfaces (APIs). Using the REST APIs, Lenovo XClarity Administrator can easily integrate with your existing management infrastructure. In addition, you can automate tasks using the PowerShell toolkit or the Python toolkit.

To obtain the latest version of the Lenovo XClarity Administrator, see:

https://datacentersupport.lenovo.com/documents/LNVO-LXCAUPD

You can also download its mobile version Lenovo XClarity Administrator Mobile in Android or iOS App store.

Documentation for Lenovo XClarity Administrator is available at:

http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/aug_product_page.html

Lenovo XClarity Essentials

Lenovo XClarity Essentials (LXCE) is a collection of server management utilities that provides a less complicated method to enable customers to manage Lenovo ThinkSystem, System x, and Thinkserver servers more efficiently and cost-effectively.

Lenovo XClarity Essentials includes the following utilities:

- Lenovo XClarity Essentials OneCLI is a collection of several command line applications, which can be used to configure the server, collect service data for the server and update firmware and device drivers on the server. If you run Lenovo XClarity Essentials OneCLI from the server operating system (in-band), you can collect operating system logs as well. You can also choose to view the service data that has been collected or to send the service data to Lenovo Support.

  To learn more about Lenovo XClarity Essentials OneCLI, see:

  https://datacentersupport.lenovo.com/documents/LNVO-CENTER

  Documentation for Lenovo XClarity Essentials OneCLI is available at:

  http://sysmgt.lenovofiles.com/help/topic/xclarity_essentials/overview.html
- Lenovo XClarity Essentials Bootable Media Creator (BoMC) is a software application to create bootable media 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.

  Using Lenovo XClarity Essentials Bootable Media Creator, you can:

  – Update the server firmware using bootable media (such as CD, DVD, ISO image, USB flash drive, or set of PXE files).
  – Perform VPD updates, inventory and FFDC collection, advanced system configuration, FoD Keys management using bootable media (such as CD, DVD, ISO image, USB flash drive, or set of PXE files)

  To learn more about Lenovo XClarity Essentials Bootable Media Creator, see:

  https://datacentersupport.lenovo.com/solutions/lnvo-bomc
- Lenovo XClarity Essentials UpdateXpress provides most of OneCLI update functions through a graphical user interface (GUI). It can be used to acquire and deploy UXSP update packages and individual updates. UXSP contains firmware and device driver updates for Microsoft Windows and for Linux.

  To learn more about Lenovo XClarity Essentials UpdateXpress, see:

  https://datacentersupport.lenovo.com/solutions/lnvo-xpress

Lenovo XClarity Provisioning Manager V3

Lenovo XClarity Provisioning Manager V3 is embedded software that provides a graphic user interface (GUI) for configuring the system with support for 11 languages. It simplifies the process of configuring Basic Input Output System (BIOS) settings and configuring Redundant Array of Independent Disks (RAID) in an GUI wizard. It also provides functions for updating applications and firmware, performing system diagnostics, and automating the process of installing the supported Windows, Linux, or VMware ESXi operating systems and associated device drivers.

Note: When you start a server and press F1, the Lenovo XClarity Provisioning Manager V3 interface is displayed by default. However, the text-based interface to system configuration (the Setup Utility) is also available. From Lenovo XClarity Provisioning Manager V3, 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 Provisioning Manager V3 provides a system summary of all installed devices and includes the following functions:

- **UEFI setup**. Use this function to configure UEFI system settings, such as processor configuration, start options, and user security. You can also view POST events and the System Event Log (SEL).
- **Firmware update**. Use this function to update the firmware for Lenovo XClarity Controller, Unified Extensible Firmware Interface (UEFI), Lenovo XClarity Provisioning Manager V3, and operating system device drivers.
- **RAID setup**. Use this function to configure RAID for the server. It provides an easy-to-use graphical wizard that supports a unified process for performing RAID setup for a variety of RAID adapters. You can perform Simple RAID Setup and Advanced RAID Setup in LXPM, also you can perform RAID configuration for different RAID adapters from UEFI Setup.
- **OS installation**. Use this function to deploy an operating system for the server with an easy-to-use Guided Install mode. Operating systems can be installed using unattended mode after you choose the Operating System version and basic settings; the device drivers are installed automatically.

  A Manual Install mode is also available. You can export the drivers from system, manually install the operating systems, and then install the drivers. This way, you do not need to go to the web to download device drivers.

  Note: In Guided Install mode, you can export the operating system installation settings to a response file during operating system installation. Then, you can use the Import function under the Cloning menu to apply the operating system installation settings to the target server.
- **Cloning**. Use this function to clone settings in one server to other similarly configured Lenovo servers.
  - **Export**: Export UEFI, RAID, and BMC settings for the current server to files respectively and save the files to a USB storage drive or a shared network folder.
  - **Import**: Apply UEFI, RAID, BMC, and operating system installation settings to the target server by using the files you have saved.
- **Diagnostics**. Use this function to view the overall health of devices installed in the server and to perform diagnostics for hard disk drives and memory. You can also collect service data that can be saved to a USB device and sent to Lenovo Support.

  Note: The service data collected by Lenovo XClarity Provisioning Manager V3 does not include the operating system logs. To collect the operating system logs and the hardware service data, use Lenovo XClarity Essentials OneCLI.

Documentation for Lenovo XClarity Provisioning Manager V3 is available at:

https://sysmgt.lenovofiles.com/help/topic/LXPMv3/LXPMv3_introduction.html

Lenovo XClarity Controller

Lenovo XClarity Controller is the management processor for the server. It is the third generation of the Integrated Management Module (IMM) service processor that consolidates the service processor functionality, super I/O, video controller, and remote presence capabilities into a single chip on the server system board.

There are two ways to access the management processor:

- **Web-based interface**. To access the web-based interface, point your browser to the IP address for the management processor.
- **Command-line interface**. To access the CLI interface, use SSH or Telnet to log in to the management processor.

Whenever power is applied to a server, the management processor is available. From the management processor interface, you can perform the following functions:

- Monitor all hardware devices installed in the server.
- Power the server on and off.
- View the system event log and system audit log for the server.
- Use the Remote management function to log in to the server itself.

Documentation for Lenovo XClarity Controller is available at:

http://sysmgt.lenovofiles.com/help/topic/com.lenovo.systems.management.xcc.doc/product_page.html

Lenovo Capacity Planner

Lenovo Capacity Planner is a power consumption evaluation tool that enhances data center planning by enabling IT administrators and pre-sales to understand important parameters of different type of racks, servers, and other devices. Lenovo Capacity Planner can dynamically calculate the power consumption, current, British Thermal Unit (BTU), and volt-ampere (VA) rating at the individual server or rack level, and therefore improves the efficiency of large scale deployments.

Lenovo Capacity Planner provides the following functions:

- Power and thermal evaluation of servers and network devices; generating evaluation reports.
- Customizable server configuration, workload, CPU turbo model, and fan speed for different user scenarios.
- Chassis-level and node-level customizable configuration for Flex System and High-Density servers.
- Visual memory configuration guidance for best memory performance.

Note: It's highly recommended that you check the power summary data for your server using Lenovo Capacity Planner before purchasing any new parts.

More information about Lenovo Capacity Planner is available at:

https://datacentersupport.lenovo.com/solutions/lnvo-lcp

Lenovo Business Vantage

Lenovo Business Vantage is a security software tool suite designed to work with the Trusted Cryptographic Module (TCM) adapter for enhanced security, to keep user data safe, and to erase confidential data completely from a hard disk drive.

Lenovo Business Vantage provides the following functions:

- **Data Safe**. Encrypt files to ensure data safety by using the TCM adapter.
- **Sure Erase**. Erase confidential data from a hard disk. This tool follows the industry standard method to do the erasing and allows the user to select different erasing levels.
- **Smart USB Protection**. Prohibit unauthorized access to the USB port of devices.
- **USB Data Safe**. Encrypt files to ensure data security on a USB storage device.

Note: This tool is available in Chinese Mainland only.

More information about Lenovo Business Vantage is available at:

http://support.lenovo.com.cn/lenovo/wsi/es/es.html

Chapter 2. Server components

Use the information in this section to learn about each of the components associated with your server.

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 16
- “Server models with eight 2.5-inch front drive bays” on page 17
- “Server models with ten 2.5-inch front drive bays” on page 18
- “Server models with four 3.5-inch front drive bays” on page 19
- “Server models with four 2.5-inch front drive bays (backplane-less)” on page 20
- “Server models with eight 2.5-inch front drive bays (backplane-less)” on page 21
- “Server models with ten 2.5-inch front drive bays (backplane-less)” on page 22
- “Server models with four 3.5-inch front drive bays (backplane-less)” on page 23
- “Server models with eight 2.5-inch front drive bays (with LCD diagnostics panel)” on page 24

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Server model with four 2.5-inch drive bays

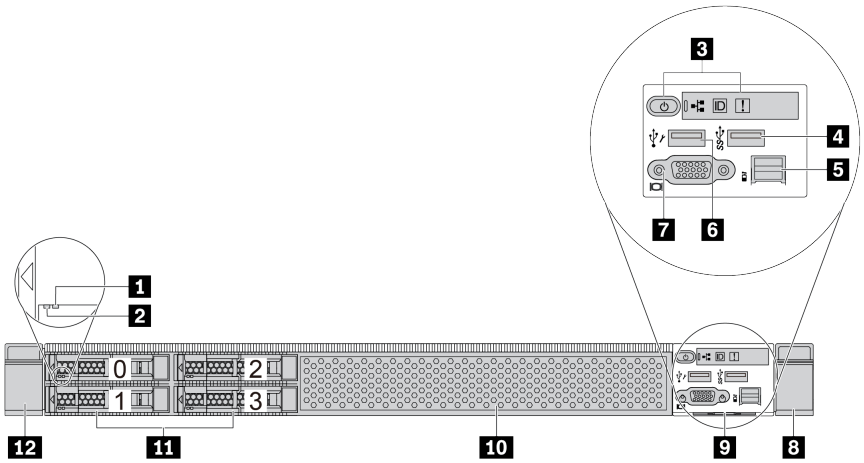


Table 3. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

Server model with eight 2.5-inch drive bays

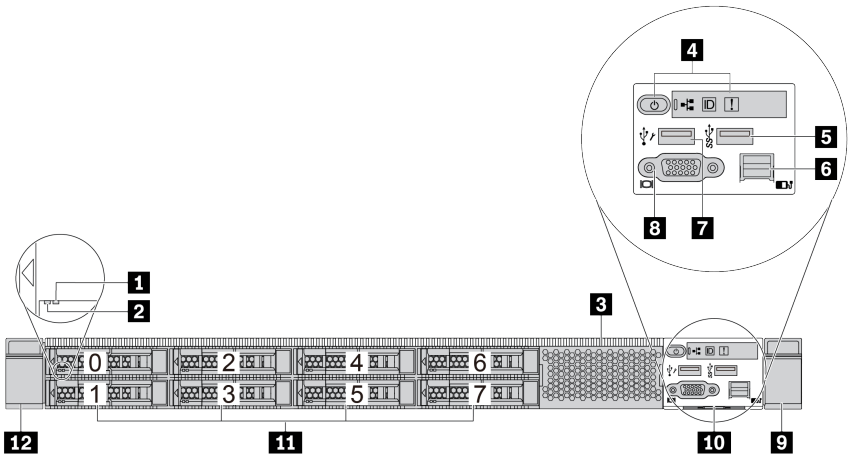


Table 4. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

Server model with ten 2.5-inch drive bays

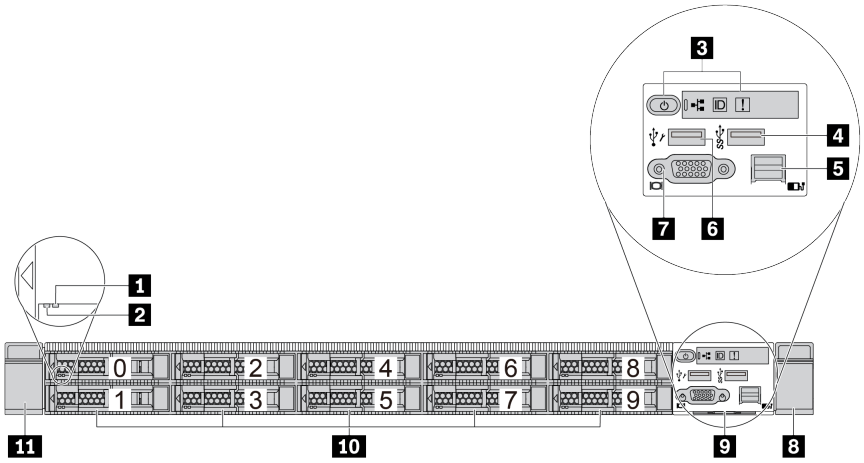


Table 5. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

Server model with four 3.5-inch drive bays

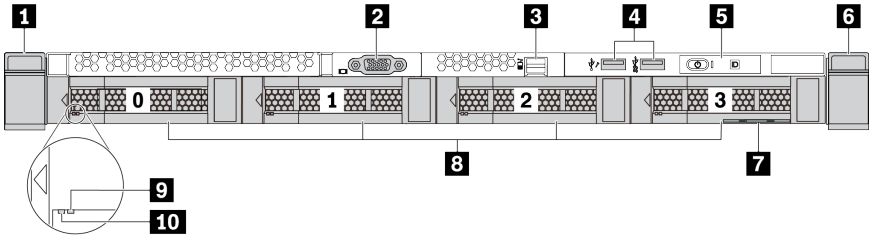


Table 6. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

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

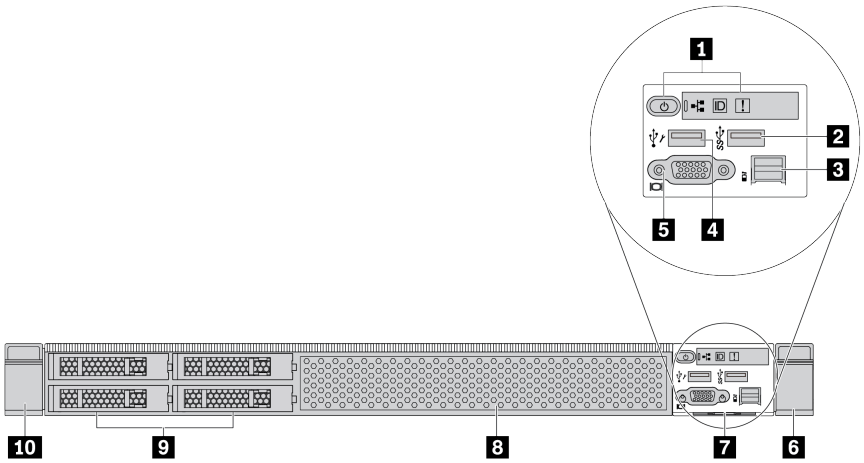


Table 7. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

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

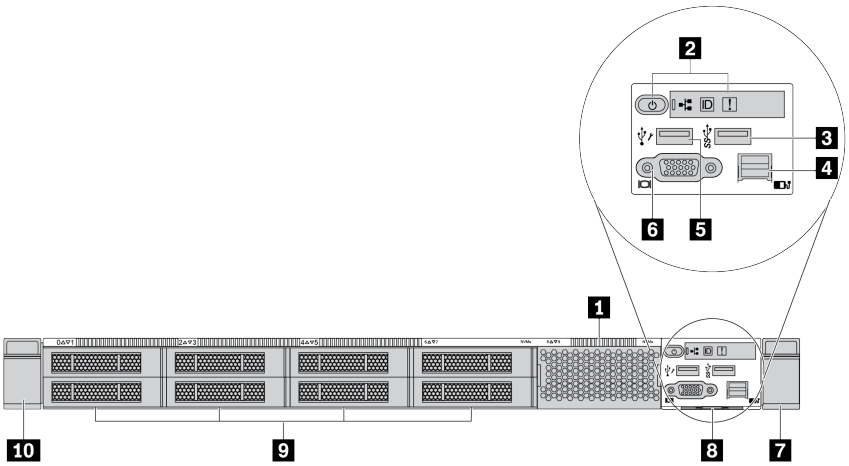


Table 8. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

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

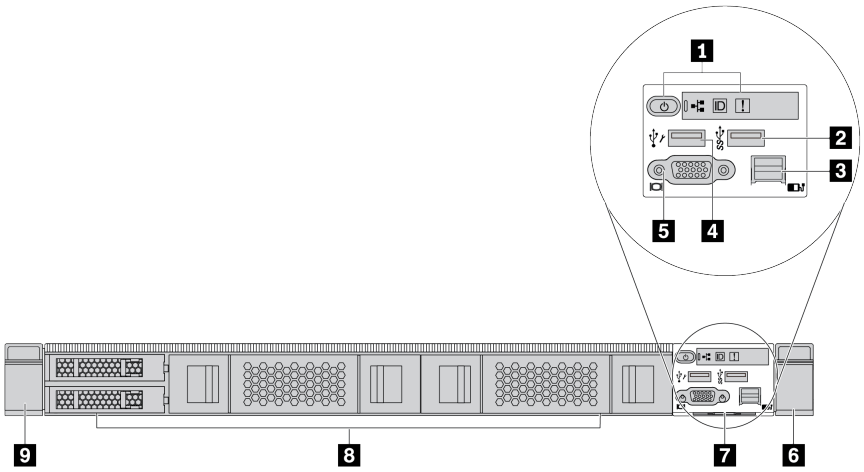


Table 9. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

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

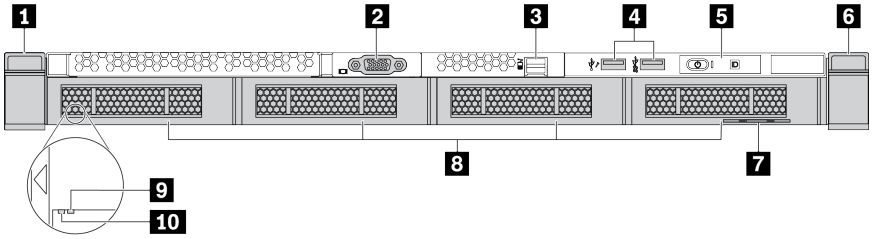


Table 10. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

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

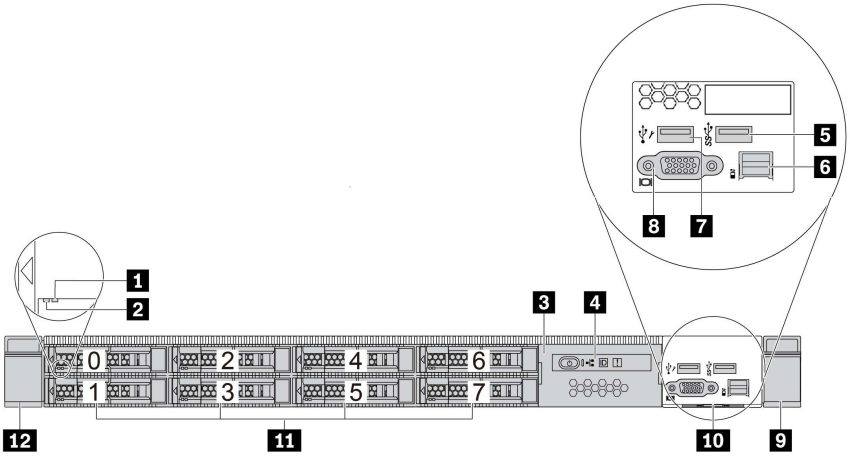


Table 11. Components on the front of the server

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

Note: For more information about each component, see “Front components overview” on page 25.

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 27.

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.

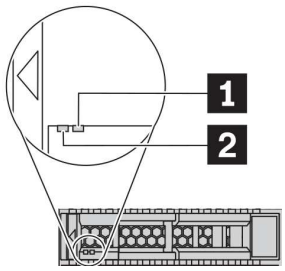


Figure 4. Drive LEDs

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 29.

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 29.

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 159.

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 be used to attach an Ethernet cable to manage the system using XClarity Controller. The USB can also be used as a regular USB connector to the host OS.

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 29.

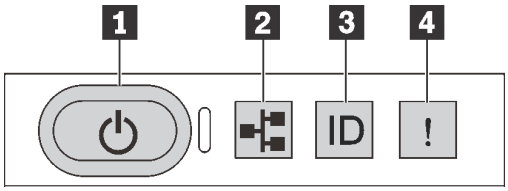


Figure 5. Diagnostics panel

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 to 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 adapater	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.

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

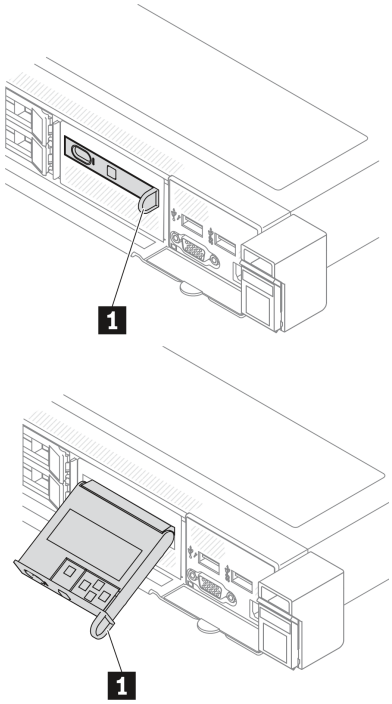
The system error LED helps you to determine if there are any system errors.

Status	Color	Description	Action
On	Yellow	An error has been detected on the server. Causes might include but are not limited to the following errors: • The temperature of the server reached the non-critical temperature threshold. • The voltage of the server reached the non-critical voltage threshold. • A fan has been detected to be running at low speed. • A hot-swap fan has been removed. • The power supply has a critical error. • The power supply is not connected to the power.	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.
Off	None	The server is off or the server is on and is working correctly.	None.

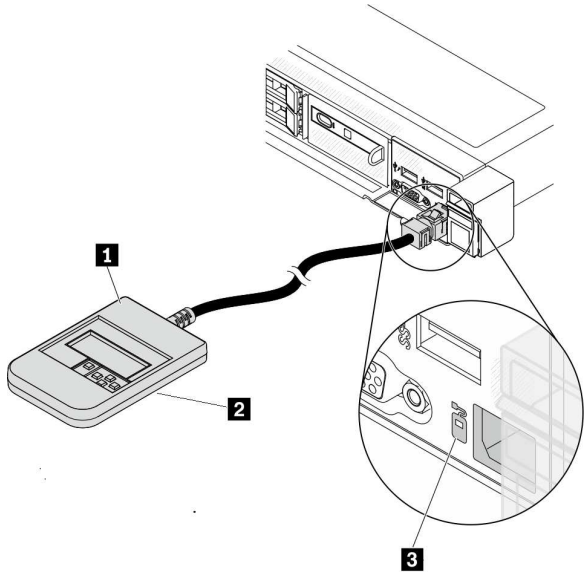
LCD diagnostics panel/handset

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.

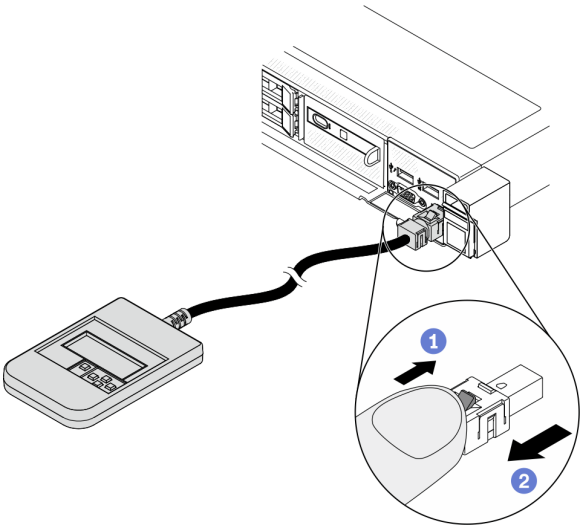
Where to find the LCD diagnostics panel

Location	Callout
The LCD diagnostics panel is attached to the front of the server.  	1 The handle with which the panel can be pulled out and inserted into the rack. **Notes:** • The panel can be inserted or pulled out regardless of the system status. • When pulling out the panel, carefully hold it by the handle and avoid any hard pulling.

Where to find the external LCD diagnostics handset

Location	Callout
The external LCD diagnostics handset is connected to the server with an external cable. 	1 The LCD diagnostics handset that can be connected to the server with an external cable. 2 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. 3 The external diagnostics connector on the front of the server that can be used to connect an external LCD diagnostics handset.

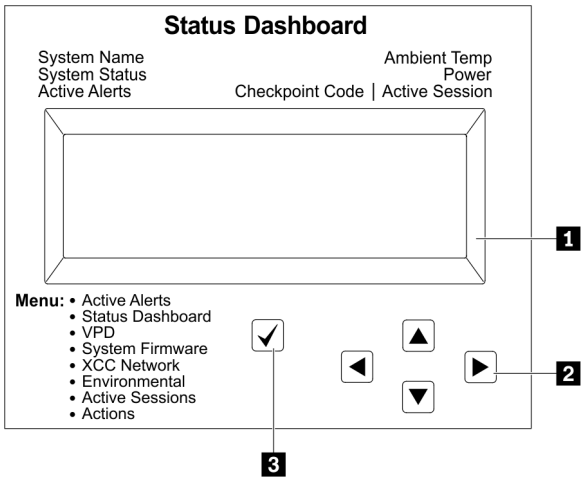
Note: Pay attention to the following steps when unplugging the external handset:



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

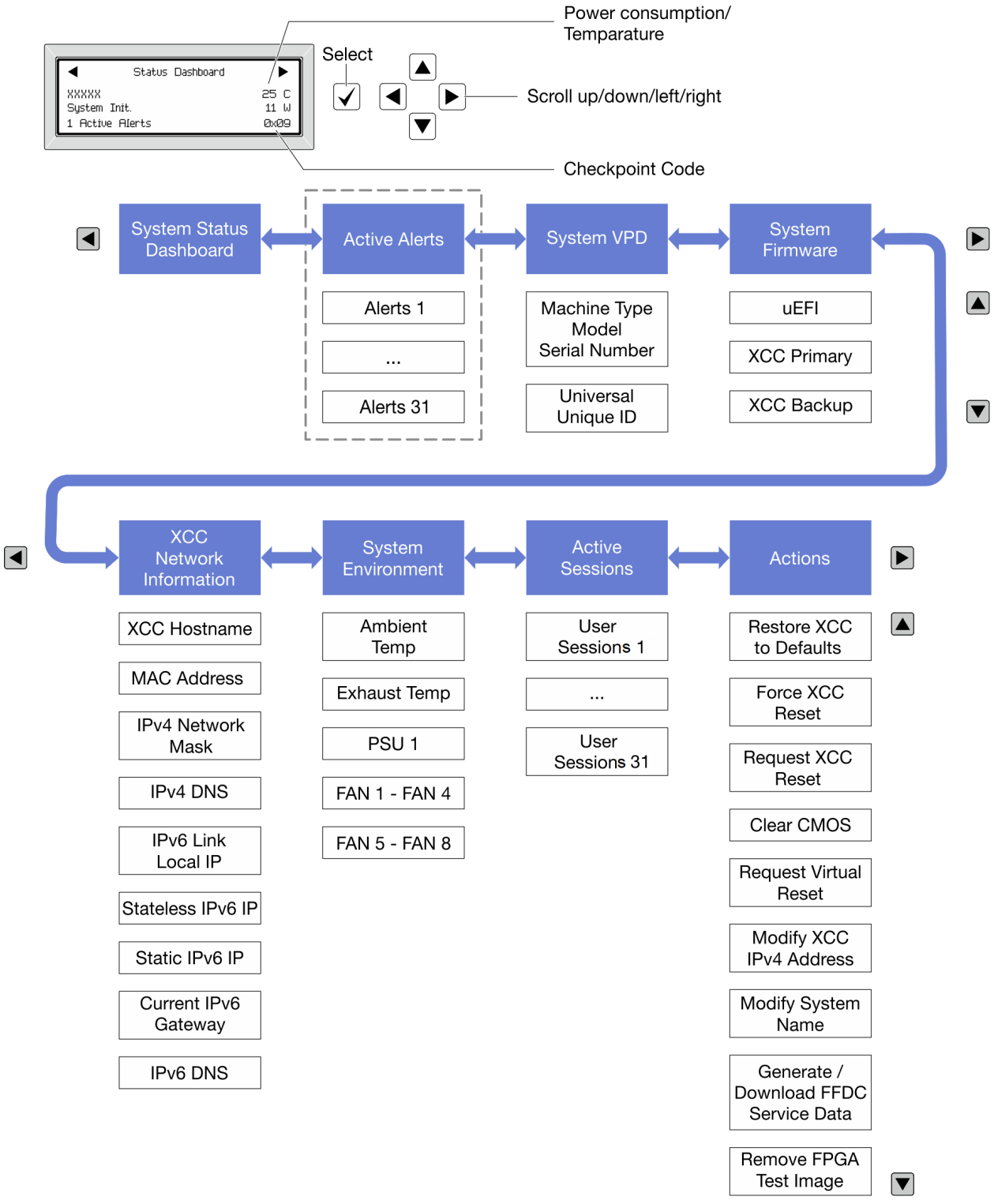
Both the integrated panel and the external handset consist of an LCD display and 5 navigation buttons.



