



ThinkSystem SR650 V3 System Configuration Guide



Machine Types: 7D75, 7D76, 7D77

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:

https://pubs.lenovo.com/safety_documentation/

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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Contents

Contents i

Safetyiii

Safety inspection checklist iv

Chapter 1. Introduction 1

Features. 1

Tech Tips 2

Security advisories 3

Specifications 3

 Technical specifications. 3

 Mechanical specifications 10

 Environmental specifications 11

Management options. 15

Chapter 2. Server components 19

Front view 19

Front I/O module 26

Rear view 29

Top view 37

System-board-assembly layout 39

 System-board-assembly connectors. 40

 System-board-assembly switches. 41

System LEDs and diagnostics display 43

 Drive LEDs 43

 Front operator panel LEDs. 44

 Integrated diagnostics panel 46

 External diagnostics handset. 51

 Rear system LEDs 57

 XCC system management port LEDs. 58

 Power supply LEDs 58

 System-board-assembly LEDs 59

 LEDs on the firmware and RoT security module 62

 LED on the liquid detection sensor module 63

Chapter 3. Parts list 65

2.5-inch drive bay chassis. 65

3.5-inch drive bay chassis. 69

Power cords 72

Chapter 4. Unboxing and setup 73

Server package contents 73

Identify the server and access the Lenovo XClarity

Controller 73

Server setup checklist 75

Chapter 5. System configuration 77

Set the network connection for the Lenovo XClarity Controller 77

Set USB port for Lenovo XClarity Controller connection. 78

Update the firmware 79

Configure the firmware 82

Memory module configuration 83

Enable Software Guard Extensions (SGX). 84

RAID configuration 84

Deploy the operating system. 85

Back up the server configuration 86

Enable Intel® On Demand 86

 Enable Intel® On Demand Troubleshooting 96

Appendix A. Getting help and technical assistance 97

Before you call 97

Collecting service data 98

Contacting Support 99

Appendix B. Documents and supports 101

Documents download 101

Support websites 101

Appendix C. Notices. 103

Trademarks 104

Important notes. 104

Electronic emission notices 104

Taiwan Region BSMI RoHS declaration 105

Taiwan Region import and export contact information 105

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information（安全信息）。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.



Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

ཐོན་ཐབས་འདི་བདེ་སྤྱད་མ་བྱས་གོང་། སྐྱར་གྱི་ཡིད་གཟབ་
བྱ་འདྲ་མིན་ཡིད་པའི་འོད་མེར་བལྟ་དགོས།

Bu ürünü kurmadan önce güvenlik bilgilerini okuyun.

مەزكۇر مەھسۇلاتنى ئورنىتىشتىن بۇرۇن بىخەتەرلىك ئۇچۇرلىرىنى ئوقۇپ چىقىڭ.

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canjbinj soengq cungj vahgangj ancien siusik.

Safety inspection checklist

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

Note: The product is not suitable for use at visual display workplaces according to §2 of the Workplace Regulations.

Note: The set-up of the server is made in the server room only.

CAUTION:

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

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

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

1. If your working condition necessitates the server being powered off or you intend to power off, make sure that the power cord is disconnected.

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.

Note: Under certain circumstances, powering off the server is not a prerequisite. Refer to the precautions before conducting any tasks.

2. Check the power cord.

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

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

a. Go to:

<http://dcsc.lenovo.com/#/>

b. Click **Preconfigured Model** or **Configure to order**.

c. Enter the machine type and model for your server to display the configurator page.

d. Click **Power → Power Cables** to see all line cords.

- Make sure that the insulation is not frayed or worn.

3. Check for any obvious non-Lenovo alterations. Use good judgment as to the safety of any non-Lenovo alterations.
4. Check inside the server for any obvious unsafe conditions, such as metal filings, contamination, water or other liquid, or signs of fire or smoke damage.
5. Check for worn, frayed, or pinched cables.
6. Make sure that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Chapter 1. Introduction

The ThinkSystem SR650 V3 server (7D75, 7D76, 7D77) is a 2-socket 2U rack server, based on the 4th Gen (Sapphire Rapids, SPR) or 5th Gen (Emerald Rapids, EMR) Intel Xeon Scalable processor family. With a very configuration-rich offering, it is a great choice for enterprises of all sizes that need industry-leading reliability, management, and security, as well as maximizing performance and flexibility for future growth.

Figure 1. ThinkSystem SR650 V3



Features

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

Your server implements the following features and technologies:

- **Features on Demand**

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

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

Intel® On Demand is a feature that allows user to customize processor capabilities according to workload and tasks at hand. For more information, see “Enable Intel® On Demand” in *User Guide*.

- **Lenovo XClarity Controller (XCC)**

The Lenovo XClarity Controller is the common management controller for Lenovo ThinkSystem server hardware. The Lenovo XClarity Controller consolidates multiple management functions in a single chip on the server system board assembly. Some of the features that are unique to the Lenovo XClarity Controller are enhanced performance, higher-resolution remote video, and expanded security options.

The server supports Lenovo XClarity Controller 2 (XCC2). For additional information about Lenovo XClarity Controller 2 (XCC2), refer to <https://pubs.lenovo.com/lxccc-overview/>.

- **UEFI-compliant server firmware**

Lenovo ThinkSystem firmware is Unified Extensible Firmware Interface (UEFI) 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 Disk Operating System (DOS).

- **Large system-memory capacity**

The server supports up to 32 TruDDR5 memory DIMMs operating at up to 4800 MHz. For more information about the specific types and maximum amount of memory, see [“Technical specifications” on page 3](#).

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

The server models support front, middle, and rear drive bays, scalable up to 20 x 3.5-inch hot-swap drives or 40 x 2.5-inch hot-swap drives. See [“Technical specifications” on page 3](#) for more information.

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

- **Lightpath Diagnostics**

Lightpath Diagnostics provides LEDs to help you diagnose problems. For more information about the Lightpath Diagnostics, see [“System LEDs and diagnostics display” on page 43](#).

- **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.

- **Active Energy Manager**

Lenovo XClarity Energy Manager is a power and temperature management solution for data centers. You can monitor and manage the power consumption and temperature of Converged, NeXtScale, System x, and ThinkServer servers, and improve energy efficiency using Lenovo XClarity Energy Manager.

- **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**

The redundant cooling by the fans in the server enables continued operation if one rotor of a fan fails.

- **ThinkSystem RAID support**

The ThinkSystem RAID adapter provides hardware redundant array of independent disks (RAID) support to create configurations, supporting RAID levels 0, 1, 5, 6, 10, 50, and 60.

Tech Tips

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

To find the Tech Tips available for your server:

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

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

Security advisories

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

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

https://datacentersupport.lenovo.com/product_security/home

Specifications

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.

Refer to the below table for specifications categories and the content of each category.

Specification category	"Technical specifications" on page 3	"Mechanical specifications" on page 10	"Environmental specifications" on page 11
Content	<ul style="list-style-type: none">• Processor• Memory• Internal drives• Expansion slots• RAID adapter• Host bus adapter (HBA)/ Expander• Graphics processing units (GPU)• Integrated functions and I/O connectors• Network• System fan• Power supplies• Operating systems• Minimal configuration for debugging	<ul style="list-style-type: none">• Dimension• Weight	<ul style="list-style-type: none">• Acoustical noise emissions• Environment• Water requirements• Particulate contamination

Technical specifications

Summary of the technical specifications of server. Depending on the model, some features might not be available, or some specifications might not apply for your server model.

Processor

Supports multi-core Intel Xeon processors, with integrated memory controller and Intel Mesh UPI (Ultra Path Interconnect) topology.

- Up to two 4th Gen (Sapphire Rapids, SPR) or 5th Gen (Emerald Rapids, EMR) Intel Xeon scalable processors with the new LGA 4677 socket
- Up to 60 cores per socket for SPR and 64 cores per socket for EMR
- Up to 4 UPI links at up to 16 GT/s for SPR and 20 GT/s for EMR
- Thermal Design Power (TDP): up to 350 watts for SPR and 385 watts for EMR

For a list of supported processors, see <https://serverproven.lenovo.com>.

Memory

- Slots: 32 dual inline memory module (DIMM) connectors that support up to 32 TruDDR5 DIMMs
- Memory module types for SPR:
 - TruDDR5 4800 MHz RDIMM: 16 GB (1Rx8), 32 GB (2Rx8), 48 GB (2Rx8)
 - TruDDR5 4800 MHz 10x4 RDIMM: 32 GB (1Rx4), 64 GB (2Rx4), 96 GB (2Rx4)
 - TruDDR5 4800 MHz 9x4 RDIMM: 32 GB (1Rx4), 64 GB (2Rx4)
 - TruDDR5 4800 MHz 3DS RDIMM: 128 GB (4Rx4), 256 GB (8Rx4)
- Memory module types for EMR:
 - TruDDR5 5600 MHz RDIMM: 16 GB (1Rx8), 24 GB (1Rx8), 32 GB (2Rx8), 48 GB (2Rx8)
 - TruDDR5 5600 MHz 10x4 RDIMM: 32 GB (1Rx4), 48 GB (1Rx4), 64 GB (2Rx4), 96 GB (2Rx4)
 - TruDDR5 5600 MHz 3DS RDIMM: 128 GB (4Rx4)
 - TruDDR5 5600 MHz Performance + RDIMM: 32 GB (2Rx8), 64 GB (2Rx4 10x4)
- Speed: Operating speed depends on processor model and UEFI settings.
 - 4800 MHz RDIMMs:
 - 1 DPC: 4800 MT/s
 - 2 DPC: 4400 MT/s
 - 5600 MHz RDIMMs:
 - 1 DPC: 5600 MT/s
 - 2 DPC:
 - 4800 MT/s for Performance + RDIMMs
 - 4400 MT/s
- Minimum memory: 16 GB
- Maximum memory: 8 TB: 32 x 256 GB 3DS RDIMMs

For a list of supported memory modules, see <https://serverproven.lenovo.com>.

Internal drives

- Front drive bays:
 - Up to 24 x 2.5-inch hot-swap SAS/SATA/NVMe drives
 - Up to 12 x 3.5-inch hot-swap SAS/SATA drives
 - Up to 4 x 3.5-inch hot-swap NVMe drives
- Middle drive bays:
 - Up to 8 x 2.5-inch hot-swap SAS/SATA/NVMe drives
 - Up to 4 x 3.5-inch hot-swap SAS/SATA drives
- Rear drive bays:
 - Up to 8 x 2.5-inch hot-swap SAS/SATA drives
 - Up to 4 x 3.5-inch hot-swap SAS/SATA drives
 - Up to 4 x 2.5-inch hot-swap NVMe drives
 - Up to two 7mm drives
- Up to two internal M.2 drives

Expansion slots

- Up to ten PCIe slots in the rear and two PCIe slots in the front
- One OCP module slot

PCIe slot availability is based on riser selection and rear drive bay selection. See [“Rear view” on page 29](#) and “PCIe slots and PCIe adapters” in *User Guide* or *Hardware Maintenance Guide*.

RAID adapter

- Onboard SATA ports with software RAID support (Intel VROC SATA RAID, supporting RAID levels 0, 1, 5, and 10)
- Onboard NVMe ports with software RAID support (Intel VROC NVMe RAID)
 - Intel VROC standard: requires an activation key and supports RAID levels 0, 1, and 10
 - Intel VROC Premium: requires an activation key and supports RAID levels 0, 1, 5, and 10
 - Intel VROC Boot (for 5th Gen processors except 4510T, 4510, 4509Y, and 3508U): requires an activation key and supports RAID level 1 only
- Hardware RAID levels 0, 1, 10:
 - ThinkSystem RAID 540-8i PCIe Gen4 12Gb Adapter
 - ThinkSystem RAID 540-16i PCIe Gen4 12Gb Adapter
- Hardware RAID levels 0, 1, 5, 10:
 - ThinkSystem RAID 5350-8i PCIe 12Gb Adapter
 - ThinkSystem RAID 5350-8i PCIe 12Gb Internal Adapter*
- Hardware RAID levels 0, 1, 5, 6, 10, 50, 60:
 - ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Adapter
 - ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Internal Adapter*
 - ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Adapter
 - ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Internal Adapter*
 - ThinkSystem RAID 940-8i 4GB Flash PCIe Gen4 12Gb Adapter
 - ThinkSystem RAID 940-16i 4GB Flash PCIe Gen4 12Gb Adapter
 - ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Adapter
 - ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Internal Adapter*
 - ThinkSystem RAID 940-32i 8GB Flash PCIe Gen4 12Gb Adapter
 - ThinkSystem RAID 940-8e 4GB Flash PCIe Gen4 12Gb Adapter

Notes:

- *Custom form factor (CFF) adapters that are supported only for server models with 2.5-inch front drive bays.
- Processors 4510T, 4510, 4509Y, and 3508U support Intel VROC standard and Intel VROC Premium.
- For more information about the RAID/HBA adapters, see [Lenovo ThinkSystem RAID Adapter and HBA Reference](#).

Host bus adapter (HBA)/Expander

- ThinkSystem 4350-8i SAS/SATA 12Gb HBA
- ThinkSystem 4350-16i SAS/SATA 12Gb HBA
- ThinkSystem 440-8i SAS/SATA PCIe Gen4 12Gb HBA
- ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb HBA
- ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb Internal HBA*
- ThinkSystem 440-8e SAS/SATA PCIe Gen4 12Gb HBA
- ThinkSystem 440-16e SAS/SATA PCIe Gen4 12Gb HBA
- ThinkSystem 48 port 12Gb Internal Expander*

Notes:

- *Custom form factor (CFF) adapters that are supported only for server models with 2.5-inch front drive bays.
- For more information about the RAID/HBA adapters, see [Lenovo ThinkSystem RAID Adapter and HBA Reference](#).

Graphics processing unit (GPU)

Your server supports the following GPUs:

- Double-wide: NVIDIA® A16, A30, A40, A100, A800, H100, H800, L40, L40S, RTX A2000, RTX A4500, RTX A6000, RTX 6000 Ada; AMD® Instinct MI210
- Single-wide: NVIDIA A2, T1000, T400, L4

Notes:

- For GPU supporting rules, see “Thermal rules” in *User Guide* or *Hardware Maintenance Guide*.
- To prevent potential thermal issues, change the **Misc** setting in the BIOS from **Option3** (default value) to **Option1** if the following two conditions are met:
 - The server is equipped with a GPU adapter.
 - The UEFI firmware version is ESE122T or later.

For the method of changing the **Misc** setting, see <https://support.lenovo.com/us/en/solutions/TT1832>.

Integrated functions and I/O connectors

- Lenovo XClarity Controller (XCC), which provides service processor control and monitoring functions, video controller, and remote keyboard, video, mouse, and remote drive capabilities.
 - The server supports Lenovo XClarity Controller 2 (XCC2). For additional information about Lenovo XClarity Controller 2 (XCC2), refer to <https://pubs.lenovo.com/xcc-overview/>.
- Front connectors:
 - One VGA connector (optional)
 - One USB 3.2 Gen1 (5 Gbps) connector
 - One USB 2.0 connector with XCC system management function
 - One external diagnostics connector
 - One integrated diagnostics panel (optional)
- Rear connectors:
 - One VGA connector
 - Three USB 3.2 Gen1 (5 Gbps) connectors
 - One XCC system management port
 - Two or four Ethernet connectors on the OCP module (optional)
 - One serial port (optional)

Network

- OCP module in the front or rear of the server, which provides two or four Ethernet connectors for network support

Note: If the ThinkSystem V3 Management NIC Adapter Kit (management NIC adapter) is installed on the server, it will not be displayed on the PCIe card list of system management software, such as XCC, LXPM, and so on.

System fan

- Supported fan types:
 - Standard fan (60 x 60 x 36 mm, single-rotor, 17000 RPM)
 - Performance fan (60 x 60 x 56 mm, dual-rotor, 21000 RPM)
- Fan redundancy: N+1 redundancy, one redundant fan rotor
 - One processor: five hot-swap system fans (one redundant fan rotor)
 - One processor with middle/rear bay or Riser 3, or two processors: six hot-swap system fans (one redundant fan rotor)

Notes:

- Single-rotor hot-swap fans cannot be mixed with dual-rotor hot-swap fans.
- The redundant cooling by the fans in the server enables continued operation if one rotor of a fan fails.
- When the system is powered off but still plugged in to AC power, fans 1 and 2 may continue to spin at a much lower speed. This is the system design to provide proper cooling.

Power supplies

The server supports up to two hot-swap power supplies for redundancy.

Power supply	100–127 V ac	200–240 V ac	240 V dc	-48 V dc
750W Platinum	√	√	√	
750W Titanium		√	√	
1100W Platinum	√	√	√	
1100W Titanium		√	√	
1800W Platinum		√	√	
1800W Titanium		√	√	
2400W Platinum		√	√	
2600W Titanium		√	√	
1100W -48V DC				√

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.**

Operating systems

Supported and certified operating systems:

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

References:

- Complete list of available operating systems: <https://lenovopress.com/osig>.
- OS deployment instructions: “[Deploy the operating system](#)” on page 85.

Notes: VMware ESXi does not support the following SSDs:

- ThinkSystem 2.5 U.3 6500 ION 30.72TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
- ThinkSystem 2.5" U.2 P5336 7.68TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
- ThinkSystem 2.5" U.2 P5336 15.36TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
- ThinkSystem 2.5" U.2 P5336 30.72TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
- ThinkSystem 2.5" U.2 P5336 61.44TB Read Intensive NVMe PCIe 4.0 x4 HS SSD

Minimal configuration for debugging

- One processor in socket 1
- One DIMM in slot 7
- One power supply
- One HDD/SSD drive, one M.2 drive, or one 7mm drive (if OS is needed for debugging)
- Five system fans

Mechanical specifications

Summary of the mechanical specifications of server. Depending on the model, some features might not be available, or some specifications might not apply.

Dimension
<ul style="list-style-type: none">• Form factor: 2U• Height: 86.5 mm (3.4 inches)• Width:<ul style="list-style-type: none">– With rack latches: 482.0 mm (19.0 inches)– Without rack latches: 444.6 mm (17.5 inches)• Depth: 763.7 mm (30.1 inches) <p>Note: The depth is measured with rack latches installed, but without the security bezel installed.</p>
Weight
Up to 39 kg (86 lb), depending on the server configuration

Environmental specifications

Summary of the environmental specifications of server. Depending on the model, some features might not be available, or some specifications might not apply.

Acoustical noise emissions

Acoustical noise emissions			
The server has the following acoustic noise emissions declaration.			
Configuration	Typical	Storage	GPU
Sound power levels (L_{WA})	<ul style="list-style-type: none">Idling: 5.6 BelOperating: 5.6 Bel	<ul style="list-style-type: none">Idling: 7.3 BelOperating: 7.3 Bel	<ul style="list-style-type: none">Idling: 7.3 BelOperating: 8.9 Bel
Sound pressure level (L_{pAm})	<ul style="list-style-type: none">Idling: 41.5 dBAOperating: 41.5 dBA	<ul style="list-style-type: none">Idling: 60.2 dBAOperating: 60.2 dBA	<ul style="list-style-type: none">Idling: 60.2 dBAOperating: 74.1 dBA
The declared sound levels are based on the following configurations, which may change depending on configurations or conditions.			
Component	Typical configuration	Storage configuration	GPU configuration
Chassis (2U)	8 x 2.5-inch front drive bays	12 x 3.5-inch front drive bays	16 x 2.5-inch front drive bays
Fan	6 x standard fans	6 x high performance fans	6 x high performance fans
Processor	2 x 205 W CPUs	2 x 205 W CPUs	2 x 205 W CPUs
Memory	8 x 64 GB RDIMMs	16 x 64 GB RDIMMs	32 x 64 GB RDIMMs
Drive	8 x 2.4 TB SAS HDDs	20 x 14 TB SAS HDDs	16 x 2.4 TB SAS HDDs
RAID adapter	1 x RAID 940-8i	1 x RAID 940-32i	1 x RAID 940-16i
OCP adapter	1 x Intel X710-T2L 10GBASE-T 2-port OCP		
Power supply	2 x 750 W PSUs	2 x 1100 W PSUs	2 x 1800 W PSUs
GPU adapter	None	None	3 x A100
Notes:			
<ul style="list-style-type: none">These sound levels were measured in controlled acoustical environments according to procedures specified by ISO7779 and are reported in accordance with ISO 9296.Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room; the noise levels from other equipment; the room ambient temperature, and employee's location in relation to the equipment. Further, compliance with such government regulations depends on a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. Lenovo recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.			

Environment

Environment

ThinkSystem SR650 V3 complies with ASHRAE Class A2 specifications with most configurations, and depending on the hardware configuration, also complies with ASHRAE Class A3 and Class A4 specifications. System performance may be impacted when the operating temperature is outside ASHRAE A2 specification.

Depending on the hardware configuration, SR650 V3 server also complies with ASHRAE Class H1 specification. System performance may be impacted when the operating temperature is outside ASHRAE H1 specification.

The restrictions to ASHRAE support are as follows (cooling by air):

- The ambient temperature must be limited to 35°C or lower if the server has any of the following components:
 - Broadcom 57416 10GBASE-T 2-port OCP
 - Broadcom 57454 10GBASE-T 4-port OCP
 - PCIe network interface card (NIC) at a rate greater than or equal to 100 GB
 - Part with AOC and at the rate of 40 GB
- The ambient temperature must be limited to 30°C or lower if the server has any of the following components:
 - 24 x 2.5" or 12 x 3.5" front bay with middle bay or rear bay
 - GPU adapters
 - 256 GB 3DS RDIMM
 - 350 W processor
 - part with AOC and at a rate greater than 40 GB
 - 5600 MHz RDIMMs with capacity greater than or equal to 96 GB
 - ThinkSystem 96GB TruDDR5 4800MHz (2Rx4) RDIMM
 - ThinkSystem 128GB TruDDR5 4800MHz (4Rx4) 3DS RDIMM v1
 - 4800 MHz 256 GB RDIMMs (except ThinkSystem 256GB TruDDR5 4800MHz (8Rx4) 3DS RDIMM v1)
- The ambient temperature must be limited to 25°C or lower if the server has any of the following components or configurations:
 - 350 W processor installed in the chassis with 24 x 2.5" or 12 x 3.5" front drives
 - 350 W processor installed in the 16 x 2.5" + FIO non-GPU configuration
 - processor (270 W <=TDP <= 300 W) installed in the chassis with middle or rear drives
 - GPU adapter installed in the chassis with 24 x 2.5" front drives
 - GPU adapter and processor with TDP rating greater than 300 W installed in the chassis with 16 x 2.5" or 8 x 3.5" front drives
 - drives larger than 3.84 TB installed in Gen 5 rear or middle NVMe drive bays
 - 36 NVMe configuration
 - 16 x 2.5" + FIO GPU configuration
 - ThinkSystem 256GB TruDDR5 4800MHz (8Rx4) 3DS RDIMM v1
 - ThinkSystem 96GB TruDDR5 4800MHz (2Rx4) RDIMM installed in the following configurations:
 - 12 x 3.5" configurations including processors with TDP less than or equal to 300 W
 - 12 x 3.5" + middle/rear drive bay configurations including processors with TDP less than or equal to 270 W
 - the following NVMe SSDs installed in the front 12 x 3.5" SAS/SATA + middle 8 x 2.5" NVMe or front 12 x 3.5" SAS/SATA + rear 4 x 2.5" NVMe configuration:
 - ThinkSystem 2.5" U.2 P5336 61.44TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
 - ThinkSystem 2.5" U.2 P5336 30.72TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
 - ThinkSystem 2.5" U.2 P5336 15.36TB Read Intensive NVMe PCIe 4.0 x4 HS SSD