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

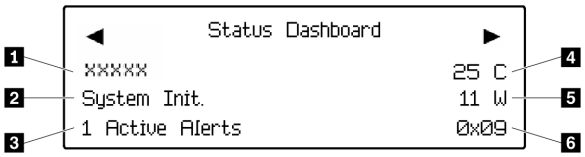
The LCD diagnostics panel/handset shows various system information. Navigate through the options with the scroll keys.



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
1 System name 2 System status 3 Active alert quantity 4 Temperature 5 Power consumption 6 Checkpoint code	

Active Alerts

Sub Menu	Example
Home screen: Active error quantity **Note:** 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: • Error message ID (Type: Error/Warning/Information) • Occurrence time • Possible sources of the error	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
• Machine type and serial number • Universal Unique ID (UUID)	Machine Type: xxxx Serial Num: xxxxxx Universal Unique ID: xxxxxxxxxxxxxxxxxxxxxxxxxxxx

System Firmware

Sub Menu	Example
UEFI • Firmware level (status) • Build ID • Version number • Release date	UEFI (Inactive) Build: D0E101P Version: 1.00 Date: 2019-12-26
XCC Primary • Firmware level (status) • Build ID • Version number • Release date	XCC Primary (Active) Build: DVI399T Version: 4.07 Date: 2020-04-07
XCC Backup • Firmware level (status) • Build ID • Version number • Release date	XCC Backup (Active) Build: D8BT05I Version: 1.00 Date: 2019-12-30

XCC Network Information

Sub Menu	Example
• XCC hostname • MAC address • IPv4 Network Mask • IPv4 DNS • IPv6 Link Local IP • Stateless IPv6 IP • Static IPv6 IP • Current IPv6 Gateway • IPv6 DNS **Note:** Only the MAC address that is currently in use is displayed (extension or shared).	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
• Ambient temperature • Exhaust temperature • PSU status • Spinning speed of fans by RPM	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 • Restore XCC to Defaults • Force XCC Reset • Request XCC Reset • Clear CMOS • Request Virtual Reseat • Modify XCC Static IPv4 Address/Net mask/Gateway • Modify System Name • Generate/Download FFDC Service Data • Remove FPGA Test Image	Request XCC Reset? This will request the BMC to reboot itself. Hold √ 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 37
- “Server model with two PCIe slots” on page 38
- “Server model with two hot-swap 2.5-inch rear drive bays and one PCIe slot” on page 39
- “Server model with two hot-swap 7mm rear drive bays and two PCIe slots” on page 40

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.

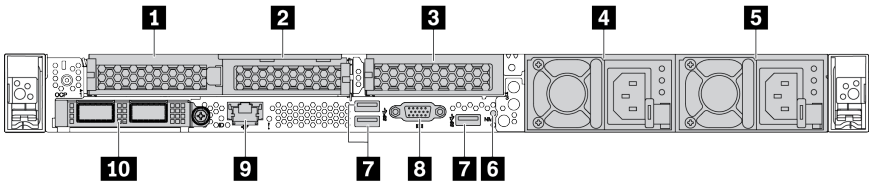


Table 12. Components on the rear of the server

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

Note: For more information about each component, see “Rear components overview” on page 41.

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.

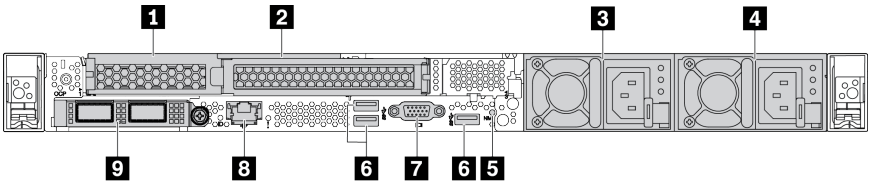


Table 13. Components on the rear of the server

Callout	Callout
1 PCIe slot 1 on riser 1 assembly	2 PCIe slot 2 on riser 1 assembly
3 Power supply 2 (optional)	4 Power supply 1
5 NMI button	6 USB 3.1 Gen 1 connectors (3)
7 VGA connector	8 XClarity Controller network connector
9 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 41.

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.

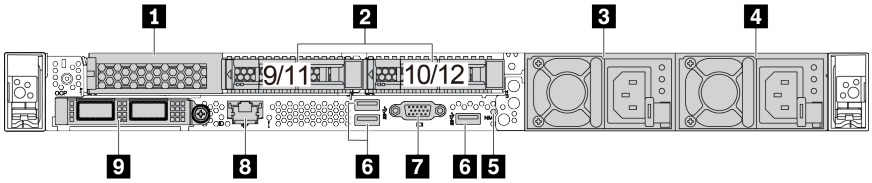


Table 14. Components on the rear of the server

1 PCIe slot 1 on riser 1 assembly	2 Rear 2.5-inch drive bays (2)
4 Power supply 2 (optional)	5 Power supply 1
6 NMI button	7 USB 3.1 Gen 1 connectors (3)
8 VGA connector	9 XClarity Controller network connector
10 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 41.

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.

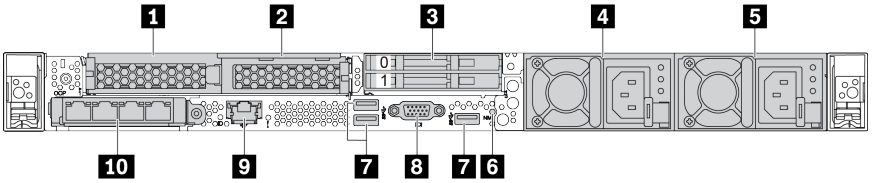


Table 15. Components on the rear of the server

1 PCIe slot 1 on riser 1 assembly	2 PCIe slot 2 on riser 1 assembly
3 Rear 7mm drive bays (2)	4 Power supply 2 (optional)
5 Power supply 1	6 NMI button
7 USB 3.1 Gen 1 connectors (3)	8 VGA connector
9 XClarity Controller network connector	10 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 41.

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.

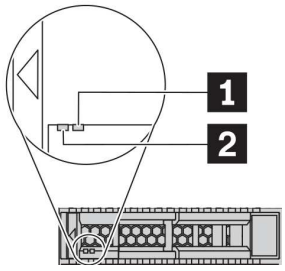


Figure 6. Drive LEDs

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

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

One of the Ethernet connectors 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 43.

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.

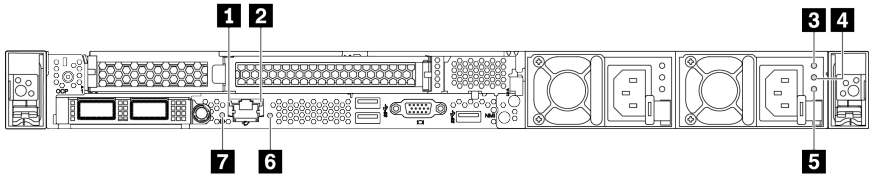


Figure 7. Rear view LEDs

Table 16. LEDs on the rear view of the server

1 Ethernet link LED	2 Ethernet activity LED
3 Power input LED	4 Power output LED
5 Power supply error LED	6 System error LED
7 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
1 Ethernet link LED	Green	On	Network link is established.
	None	Off	Network link is disconnected.
2 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	• Green: The power supply is connected to the ac power source. • Off: The power supply is disconnected from the ac power source or a power problem occurs.
4 Power output LED	• Green: The server is on and the power supply is working normally. • 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 **Advanced → Power → Zero Output**, and select **Disable**. If you disable the zero-out mode, both power supplies will be in the active state. • 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.
5 Power supply error LED	• Yellow: The power supply has failed. To resolve the issue, replace the power supply. • Off: The power supply is working normally.

6 System ID LED

The blue system ID LED helps you to 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 to determine if there are any system errors. For details, see “Diagnostics panel” on page 27.

System board components

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

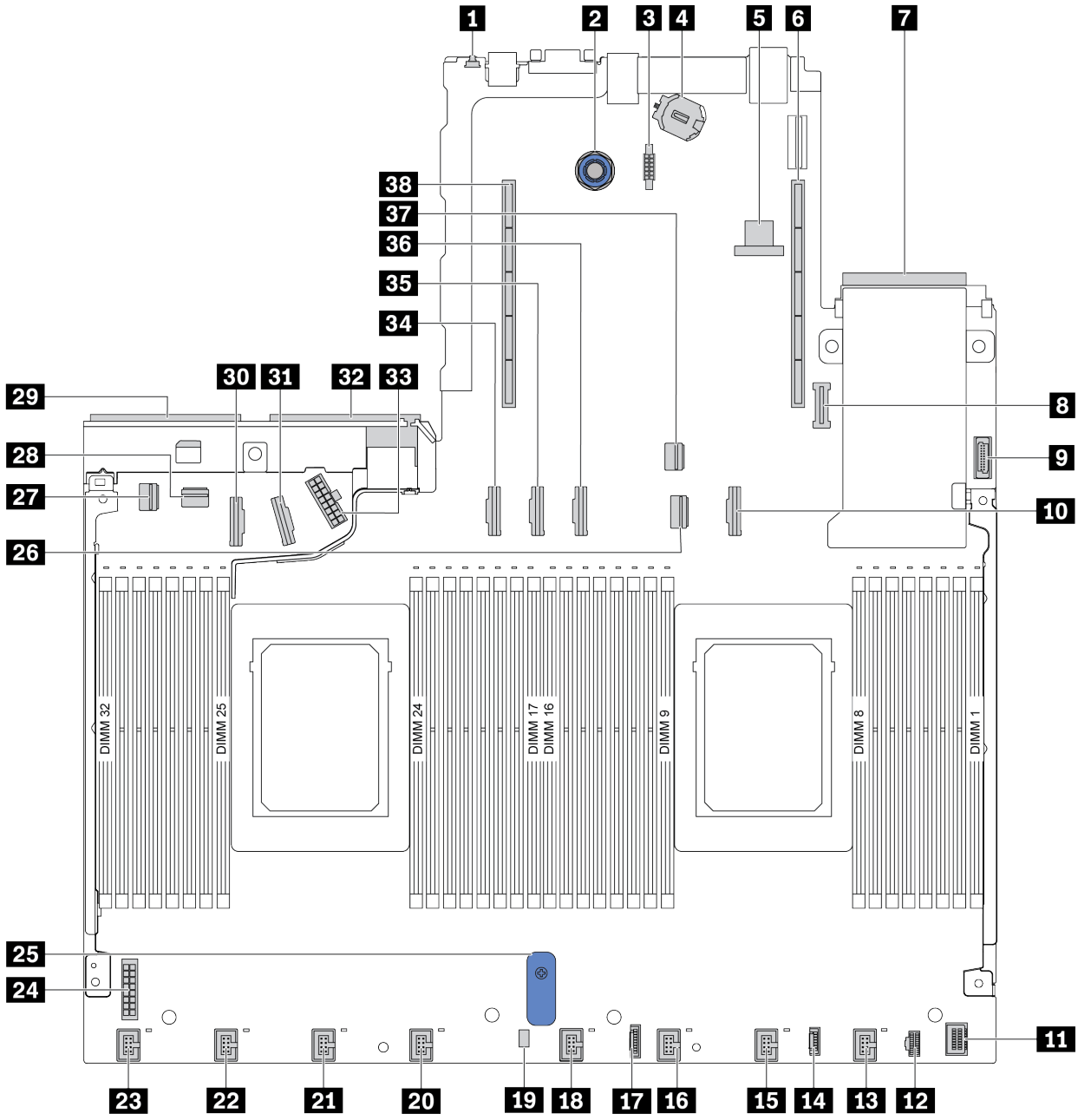


Figure 8. System board components

1 NMI Button	2 System Board Release Pin
3 Serial Port Module Connector	4 CMOS Battery (CR2032)
5 Internal USB Connector	6 Riser 1 slot
7 OCP 3.0 Network Card Connector	8 TPM Module Connector

9 Front USB Connector	10 PCIe Connector 3
11 Front VGA Connector	12 M.2 Power Connector
13 Fan 1 connector	14 Connector for external diagnostics panel
15 Fan 2 connector	16 Fan 3 connector
17 Diagnostics panel connector	18 Fan 4 connector
19 Intrusion Switch cable Connector	20 Fan 5 connector
21 Fan 6 connector	22 Fan 7 connector
23 Fan 8 connector	24 Backplane Power Connector
25 System Board Lift Handle	26 PCIe Connector 1
27 PCIe Connector 4	28 PCIe Connector 5
29 Power Supply 1 Connector	30 PCIe Connector 7
31 PCIe Connector 8	32 Power Supply 2 Connector
33 Internal Raid Power Connector	34 PCIe Connector 6
35 PCIe Connector 9 (Reserved)	36 PCIe Connector 10 (Reserved)
37 PCIe Connector 2	38 Riser 2 slot

Parts list

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

For more information about ordering the parts shown in Figure 9 “Server components” on page 47:

https://datacentersupport.lenovo.com/products/servers/thinksystem/sr645/7d2x/parts

Note: Depending on the model, your server might look slightly different from the illustration.

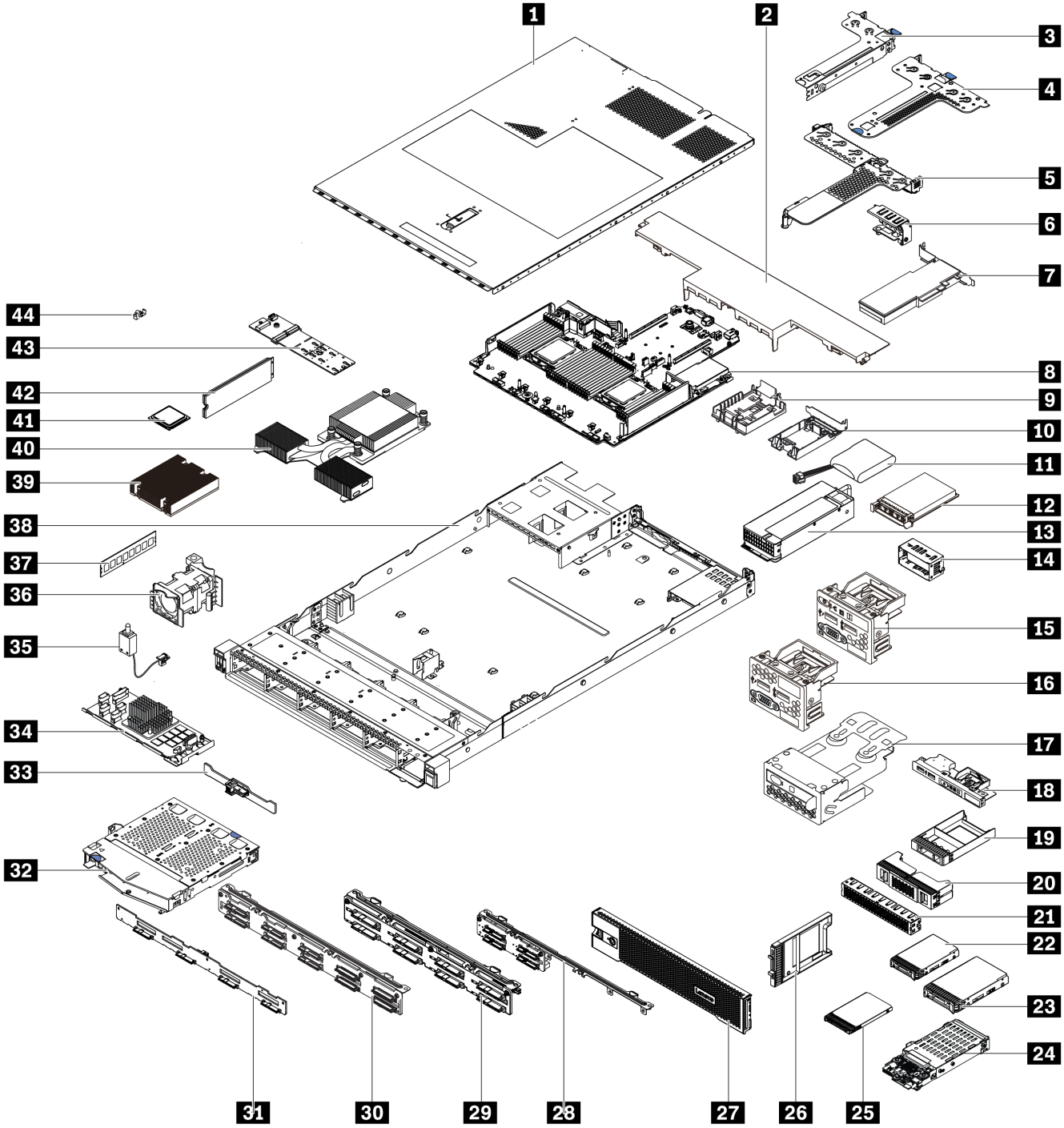


Figure 9. Server components

The parts listed in the following table 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:** 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.

Table 17. Parts listing

Index	Description	Tier 1 CRU	Tier 2 CRU	FRU	Consumable and Structural parts
For more information about ordering the parts shown in Figure 9 “Server components” on page 47: https://datacentersupport.lenovo.com/products/servers/thinksystem/sr645/7d2x/parts					
1	Top cover	√			
2	Standard air baffle				√
3	Riser assembly (LP)	√			
4	Riser assembly (LP+LP)	√			
5	Riser assembly (LP+FH)	√			
6	Rearwall bracket				√
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 1 2.5-inch drive bay filler				√

Table 17. Parts listing (continued)

Index	Description	Tier 1 CRU	Tier 2 CRU	FRU	Consumable and Structural parts
21	2 x 3 2.5-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	√			
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	√			

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.

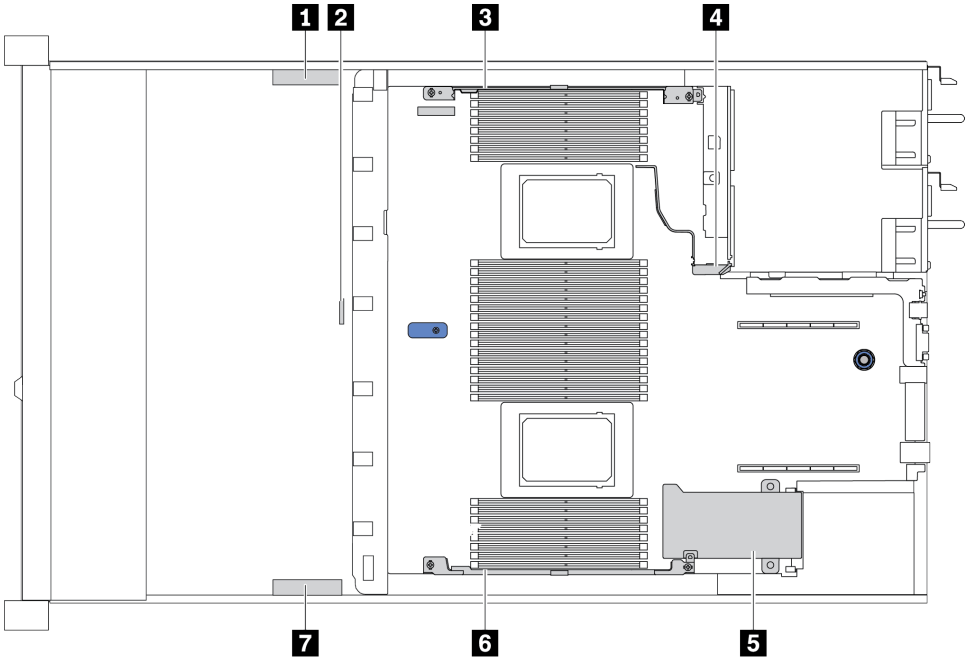
Chapter 3. Internal cable routing

Some of the components in the server have internal cables and cable connectors. For details, see the following cable routing sections:

- “CFF RAIR/HBA adapter cabling routing” on page 54
- “FIO cable routing” on page 55
- “Intrusion switch cable routing” on page 56
- “Super capacitor cable routing” on page 57
- “7mm drive backplane cable routing (power & signal)” on page 59
- “M.2 drive backplane cable routing (power & signal)” on page 60
- “2.5-inch/3.5-inch drive backplane (power)” on page 61
- “2.5-inch/3.5-inch drive backplane (signal)” on page 62

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
1 3 4	Route to BP Pwr connector, Raid Pwr connector, and PCIe connectors (4, 5, 7, 8)

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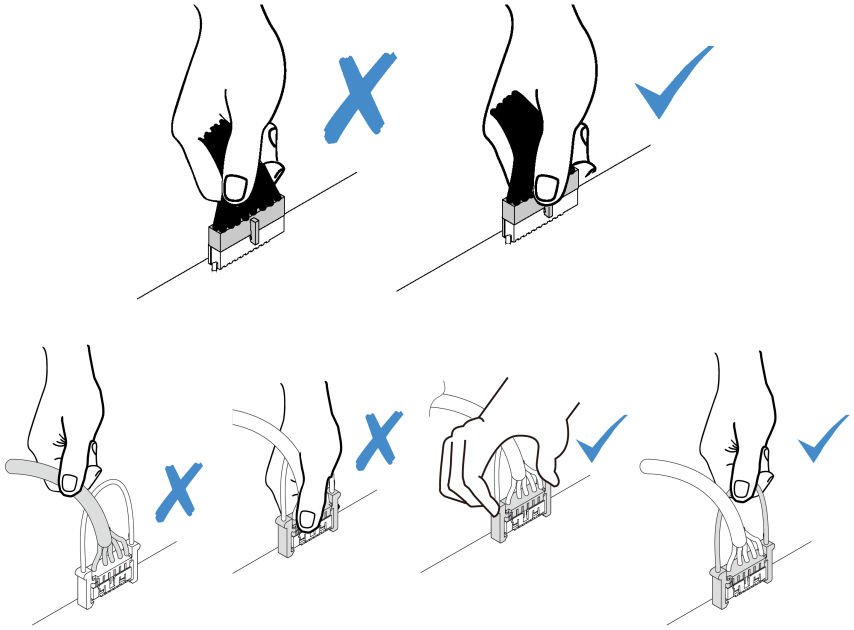
2	Route to intrusion switch cable
5 6 7	Route to FIO connector, LCD external connector, M.2 Pwr connector, VGA 2 connector, Front USB connector, PCIe connectors (1–3, 6, 9, 10), and Raid/HBA connectors

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.

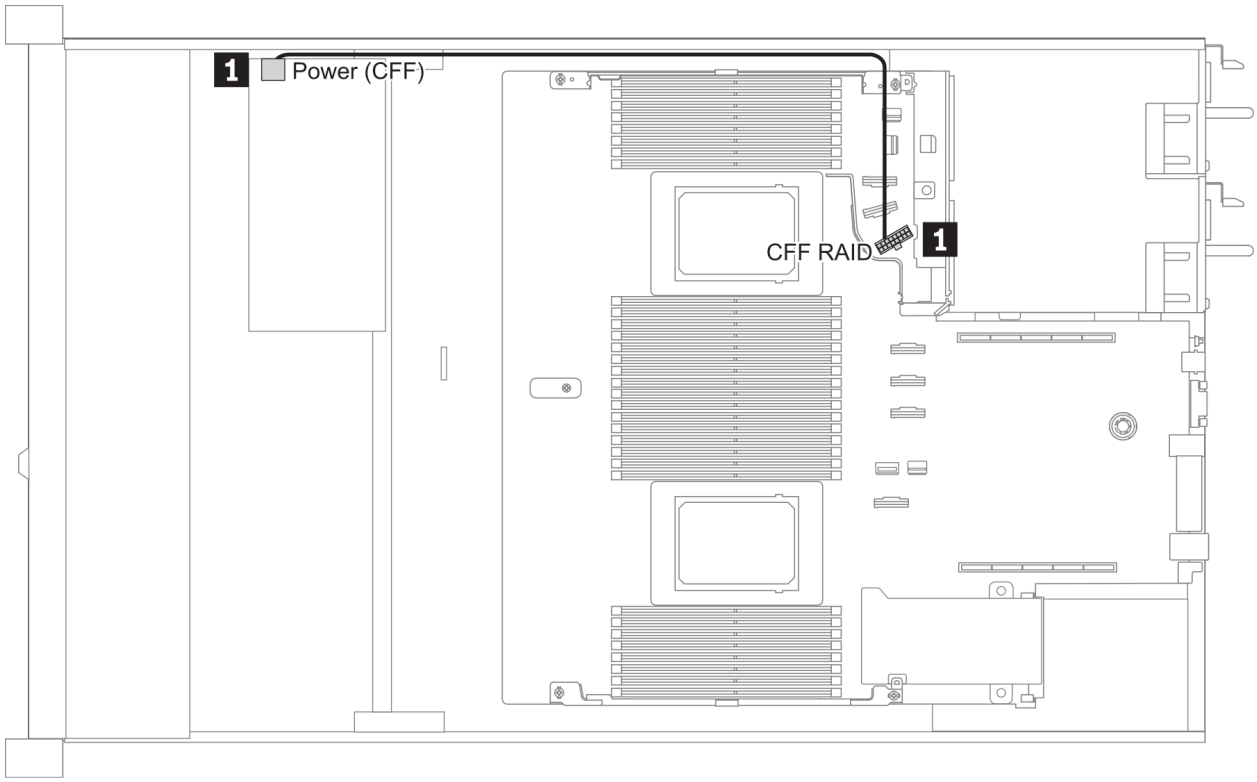


CFF RAIR/HBA adapter cabling routing

Use the section to understand the power cable routing for CFF RAID/HBA adapter.

Power cable routing for CFF RAID/HBA adapters

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 (signal)” on page 62



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

FIO cable routing

Use the section to understand the cable routing for FIO.

Cable routing for FIO

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 15.