The restrictions to ASHRAE support are as follows (cooling by Direct Water Cooling Module (DWCM)):

- The ambient temperature must be limited to 35°C or lower if the server has any of the following components or configurations:
 - Broadcom 57416 10GBASE-T 2-port OCP
 - Broadcom 57454 10GBASE-T 4-port OCP
 - PCIe network interface card (NIC) at a rate greater than or equal to 100 GB
 - Part with AOC and at the rate of 40 GB
 - GPU adapters (< 300 W) installed in 8 x 3.5" or 16 x 2.5" configurations
 - 64 GB < DIMM < 256 GB
 - 8 x 2.5" GPU configuration
 - storage configuration without middle or rear NVMe backplane
- The ambient temperature must be limited to 30°C or lower if the server has any of the following components:

Environment

- 256 GB 3DS RDIMM
- part with AOC and at a rate greater than 40 GB
- GPU adapters (>= 300 W) installed in 8 x 3.5" or 16 x 2.5" configurations
- three A40 GPU adapters installed in 24 x 2.5" configurations
- storage configuration with middle or rear NVMe backplane
- 5600 MHz RDIMMs with capacity greater than or equal to 96 GB
- ThinkSystem 96GB TruDDR5 4800MHz (2Rx4) RDIMM
- ThinkSystem 128GB TruDDR5 4800MHz (4Rx4) 3DS RDIMM v1
- 4800 MHz 256 GB RDIMMs (except ThinkSystem 256GB TruDDR5 4800MHz (8Rx4) 3DS RDIMM v1)
- The ambient temperature must be limited to 25°C or lower if the server has any of the following components:
 - three H800/H100 GPU adapters installed in 24 x 2.5" configurations
 - three H800/H100 GPU adapters installed in 16 x 2.5" + FIO configurations
 - ThinkSystem 256GB TruDDR5 4800MHz (8Rx4) 3DS RDIMM v1
 - the following NVMe SSDs installed in the front 12 x 3.5" SAS/SATA + middle 8 x 2.5" NVMe or front 12 x 3.5" SAS/SATA + rear 4 x 2.5" NVMe configuration:
 - ThinkSystem 2.5" U.2 P5336 61.44TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
 - ThinkSystem 2.5" U.2 P5336 30.72TB Read Intensive NVMe PCIe 4.0 x4 HS SSD
 - ThinkSystem 2.5" U.2 P5336 15.36TB Read Intensive NVMe PCIe 4.0 x4 HS SSD

For detailed thermal information, see "Thermal rules" in *User Guide* or *Hardware Maintenance Guide*.

Note: When the ambient temperature is greater than the supported max temperature (ASHARE A4 45°C), the server will shut down. The server will not power on again until the ambient temperature falls within the supported temperature range.

- **Air temperature:**

- Operating:

- ASHRAE class H1: 5°C to 25°C (41°F to 77°F)

- The maximum ambient temperature decreases by 1°C for every 500 m (1640 ft) increase in altitude above 900 m (2,953 ft)

- ASHRAE class A2: 10°C to 35°C (50°F to 95°F)

- The maximum ambient temperature decreases by 1°C for every 300 m (984 ft) increase in altitude above 900 m (2,953 ft)

- ASHRAE class A3: 5°C to 40°C (41°F to 104°F)

- The maximum ambient temperature decreases by 1°C for every 175 m (574 ft) increase in altitude above 900 m (2,953 ft)

- ASHRAE class A4: 5°C to 45°C (41°F to 113°F)

- The maximum ambient temperature decreases by 1°C for every 125 m (410 ft) increase in altitude above 900 m (2,953 ft)

- Server off: -10°C to 60°C (14°F to 140°F)

- Shipment/storage: -40°C to 70°C (-40°F to 158°F)

- **Maximum altitude:** 3,050 m (10,000 ft)

- **Relative Humidity** (non-condensing):

- Operating

- ASHRAE class H1: 8%–80%; maximum dew point: 17°C (62.6°F)

- ASHRAE class A2: 20%–80%; maximum dew point: 21°C (70°F)

- ASHRAE class A3: 8%–85%; maximum dew point: 24°C (75°F)

- ASHRAE class A4: 8%–90%; maximum dew point: 24°C (75°F)

- Shipment/storage: 8% to 90%

Water requirements

Water requirements	
ThinkSystem SR650 V3 is supported in the following environment:	
<ul style="list-style-type: none">• Maximum pressure: 3 bars• Water inlet temperature and flow rates:	
Water inlet temperature	Water flow rate
50°C (122°F)	1.5 liters per minute (lpm) per server
45°C (113°F)	1 liter per minute (lpm) per server
40°C (104°F) or lower	0.5 liters per minute (lpm) per server

Note: The water required to initially fill the system side cooling loop must be reasonably clean, bacteria-free water (<100 CFU/ml) such as de-mineralized water, reverse osmosis water, de-ionized water, or distilled water. The water must be filtered with an in-line 50 micron filter (approximately 288 mesh). The water must be treated with anti-biological and anti-corrosion measures.

Particulate contamination

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

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

Table 1. Limits for particulates and gases

Contaminant	Limits
Reactive gases	<p>Severity level G1 as per ANSI/ISA 71.04-1985¹:</p> <ul style="list-style-type: none"> The copper reactivity level shall be less than 200 Angstroms per month ($\text{\AA}/\text{month} \approx 0.0035 \mu\text{g}/\text{cm}^2\text{-hour weight gain}$).² The silver reactivity level shall be less than 200 Angstroms per month ($\text{\AA}/\text{month} \approx 0.0035 \mu\text{g}/\text{cm}^2\text{-hour weight gain}$).³ The reactive monitoring of gaseous corrosivity must be conducted approximately 5 cm (2 in.) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.
Airborne particulates	<p>Data centers must meet the cleanliness level of ISO 14644-1 class 8.</p> <p>For data centers without airside economizer, the ISO 14644-1 class 8 cleanliness might be met by choosing one of the following filtration methods:</p> <ul style="list-style-type: none"> The room air might be continuously filtered with MERV 8 filters. Air entering a data center might be filtered with MERV 11 or preferably MERV 13 filters. <p>For data centers with airside economizers, the choice of filters to achieve ISO class 8 cleanliness depends on the specific conditions present at that data center.</p> <ul style="list-style-type: none"> The deliquescent relative humidity of the particulate contamination should be more than 60% RH.⁴ Data centers must be free of zinc whiskers.⁵
<p>¹ ANSI/ISA-71.04-1985. <i>Environmental conditions for process measurement and control systems: Airborne contaminants</i>. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.</p> <p>² The derivation of the equivalence between the rate of copper corrosion growth in the thickness of the corrosion product in $\text{\AA}/\text{month}$ and the rate of weight gain assumes that Cu_2S and Cu_2O grow in equal proportions.</p> <p>³ The derivation of the equivalence between the rate of silver corrosion growth in the thickness of the corrosion product in $\text{\AA}/\text{month}$ and the rate of weight gain assumes that Ag_2S is the only corrosion product.</p> <p>⁴ The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.</p> <p>⁵ Surface debris is randomly collected from 10 areas of the data center on a 1.5 cm diameter disk of sticky electrically conductive tape on a metal stub. If examination of the sticky tape in a scanning electron microscope reveals no zinc whiskers, the data center is considered free of zinc whiskers.</p>	

Management options

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

Overview

Options	Description
Lenovo XClarity Controller	<p>Baseboard management controller (BMC)</p> <p>Consolidates the service processor functionality, Super I/O, video controller, and remote presence capabilities into a single chip on the server system board (system board assembly).</p> <p>Interface</p> <ul style="list-style-type: none"> • CLI application • Web GUI interface • Mobile application • Redfish API <p>Usage and downloads</p> <p>https://pubs.lenovo.com/lxcc-overview/</p>
Lenovo XCC Logger Utility	<p>Application that reports the XCC events to local OS system log.</p> <p>Interface</p> <ul style="list-style-type: none"> • CLI application <p>Usage and downloads</p> <ul style="list-style-type: none"> • https://pubs.lenovo.com/lxcc-logger-linux/ • https://pubs.lenovo.com/lxcc-logger-windows/
Lenovo XClarity Administrator	<p>Centralized interface for multi-server management.</p> <p>Interface</p> <ul style="list-style-type: none"> • Web GUI interface • Mobile application • REST API <p>Usage and downloads</p> <p>https://pubs.lenovo.com/lxca/</p>
Lenovo XClarity Essentials toolset	<p>Portable and light toolset for server configuration, data collection, and firmware updates. Suitable both for single-server or multi-server management contexts.</p> <p>Interface</p> <ul style="list-style-type: none"> • OneCLI: CLI application • Bootable Media Creator: CLI application, GUI application • UpdateXpress: GUI application <p>Usage and downloads</p> <p>https://pubs.lenovo.com/lxce-overview/</p>

Options	Description
Lenovo XClarity Provisioning Manager	<p>UEFI-based embedded GUI tool on a single server that can simplify management tasks.</p> <p>Interface</p> <ul style="list-style-type: none"> • Web interface (BMC remote access) • GUI application <p>Usage and downloads</p> <p>https://pubs.lenovo.com/lxpm-overview/</p> <p>Important: Lenovo XClarity Provisioning Manager (LXPM) supported version varies by product. All versions of Lenovo XClarity Provisioning Manager are referred to as Lenovo XClarity Provisioning Manager and LXPM in this document, unless specified otherwise. To see the LXPM version supported by your server, go to https://pubs.lenovo.com/lxpm-overview/.</p>
Lenovo XClarity Integrator	<p>Series of applications that integrate the management and monitoring functionalities of the Lenovo physical servers with the software used in a certain deployment infrastructure, such as VMware vCenter, Microsoft Admin Center, or Microsoft System Center while delivering additional workload resiliency.</p> <p>Interface</p> <ul style="list-style-type: none"> • GUI application <p>Usage and downloads</p> <p>https://pubs.lenovo.com/lxci-overview/</p>
Lenovo XClarity Energy Manager	<p>Application that can manage and monitor server power and temperature.</p> <p>Interface</p> <ul style="list-style-type: none"> • Web GUI Interface <p>Usage and downloads</p> <p>https://datacentersupport.lenovo.com/solutions/Invo-lxem</p>
Lenovo Capacity Planner	<p>Application that supports power consumption planning for a server or rack.</p> <p>Interface</p> <ul style="list-style-type: none"> • Web GUI Interface <p>Usage and downloads</p> <p>https://datacentersupport.lenovo.com/solutions/Invo-lcp</p>

Functions

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

Notes:

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

Chapter 2. Server components

This section contains information about each of the components associated with the 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:

- “Front view with eight 2.5-inch front drive bays (model 1)” on page 19
- “Front view with eight 2.5-inch front drive bays (model 2)” on page 20
- “Front view with sixteen 2.5-inch front drive bays (model 1)” on page 20
- “Front view with sixteen 2.5-inch front drive bays (model 2)” on page 21
- “Front view with sixteen 2.5-inch front drive bays (model 3)” on page 21
- “Front view with twenty-four 2.5-inch front drive bays” on page 22
- “Front view with 2.5-inch front drive bays (backplane-less)” on page 22
- “Front view with eight 3.5-inch front drive bays” on page 22
- “Front view with twelve 3.5-inch front drive bays” on page 23
- “Front view with 3.5-inch front drive bays (backplane-less)” on page 23

Front view with eight 2.5-inch front drive bays (model 1)