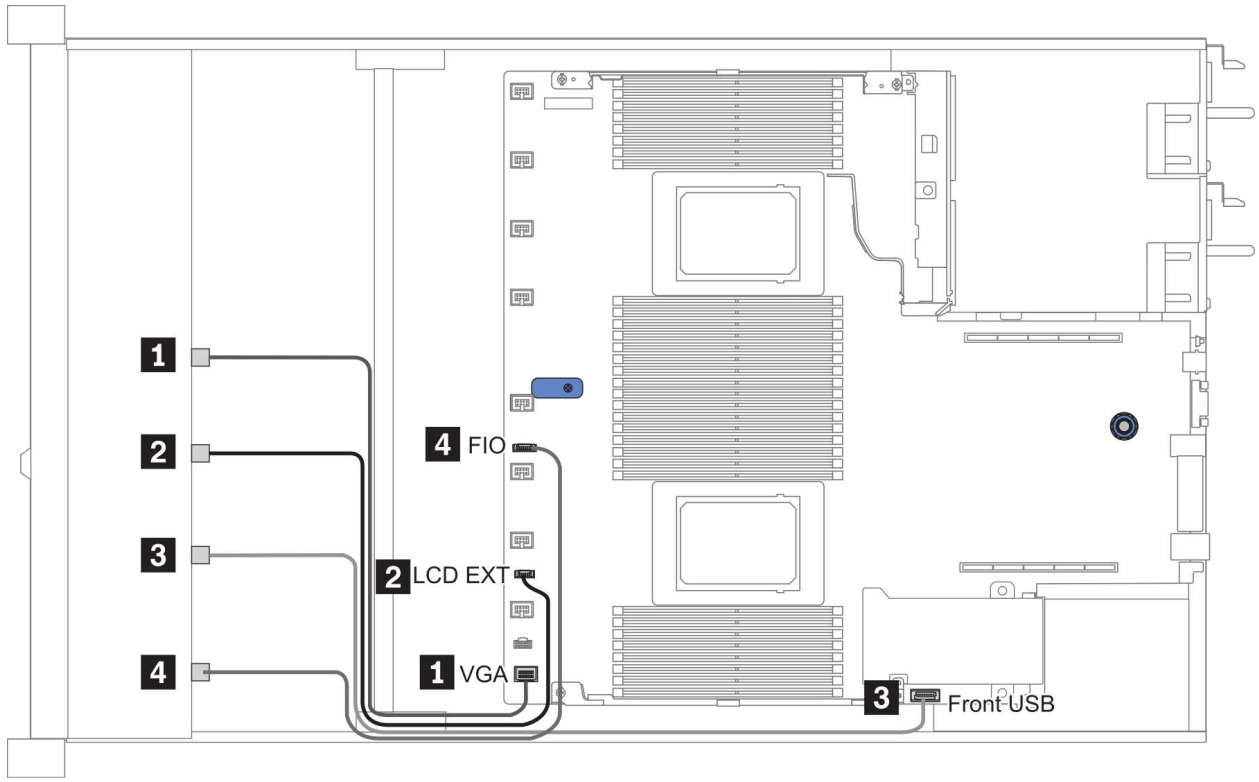


Figure 10. Cable routing for FIO

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

Intrusion switch cable routing

Use the section to understand the cable routing for the intrusion switch.

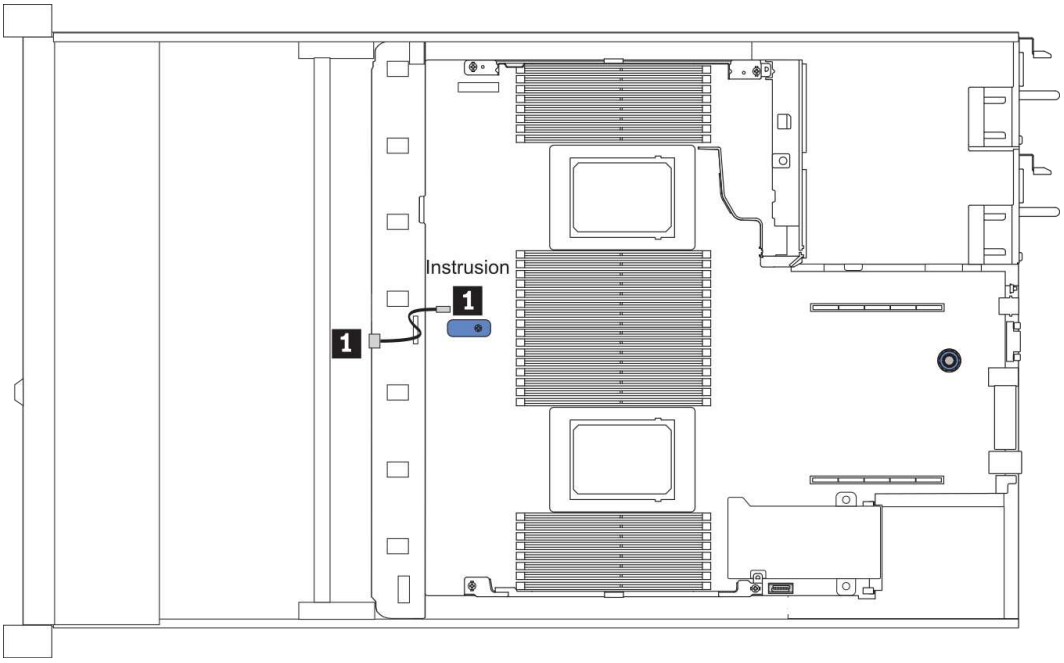


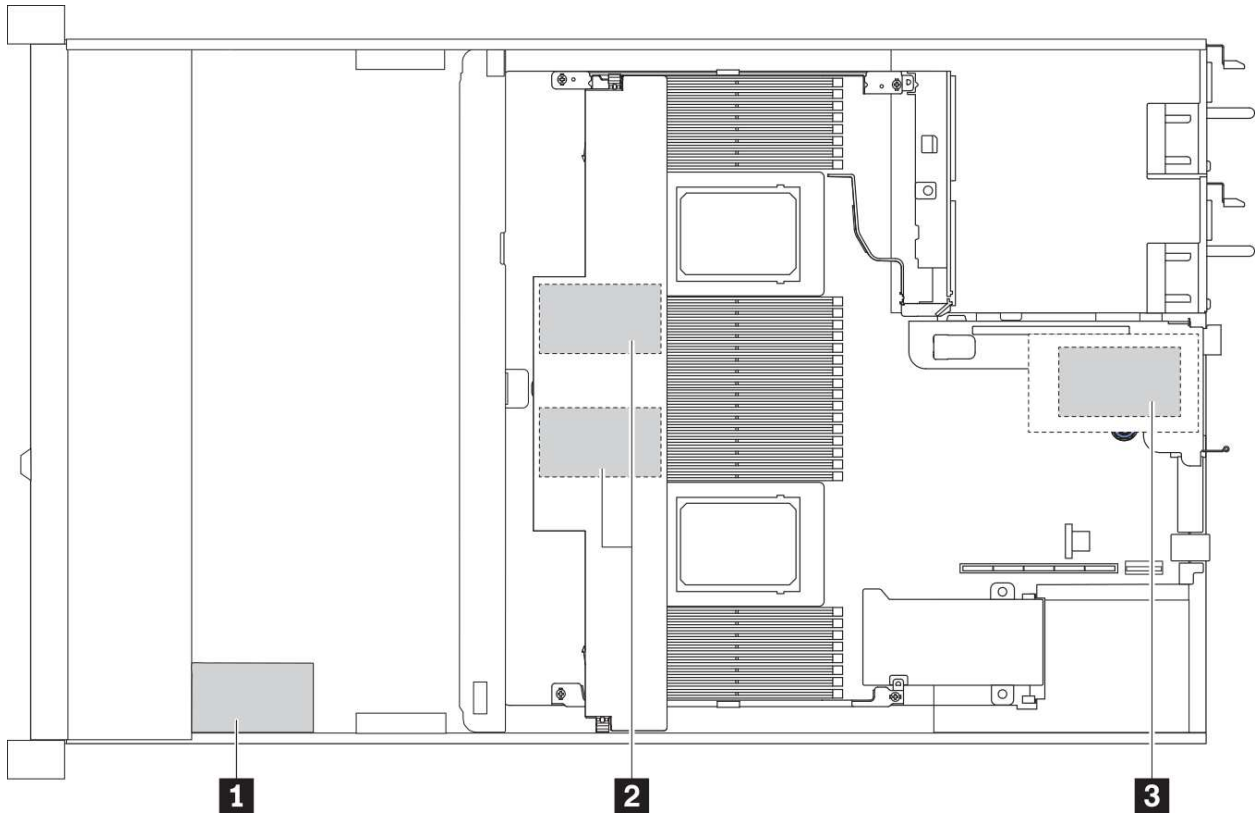
Figure 11. Intrusion switch cable routing

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

Super capacitor cable routing

Use the section to understand the cable routing for backplanes.

RAID super capacitor module location



1	Super capacitor on the chassis
2	Super capacitors in the air baffle
3	Super capacitors in riser 3 assembly

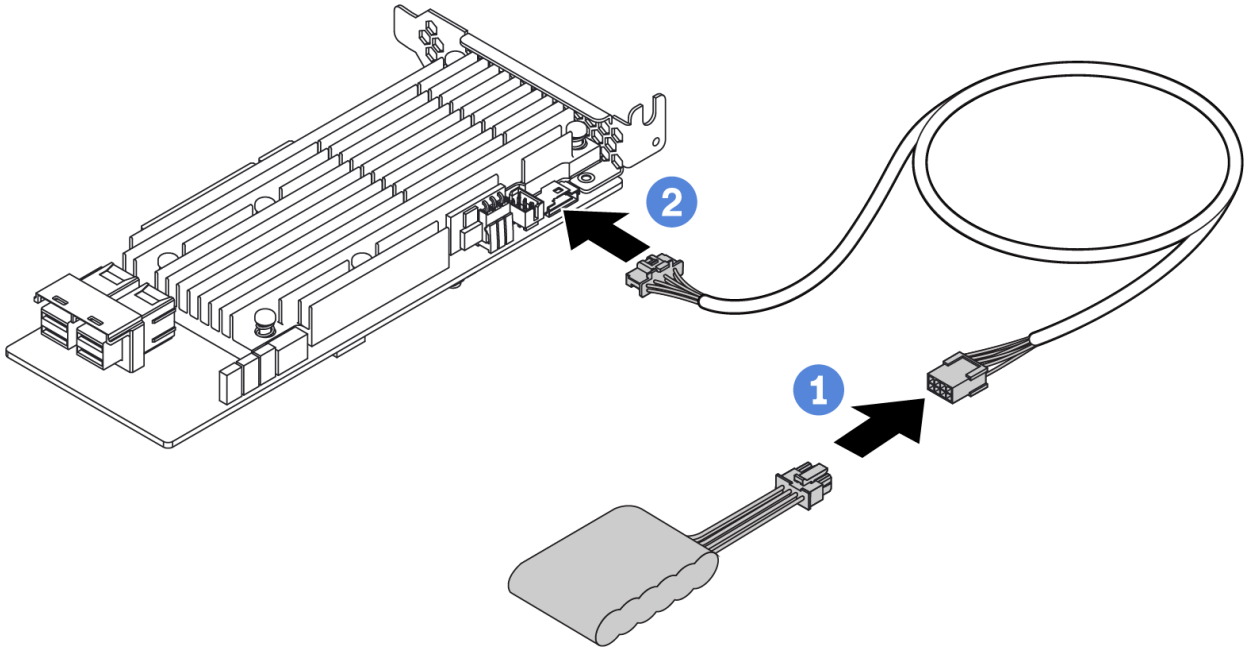


Figure 12. Power cable routing for super capacitor

Note: The super capacitor cable can either be long or short. Refer to Table 25 “Super capacitor installation rules” on page 102 for more information.

7mm drive backplane cable routing (power & signal)

This section provides cable routing information for the 7mm drives.

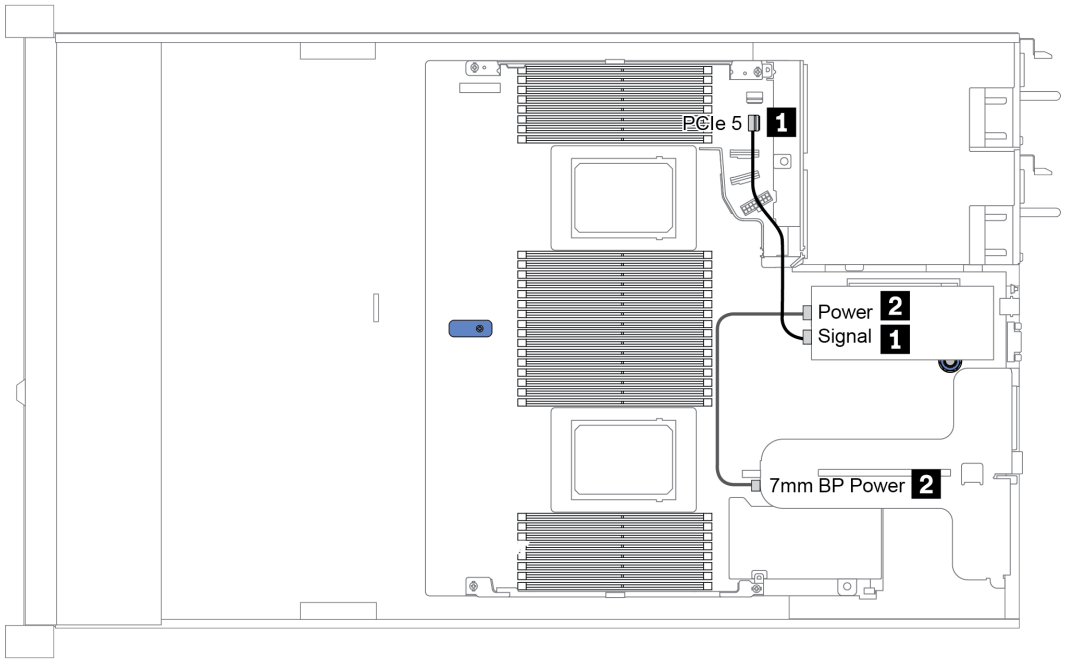


Figure 13. Cable routing for 7mm drives

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

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

This section provides cable routing information for the M.2 drives.

Notes:

- M.2 drives can be installed on the chassis (scenario 1) or 3.5-inch front drive cage (scenario 2). The following illustration shows the cable connection for 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 the server model is one of the following:
  - Server models with 10 x 2.5-inch front drive bays (AnyBay)
  - Server models with 10 x 2.5-inch front drive bays (NVMe)
  - Server models with 10 x 2.5-inch front drive bays (8AnyBay+2NVMe)

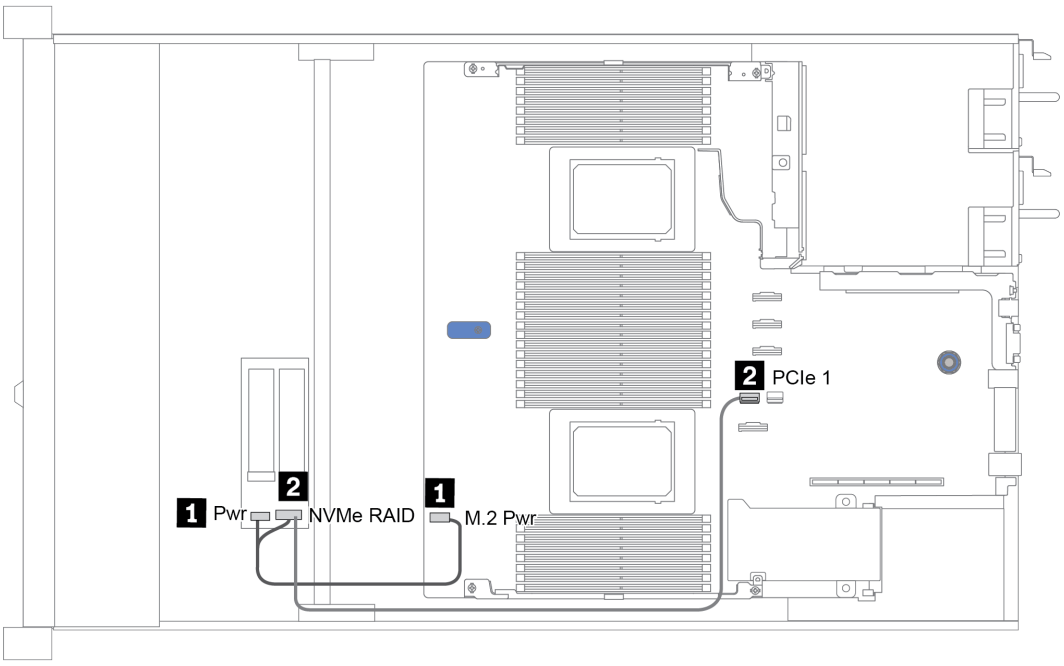


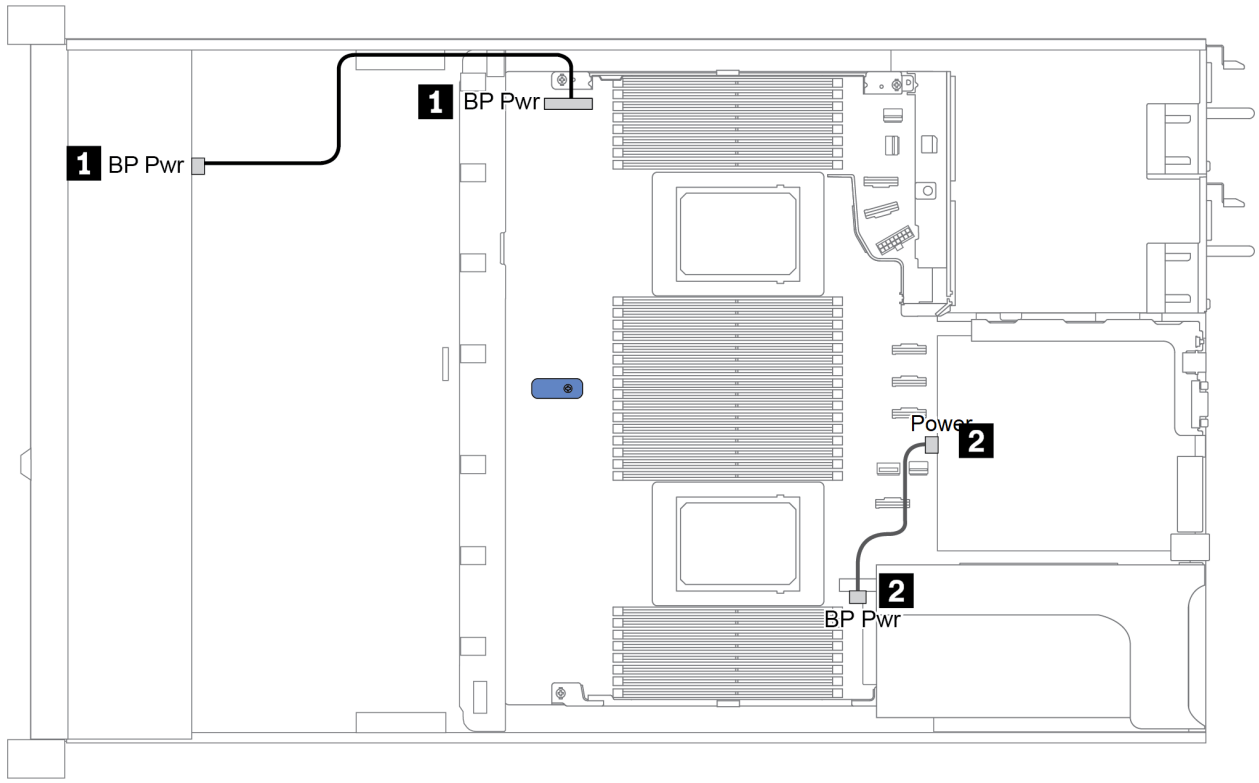
Figure 14. Cable routing for M.2 drives

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

2.5-inch/3.5-inch drive backplane (power)

Use the section to understand the power cable routing for 2.5-inch or 3.5-inch drive backplanes.

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



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

2.5-inch/3.5-inch drive backplane (signal)

Use the section to understand the cable routing for signal cable connections for 2.5-inch/3.5-inch drive backplanes.

Your server supports the following server models with:

- “4 x 2.5-inch front drive bays (SAS/SATA)” on page 63
- “8 x 2.5-inch front drive bays (SAS/SATA)” on page 64
- “4 x 3.5-inch front drive bays (SAS/SATA)” on page 67
- “4 x 3.5-inch front drive bays (AnyBay)” on page 71
- “10 x 2.5-inch front drive bays (AnyBay)” on page 75

Notes: The 10 x 2.5-inch AnyBay backplane can also be used on the following models:

- “10 x 2.5-inch front drive bays (NVMe)” on page 77
- “10 x 2.5-inch front drive bays (8AnyBay + 2NVMe)” on page 80
- “10 x 2.5-inch front drive bays (6SAS/SATA + 4AnyBay)” on page 82
- “10 x 2.5-inch front drive bays (6SAS/SATA + 4NVMe)” on page 86
- “10 x 2.5-inch front drive bays (6 SAS/SATA + 2 AnyBay + 2 NVMe)” on page 88

4 x 2.5-inch front drive bays (SAS/SATA)

The server model is configured with one 4 x 2.5-inch SAS/SATA front drive backplane. Below lists all supported configurations with this front drive backplane.

Configuration option	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 and 2: (front drive bays only)

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

The following illustration shows the cable routing for the configuration 2, the routing for configuration 1 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters in the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

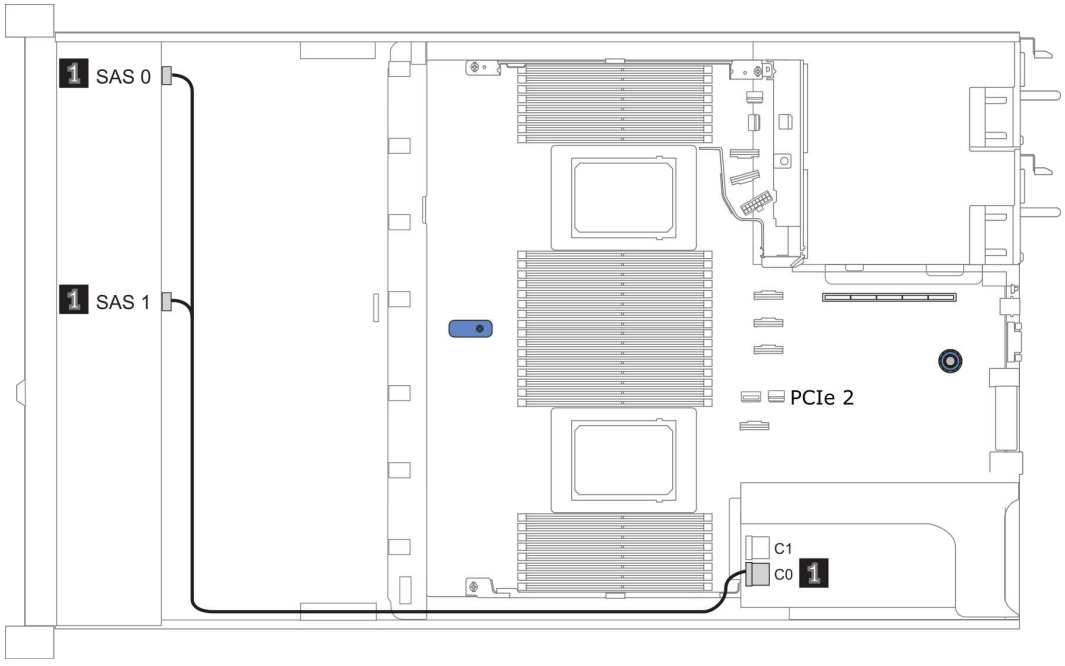


Figure 15. Cable routing for configuration 2

8 x 2.5-inch front drive bays (SAS/SATA)

The server model is configured with one 8 x 2.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

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, 2, and 3: front drive bays only” on page 65
- “Configuration 4, 5, and 6: front drive bays and rear drive bays” on page 66

Configuration 1, 2, and 3: (front drive bays only)

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

The following illustration shows the cable routing for the configuration 2, the routing for configuration 1 and 3 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

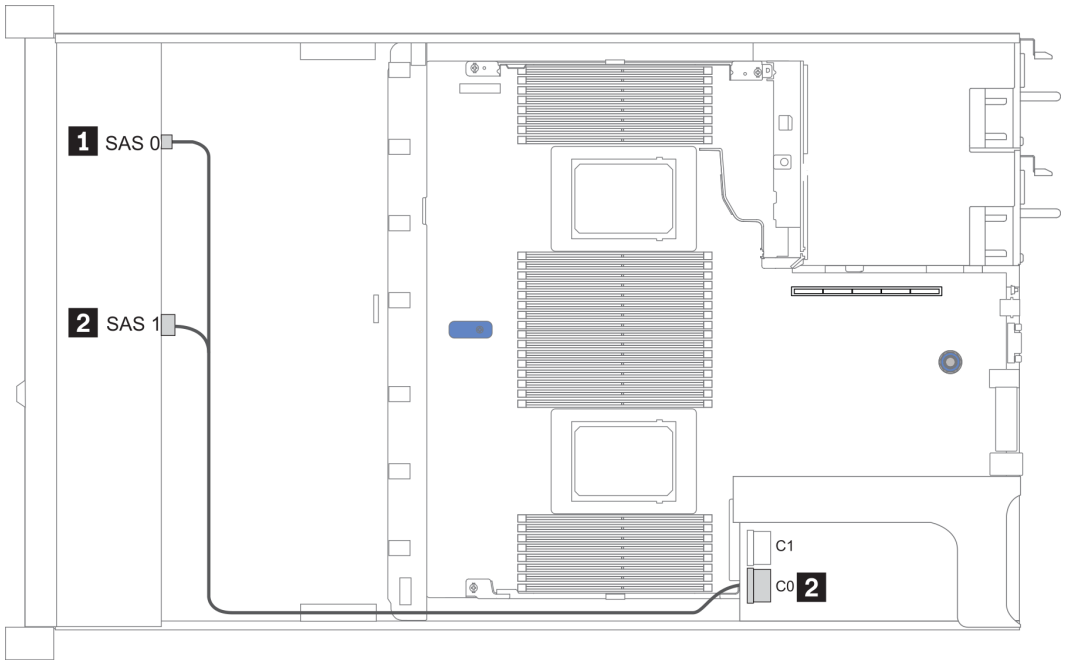


Figure 16. Cable routing for configuration 2

Configuration 4, 5, and 6: (front drive bays and rear drive bays)

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

The following illustration shows the cable routing for the configuration 6, the routing for configuration 4 and 5 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

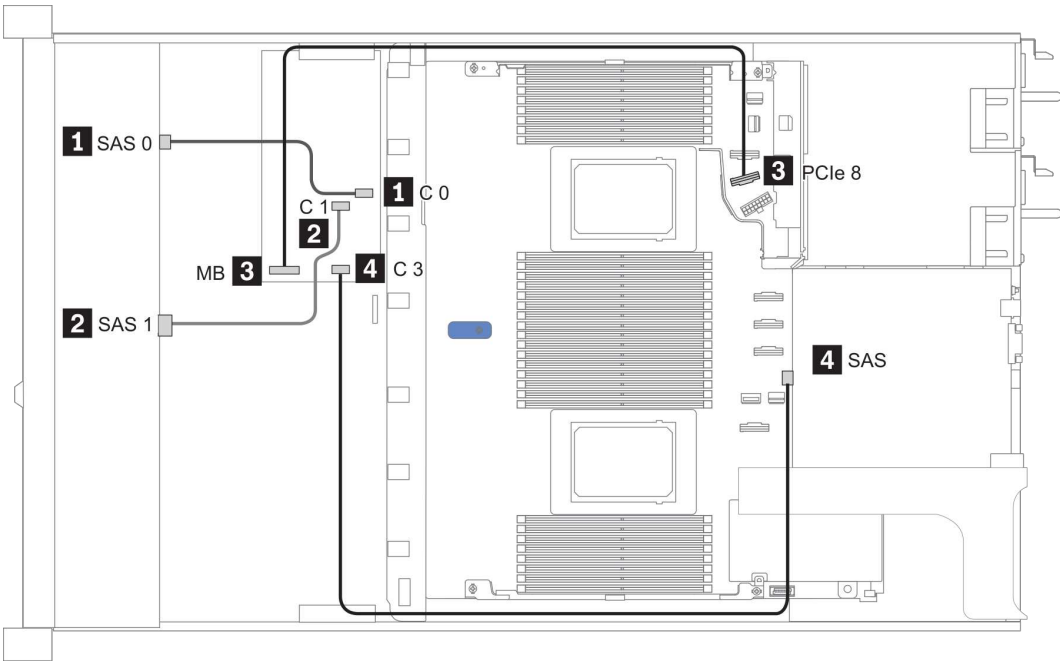


Figure 17. Cable routing for configuration 6

4 x 3.5-inch front drive bays (SAS/SATA)

The server model is configured with one 4 x 3.5-inch SAS/SATA front drive backplane. Below lists all supported configurations with this front drive backplane.