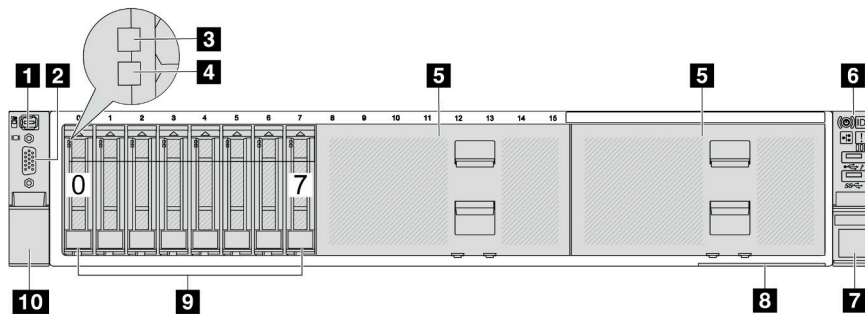


Table 2. Components on the front of the server

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “Drive bay fillers” on page 24	6 “Front I/O module (on rack latch)” on page 25
7 “Rack latch (right)” on page 25	8 “Pull-out information tab” on page 25
9 “Drive bays” on page 24	10 “Rack latch (left)” on page 25

Front view with eight 2.5-inch front drive bays (model 2)

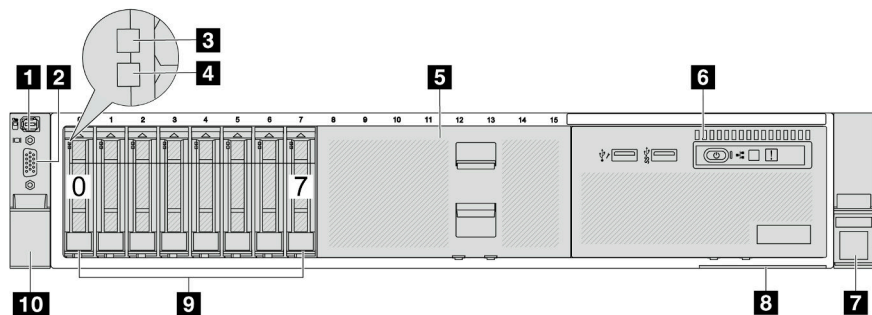


Table 3. Components on the front of the server

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “Drive bay filler” on page 24	6 “Front I/O module (on media bay)” on page 25
7 “Rack latch (right)” on page 25	8 “Pull-out information tab” on page 25
9 “Drive bays” on page 24	10 “Rack latch (left)” on page 25

Front view with sixteen 2.5-inch front drive bays (model 1)

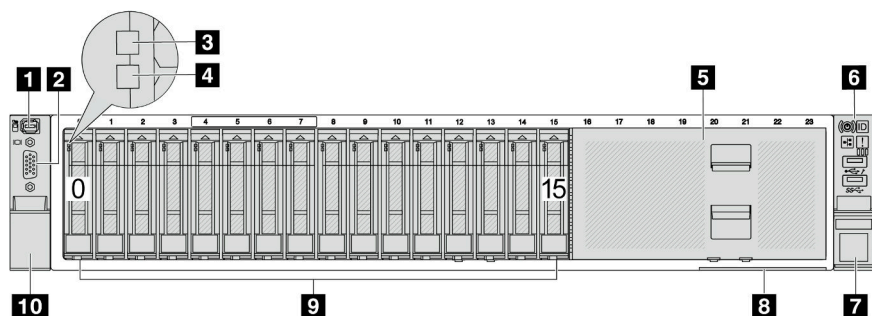


Table 4. Components on the front of server models

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “Drive bay filler” on page 24	6 “Front I/O module (on rack latch)” on page 25
7 “Rack latch (right)” on page 25	8 “Pull-out information tab” on page 25
9 “Drive bays” on page 24	10 “Rack latch (left)” on page 25

Front view with sixteen 2.5-inch front drive bays (model 2)

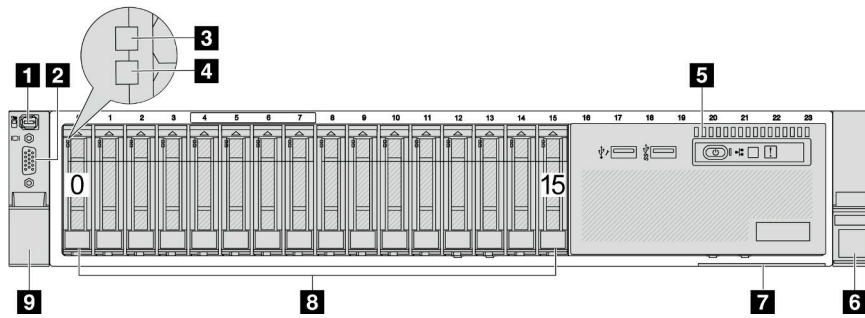


Table 5. Components on the front of the server

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “Front I/O module (on media bay)” on page 25	6 “Rack latch (right)” on page 25
7 “Pull-out information tab” on page 25	8 “Drive bays” on page 24
9 “Rack latch (left)” on page 25	

Front view with sixteen 2.5-inch front drive bays (model 3)

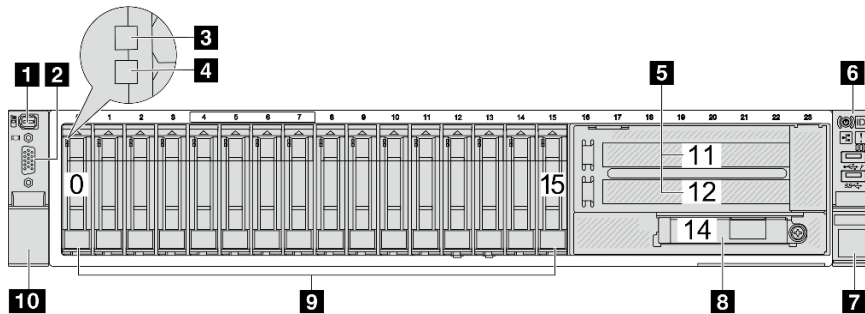


Table 6. Components on the front of server models

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “PCIe slots (x2)” on page 25	6 “Front I/O module (on rack latch)” on page 25
7 “Rack latch (right)” on page 25	8 “Ethernet connectors on OCP module (optional)” on page 25
9 “Drive bays” on page 24	10 “Rack latch (left)” on page 25

Front view with twenty-four 2.5-inch front drive bays

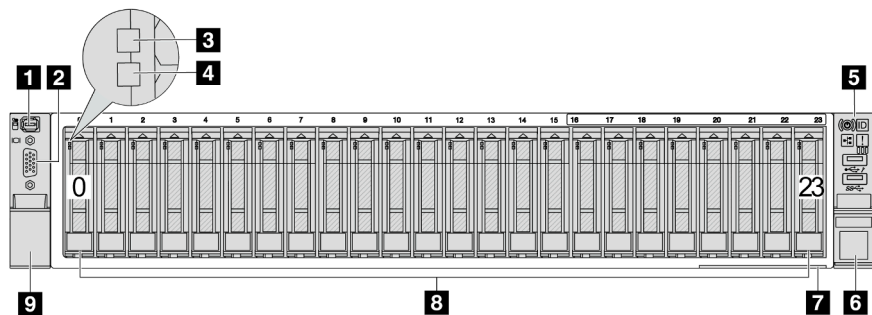


Table 7. Components on the front of server models

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “Front I/O module (on rack latch)” on page 25	6 “Rack latch (right)” on page 25
7 “Pull-out information tab” on page 25	8 “Drive bays” on page 24
9 “Rack latch (left)” on page 25	

Front view with 2.5-inch front drive bays (backplane-less)

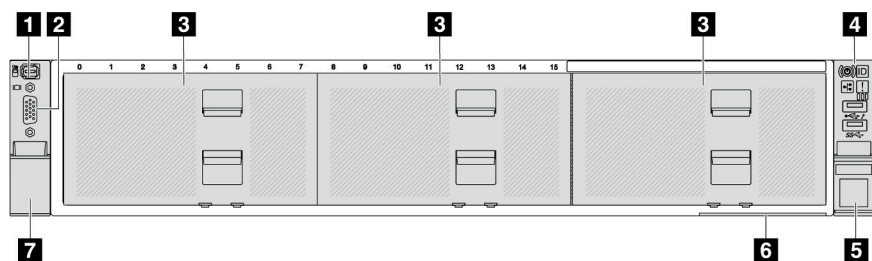


Table 8. Components on the front of server models

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive bay fillers” on page 24	4 “Front I/O module (on rack latch)” on page 25
5 “Rack latch (right)” on page 25	6 “Pull-out information tab” on page 25
7 “Rack latch (left)” on page 25	

Front view with eight 3.5-inch front drive bays

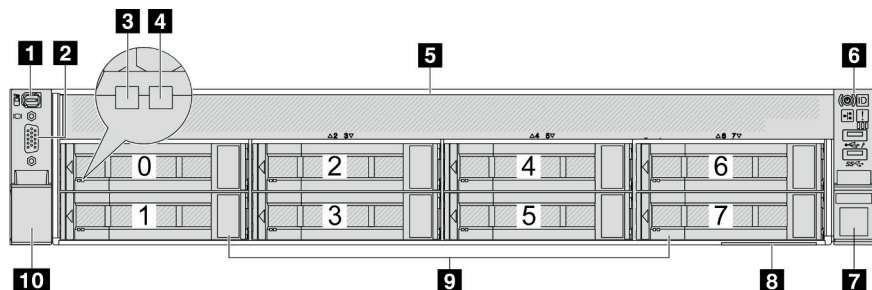


Table 9. Components on the front of server models

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “Drive bay filler” on page 24	6 “Front I/O module (on rack latch)” on page 25
7 “Rack latch (right)” on page 25	8 “Pull-out information tab” on page 25
9 “Drive bays” on page 24	10 “Rack latch (left)” on page 25

Front view with twelve 3.5-inch front drive bays

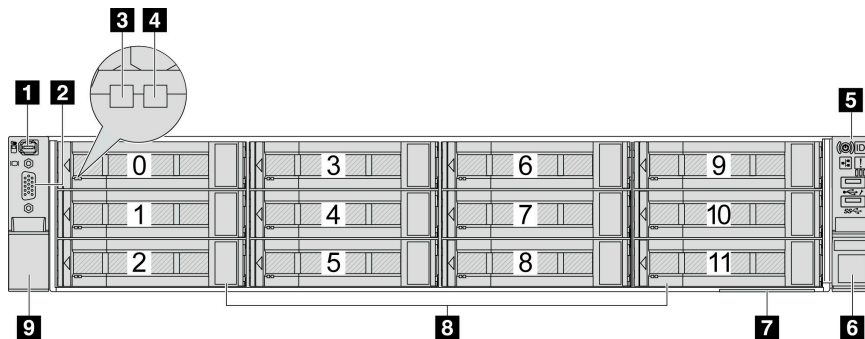


Table 10. Components on the front of server models

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Drive activity LED” on page 24	4 “Drive status LED” on page 24
5 “Front I/O module (on rack latch)” on page 25	6 “Rack latch (right)” on page 25
7 “Pull-out information tab” on page 25	8 “Drive bays” on page 24
9 “Rack latch (left)” on page 25	

Front view with 3.5-inch front drive bays (backplane-less)

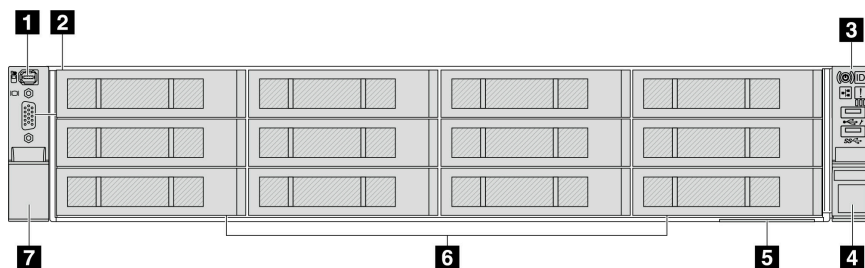


Table 11. Components on the front of server models

Callout	Callout
1 “External diagnostics connector (optional)” on page 24	2 “VGA connector (optional)” on page 25
3 “Front I/O module (on rack latch)” on page 25	4 “Rack latch (right)” on page 25

Table 11. Components on the front of server models (continued)

Callout	Callout
5 “Pull-out information tab” on page 25	6 “Drive bay fillers” on page 24
7 “Rack latch (left)” on page 25	

Front components overview

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.