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 and 2: front drive bays only" on page 68
- "Configuration 3 to 6: front drive bays and rear drive bays" on page 69

Configuration 1 and 2: (front drive bays only)

Front: one 4 x 3.5-inch SAS/SATA backplane

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

The following illustration shows the cable routing for the configuration 2, the routing for configuration 1 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

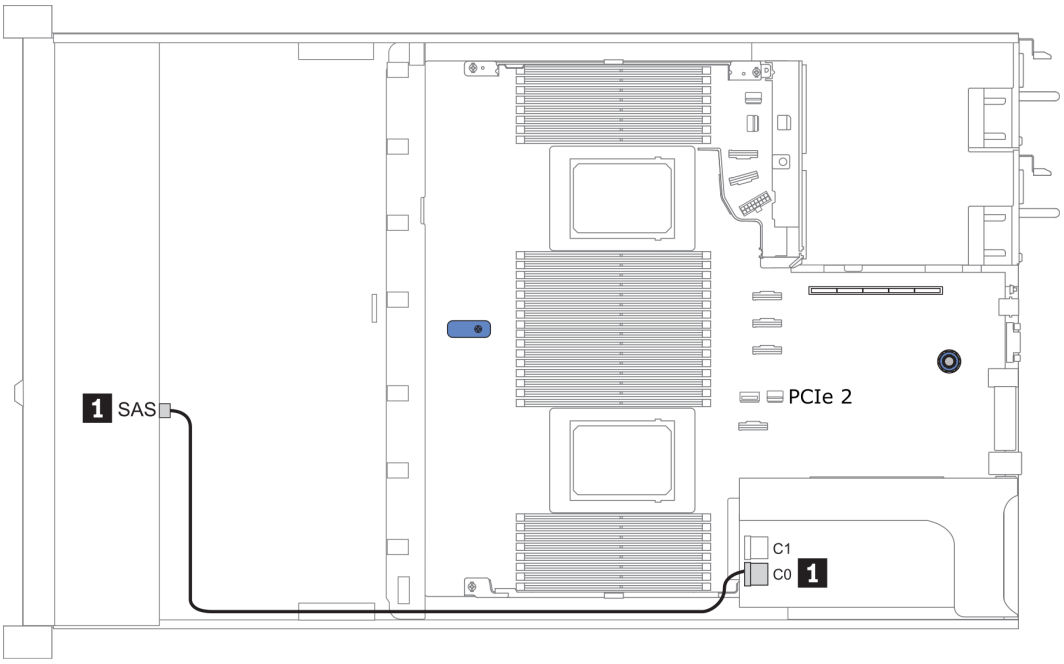


Figure 18. Cable routing for configuration 2

Configuration 3 and 4: (front drive bays and rear drive bays)

Front: one 4 x 3.5-inch SAS/SATA backplane

Rear: one 2 x 2.5-inch SAS/SATA backplane

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

The following illustration shows the cable routing for the configuration 4, the routing for configuration 3 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

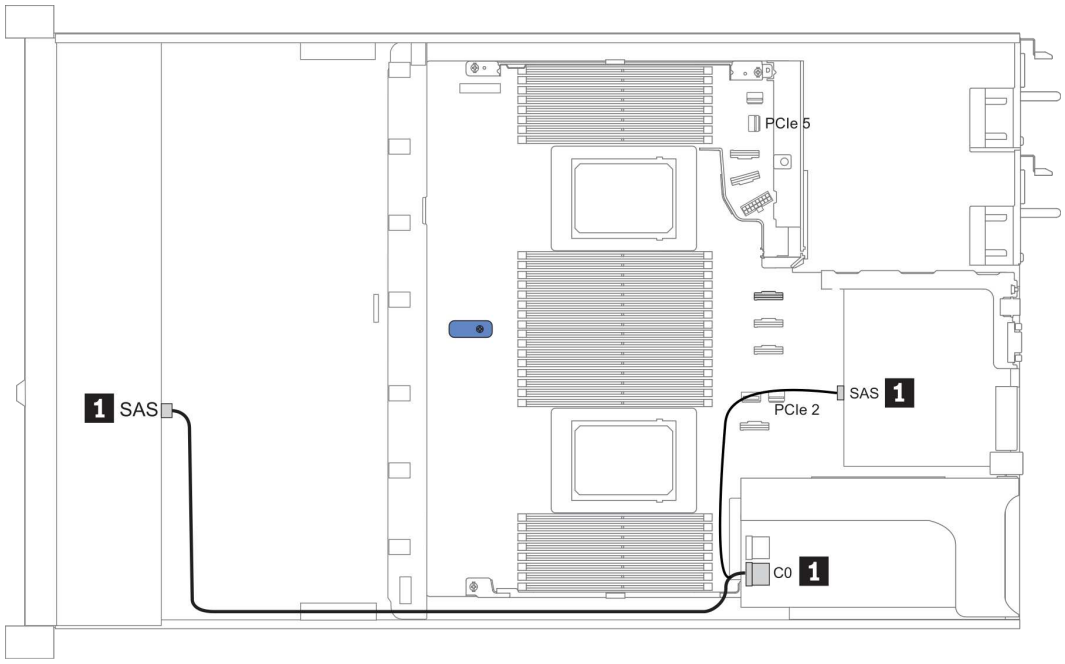


Figure 19. Cable routing for configuration 4

Front: one 4 x 3.5-inch SAS/SATA backplane

Rear: one 2 x 2.5-inch NVMe backplane

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	

The following illustration shows the cable routing for the configuration 5, the routing for configuration 6 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

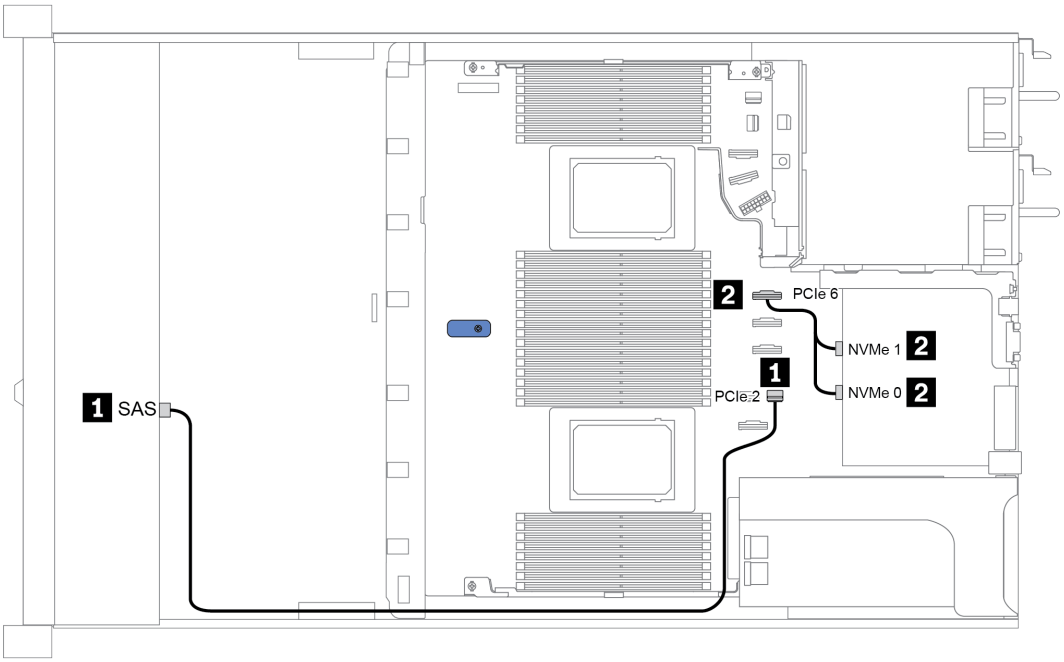


Figure 20. Cable routing for configuration 5

4 x 3.5-inch front drive bays (AnyBay)

The server model is configured with one 4 x 3.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

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 and 2: front drive bays only" on page 72
- "Configuration 3 to 6: front drive bays and rear drive bays" on page 73

Configuration 1 and 2: (front drive bays only)

Front: one 4 x 3.5-inch AnyBay backplane

Con-fig.	Front BP	System board	Storage controller
			SFF 8i RAID/HBA
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

The following illustration shows the cable routing for the configuration 2, the routing for configuration 1 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

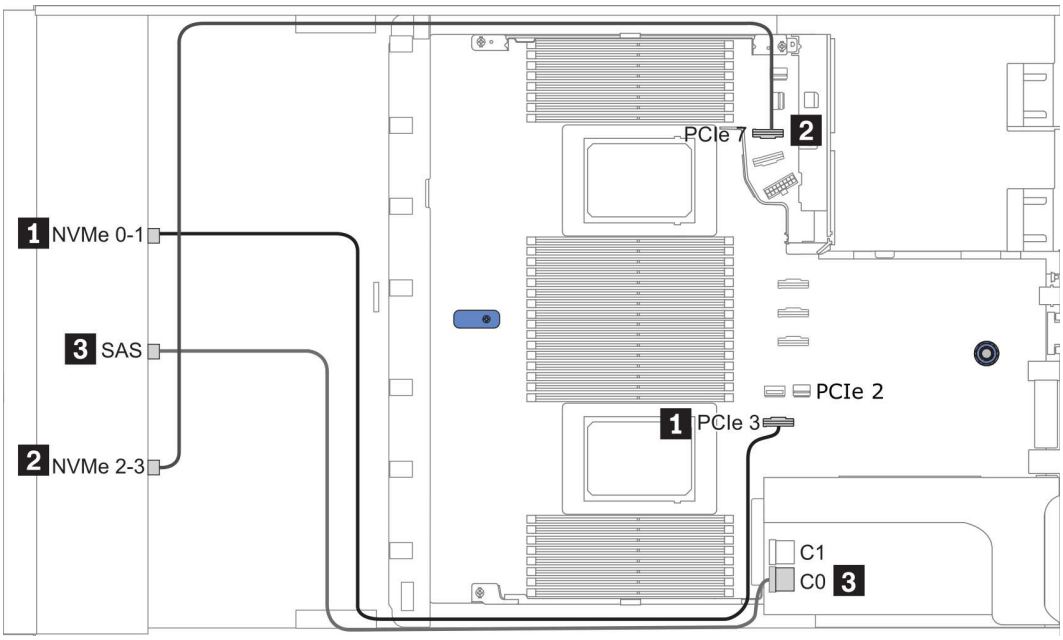


Figure 21. Cable routing for configuration 2

Configuration 3 and 4: (front drive bays and rear drive bays)

Front: one 4 x 3.5-inch AnyBay backplane

Rear: one 2 x 2.5-inch SAS/SATA backplane

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

The following illustration shows the cable routing for the configuration 4, the routing for configuration 3 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

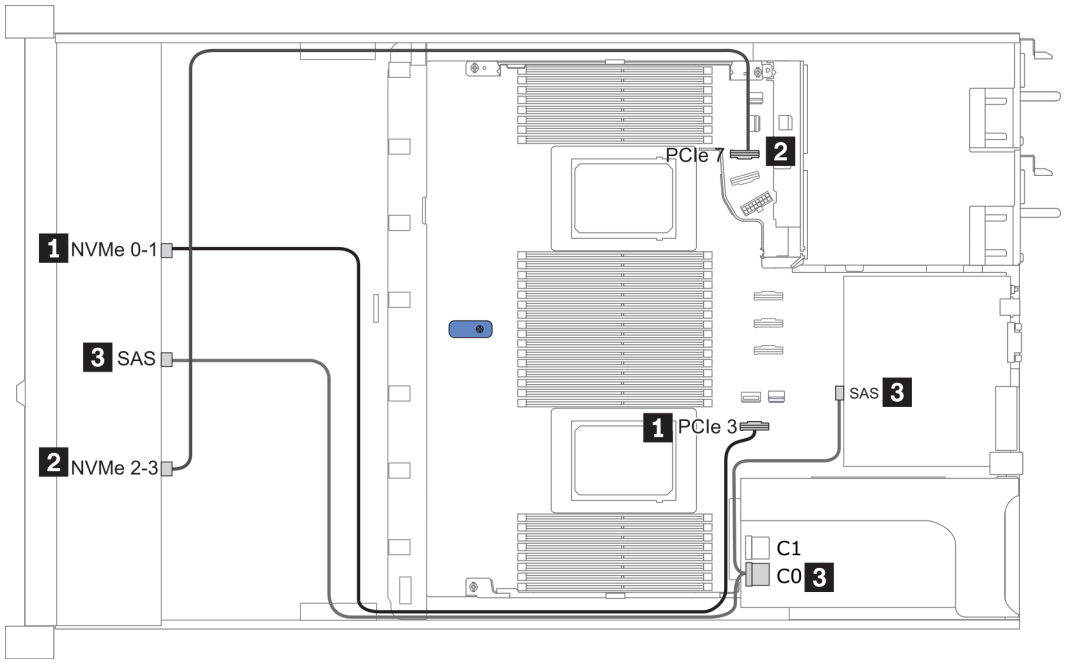


Figure 22. Cable routing for configuration 4

Front: one 4 x 3.5-inch AnyBay backplane

Rear: one 2 x 2.5-inch NVMe backplane

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

The following illustration shows the cable routing for the configuration 6, the routing for configuration 5 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

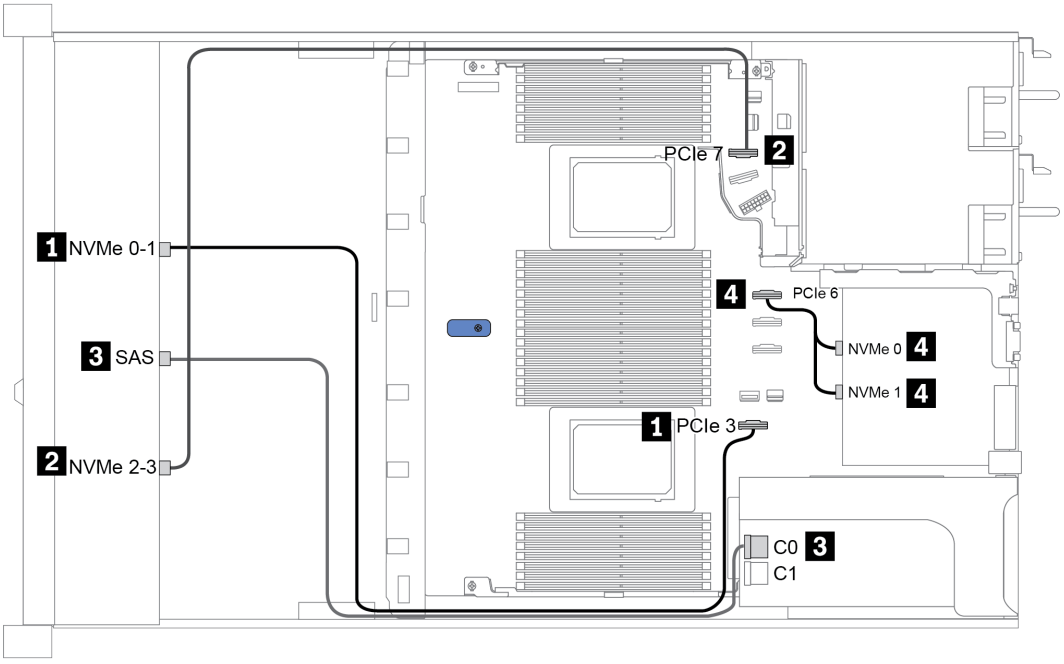


Figure 23. Cable routing for configuration 6

10 x 2.5-inch front drive bays (AnyBay)

The server model is configured with one 10 x 2.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

Configuration option	Front BP		Rear BP		Storage controller	
	Qty.	Onboard	Qty.	Onboard	Qty.	Type
Config. 1	1	10 NVMe			1	SFF 16i RAID/HBA
Config. 2	1	10 NVMe	1		1	SFF 16i RAID/HBA

Table 18. Cable routing information for configuration 1 and 2

Config.	Front BP	Rear BP	System board	Storage controller
				SFF 16i 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, SAS 1			Gen 4: C 0 Gen 3: C 0, C 1
	SAS 2			Gen 3: C 2
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
	SAS 2	SAS		Gen 4: C 1 Gen 3: C 2, C 3

The following illustration shows the cable routing for the configuration 1, the routing for configuration 2 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

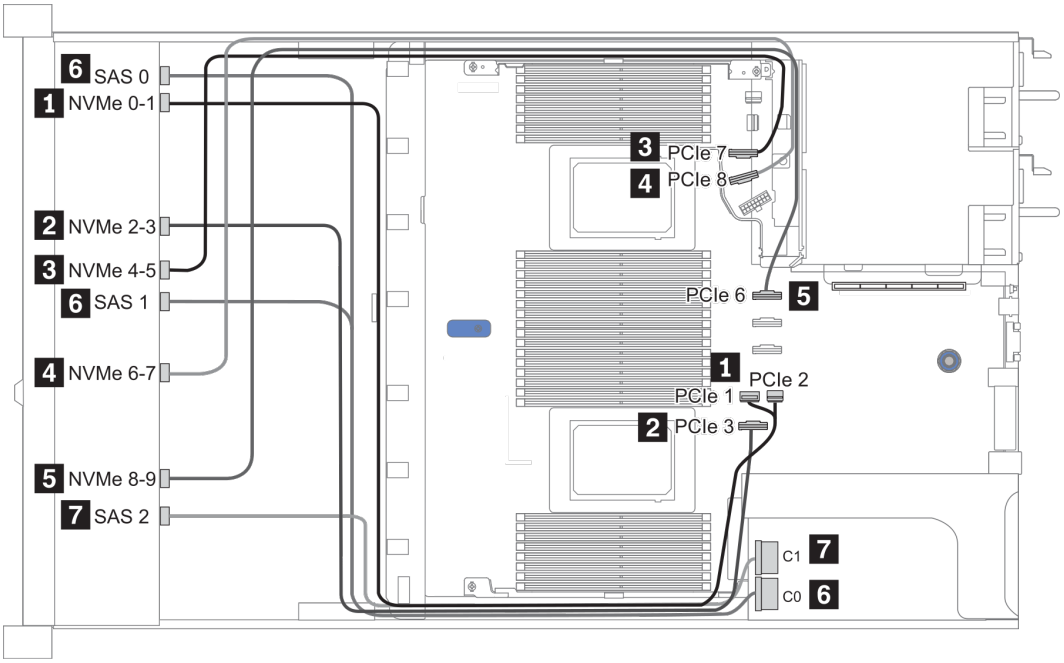


Figure 24. Cable routing for configuration 1

10 x 2.5-inch front drive bays (NVMe)

The server model is configured with one 10 x 2.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

Note: The AnyBay backplane is used as a pure NVMe backplane.

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

Table 19. Cable routing information for configuration 1 and 2

Config.	Front BP	Rear 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
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	PCIe 5

The following illustration shows the cable routing for the configuration 1, the routing for configuration 2 is similar.

Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

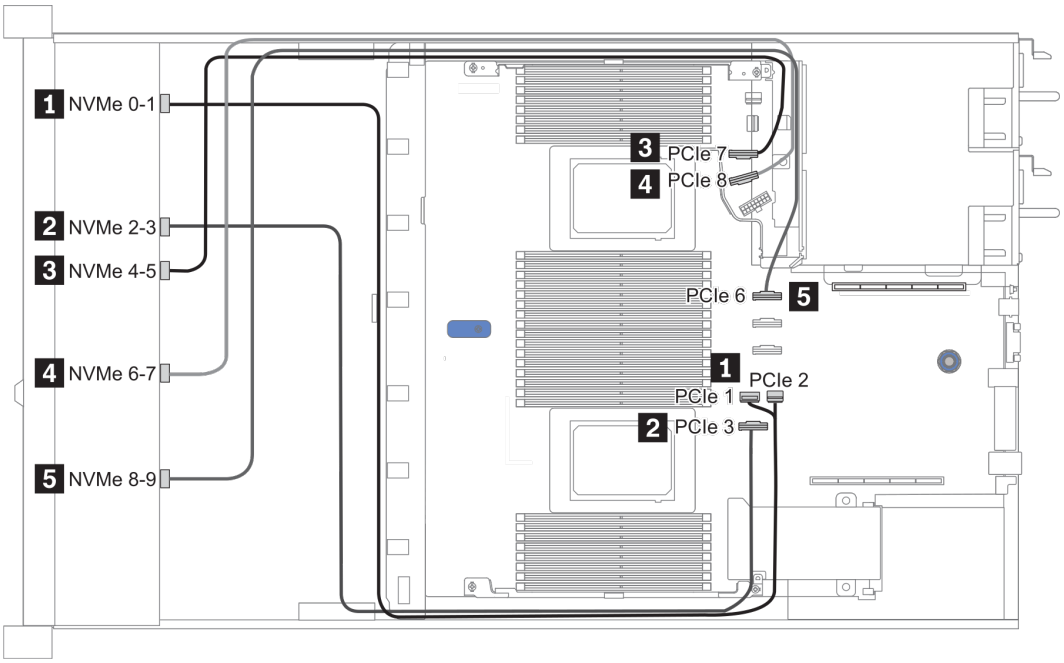


Figure 25. Cable routing for configuration 2

10 x 2.5-inch front drive bays (8AnyBay + 2NVMe)

The server model is configured with one 10 x 2.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

Note: 10 AnyBay backplane is used as “8AnyBay + 2NVMe” backplane.

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

Table 20. Cable routing information for configuration 1 and 2

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

The following illustration shows the cable routing for the configuration 2, the routing for configuration 1 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

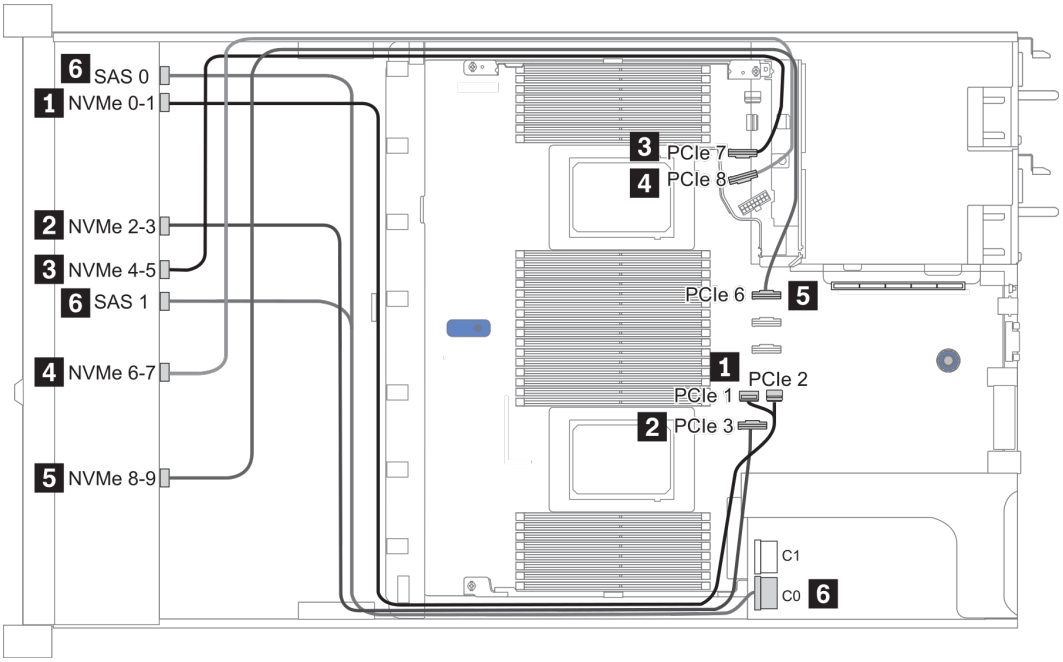


Figure 26. Cable routing for configuration 1

10 x 2.5-inch front drive bays (6SAS/SATA + 4AnyBay)

The server model is configured with one 10 x 2.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

Note: The AnyBay backplane is used as “6 SAS/SATA + 4 AnyBay” backplane.