Drive bay filler

The drive bay filler is used to cover a vacant drive bay. The EMI integrity and cooling of the server are protected by having all drive bays occupied. The vacant drive bays must be occupied by drive bay fillers or drive fillers.

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.

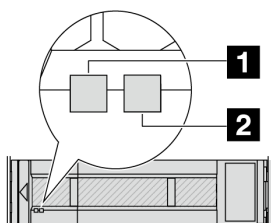


Figure 2. Drive LEDs

Drive LED	Status	Description
1 Drive activity LED (left)	Solid green	The drive is powered but not active.
	Blinking green	The drive is active.
2 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 drive is being identified.

External diagnostics connector

The connector is for connecting an External Diagnostics Handset. For more about its functions, see [“External diagnostics handset” on page 51](#)

Front I/O module

The front IO module provides controls, connectors, and LEDs. The front I/O module varies by model. For more information, see [“Front I/O module” on page 26](#).

PCIe slots

The PCIe slots are on the rear or front of the server, and your server supports up to 12 PCIe slots. For more information, see “PCIe slots and PCIe adapters” in *User Guide* or *Hardware Maintenance Guide*.

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](#).

Rack latch

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.

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.

Ethernet connectors



Figure 3. OCP module (two connectors)

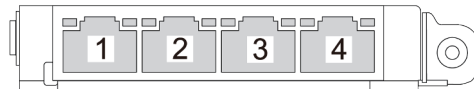


Figure 4. OCP module (four connectors)

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

By default, one of the Ethernet connectors on the OCP module can also function as a management connector using the shared management capacity.

Front I/O module

The front IO module provides controls, connectors, and LEDs. The front I/O module varies by model.

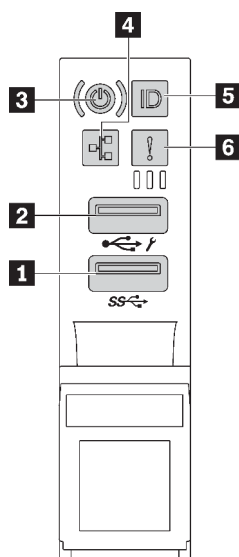


Figure 5. Front I/O module (on rack latch)

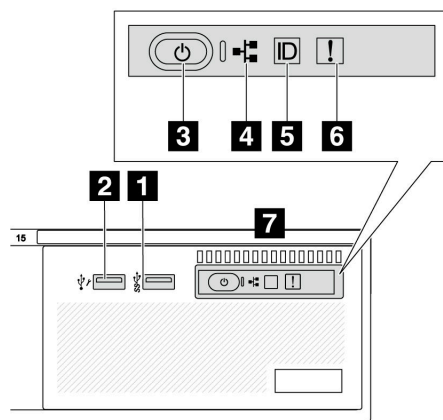


Figure 6. Front I/O module (on media bay)

Table 12. Components on the front I/O module

Callout	Callout
1 USB 3 (5 Gbps) connector	2 USB 2.0 connector with XClarity Controller management
3 Power button with power status LED	4 Network activity LED (for OCP module)
5 System ID button with system ID LED	6 System error LED
7 Front operator panel	

1 USB 3 (5 Gbps) connector

The USB 3.2 Gen 1 (5 Gbps) connector can be used to attach a USB-compatible device, such as a USB keyboard, USB mouse, or USB storage device.

2 USB 2.0 connector with XClarity Controller management

Depending on the setting, this connector supports USB 2.0 function, XClarity Controller management function, or both. It is the only USB port that supports USB automation update of the firmware and RoT security module.

- If the connector is set for USB 2.0 function, it can be used to attach a USB-compatible device, such as a USB keyboard, USB mouse, or USB storage device.
- If the connector is set for XClarity Controller management function, it can be used to connect the server to an android or iOS device, where you can then install and launch the Lenovo XClarity Mobile app to manage the system using XClarity Controller.

For details about using the Lenovo XClarity Mobile app, refer to https://pubs.lenovo.com/lxca/lxca_usemobileapp

- If the connector is set to have both functions, you can press the system ID button for three seconds to switch between the two functions.

3 Power button with power status LED

You can press this button to turn the server on and off manually. The power status LED helps you determine the current power status.

Status	Color	Description
Off	None	Power is not present, or the power supply has failed.
Fast blinking (about four flashes per second)	Green	<ul style="list-style-type: none">• The server is off, but the XClarity Controller is initializing, and the server is not ready to be powered on.• System-board-assembly power has failed.
Slow blinking (about one flash per second)	Green	The server is off and is ready to be powered on (standby state).
Solid on	Green	The server is on and running.

4 Network activity LED

Compatibility of the NIC adapter and the network activity LED:

NIC adapter	Network activity LED
OCP module	Support
PCIe NIC adapter	Not support

When an OCP module is installed, the network activity LED on the front I/O module helps you identify the network connectivity and activity. If no OCP module 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. Note: If the network activity LED is off when an OCP module is installed, check the network ports in the rear of your server to determine which port is disconnected.

5 System ID button with system ID LED

Use this system ID button and the blue system ID LED to visually locate the server. Each time you press the system ID button, the state of the system ID LED changes. The LED 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 LED 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.

6 System error LED

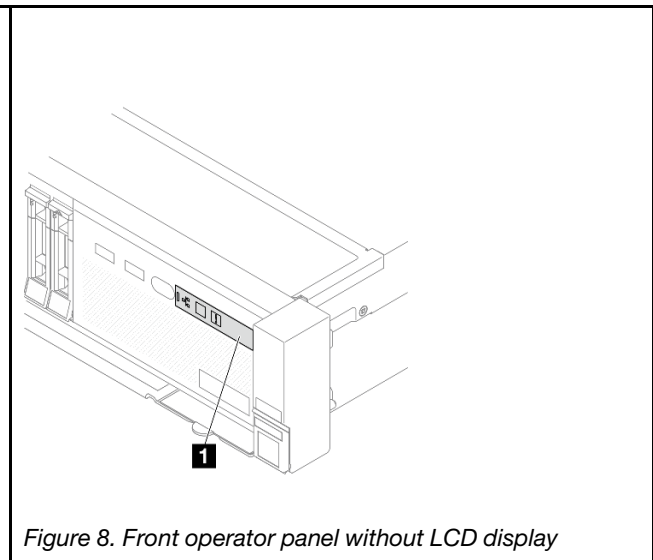
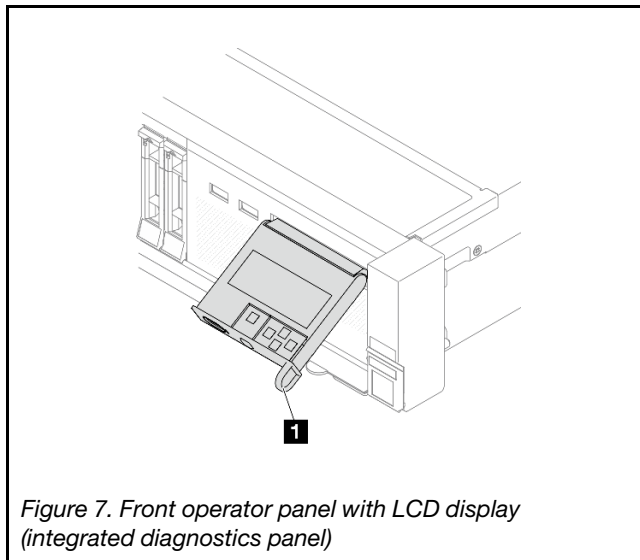
The system error LED provides basic diagnostic functions for your server. If the system error LED is lit, one or more LEDs elsewhere in the server might also be lit to direct you to the source of the error.

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: <ul style="list-style-type: none">• A fan failure• A memory error• A storage failure• A PCIe device failure• A power supply failure• A processor error• A system I/O board or processor board error	<ul style="list-style-type: none">• Check the Lenovo XClarity Controller event log and the system event log to determine the exact cause of the error.• Check if additional LEDs elsewhere in the server are also lit that will direct you to the source of the error. See “System LEDs and diagnostics display” on page 43.• Save the log if necessary.
Off	None	The server is off, or the server is on and is working correctly.	None.

7 Front operator panel

Depending on the server model, the server comes with the front operator panel with LCD display (called integrated diagnostics panel) or the front operator panel without LCD display.

The integrated diagnostics panel provides an LCD display to quickly access system information such as active errors, system status, firmware information, network information, and health information. For details, see [“Integrated diagnostics panel” on page 46](#).



Rear view

The rear of the server provides access to several connectors and components.

Refer to the following rear view for different server models:

- “Rear view with eight PCIe slots” on page 29
- “Rear view with ten PCIe slots” on page 29
- “Rear view with four 2.5-inch rear drive bays and six PCIe slots” on page 30
- “Rear view with eight 2.5-inch rear drive bays and four PCIe slots” on page 30
- “Rear view with two 3.5-inch rear drive bays and four PCIe slots” on page 31
- “Rear view with four 3.5-inch rear drive bays and two PCIe slots” on page 31
- “Rear view with seven PCIe slots and a DWCM” on page 32
- “Rear view with nine PCIe slots and a DWCM” on page 32
- “Rear view with four 2.5-inch rear drive bays, five PCIe slots, and a DWCM” on page 33
- “Rear view with eight 2.5-inch rear drive bays, three PCIe slots, and a DWCM” on page 33
- “Rear view with two 3.5-inch rear drive bays, three PCIe slots, and a DWCM” on page 34
- “Rear view with four 3.5-inch rear drive bays, one PCIe slot, and a DWCM” on page 34

Rear view with eight PCIe slots

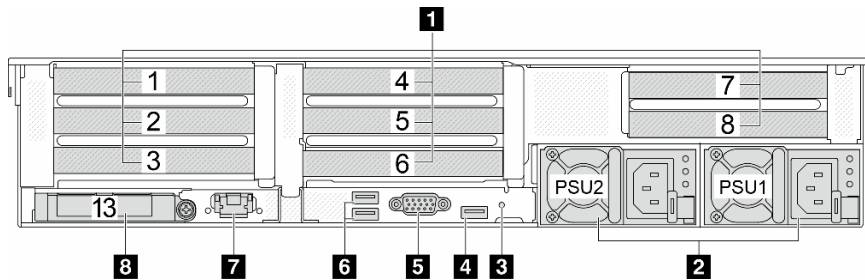


Table 13. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Power supplies” on page 35
3 “NMI button” on page 35	4 “USB 3 (5 Gbps) connector” on page 35
5 “VGA connector” on page 35	6 “USB 3 (5 Gbps) connectors” on page 35
7 “XCC system management port” on page 35	8 “Ethernet connectors on OCP module (optional)” on page 36

Rear view with ten PCIe slots

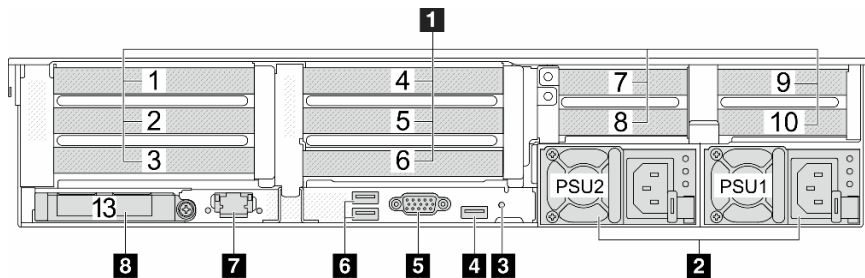


Table 14. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Power supplies” on page 35
3 “NMI button” on page 35	4 “USB 3 (5 Gbps) connector” on page 35
5 “VGA connector” on page 35	6 “USB 3 (5 Gbps) connectors” on page 35
7 “XCC system management port” on page 35	8 “Ethernet connectors on OCP module (optional)” on page 36