Configuration option	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, 2, and 3: front drive bays only” on page 83
- “Configuration 4 and 5: front drive bays and rear drive bays” on page 85

Configuration 1, 2, and 3: (front drive bays only)

Con-fig.	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	PCIe 3		
	NVMe 2–3	PCIe 7		
	SAS 0, SAS 1		Gen 4: C 0 Gen 3: C 0, C 1	
	SAS 2		Gen 4: C 1 Gen 3: C 2, C 3	
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

The following illustration shows the cable routing for the configuration 2, the routing for configurations 1 and 3 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

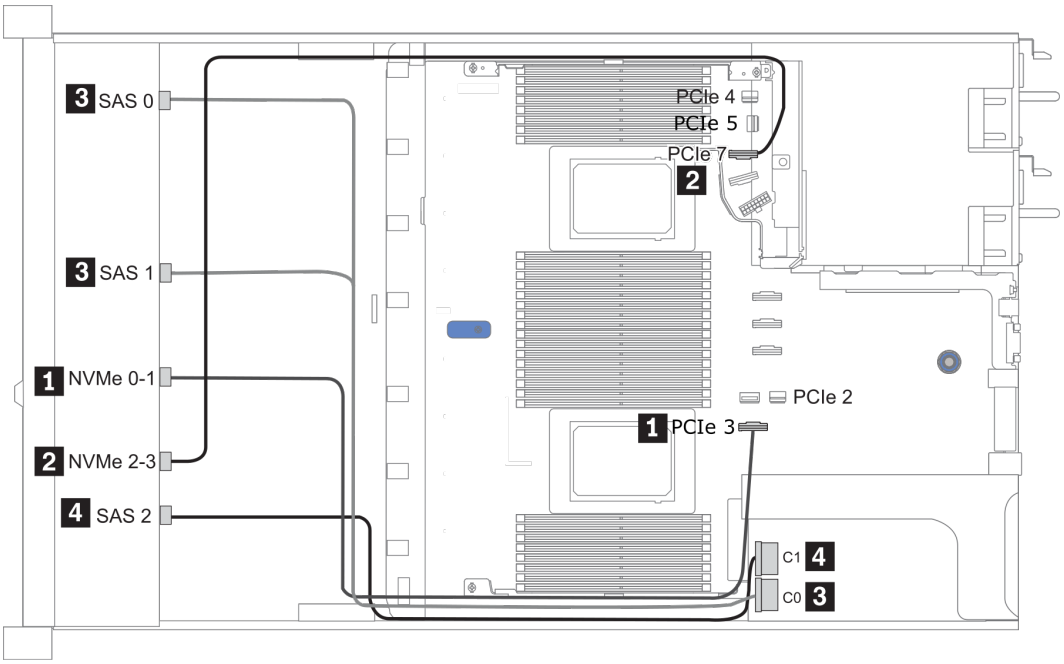


Figure 27. Cable routing for configuration 2

Configurations 4 and 5: (front drive bays and rear drive bays)

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

The following illustration shows the cable routing for the configuration 5, the routing for configurations 4 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

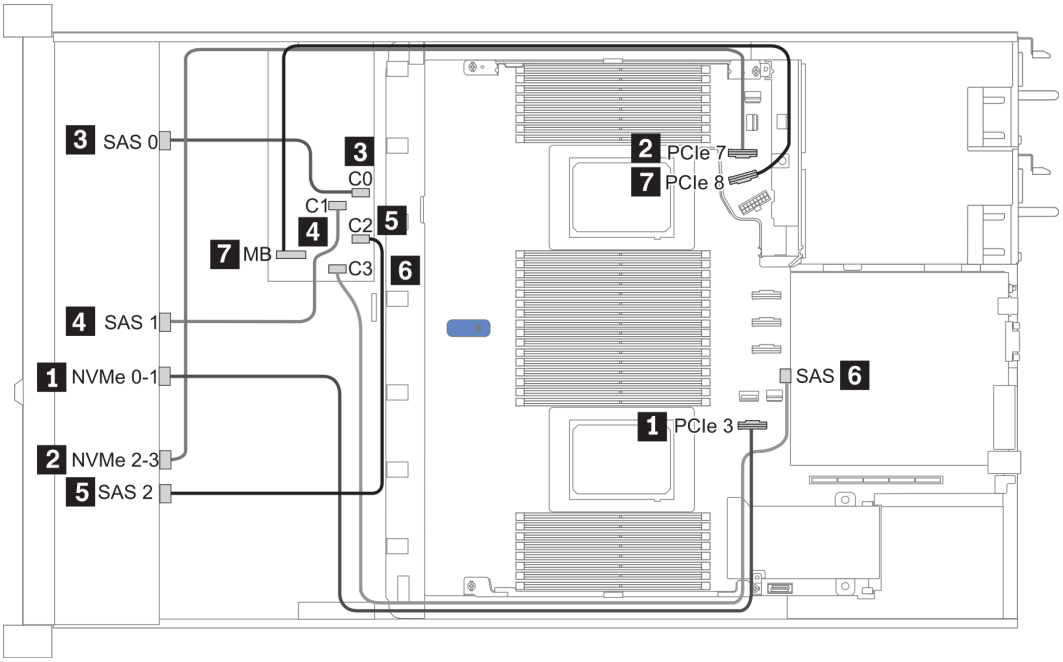


Figure 28. Cable routing for configuration 5

10 x 2.5-inch front drive bays (6SAS/SATA + 4NVMe)

The server model is configured with one 10 x 2.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

Note: The AnyBay backplane is used as “6 SAS/SATA + 4 NVMe” backplane.

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

Cable routing information for configuration 1

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	PCIe 5

The following illustration shows the cable routing for the configuration 1. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

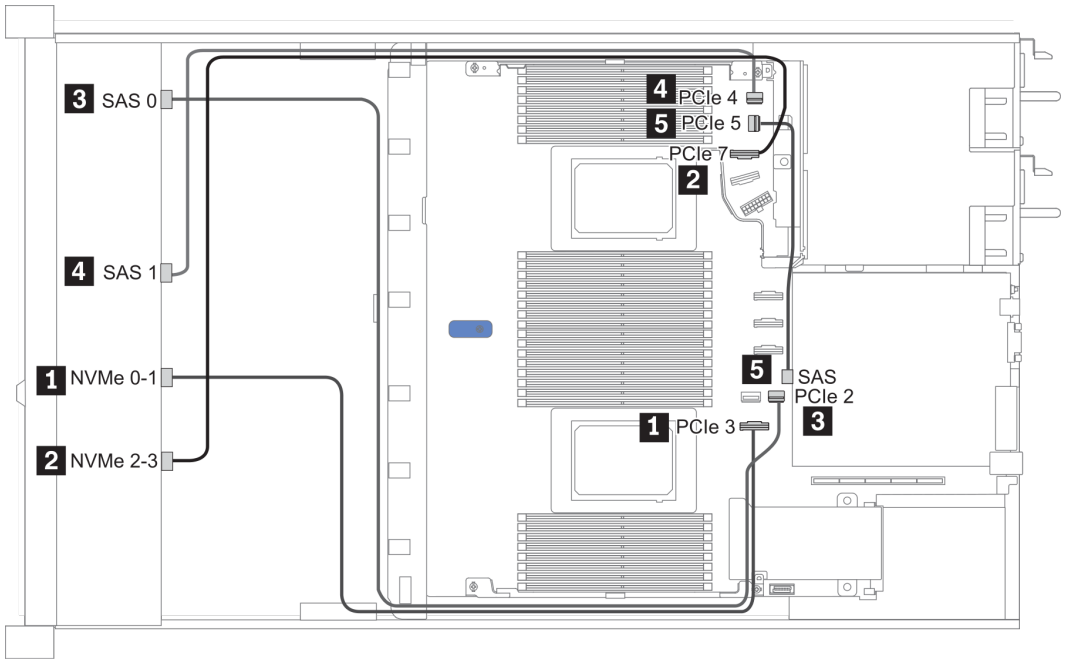


Figure 29. Cable routing for configuration 1

10 x 2.5-inch front drive bays (6 SAS/SATA + 2 AnyBay + 2 NVMe)

The server model is configured with one 10 x 2.5-inch AnyBay front drive backplane. Below lists all supported configurations with this front drive backplane.

Note: The AnyBay backplane is used as “6 SAS/SATA + 2 AnyBay + 2 NVMe” backplane.

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

Cable routing information for configuration 1, 2, and 3

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

The following illustration shows the cable routing for the configuration 3, the routing for configurations 1 and 2 is similar. Connections between connectors: 1 ↔ 1, 2 ↔ 2, 3 ↔ 3, ... n ↔ n

Note: For models that support Gen 3 and Gen4 adapters at the same slot, the illustration shows only the cable routing information for Gen 4 adapters, the routing and connector information is similar for Gen 3 adapters.

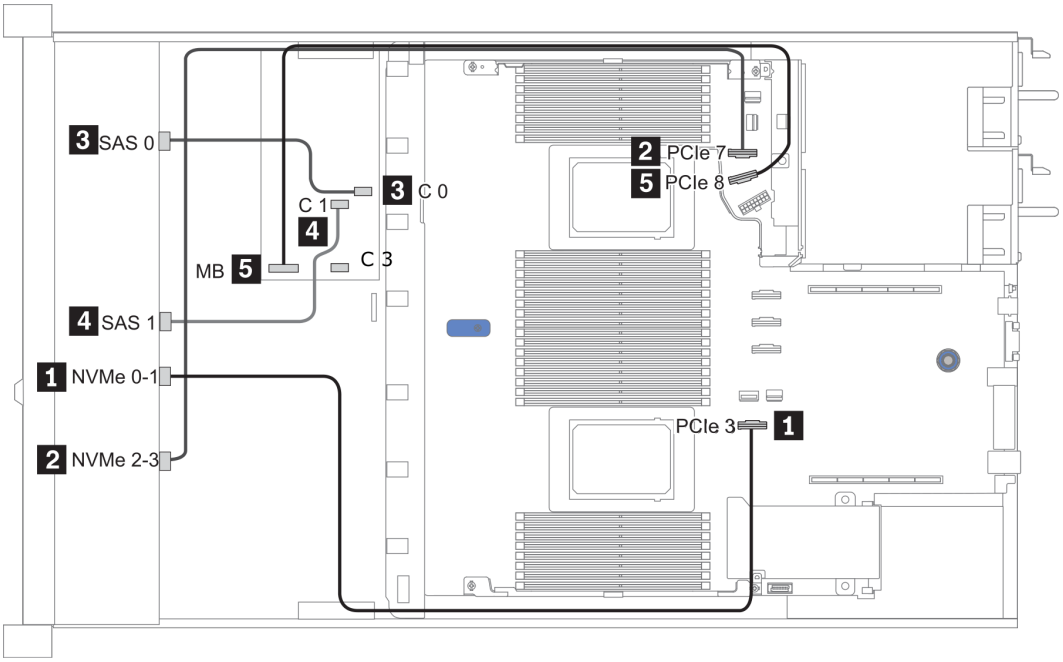


Figure 30. Cable routing for configuration 3

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.

Server setup checklist

Use the server setup checklist to ensure that you have performed all tasks that are required to set up your server.

The server setup procedure varies depending on the configuration of the server when it was delivered. In some cases, the server is fully configured and you just need to connect the server to the network and an ac power source, and then you can power on the server. In other cases, the server needs to have hardware options installed, requires hardware and firmware configuration, and requires an operating system to be installed.

The following steps describe the general procedure for setting up a server:

1. Unpack the server package. See “Server package contents” on page 2.
2. Set up the server hardware.
   a. Install any required hardware or server options. See the related topics in “Install server hardware options” on page 104.
   b. If necessary, install the server into a standard rack cabinet by using the rail kit shipped with the server. See the *Rack Installation Guide* that comes with optional rail kit.
   c. Connect the Ethernet cables and power cords to the server. See “Rear view” on page 36 to locate the connectors. See “Cable the server” on page 157 for cabling best practices.
   d. Power on the server. See “Power on the server” on page 157.

      Note: You can access the management processor interface to configure the system without powering on the server. Whenever the server is connected to power, the management processor interface is available.
   e. Validate that the server hardware was set up successfully. See “Validate server setup” on page 158.
3. Configure the system.
   a. Connect the Lenovo XClarity Controller to the management network. See “Set the network connection for the Lenovo XClarity Controller” on page 159.
   b. Update the firmware for the server, if necessary. See “Update the firmware” on page 160.
   c. Configure the firmware for the server. See “Configure the firmware” on page 162.

      The following information is available for RAID configuration:

      - https://lenovopress.com/lp0578-lenovo-raid-introduction
      - https://lenovopress.com/lp0579-lenovo-raid-management-tools-and-resources
   d. Install the operating system. See “Install the operating system” on page 166.
   e. Back up the server configuration. See “Back up the server configuration” on page 167.
   f. Install the applications and programs for which the server is intended to be used.

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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 to ensure your safety at work: 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.
- 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.

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.

Technical rules

Refer to the below technical rules and limitations when you install the related server components.

Technical rules for processors and heat sinks

Understanding the technical rules helps you choose the correct heat sinks, fans, and other components based on what processors are configured for your server.

Supported heat sinks for processors

The following lists the required heat sinks when different processors are installed.

Heat sink/fan	Processor TDP	
	120W-155W	180W-280W
Heat sink	Standard	Performance

Supported fans for processors

The following lists the required fans when different processors are installed.

Processor		Fan type				Fan quantity
		10 x 2.5'' models		4 x 2.5'', 4 x 3.5'', 8 x 2.5'' models		
		STD[1]	Perf.	STD	Perf.	
TDP	120W	√		√		
	155W		√	√		
	180W-280W		√		√	
Quantity	One					6[2]
	Two					8

1. Standard fans are enough for low-wattage processors while you can still use performance fans for better cooling.
2. Two fan dummies (fan cages 7 and 8) are required when one processor is installed.

Supported processors by server model

Server model	Processor				
	Group C	Group B	Group A	Group D[2]	Group Z
	120 W	155 W	180 W, 200 W	225 W, 240 W	280 W
4 x 2.5''					√[4]
4 x 3.5''	√	√	√	√[3]	
8 x 2.5''	√	√	√	√[3]	
10 x 2.5''	√	√	√[1]	√[3]	

1. For the server model, the 200W processors are supported only when:
   - No 2.5-inch rear drives are installed
2. Maximum GPU quantity supported:
   - When group C, group B, or group A processors are installed, the server supports up to 3 GPUs;
   - When group D processors are installed, the server supports up to 2 GPUs.
3. The type of processors are supported only when:
   - No 2.5-inch rear drives installed
   - No more than two GPUs installed (supported slots: 1, 3)
4. The type of processors are supported only when:
   - Performance fans are installed.
   - No 2.5-inch or 7mm rear drives are installed

Drive bay configurations and requirements

Understanding the drive bay configurations supported by the server helps you better and the requirements for hardware configurations.

Depending on models, the server supports:

- Up to ten 2.5-inch or four 3.5-inch SAS/SATA/NVMe front drives
- Up to two 2.5-inch SAS/SATA or two 7mm SAS/SATA rear drives
- Up to two M.2 SATA/NVMe drives

For a list of supported drives, see:
https://static.lenovo.com/us/en/serverproven/index.shtml

Drive bay combinations

The following table shows the supported drive bay combinations for the chassis with 3.5-inch/2.5-inch front drive bays.

Table 21. 2.5-inch drive bay combinations

No.	Total drives	Front bays			Rear bays	7mm drives	M.2 drives
		SAS/SATA	AnyBay	NVMe	SAS/SATA	SATA/NVMe	SATA/NVMe
1	4	4					Optional
2a	8	8				Optional	Optional

Table 21. 2.5-inch drive bay combinations (continued)

No.	Total drives	Front bays			Rear bays	7mm drives	M.2 drives
		SAS/SATA	AnyBay	NVMe	SAS/SATA	SATA/NVMe	SATA/NVMe
2b	10	8			2		Optional
3a	10		10			Optional	Optional
3b	12		10		2		Optional
3c	10			10		Optional	Optional
3d	12			10	2		Optional
3e	10		8	2			
3f	10	6	4			Optional	Optional
3g	12	6	4		2		Optional
3h	12	6		4	2		Optional
3i	10	6	2	2			Optional

Table 22. 3.5-inch drive bay combinations

No.	Total drives	Front bays		Rear bays		7mm drives	M.2 drives
		SAS/SATA	AnyBay	SAS/SATA	NVMe	SATA/NVMe	SATA/NVMe
1a	4	4				Optional	Optional
1b	6	4		2			Optional
1c	6	4			2		Optional
2a	4		4			Optional	Optional
2c	6			2			Optional
2d	6				2		Optional

Note: For models without any backplanes or drives, field upgrades to other models are available. For details, check the option part numbers you will need when ordering for different configurations:Field upgrades

Drive installation requirements

The following notes describe information that you must consider when you install a drive.

- The drive bays are numbered to indicate the installation order (starting from number “0”). Follow the installation order when you install a drive. See “Front view” on page 15.
- The drives in a single RAID array must be the same type, same size, and same capacity.
- You can mix drives of different types and different capacities in one system, but not in one RAID array. The following priorities are recommended:
  - Drive type priority: NVMe SSD, SAS SSD, SATA SSD, SAS HDD, SATA HDD
  - Drive capacity priority: the lowest capacity first
  - RAID arrays are not support for NVMe SSD drives.
  - RAID arrays are not support for AIC(all-in-card) SSD drives.
  - RAID arrays are not support for SED or FIPS HDD/SSD drives.

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(Self-Encrypting Drives) are FIPS 140-2 Level 2 validated drives.

- When one or more SED drives are installed, the following internal SAS HBA adapters are not supported:
  - 430-8i
  - 430-16i
  - 440-16i

Technical rules for DIMMs

Memory modules must be installed in a specific sequence based on the memory configuration that you implement on your server. Understanding the technical rules for DIMMs helps you install the correct DIMMs in the correct sequence.

Your server has 8 channels, 32 memory slots, and supports:

- Minimum capacity:
  - 16 GB using RDIMMs
  - 128 GB using 3DS RDIMMs
- Maximum capacity:
  - 2 TB using RDIMMs
  - 4 TB using 3DS RDIMMs
- Type (depending on the model): TruDDR4 3200, dual-rank, 16 GB/32 GB/64 GB RDIMM
  For a list of supported memory options, see: https://static.lenovo.com/us/en/serverproven/index.shtml

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

The following figure and table help you locate the memory slots and channels on the system board.

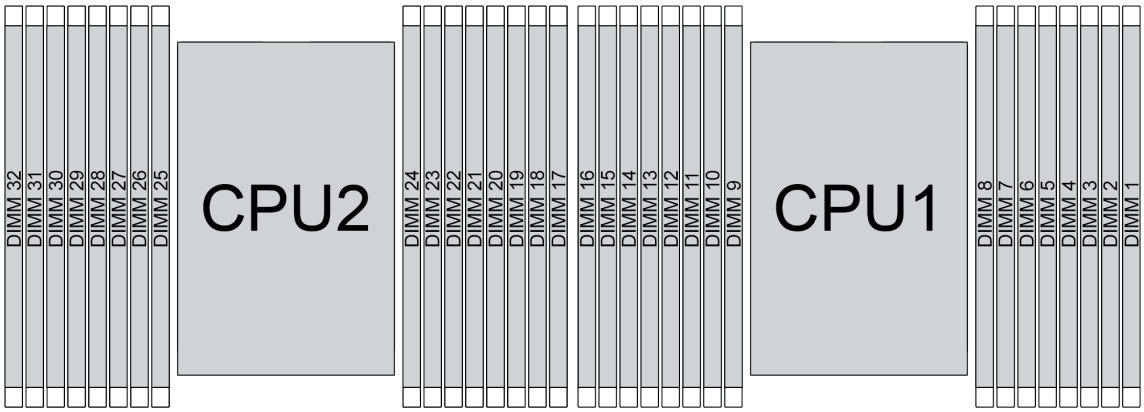


Figure 31. Memory module locations

Table 23. Memory slot and channel identification

Channel	D1	D0	C1	C0	B1	B0	A1	A0	E0	E1	F0	F1	G0	G1	H0	H1
Slot number	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

Rules you need to follow when installing or replacing a DIMM.

- **Slot**:
  - When a **data bus daisy chain topology** is used: populate DIMMs **from farthest slot (slot 1) to closest slot (slot 0) to the processor** on a per-channel basis.
  - When a **data bus balanced tee route topology** is used: populate DIMMs **in either slot** on a per-channel basis.

  Table 24. DIMM installation sequence

Number of processor	Slot sequence
With one processor	14, 16, 3, 1, 10, 12, 7, 5, 13, 15, 4, 2, 9, 11, 8, 6
With two processors	14, 30, 16, 32, 3, 19, 1, 17, 10, 26, 12, 28, 7, 23, 5, 21, 13, 29, 15, 31, 4, 20, 2, 18, 9, 25, 11, 27, 8, 24, 6, 22

- **Capacity**:

  DIMMs with different capacities (only two different capacities) **can be mixed**, install the one with **the highest capacity first**.
- **Rank**:

  DIMMs with different ranks **can be mixed**, install the one with **the highest rank first**.
- **Frequency**:

  DIMMs with different frequencies **can be mixed** in the same channel.
- **Voltage**:

  DIMMs with different operating voltage **cannot be mixed**. (The only supported DIMM voltage is 1.2V.)
- **ECC/Non-ECC**:

  ECC and non-ECC DIMM **cannot be mixed**. (Non-ECC DIMM is not supported for the server.)
- **DRAM**:

  x4 and x8 DRAM based DIMMs **can be mixed**, but **not in the same channel**.
- **Type**:

  DIMMs of different base module types **can be mixed**, but **not in the same channel**.
- **Vendor**:

  DIMMs from different vendors **can be mixed** in the same channel.

Technical rules for PCIe adapters

Understanding

Type of PCIe adapters supported for different models

Server models	Supported types and slot location
Server models with three PCIe slots	**Riser 1 assembly** • Slot 1: PCIe x16 (x8, x4, x1), low-profile • Slot 2: PCIe x16 (x8, x4, x1), low-profile **Riser 2 assembly** • Slot 3: PCIe x16 (x8, x4, x1), low-profile
Server models with two PCIe slots	**Riser 1 assembly** • Slot 1: PCIe x16 (x8, x4, x1), low-profile • Slot 2: PCIe x16 (x8, x4, x1), full-height **Note:** One rearwall bracket must be installed next to the two PCIe slots.
Server models with two hot-swap 7mm drive bays and two PCIe slots	**Riser 1 assembly** • Slot 1: PCIe x16 (x8, x4, x1), low-profile • Slot 2: PCIe x16 (x8, x4, x1), low-profile
Server models with two hot-swap 2.5-inch drive bays and one PCIe slot	**Riser 1 assembly** • Slot 1: PCIe x16 (x8, x4, x1), low-profile

Rules you need to follow when installing or replacing a PCIe adapter.

- Slot priority for most PCIe adapters:
  - One processor installed: Slot 1, slot 2
  - Two processors installed: Slot 1, slot 3, slot 2
- Slot priority exceptions:
  - CFF RAID/HBA adapters are always installed on slot 5.
  - P2200 GPU is always installed on slot 2.
  - The following two Mellanox ConnectX-6 adapters are always installed on slot 1:
    - Mellanox ConnectX-6 HDR IB/200GbE Single Port x16 PCIe Adapter
    - Mellanox HDR Auxiliary x16 PCIe 3.0 Connection Card
- Gen 3 riser cards **only** support Gen 3 adapters.
- Gen 4 riser cards support **both** Gen 3 and Gen 4 adapters.
- Gen 3 and Gen 4 SFF RAID adapters are available on the following server models when **one** processor is installed.
  - Server models with 8 x 2.5-inch front drive bays (SAS/SATA)
  - Server models with 4 x 2.5-inch front drive bays (SAS/SATA)
  - Server models with 4 x 3.5-inch front drive bays (SAS/SATA)
- Gen 3 and Gen 4 internal SFF RAID adapters are available on the following server models when **two** processors are installed.
  - Server models with 10 x 2.5-inch front drive bays (6 SAS/SATA +4 AnyBay, 10 AnyBay, or 10 NVMe)
  - Server models with 4 x 3.5-inch front drive bays (AnyBay)
  - Server models with 2 x 2.5-inch rear drive bays (SAS/SATA)
- Gen 4 internal CFF RAID/HBA adapters are available on the following server models and when **two** processors are installed.
  - Server models with 8 x 2.5-inch front drive bays (SAS/SATA)
  - Server models with 10 x 2.5-inch front drive bays (6 SAS/SATA +4 AnyBay, 10 AnyBay, or 10 NVMe)
  - Server models with 4 x 3.5-inch front drive bays (AnyBay)
  - Server models with 2 x 2.5-inch rear drive bays (SAS/SATA)
- One super capacitor module is required for each 930/940 series internal RAID adapter. Locations and quantities of RAID super capacitors vary by models:

Table 25. Super capacitor installation rules

Server model	**Max. qty.**	**Installation priority**	**With standard heat sinks**	**With performance heat sinks**	**Cable**
Server models with 2.5'' chassis	3	Super cap 1---> 2---->3	– Super cap 1 on front chassis – Super cap 2 and 3 on front chassis	Super cap 1 on front chassis	– Long cable: not for CFF RAID/HBA – Short cable: for CFF RAID/HBA
Server models with 3.5'' chassis	2		Super cap 1 and 2 on front chassis	Super cap 1 in an low-profile riser cage	Long cable

Technical rules for GPU adapters

Understanding the technical rules helps you choose the correct GPUs and install them in the supported slots based on what is configured for your server.

The following are installation rules for installing GPUs for your server:

- Performance fan must be selected.
- PCIe SSD adapter is not supported.
- PCIe slot priority when one processor is installed:
  - Tesla T4, P620: Slot 1, slot 2
  - P2200: Slot 2
- PCIe slot priority when two processors are installed:
  - Tesla T4, P620: Slot 1, slot 3, slot 2
  - P2200: Slot 2
- Maximum quantity supported:

When processor TDP is...	Maximun. quantity supported
≤ 200W	3
≥225W	2 **Note:** Slot priority: slot 1, slot 3

Technical rules for system fans

Depending on models, the server supports:

- Standard fan (21000 RPM)
- Performance fan (24000 RPM)

The following lists the required fans when different processors are installed.

Server model	Processor TDP			
	120W	155W	180W-240W	280 W
4 x 2.5'', 4 x 3.5'', 8 x 2.5'' models	Standard	Standard	Performance	NA
10 x 2.5'' models	Standard	Performance	Performance	NA
backplane-less	NA	NA	NA	Performance

Notes:

- Standard fans are enough for low-wattage processors while you can still use performance fans for better cooling.
- 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.

Environmental restrictions

Use this topic to understand the environmental restrictions for different server models.

Server model	Ambient temperature restrictions
All models	**Mellanox CX6 adapter** • With all-optical communication (AOC) module: All models support Mellanox CX6 adapters under an ambient temperature of no more than 30°(86°F). • Without AOC module: All models support Mellanox CX6 adapters under an ambient temperature of no more than 35°(95°F). **GPU adapters**: All models support up to three P620/P2200 GPUs under an ambient temperature of no more than 35°(95°F). **OCP 3.0 adapter** All models support an OCP 3.0 adapters under an ambient temperature of no more than 35°(95°F). **2.5'' rear drives**: When 120W or 155W processors are installed, all models support 2.5'' rear drives under an ambient tempera (95°F) . **7mm rear drives**: All models support 7mm rear drives under an ambient temperature of no more than 35°(95°F).
8 x 2.5'' and 4 x 3.5'' models	**GPU adapters**: • When 120W, 155W, 180W, or 200W processors are installed, the models support up to three Tesla T4 GP temperature of no more than 35°(95°F). • When 225W or 240W processors are installed, the models support up to two Tesla T4 GPUs under an amb more than 35°(95°F). **2.5'' rear drives**: When 180W or 200W processors are installed, the models support 2.5'' rear drives up to an ambient tempera
10 x 2.5'' models	**GPU adapters**: • When 120W or 155W processors are installed, the models support up to three Tesla T4 GPUs under an ar more than 30°(86°F). • When 180W or 200W processors are installed, the models support up to three Tesla T4 GPUs under an ar more than 35°(95°F). • When 225W or 240W processors are installed, the models support up to two Tesla T4 GPUs under an amb more than 35°(95°F).
4 x 2.5'' models	**GPU adapters**: The only supported processors are 280W processors. The models support up to three Tesla T4 GPUs under of no more than 35°(95°F).

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 92 to ensure that you work safely.

A video for this task is available at:

- Youtube: https://www.youtube.com/playlist?list=PLYV5R7hVcs-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

Procedure

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

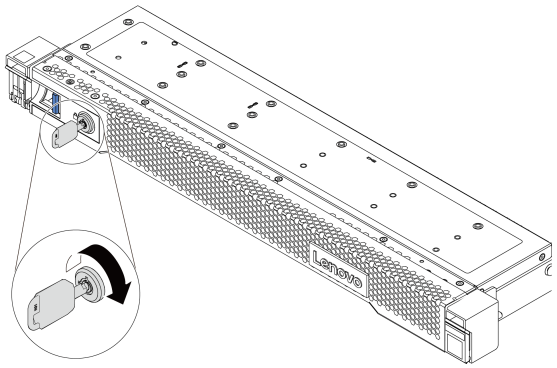


Figure 32. Unlocking the security bezel

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

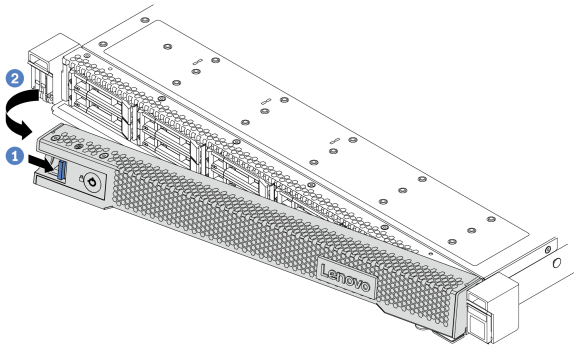


Figure 33. Security bezel removal

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

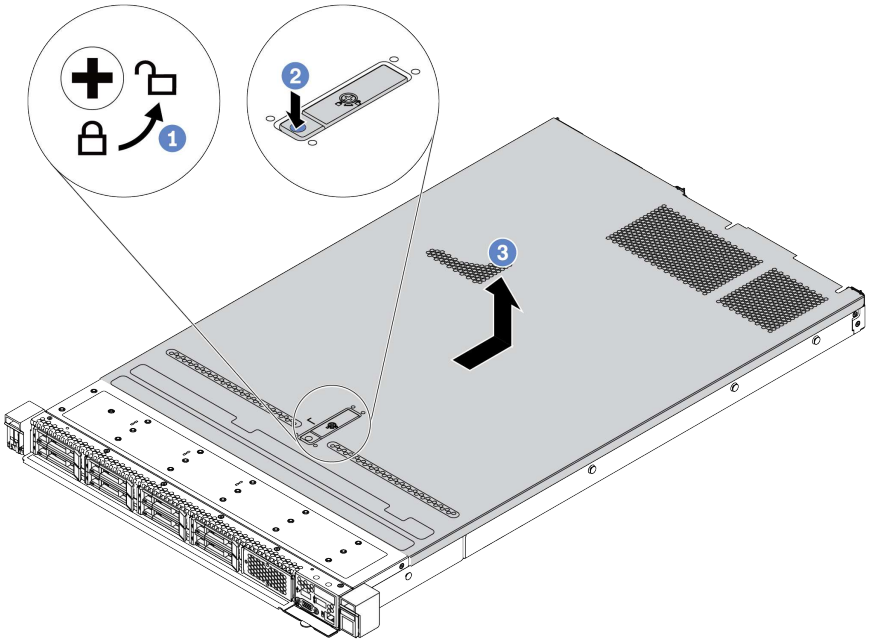


Figure 34. Top cover removal

a. Use a screwdriver to turn the cover lock to the unlocked position as shown.
b. Press the release button on the cover latch and then fully open the cover latch.
c. 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.

Attention:

- Read “Installation guidelines” on page 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

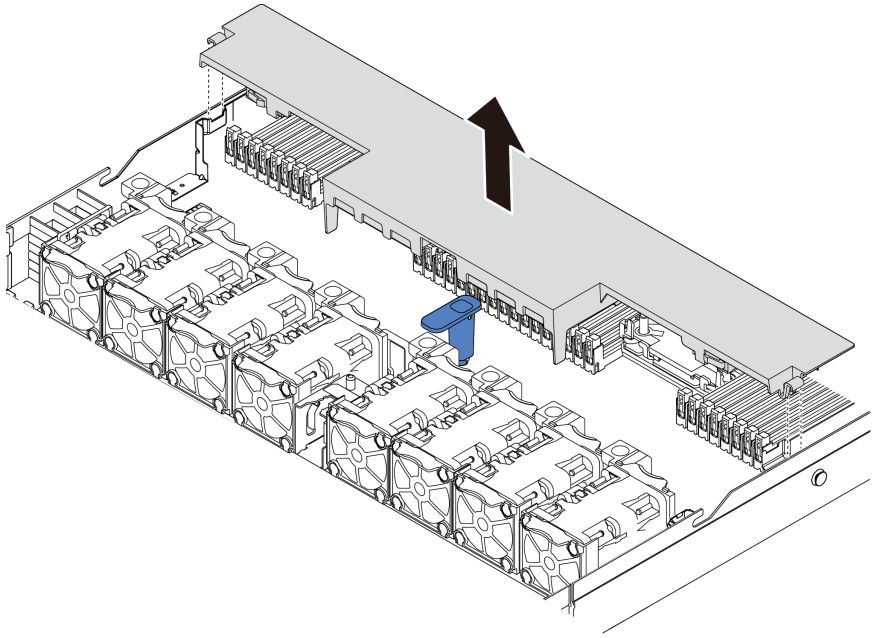


Figure 35. Air baffle removal

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.

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

Attention:

- Read “Installation guidelines” on page 92 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 “” on page .
- Before you install a new processor, update your system firmware to the latest level. See “Update the firmware” on page 160.
- Optional devices available for your system might have specific processor requirements. See “Technical rules” on page 96.
- 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

Procedure

Step 1. Install the processors.

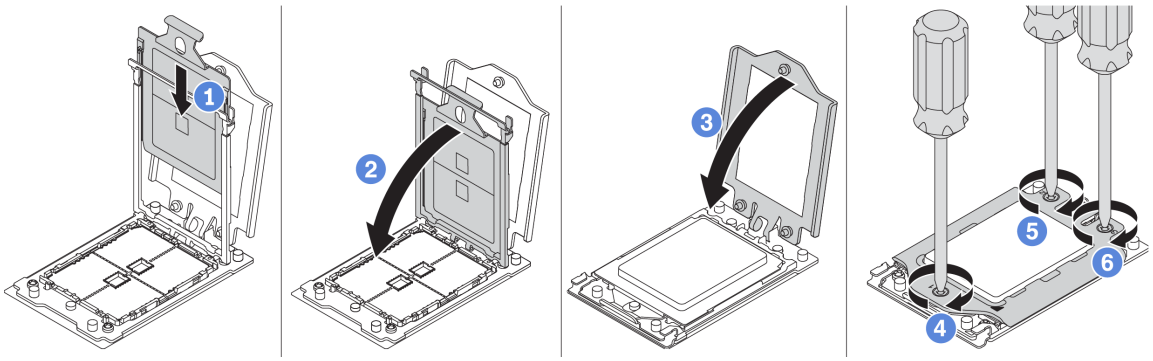


Figure 36. Processor installation

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 ± 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 ± 0.5 inch-pounds.

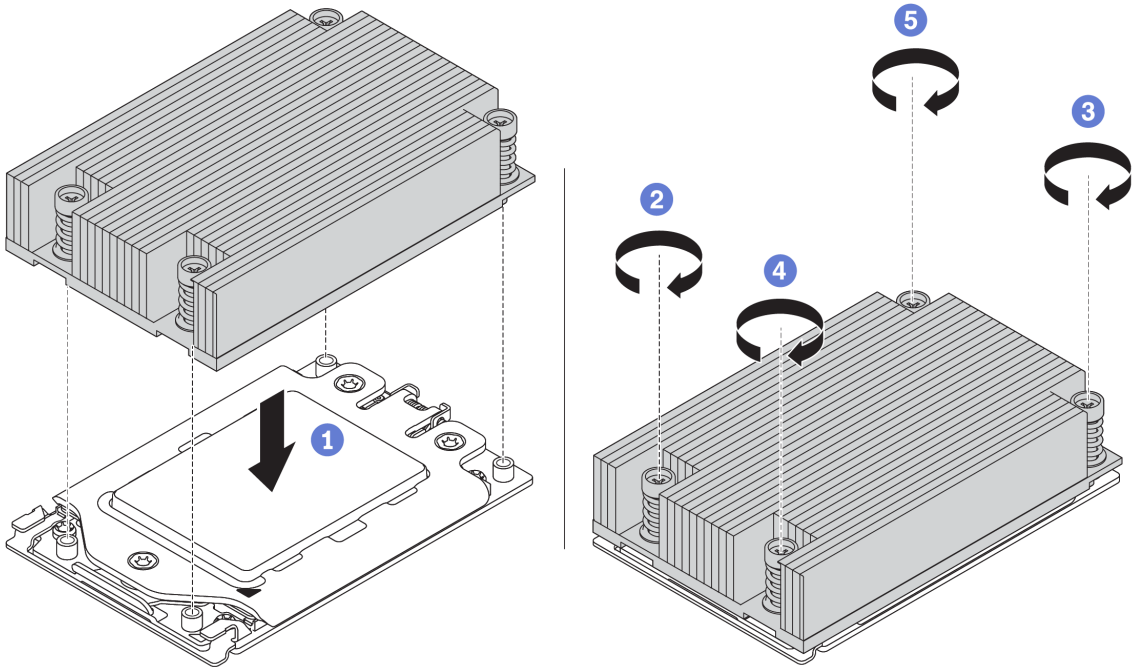


Figure 37. Standard heat sink installation

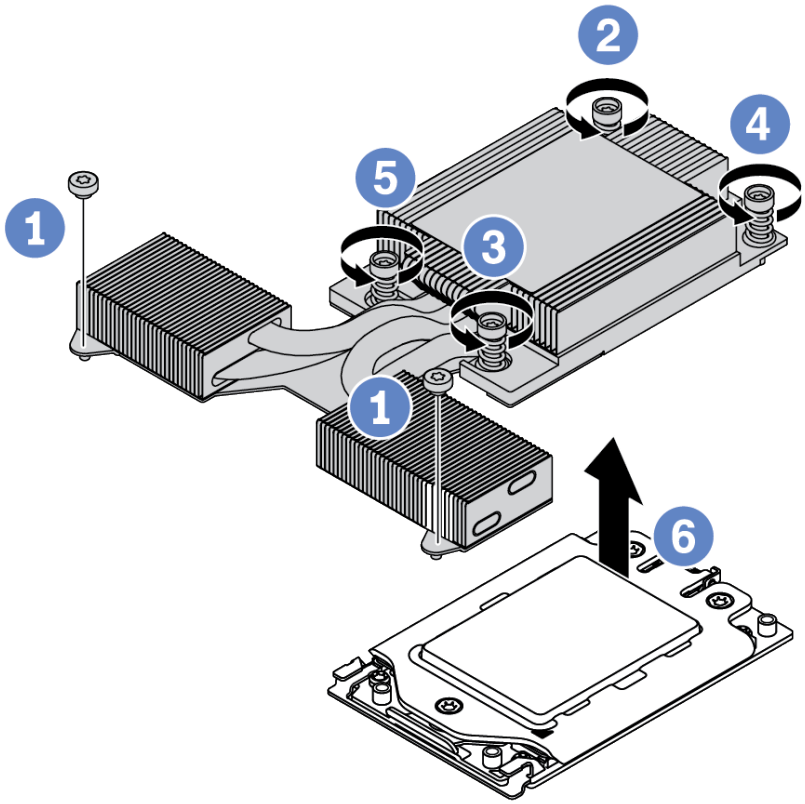


Figure 38. Performance heat sink installation

After you finish

1. If there are memory modules to install, install them. See “Install a memory module” on page 115.
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 92 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 95:
  - 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. Locate the required memory module slot on the system board.

> **Note:** Ensure that you observe the installation rules and sequence in “Memory module installation rules” on page 117.

Step 3. Install the memory module into the slot.

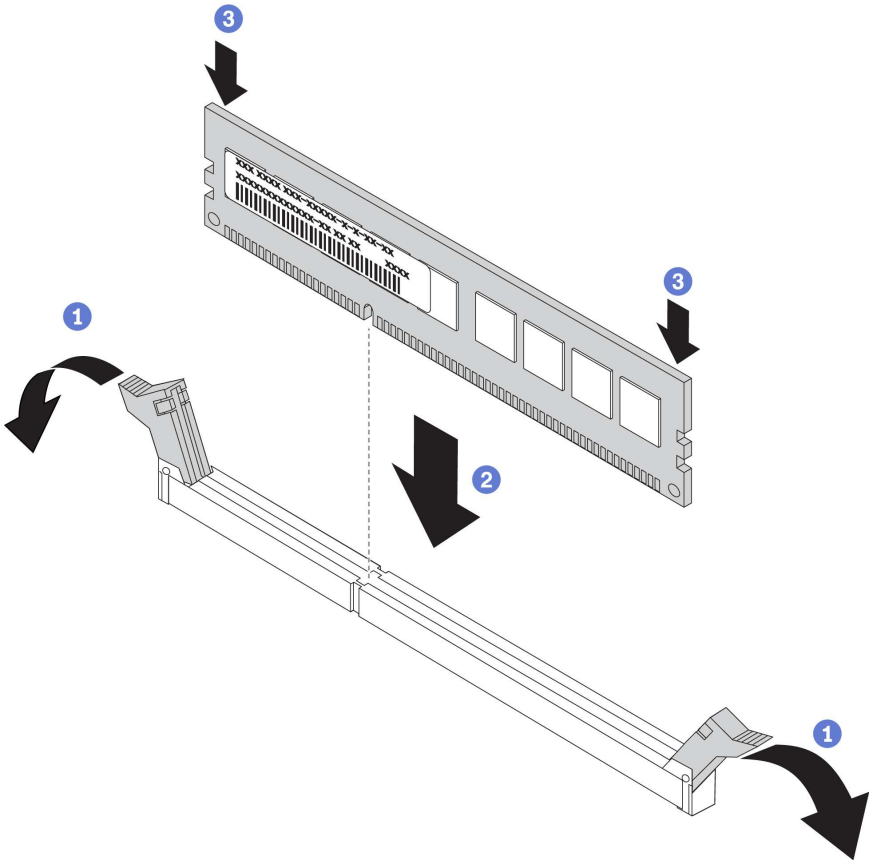


Figure 39. Memory module installation

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.

Memory module installation rules

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

Your server has 8 channels, 32 memory slots, and supports:

- Minimum capacity:
  - 16 GB using RDIMMs
  - 128 GB using 3DS RDIMMs
- Maximum capacity:
  - 2 TB using RDIMMs
  - 4 TB using 3DS RDIMMs
- Type (depending on the model): TruDDR4 3200, dual-rank, 16 GB/32 GB/64 GB RDIMM
  For a list of supported memory options, see: https://static.lenovo.com/us/en/serverproven/index.shtml

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

The following figure and table help you locate the memory slots and channels on the system board.

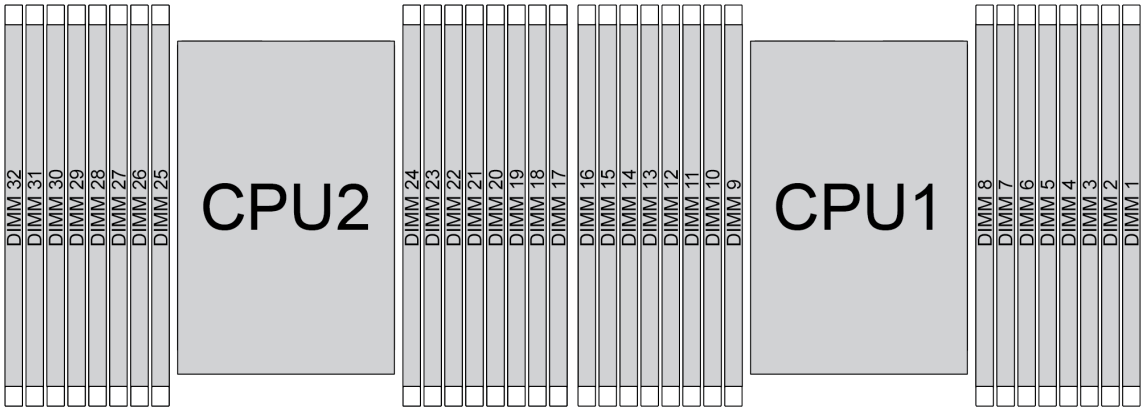


Figure 40. Memory module locations

Table 26. Memory slot and channel identification

Channel	D1	D0	C1	C0	B1	B0	A1	A0	E0	E1	F0	F1	G0	G1	H0	H1
Slot number	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

Rules you need to follow when installing or replacing a DIMM.

- **Slot**:
  - When a **data bus daisy chain topology** is used: populate DIMMs **from farthest slot (slot 1) to closest slot (slot 0) to the processor** on a per-channel basis.
  - When a **data bus balanced tee route topology** is used: populate DIMMs **in either slot** on a per-channel basis.

  Table 27. DIMM installation sequence

Number of processor	Slot sequence
With one processor	14, 16, 3, 1, 10, 12, 7, 5, 13, 15, 4, 2, 9, 11, 8, 6
With two processors	14, 30, 16, 32, 3, 19, 1, 17, 10, 26, 12, 28, 7, 23, 5, 21, 13, 29, 15, 31, 4, 20, 2, 18, 9, 25, 11, 27, 8, 24, 6, 22

- **Capacity**:

  DIMMs with different capacities (only two different capacities) **can be mixed**, install the one with **the highest capacity first**.
- **Rank**:

  DIMMs with different ranks **can be mixed**, install the one with **the highest rank first**.
- **Frequency**:

  DIMMs with different frequencies **can be mixed** in the same channel.
- **Voltage**:

  DIMMs with different operating voltage **cannot be mixed**. (The only supported DIMM voltage is 1.2V.)
- **ECC/Non-ECC**:

  ECC and non-ECC DIMM **cannot be mixed**. (Non-ECC DIMM is not supported for the server.)
- **DRAM**:

  x4 and x8 DRAM based DIMMs **can be mixed**, but **not in the same channel**.
- **Type**:

  DIMMs of different base module types **can be mixed**, but **not in the same channel**.
- **Vendor**:

  DIMMs from different vendors **can be mixed** in the same channel.

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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 (power)” on page 61 and “2.5-inch/3.5-inch drive backplane (signal)” on page 62.

Step 3. Align the two pins on the backplane with the corresponding holes in the chassis.

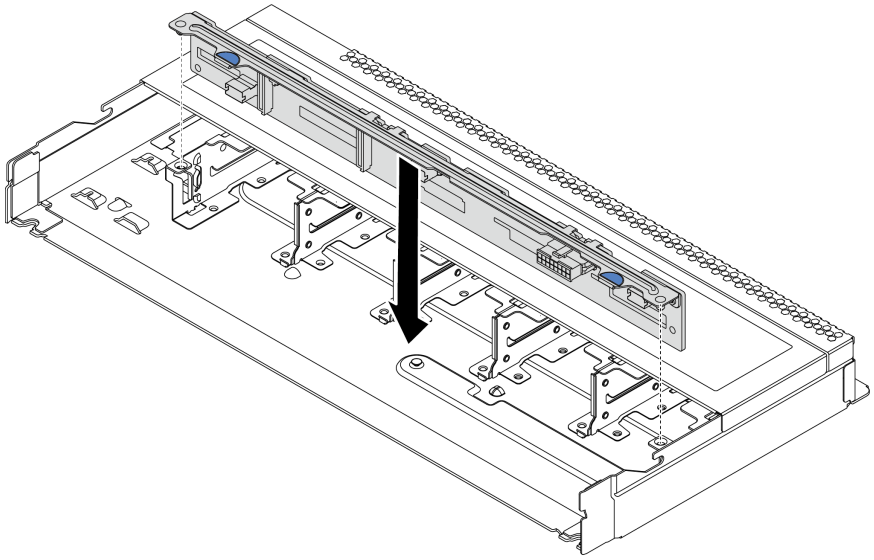


Figure 41. Installation of backplane for ten 2.5-inch hot-swap drives

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

Step 3. Put the backplane down into place.

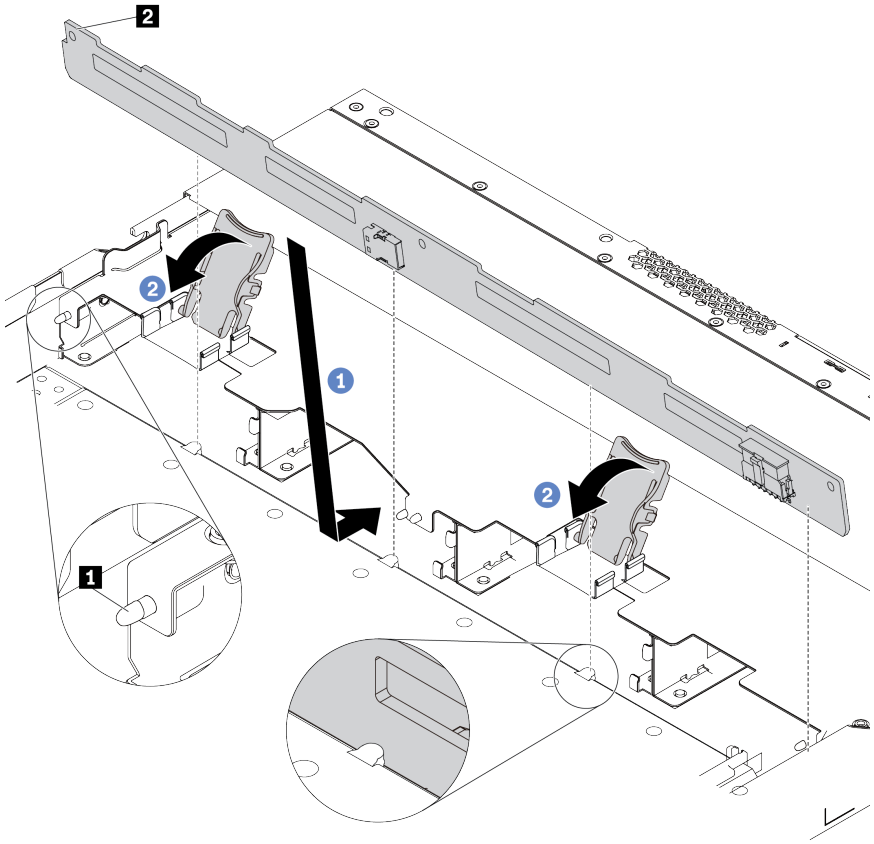


Figure 42. Installation of backplane for four 3.5-inch hot-swap drives

a. Lean the backplane backward, align its bottom with the two pins on the front chassis base, then align the two holes on the backplane with the two pins on the front drive cage so that the holes can pass through the two pins.

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 (power)” on page 61 and “2.5-inch/3.5-inch drive backplane (signal)” on page 62.

After you finish

Reinstall all the drives and drive fillers into the drive bays. See “Install a hot-swap drive” on page 129.

Install the 7mm drive backplanes

Use this information to install the 7mm drive backplanes.

About this task

Attention:

- Read “Installation guidelines” on page 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

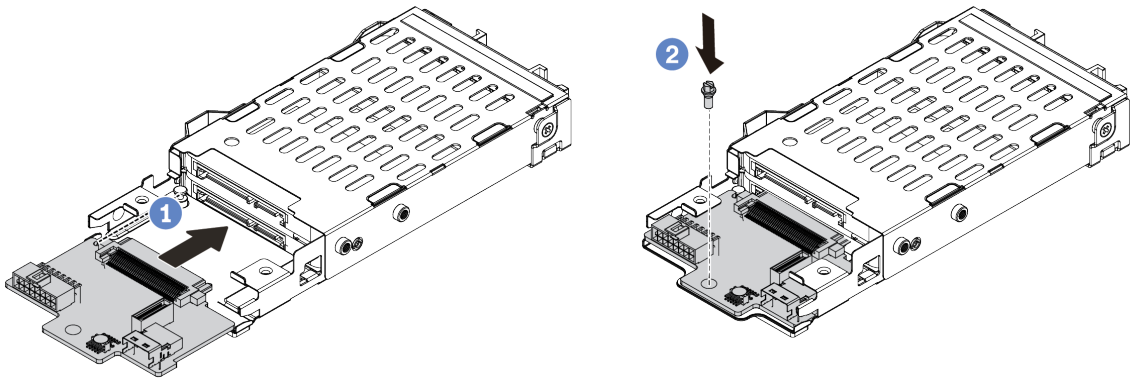


Figure 43. 7mm drive backplane installation (bottom)

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.

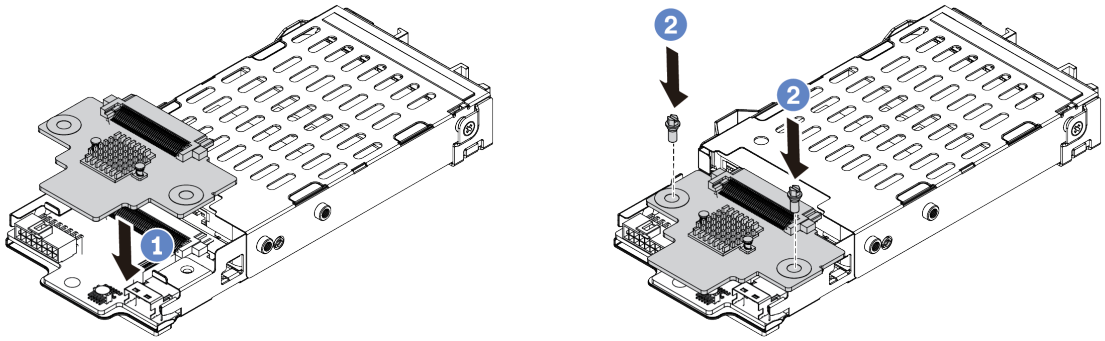


Figure 44. 7mm drive backplane installation (top)

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 59.

After you finish

1. Install the 7mm drive cage assembly on the rear chassis. See “Install the rear hot-swap drive assembly” on page 131
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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

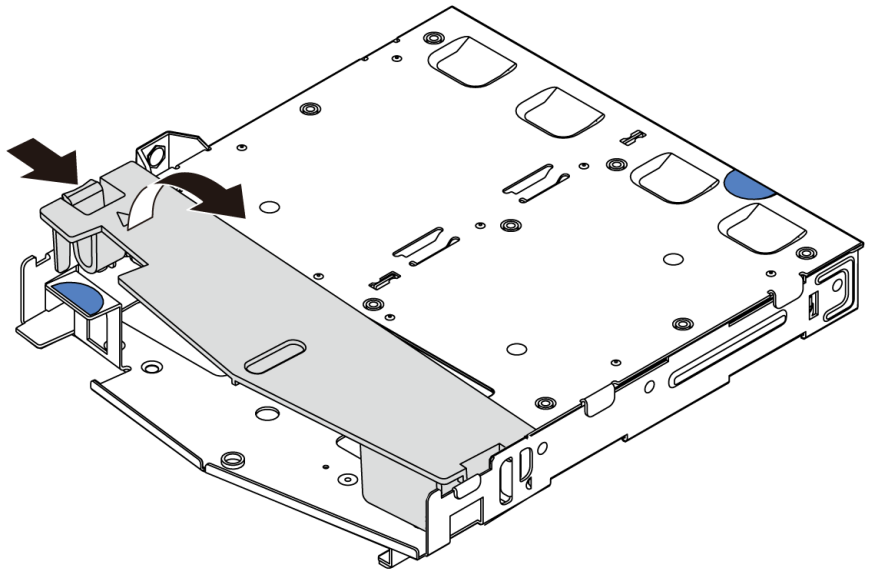


Figure 45. Air baffle removal

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

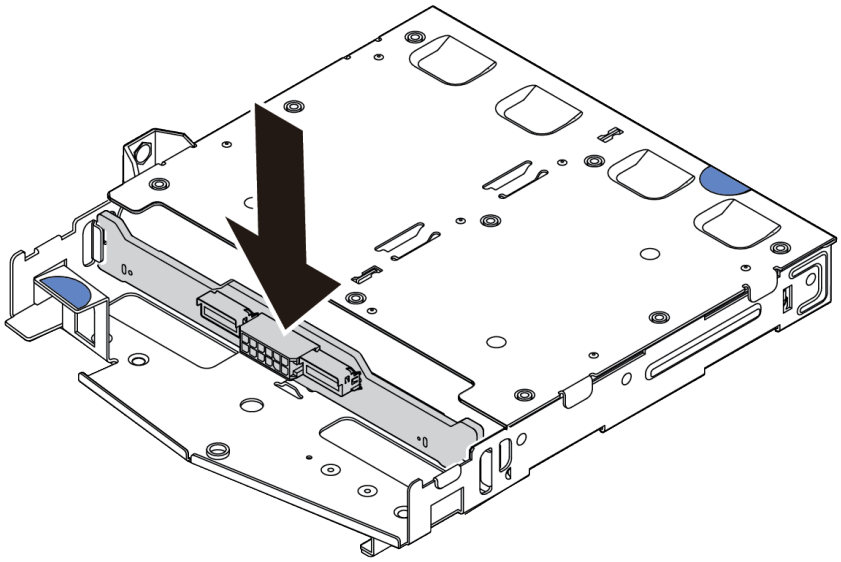


Figure 46. Rear backplane installation

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.