Rear view with four 2.5-inch rear drive bays and six PCIe slots

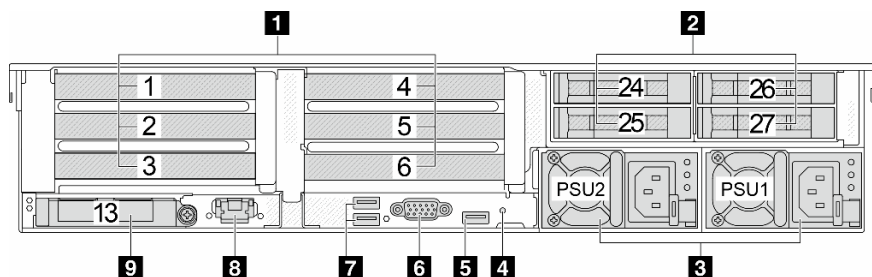


Table 15. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 2.5-inch drive bays (4)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 “VGA connector” on page 35
7 “USB 3 (5 Gbps) connector” on page 35	8 “XCC system management port” on page 35
9 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with eight 2.5-inch rear drive bays and four PCIe slots

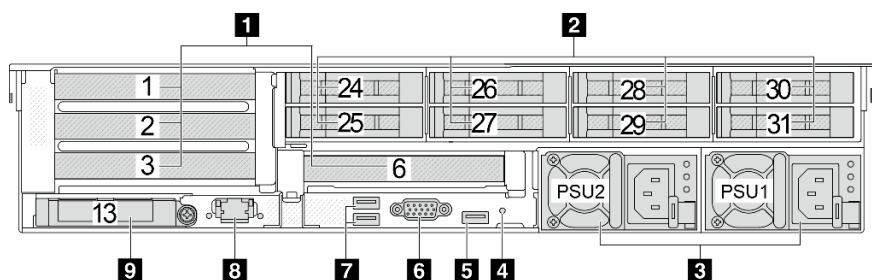


Table 16. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 2.5-inch drive bays (8)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 “VGA connector” on page 35

Table 16. Components on the rear of the server (continued)

Callout	Callout
7 “USB 3 (5 Gbps) connector” on page 35	8 “XCC system management port” on page 35
9 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with two 3.5-inch rear drive bays and four PCIe slots

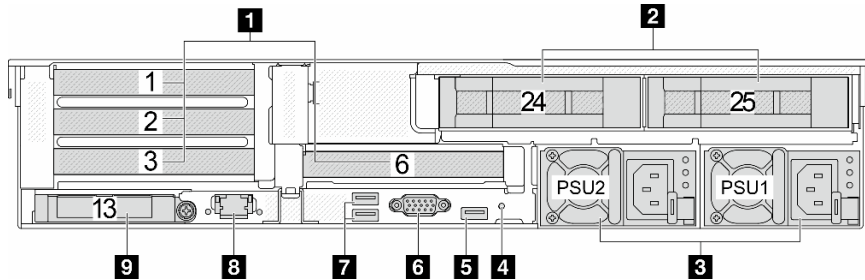


Table 17. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 3.5-inch drive bays (2)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 “VGA connector” on page 35
7 “USB 3 (5 Gbps) connector” on page 35	8 “XCC system management port” on page 35
9 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with four 3.5-inch rear drive bays and two PCIe slots

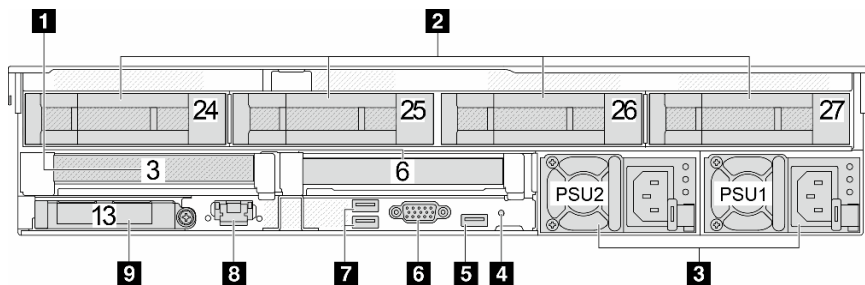


Table 18. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 3.5-inch drive bays (4)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 “VGA connector” on page 35
7 “USB 3 (5 Gbps) connector” on page 35	8 “XCC system management port” on page 35
9 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with seven PCIe slots and a DWCM

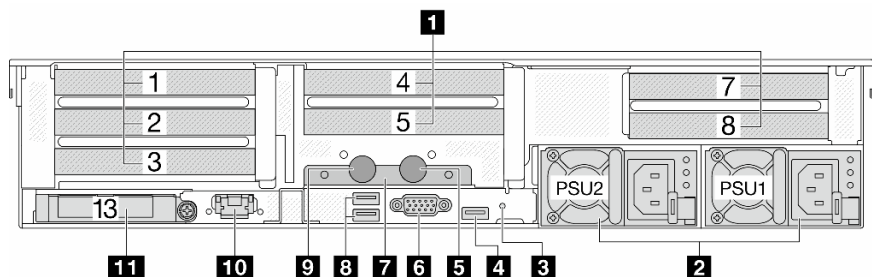


Table 19. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Power supplies” on page 35
3 “NMI button” on page 35	4 “USB 3 (5 Gbps) connector” on page 35
5 Outlet hose	6 “VGA connector” on page 35
7 Hose holder	8 “USB 3 (5 Gbps) connectors” on page 35
9 Inlet hose	10 “XCC system management port” on page 35
11 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with nine PCIe slots and a DWCM

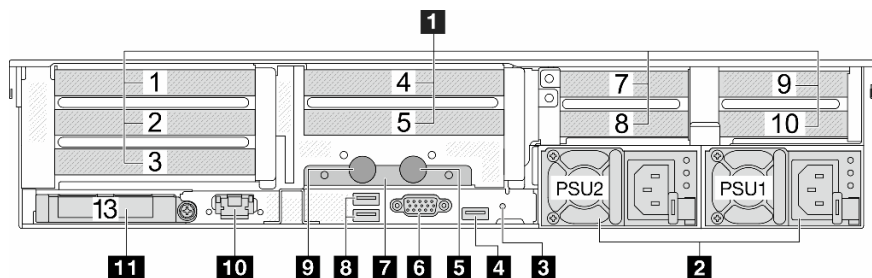


Table 20. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Power supplies” on page 35
3 “NMI button” on page 35	4 “USB 3 (5 Gbps) connector” on page 35
5 Outlet hose	6 “VGA connector” on page 35
7 Hose holder	8 “USB 3 (5 Gbps) connectors” on page 35
9 Inlet hose	10 “XCC system management port” on page 35
11 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with four 2.5-inch rear drive bays, five PCIe slots, and a DWCM

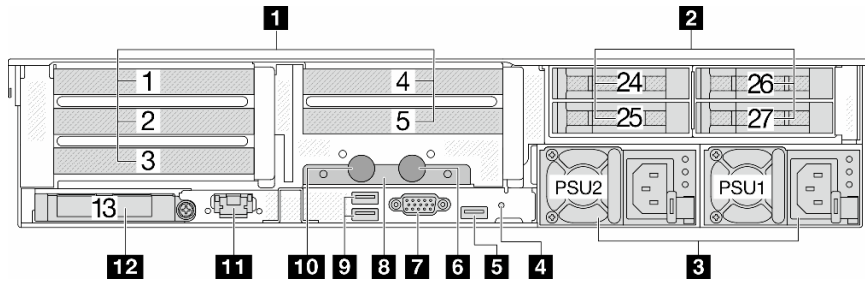


Table 21. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 2.5-inch drive bays (4)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 Outlet hose
7 “VGA connector” on page 35	8 Hose holder
9 “USB 3 (5 Gbps) connectors” on page 35	10 Inlet hose
11 “XCC system management port” on page 35	12 “Ethernet connectors on OCP module (optional)” on page 36

Rear view with eight 2.5-inch rear drive bays, three PCIe slots, and a DWCM

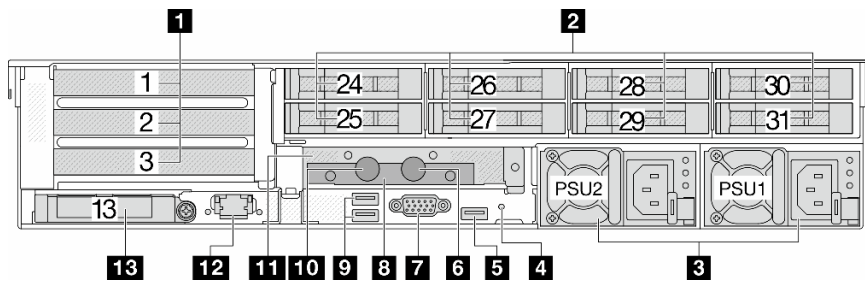


Table 22. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 2.5-inch drive bays (8)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 Outlet hose
7 “VGA connector” on page 35	8 Hose holder
9 “USB 3 (5 Gbps) connectors” on page 35	10 Inlet hose
11 1FH riser cage for DWCM	12 “XCC system management port” on page 35
13 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with two 3.5-inch rear drive bays, three PCIe slots, and a DWCM

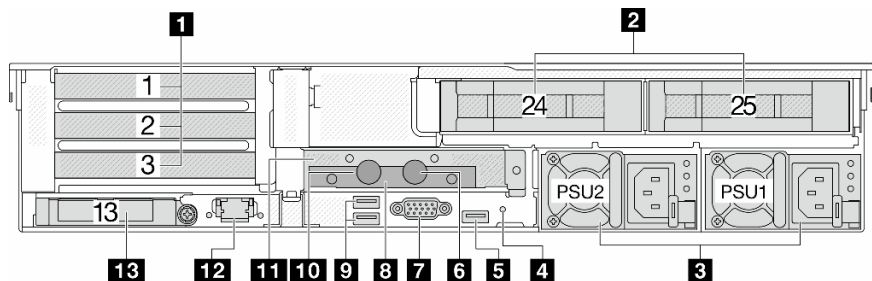


Table 23. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 3.5-inch drive bays (2)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 Outlet hose
7 “VGA connector” on page 35	8 Hose holder
9 “USB 3 (5 Gbps) connectors” on page 35	10 Inlet hose
11 1FH riser cage for DWCM	12 “XCC system management port” on page 35
13 “Ethernet connectors on OCP module (optional)” on page 36	

Rear view with four 3.5-inch rear drive bays, one PCIe slot, and a DWCM

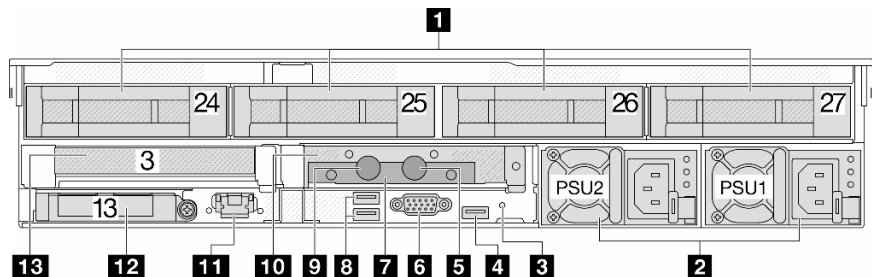


Table 24. Components on the rear of the server

Callout	Callout
1 “PCIe slots” on page 35	2 “Rear 3.5-inch drive bays (4)” on page 35
3 “Power supplies” on page 35	4 “NMI button” on page 35
5 “USB 3 (5 Gbps) connector” on page 35	6 Outlet hose
7 “VGA connector” on page 35	8 Hose holder
9 “USB 3 (5 Gbps) connectors” on page 35	10 Inlet hose
11 1FH riser cage for DWCM	12 “XCC system management port” on page 35
13 “Ethernet connectors on OCP module (optional)” on page 36	

Rear components overview

PCIe slots

The PCIe slots are on the rear or front of the server, and your server supports up to 12 PCIe slots. For more information, see “PCIe slots and PCIe adapters” in *User Guide* or *Hardware Maintenance Guide*.