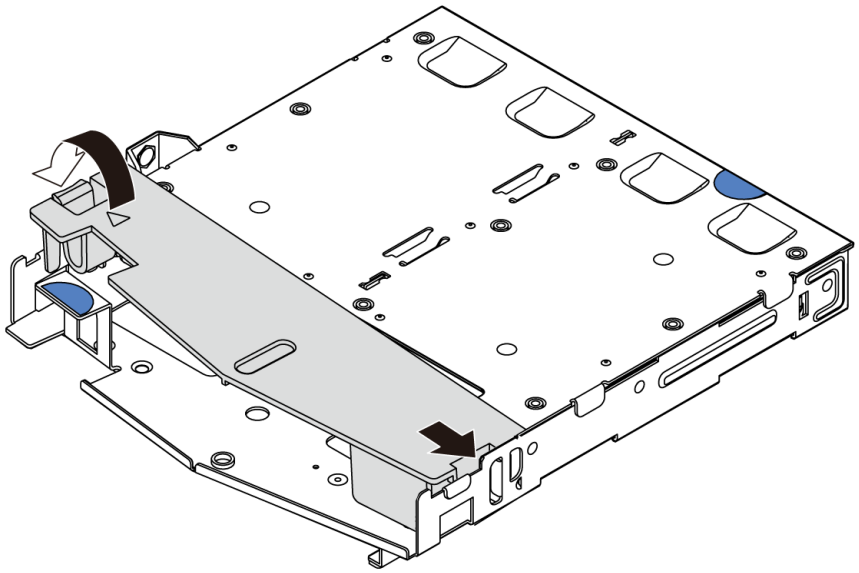


Figure 47. Air baffle installation

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 131.
2. Install the drives or drive fillers into the rear hot-swap drive assembly. See “Install a hot-swap drive” on page 129.

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

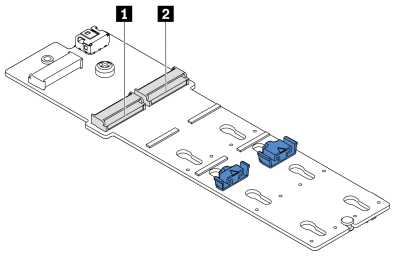
Notes:

- 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 128.

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.



1 Slot 0
2 Slot 1

Figure 48. M.2 drive slot

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

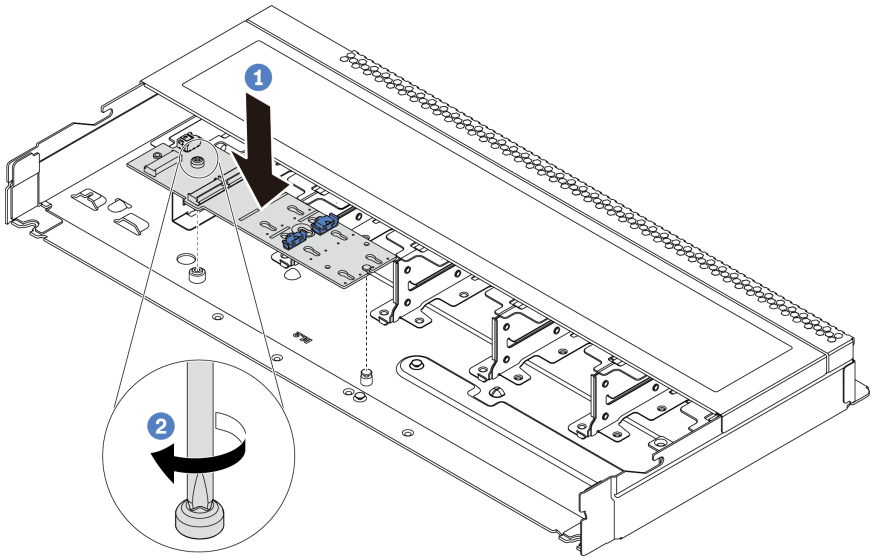


Figure 49. M.2 adapter installation

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.

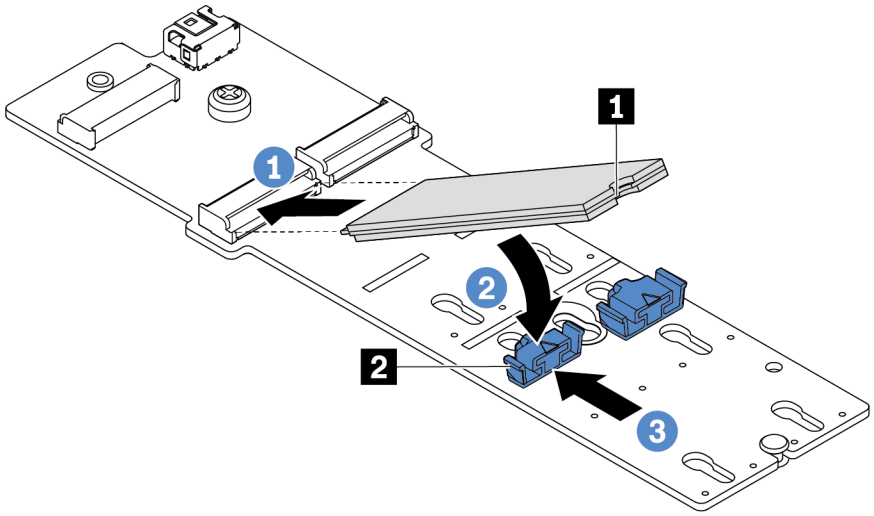


Figure 50. M.2 drive installation

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 V3 to configure the RAID. For more information, see: https://sysmgt.lenovofiles.com/help/topic/LXPMv3/LXPMv3_introduction.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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

Procedure

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

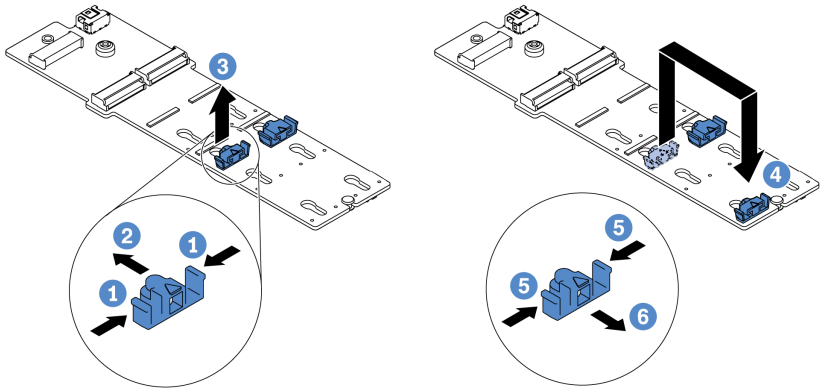


Figure 51. M.2 retainer adjustment

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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 “Drive bay configurations and requirements” on page 97.

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

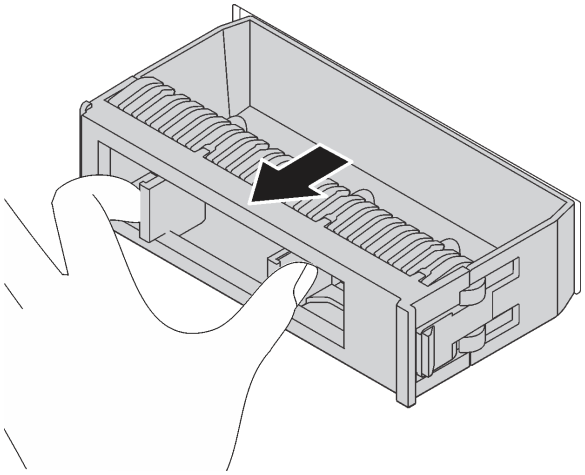


Figure 52. Drive filler removal

Step 3. Install the drive in the drive bay.

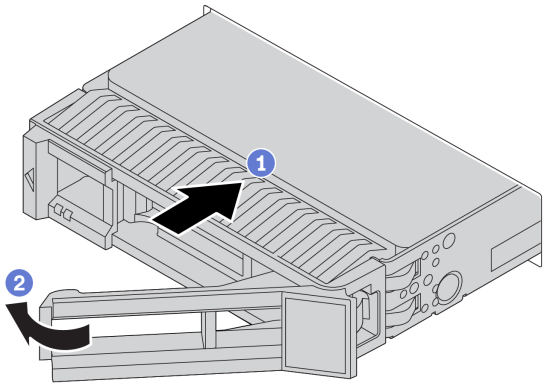


Figure 53. Hot-swap drive installation

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 25.

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

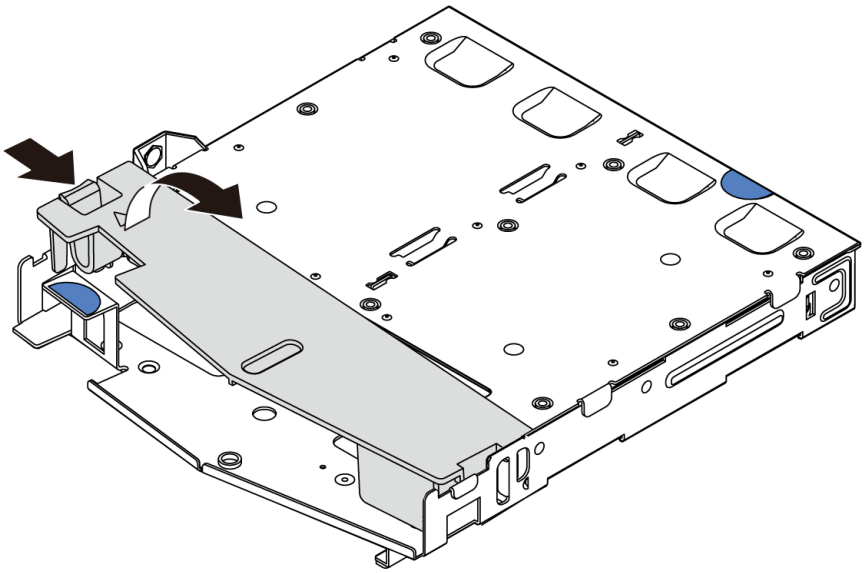


Figure 54. Air baffle removal

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

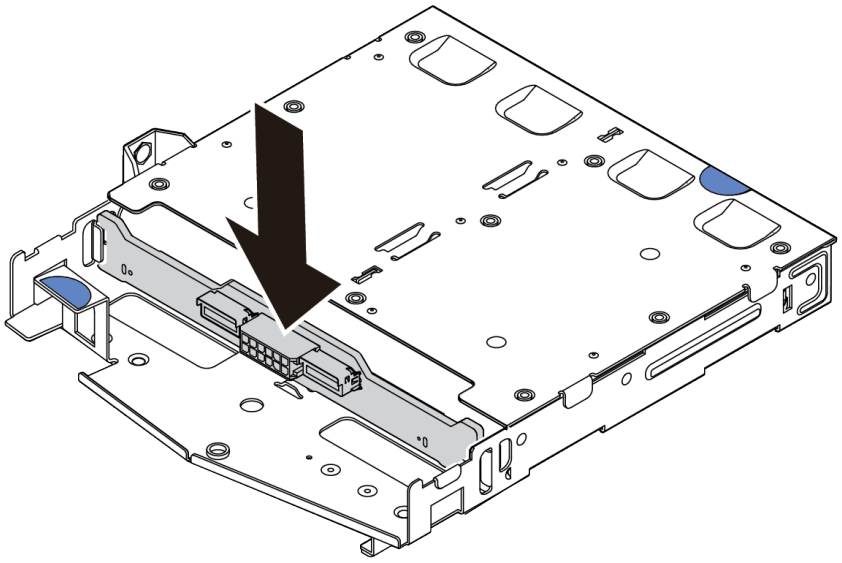


Figure 55. Rear backplane installation

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.

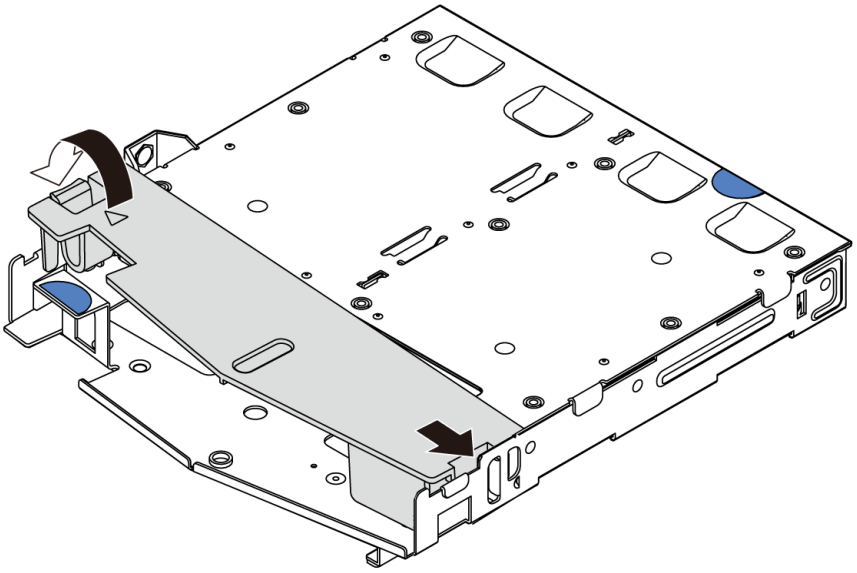


Figure 56. Air baffle installation

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.

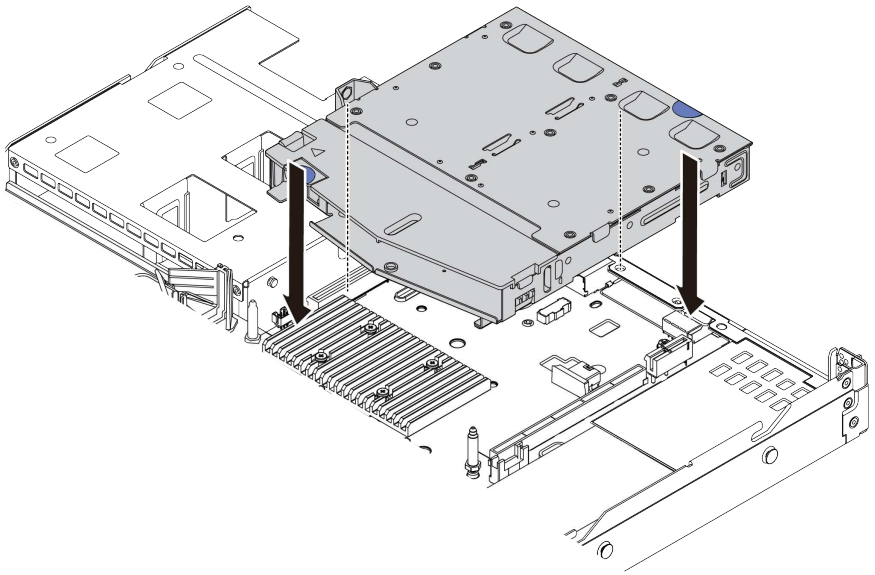


Figure 57. Rear hot-swap drive cage installation

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 129.

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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 36.

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.

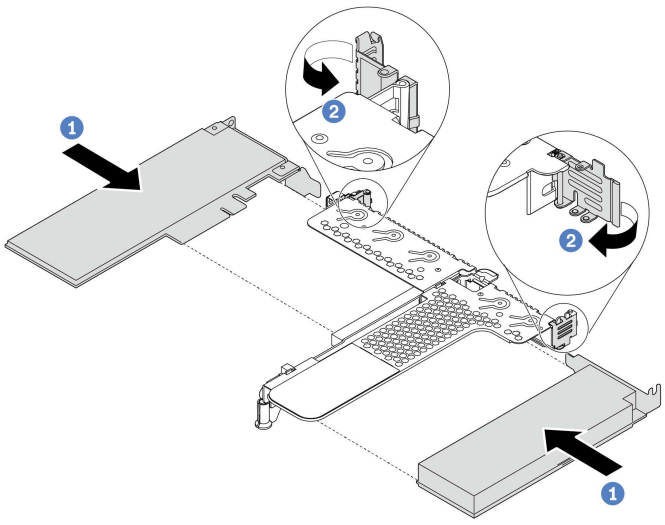


Figure 58. PCIe adapter installation into the LPFH riser assembly

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.

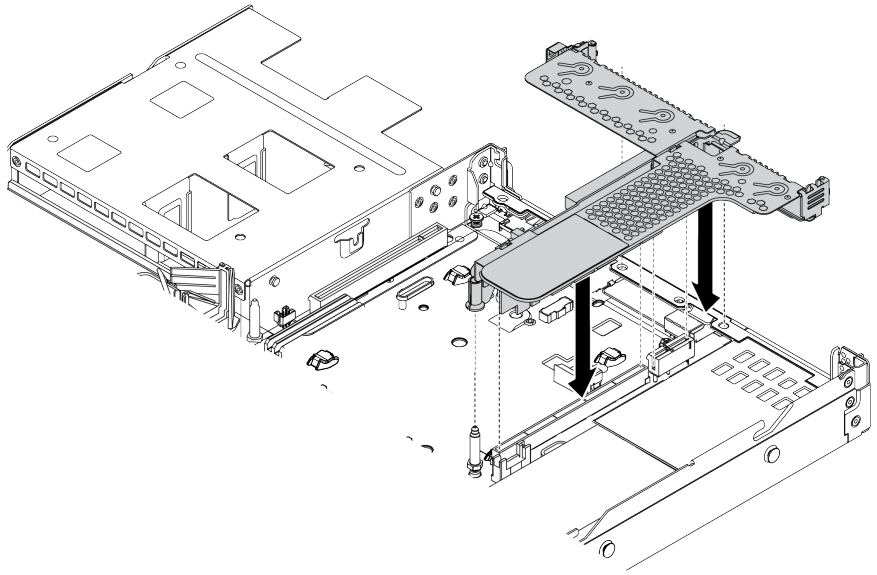


Figure 59. Riser assembly installation

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

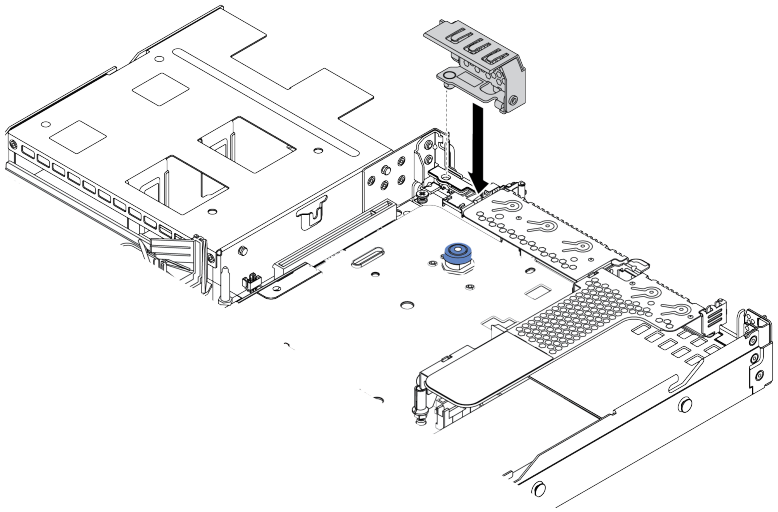


Figure 60. Rear wall bracket installation

Install the internal RAID adapter

Use this information to install the internal RAID adapter.

About this task

Attention:

- Read “Installation guidelines” on page 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

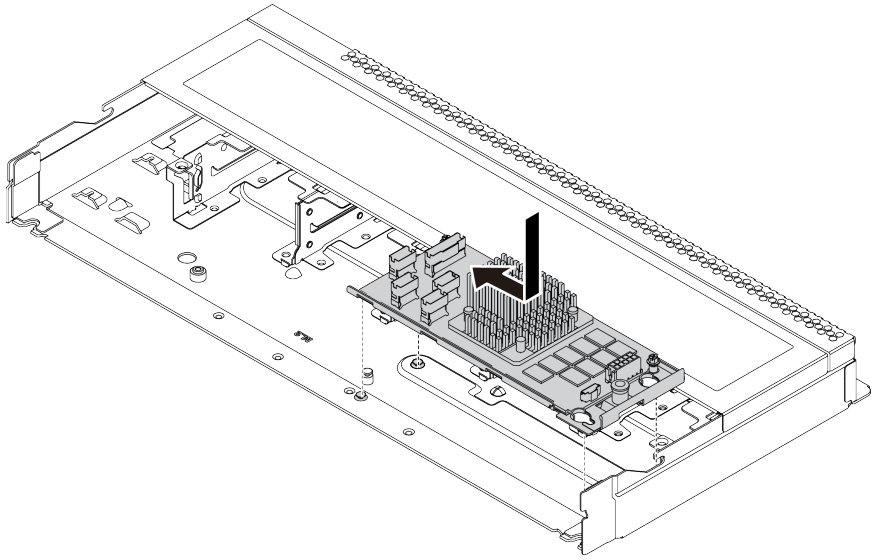


Figure 61. Internal RAID adapter installation

Step 4. Connect cables to the internal RAID adapter.

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 92 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.

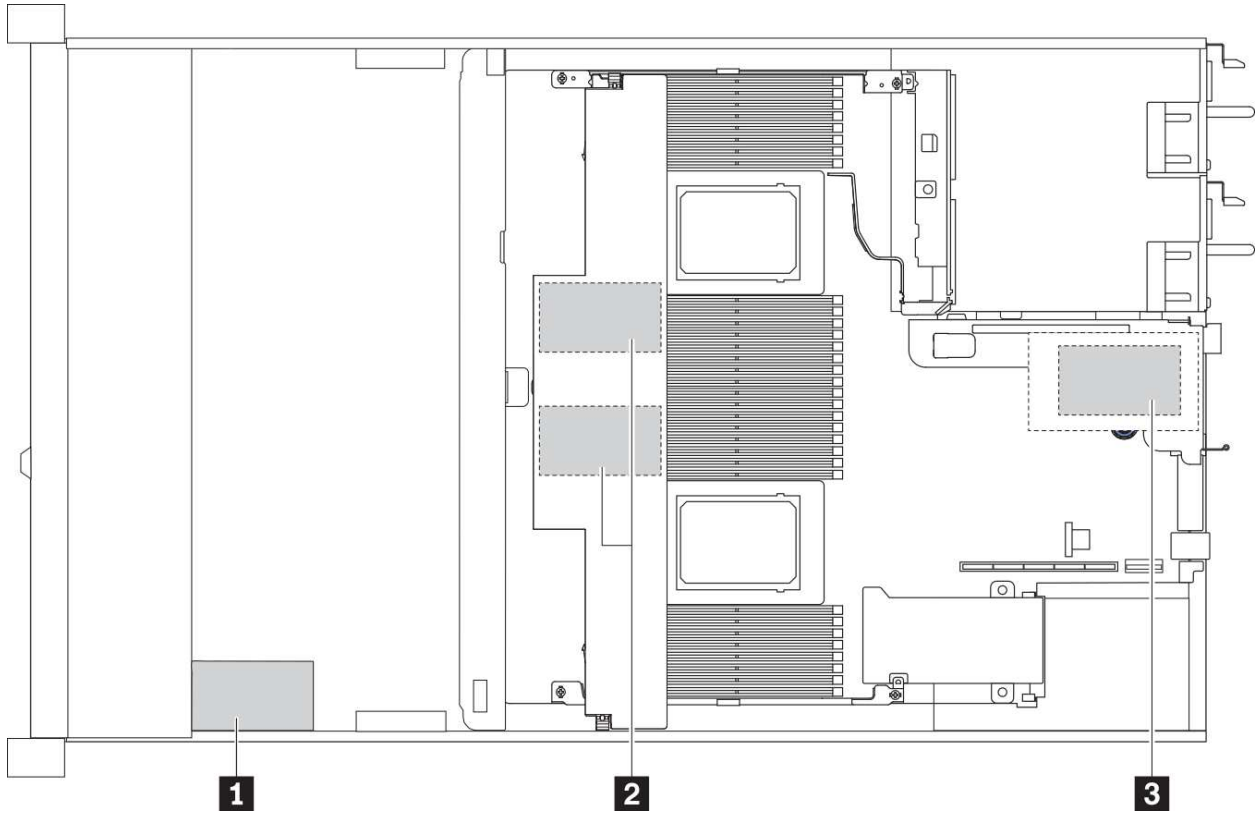


Figure 62. RAID super capacitor module location

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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. Install the RAID super capacitor module on the riser.

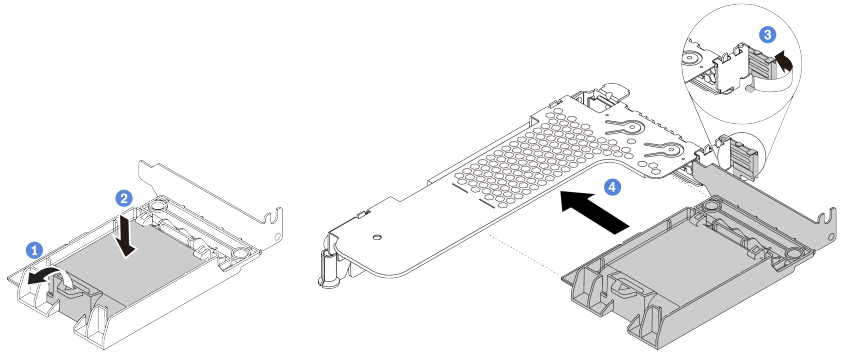


Figure 63. Installation of the RAID super capacitor module on the riser

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 134.

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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

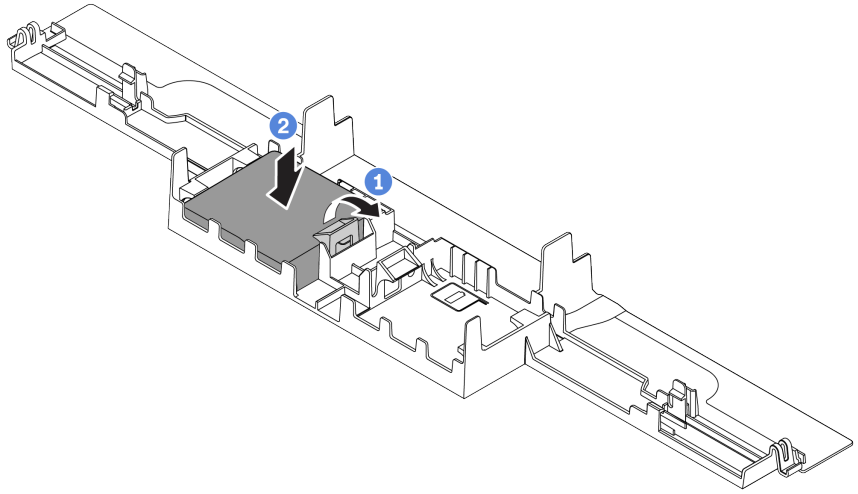


Figure 64. Installation of the RAID super capacitor module on the air baffle

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 147.