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.

Power supplies

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 [“Power supply LEDs” on page 58](#).

NMI button

Use this button only when you are directed to do so by Lenovo Support. 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.

USB 3 (5 Gbps) connectors

The USB 3.2 Gen 1 (5 Gbps) connectors are direct connect interfaces (DCIs) for debugging, which 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.

XCC system management port

The server has a 1 Gb RJ-45 connector dedicated to Lenovo XClarity Controller (XCC) functions. Through the system management port, you can access the Lenovo XClarity Controller directly by connecting your laptop to the management port using an Ethernet cable. Make sure that you modify the IP settings on the laptop so that it is on the same network as the server default settings. A dedicated management network provides additional security by physically separating the management network traffic from the production network.

For more information, see:

- [Set the network connection for the Lenovo XClarity Controller](#)
- [“XCC system management port LEDs” on page 58](#)

Ethernet connectors

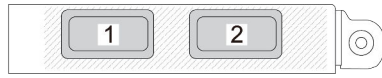


Figure 9. OCP module (two connectors)

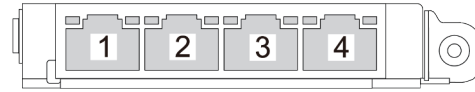


Figure 10. OCP module (four connectors)

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

By default, one of the Ethernet connectors on the OCP module can also function as a management connector using the shared management capacity.

Inlet and outlet hoses

The Direct Water Cooling Module (DWCM) spreads two hoses out to connect to the manifolds. The inlet hose conveys warm water from the facility to the cold plates to cool down the processors, and the outlet hose conducts hot water out of the DWCM to realize system cooling.

Top view

This section contains information on the top view of the server with standard heat sinks or a direct water cooling module (DWCM).

Notes:

- The following illustrations show the top view of the server without any air baffle, middle cage, or rear cage installed.
- The following illustrations show the server rear configuration with three riser assemblies. The server rear configurations vary by server model. For details, see [“Rear view” on page 29](#).

Top view with standard heat sinks

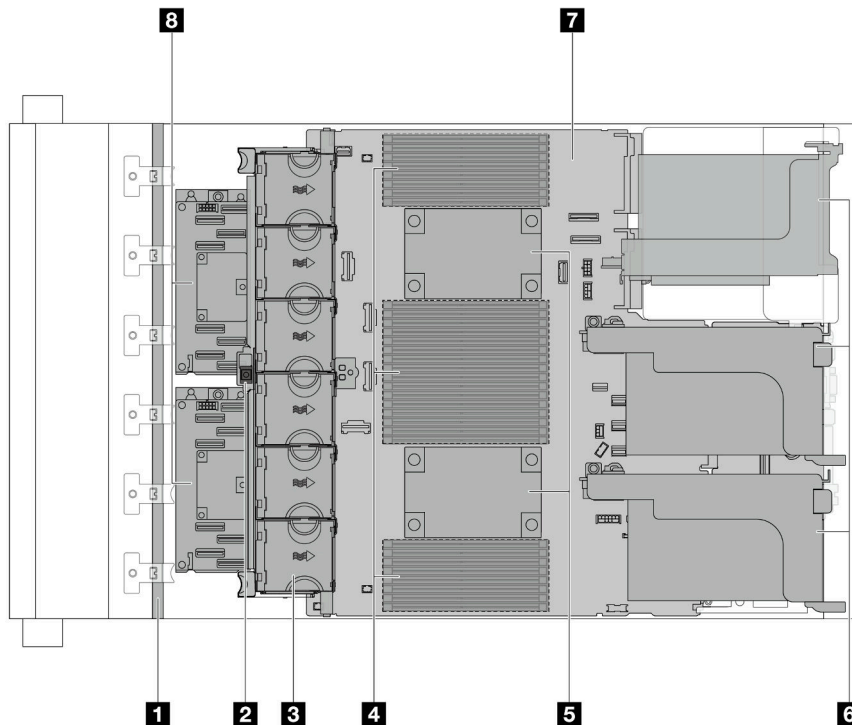


Figure 11. Top view with standard heat sinks

Table 25. Component identification (top view with standard heat sinks)

1 Front backplane(s)	2 Intrusion switch
3 System fans	4 Memory modules
5 Processor and heat sink modules (PHM)	6 Riser assemblies
7 System board assembly	8 CFF RAID adapter/expander

Note: The illustration shows the server with CFF adapters which are available only in the 2.5-inch chassis. In some configurations, there might be installed with a RAID flash power module. For details, see “Location of RAID flash power modules” in *User Guide* or *Hardware Maintenance Guide*.

Top view with DWCM

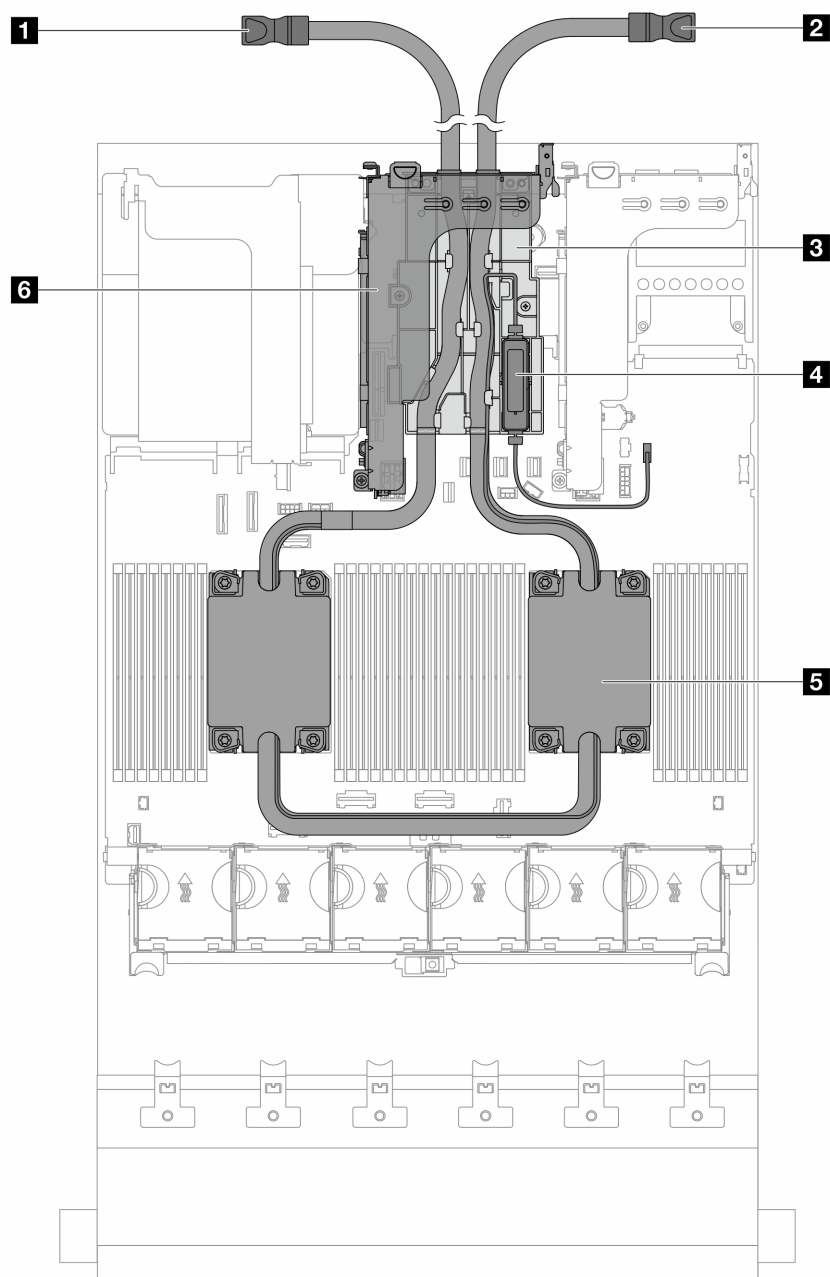


Figure 12. Top view with DWCM

Table 26. Components identification (top view of DWCM)

1 Outlet hose	2 Inlet hose
3 Hose holder	4 Liquid detection sensor module
5 Cold plate assembly	6 Riser cage for DWCM

System-board-assembly layout

This section provides information about the connectors, switches, and jumpers that are available on the system board assembly.

The following illustration shows the layout of the system board assembly which contains the firmware and RoT security module, system I/O board, and processor board.

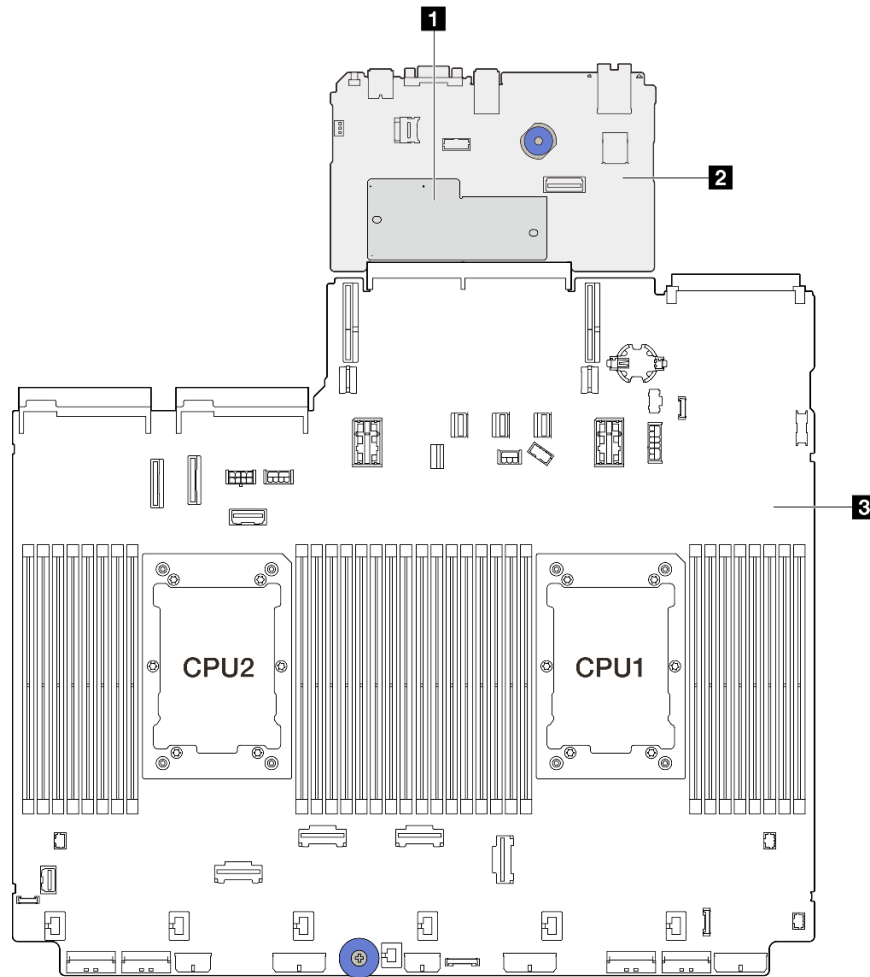


Figure 13. System-board-assembly layout

1 Firmware and RoT security module	2 System I/O board	3 Processor board
---	---------------------------	--------------------------

For more information about the connectors, switches, or LEDs that are available on the system board assembly, see:

- [“System-board-assembly connectors” on page 40](#)
- [“System-board-assembly switches” on page 41](#)
- [“System-board-assembly LEDs” on page 59](#)
- [“LEDs on the firmware and RoT security module” on page 62](#)

System-board-assembly connectors

The following illustration shows the internal connectors on the system board assembly which contains the system I/O board and processor board.