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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. If the server comes with a tray that covers the place of the RAID super capacitor module on the chassis, remove it first.

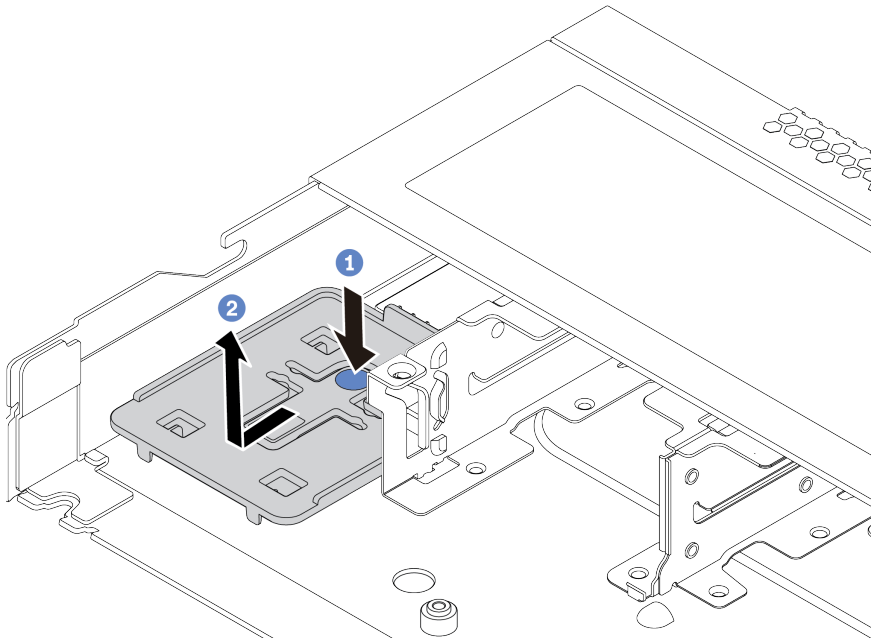


Figure 65. Tray removal

Step 3. If the server does not have a RAID super capacitor module holder on the chassis, install one first.

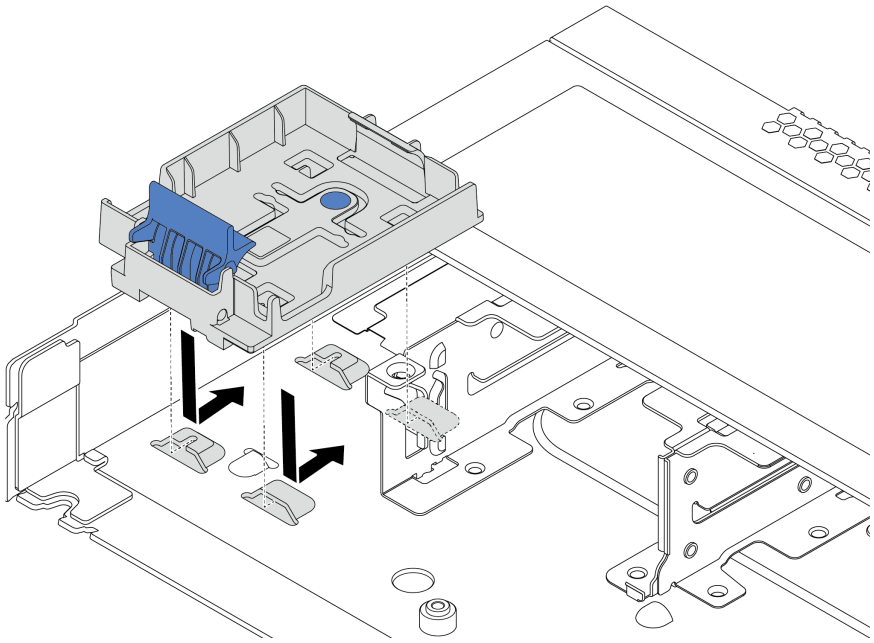


Figure 66. RAID super capacitor module holder installation

Step 4. Install the RAID super capacitor module on the chassis.

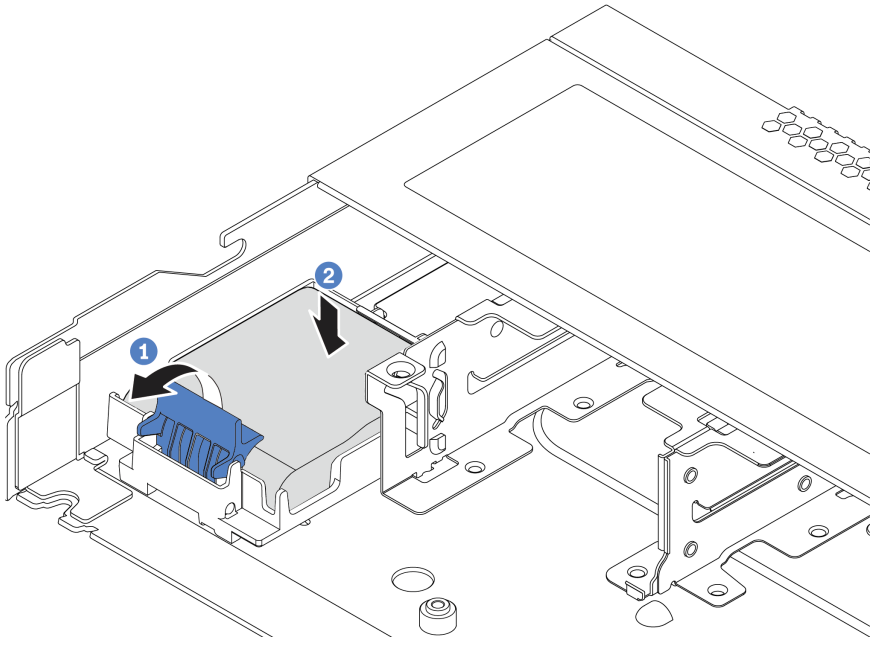


Figure 67. Installation of the RAID super capacitor module on the chassis

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

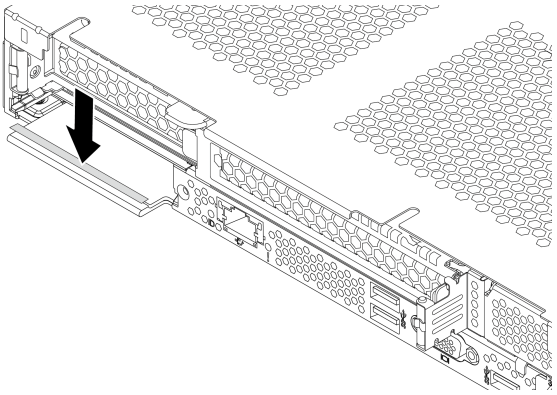


Figure 68. OCP 3.0 Ethernet adapter label installation

Step 4. Install the OCP 3.0 Ethernet adapter.

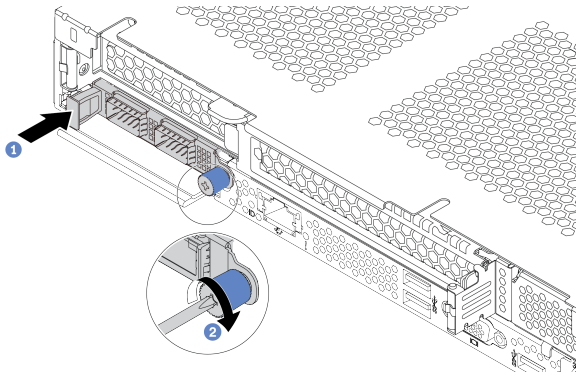


Figure 69. OCP 3.0 Ethernet adapter installation

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.

Attention:

- Read “Installation guidelines” on page 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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 for system fans” on page 103.

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.

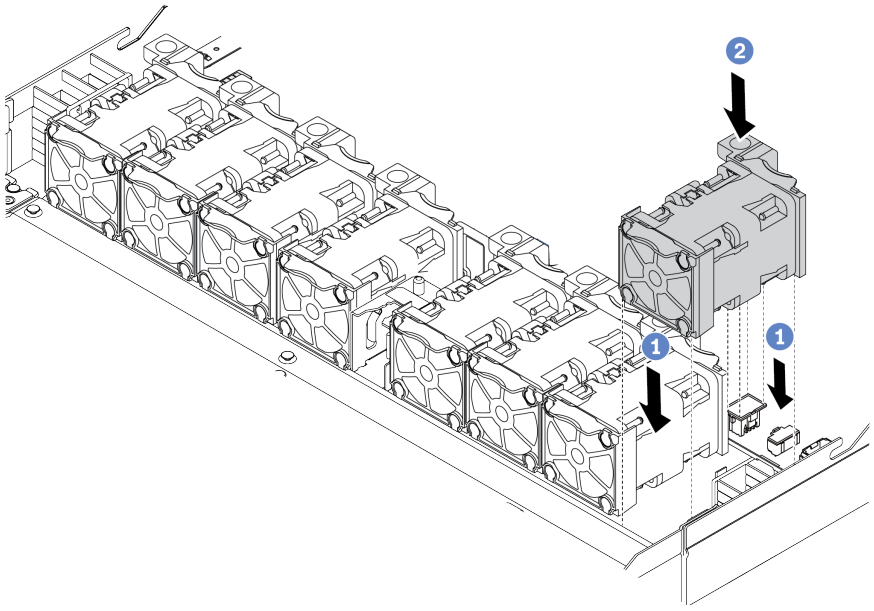


Figure 70. System fan installation

Install an intrusion switch

Use this information to install an intrusion switch.

About this task

Attention:

- Read “Installation guidelines” on page 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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.

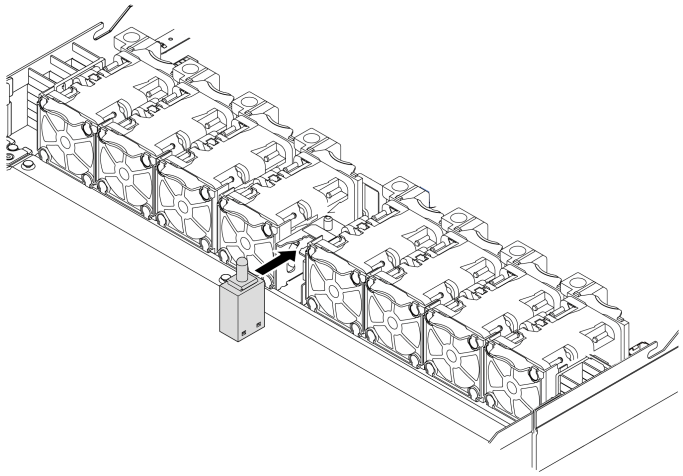


Figure 71. Intrusion switch installation

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 components” on page 45.

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.

Attention:

- Read “Installation guidelines” on page 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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 139.

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

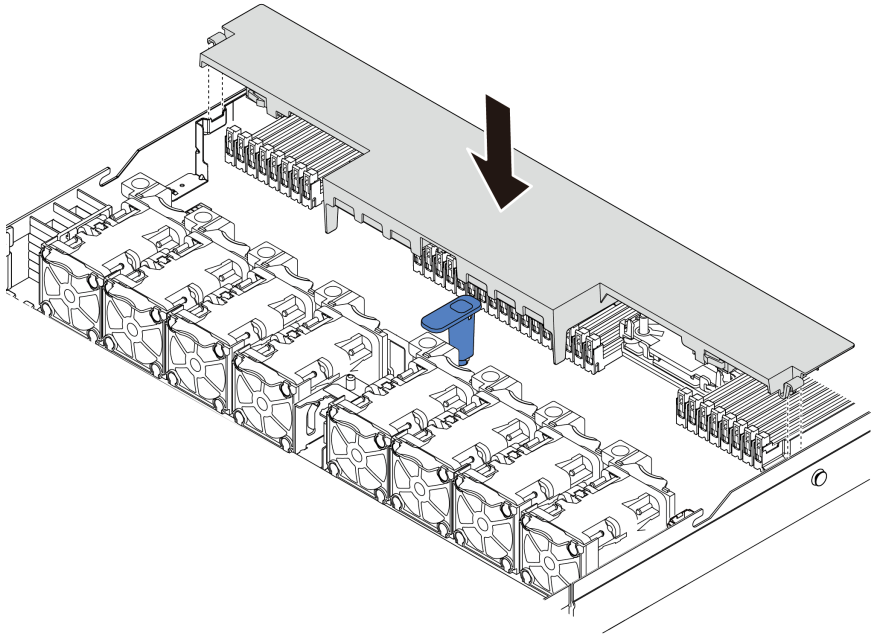


Figure 72. Air baffle installation

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 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

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 51.

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.

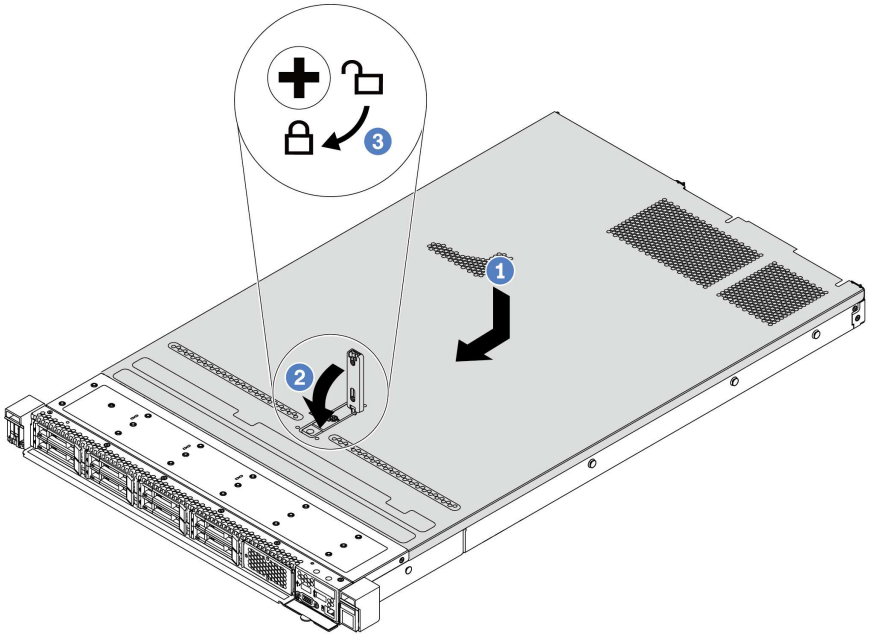


Figure 73. Top cover installation

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 following describes the information that you must consider when installing a power supply:

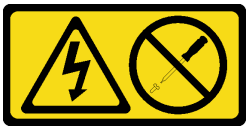
- The server is shipped with only one power supply by default. In this case, the power supply is non-hot-swap and before removing it, you must turn off the server first. To support redundancy mode or hot-swap, install an additional hot-swap power supply.
- If you are replacing the existing power supply with a new power supply:
  - Use Lenovo Capacity Planner to calculate the required power capacity for what is configured for your server. More information about Lenovo Capacity Planner is available at:

    https://datacentersupport.lenovo.com/solutions/lnvo-lcp
  - Ensure that the devices that you are installing are supported. For a list of supported optional devices for the server, go to:
    https://static.lenovo.com/us/en/serverproven/index.shtml
  - Attach the power information label that comes with this option onto the existing label near the power supply.

Figure 74. Example power supply unit label on the top cover

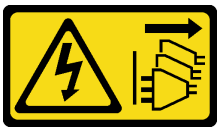
Safety information for AC power supplies

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.

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.

S001

DANGER

Electrical current from power, telephone, and communication cables is hazardous.
To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect any equipment that will be attached to this product to properly wired outlets .**
- **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.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	To Disconnect:
1. Turn everything OFF. 2. Attach all cables to devices. 3. Attach signal cables to connectors. 4. Attach power cords to outlet. 5. Turn device ON.	1. Turn everything OFF. 2. Remove power cords from outlet. 3. Remove signal cables from connectors. 4. Remove all cables from devices.

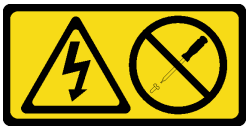
Safety information for DC power supplies

CAUTION:
240 V dc input (input range: 180-300 V dc) is supported in Chinese Mainland ONLY. Power supply with 240 V dc input cannot support hot plugging power cord function. Before removing the power supply with dc input, please turn off server or disconnect dc power sources at the breaker panel or by turning off the power source. Then, remove the power cord.

在直流输入状态下，若电源供应器插座不支持热插拔功能，请务必不要对设备电源线进行热插拔，此操作可能导致设备损坏及数据丢失。因错误执行热插拔导致的设备故障或损坏，不属于保修范围。

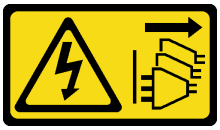
NEVER CONNECT AND DISCONNECT THE POWER SUPPLY CABLE AND EQUIPMENT WHILE YOUR EQUIPMENT IS POWERED ON WITH DC SUPPLY (hot-plugging). Otherwise you may damage the equipment and result in data loss, the damages and losses result from incorrect operation of the equipment will not be covered by the manufacturers' warranty.

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

DANGER

Electrical current from power, telephone, and communication cables is hazardous.
To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded power source.**
- **Connect to properly wired power sources any equipment that will be attached to this product.**
- **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.**
- **Disconnect the attached ac power cords, dc power sources, network connections, telecommunications systems, and serial cables before you open the device covers, unless you are instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:

1. Turn OFF all power sources and equipment that is to be attached to this product.
2. Attach signal cables to the product.
3. Attach power cords to the product.
   - For ac systems, use appliance inlets.
   - For dc systems, ensure correct polarity of -48 V dc connections: RTN is + and -48 V dc is -. Earth ground should use a two-hole lug for safety.
4. Attach signal cables to other devices.
5. Connect power cords to their sources.
6. Turn ON all the power sources.

To Disconnect:

1. Turn OFF all power sources and equipment that is to be attached to this product.
   - For ac systems, remove all power cords from the chassis power receptacles or interrupt power at the ac power distribution unit.
   - For dc systems, disconnect dc power sources at the breaker panel or by turning off the power source. Then, remove the dc cables.
2. Remove the signal cables from the connectors.
3. Remove all cables from the devices.

Attention:

- Read “Installation guidelines” on page 92 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-DY1RaWHYM4xDloAwuBQHR0
- Youku: http://list.youku.com/albumlist/show/id_52339628

Procedure

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

Step 2. If there is a power-supply filler installed, remove it.

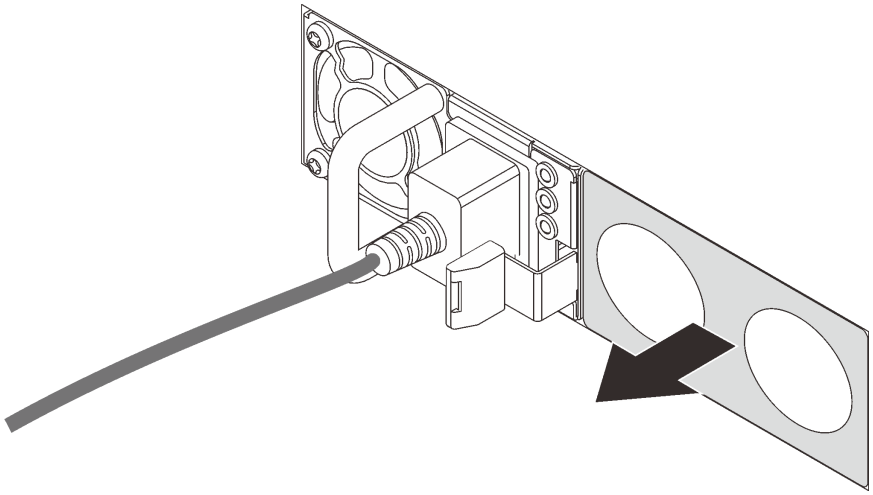


Figure 75. Hot-swap power supply filler removal

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

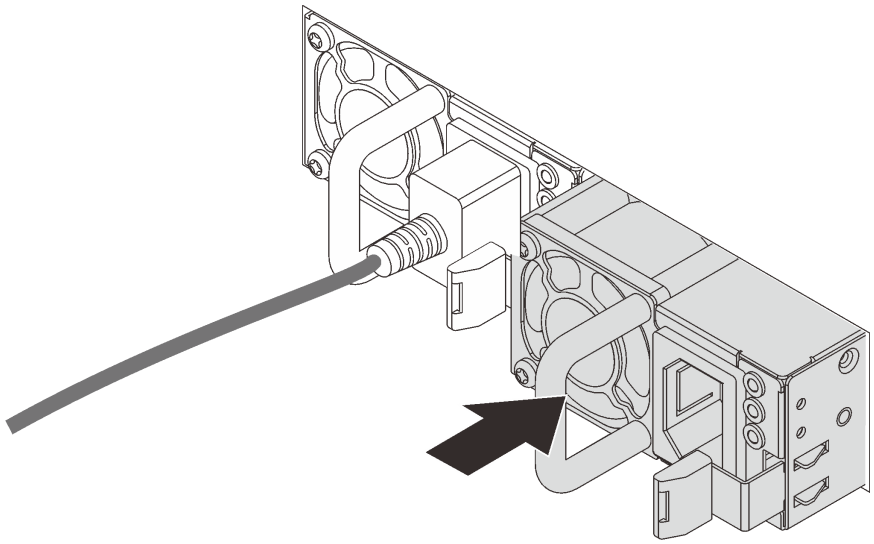


Figure 76. Hot-swap power supply installation

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.

Cable the server

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 restart automatically after a power interruption.
- The server can respond to remote power-on requests sent to the BMC.

For information about powering off the server, see “Power off the server” on page 158.

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.

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 157.

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 V3.

Step 1. Start the server.

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

Step 3. Specify how the Lenovo XClarity Controller will connect to the network.

- 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.

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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 processor.
- **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 processor. 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 running on the server.
- **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 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
Lenovo XClarity Provisioning Manager V3 Limited to core system firmware only.	√			√	√		√
Lenovo XClarity Essentials OneCLI Supports all core system firmware, I/O firmware, and installed operating system driver updates.	√	√	√	√		√	√
Lenovo XClarity Essentials UpdateXpress Supports all core system firmware, I/O firmware, and installed operating system driver updates.	√	√	√	√	√		√
Lenovo XClarity Essentials Bootable Media Creator 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.	√			√	√	√	√

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 V3**

  From Lenovo XClarity Provisioning Manager V3, you can update the Lenovo XClarity Controller firmware, the UEFI firmware, and the Lenovo XClarity Provisioning Manager V3 software.

  Note: By default, the Lenovo XClarity Provisioning Manager V3 Graphical User Interface (GUI) is displayed when you press F1. If you have changed that default to be the text-based system setup, you can bring up the GUI from the text-based system setup interface.

Additional information about using Lenovo XClarity Provisioning Manager V3 to update firmware is available at:

http://sysmgt.lenovofiles.com/help/topic/LXPMv3/LXPMv3_platform_update.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.

    Additional information about configuring Ethernet over USB is available at:

    http://sysmgt.lenovofiles.com/help/topic/com.lenovo.systems.management.xcc.doc/NN1ia_c_configuringUSB.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.

  – Specific details about updating firmware using Lenovo XClarity Controller are available at:

    http://sysmgt.lenovofiles.com/help/topic/com.lenovo.systems.management.xcc.doc/NN1ia_c_manageserverfirmware.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).

  Specific details about updating firmware using Lenovo XClarity Essentials OneCLI is available at:

  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 UXSP update packages and individual updates. UXSP contains firmware and device driver updates for Microsoft Windows and for Linux.

  You can obtain UXSP from the following location:

  https://datacentersupport.lenovo.com/solutions/lnvo-xpress

- **Lenovo XClarity Essentials Bootable Media Creator**

  You can use Lenovo XClarity Essentials Bootable Media Creator (BoMC) 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 BoMC from the following location:

  https://datacentersupport.lenovo.com/solutions/lnvo-bomc

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 actually model name, such as "ThinkSystem RAID 930-16i 4GB Flash." In some cases, the UEFI boot process might also hang.

- **Lenovo XClarity Provisioning Manager V3**

  From Lenovo XClarity Provisioning Manager V3, you can configure the UEFI settings for your server.

  Note: The Lenovo XClarity Provisioning Manager V3 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 V3, 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

- **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:

  http://sysmgt.lenovofiles.com/help/topic/com.lenovo.systems.management.xcc.doc/NN1ia_c_manageserverfirmware.html

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

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 “Memory module installation rules” on page 117.

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

Install the operating system

Several options are available to install an operating system on the server.

- **Lenovo XClarity Provisioning Manager V3**

  Lenovo XClarity Provisioning Manager V3 is used to install operating system of single server. You can complete operating system installation by following the instructions in Lenovo XClarity Provisioning Manager V3 OS Installation function.

- **Install the operating system manually**

  If you cannot install the operating system through Lenovo XClarity Provisioning Manager V3, you can install the operating system manually. For more information about installing a specific operating system, perform the following steps.

  1. Go to http://datacentersupport.lenovo.com and navigate to the support page for your server.
  2. Click **Documentation** from the navigation pane.
  3. Select an operating system under **Operating Systems** to view the installation instructions.

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:

  http://sysmgt.lenovofiles.com/help/topic/com.lenovo.systems.management.xcc.doc/NN1ia_c_backupthexcc.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/toolsctr_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.

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 169
- “The server immediately displays the POST Event Viewer when it is turned on” on page 169
- “Embedded hypervisor is not in the boot list” on page 170
- “Server cannot recognize a hard drive” on page 170
- “Displayed system memory is less than installed physical memory” on page 171
- “A Lenovo optional device that was just installed does not work.” on page 171
- “Voltage planar fault is displayed in the event log” on page 172

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

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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 XClarity Controller product documentation:

   http://sysmgt.lenovofiles.com/help/topic/com.lenovo.systems.management.xcc.doc/dw1lm_c_chapter2_openingandusing.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 V3 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 V3 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 V3 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 “Specifications” on page 5 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.

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.

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 to see if someone else has encountered a similar problem.

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

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messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

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.

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 V3**

  Use the Collect Service Data function of Lenovo XClarity Provisioning Manager V3 to collect system service data. You can collect existing system log data or run a new diagnostic to collect new data.

- **BMC**

  You can use the BMC Web user 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 .

    https://sysmgt.lenovofiles.com/help/topic/LXPMv3/LXPMv3_introduction.html

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/supportphonelist for your region support details.

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.

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Morrisville, NC 27560
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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.

Lenovo makes no representations or warranties with respect to non-Lenovo products. Support (if any) for the non-Lenovo products is provided by the third party, not Lenovo.

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

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 28. Limits for particulates and gases

Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2[1]. • Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. • The deliquescent relative humidity of the particulate contamination must be more than 60%[2]. • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985[3] • Silver: Corrosion rate of less than 300 Å in 30 days

[1] ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[2] 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.

[3] ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

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.

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^{+6})	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
機架	○	○	○	○	○	○
外部蓋板	○	○	○	○	○	○
機械組合件	–	○	○	○	○	○
空氣傳動設備	–	○	○	○	○	○
冷卻組合件	–	○	○	○	○	○
內存模組	–	○	○	○	○	○
處理器模組	–	○	○	○	○	○
電纜組合件	–	○	○	○	○	○
電源供應器	–	○	○	○	○	○
儲備設備	–	○	○	○	○	○
電路卡	–	○	○	○	○	○
光碟機	–	○	○	○	○	○

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.

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.

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.

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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