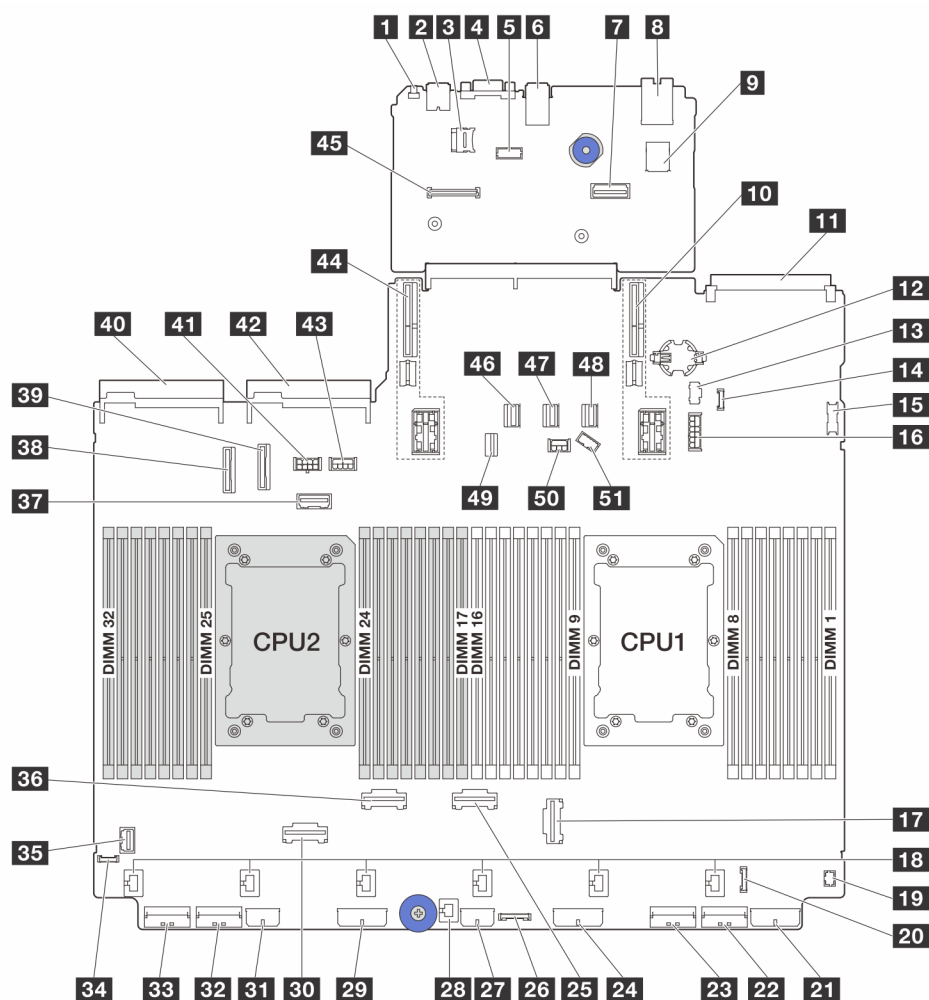


Figure 14. System-board-assembly connectors

1 NMI button	2 Rear USB connector
3 MicroSD socket	4 VGA connector
5 Serial port connector	6 Rear USB connectors
7 Second management Ethernet connector	8 XCC system management port
9 Internal USB connector	10 Riser 1 slot
11 OCP 3.0 slot	12 CMOS battery (CR2032)
13 M.2 power connector	14 Leak detection connector
15 Front USB connector	16 7mm backplane power connector
17 PCIe connector 3	18 Fan connectors
19 Front I/O connector (for Y cable)	20 Front I/O connector

21 Backplane 3 power connector	22 PCIe connector 1
23 PCIe connector 2	24 Backplane 2 power connector
25 PCIe connector 4	26 CFF Retimer connector
27 CFF expander power connector	28 Intrusion switch connector
29 Backplane 1 power connector	30 PCIe connector 6
31 CFF RAID/HBA power connector	32 PCIe connector 7
33 PCIe connector 8	34 External diagnostics connector
35 Front VGA connector	36 PCIe connector 5
37 Riser 3 sideband connector	38 PCIe connector 9
39 PCIe connector 10	40 Power supply 1 connector
41 Riser 3 power connector	42 Power supply 2 connector
43 GPU power connector	44 Riser 2 slot
45 Firmware and RoT security module connector	46 SATA connector 0
47 SATA connector 1	48 SATA connector 2
49 M.2/7mm backplane signal connector	50 Backplane power connector
51 Backplane sideband connector	

System-board-assembly switches

The following illustrates locations and functions of the switch block on the on the system board assembly which contains the system I/O board and processor board.

Important:

- Before you change any switch settings or move any jumpers, turn off the server; then, disconnect all power cords and external cables. Review the following information:
 - https://pubs.lenovo.com/safety_documentation/
 - “Installation Guidelines”, “Handling static sensitive devices”, and “Power off the server ” in *User Guide* or *Hardware Maintenance Guide*.
- Any system-board switch or jumper block that is not shown in the illustrations in this document are reserved.

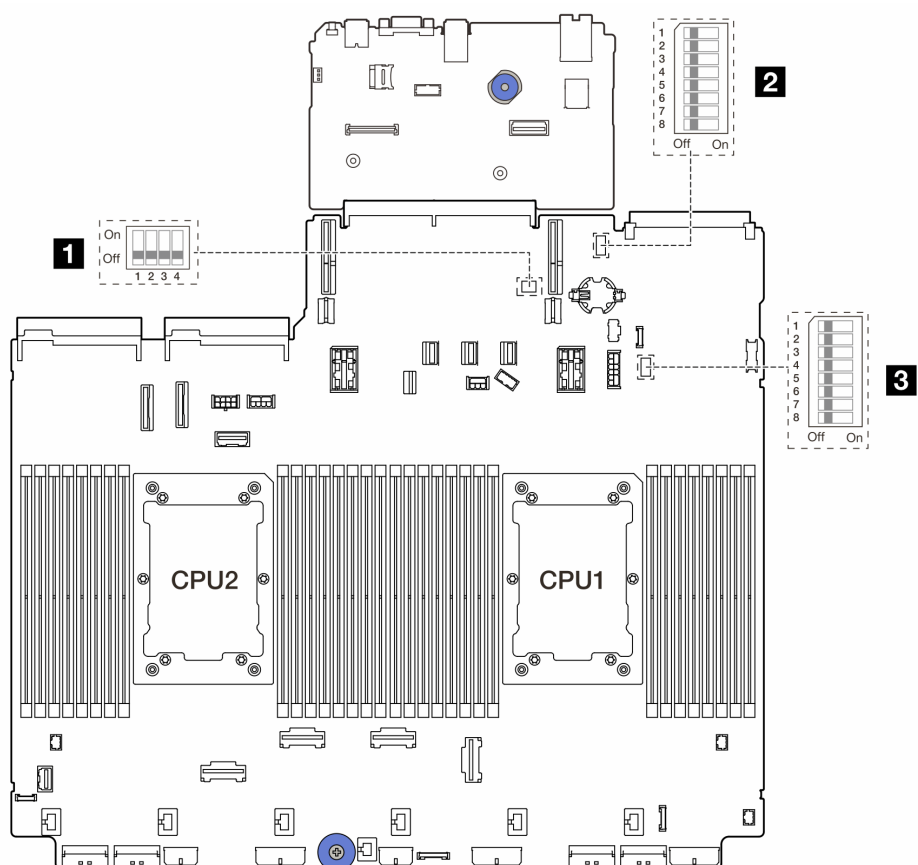
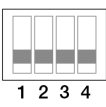


Figure 15. System-board-assembly switch blocks

1 SW2	2 SW6	3 SW7
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SW2 switch block

Table 27. SW2 switch block

Switch block	Switch number	Switch name	Default position	Description
On Off 	SW2-1	FPGA reset	OFF	Forces FPGA into reset when changing it to the ON position.
	SW2-2	Force BMC CPU reset	OFF	Forces BMC and CPU into reset when changing it to the ON position.
	SW2-3	Reserved	OFF	Reserved
	SW2-4	BIOS image swap	OFF	Enables BIOS image swap when changing it to the ON position.


SW6 switch block

Table 28. SW6 switch block

Switch block	Switch number	Switch name	Default position	Description
	SW6-1	ME security override	OFF	Disables ME Security checks when changing it to the ON position.
	SW6-2	Clear CMOS	OFF	Clears the real-time clock (RTC) registry when changing it to the ON position.
	SW6-3	Password override	OFF	Overrides the power-on password when changing it to the ON position.
	SW6-4	ME recovery	OFF	Boots ME into recovery mode when changing it to the ON position.
	SW6-5	BIOS recovery	OFF	Boots BIOS into recovery mode when changing it to the ON position.
	SW6-6	Reserved	OFF	Reserved
	SW6-7	Reserved	OFF	Reserved
	SW6-8	Reserved	OFF	Reserved

SW7 switch block

Table 29. SW7 switch block

Switch block	Switch number	Switch name	Default position	Description
	SW7-1	XCC boot primary	OFF	XCC boots from upper half of flash region when switched to ON.
	SW7-2	XCC force update	OFF	XCC boots from kernel code only when switched to ON.
	SW7-3	Power permission override	OFF	Ignores Power Permission and allows system to power-on when switched to ON.
	SW7-4	Force XCC reset	OFF	Forces XCC into reset when switched to ON.
	SW7-5	Reserved	OFF	Reserved
	SW7-6	Reserved	OFF	Reserved
	SW7-7	Reserved	OFF	Reserved
	SW7-8	Reserved	OFF	Reserved

System LEDs and diagnostics display

See the following section for information on available system LEDs and diagnostics display.

Drive LEDs

This topic provides information on 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.

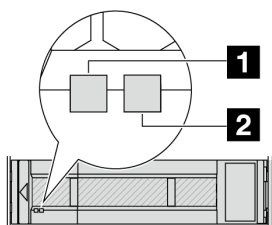


Figure 16. Drive LEDs

Drive LED	Status	Description
1 Drive activity LED (left)	Solid green	The drive is powered but not active.
	Blinking green	The drive is active.
2 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 drive is being identified.

Front operator panel LEDs

This topic provides information on the front operator panel LEDs.

Depending on the server model, the server comes with the front operator panel without LCD display or front operator with LCD display (integrated diagnostics panel). For information about the integrated diagnostics panel with LCD display, see [“Integrated diagnostics panel” on page 46](#).

The following illustration shows the front operator panel on the media bay. For some server models, the front operator panel is integrated on the rack latch. See [“Front I/O module” on page 26](#).

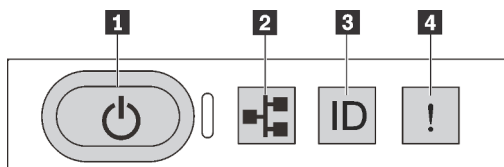


Figure 17. Front operator panel LEDs

1 Power button with power status LED (green)	2 Network activity LED (green)
3 System ID button with system ID LED (blue)	4 System Error LED (yellow)

1 Power button with power status LED (green)

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 states of the power LED are as follows:

Status	Color	Description
Off	None	Power is not present, or the power supply has failed.
Fast blinking (about four flashes per second)	Green	<ul style="list-style-type: none"> The server is off, but the XClarity Controller is initializing, and the server is not ready to be powered on. System-board-assembly power has failed.
Slow blinking (about one flash per second)	Green	The server is off and is ready to be powered on (standby state).
Solid on	Green	The server is on and running.

2 Network activity LED (green)

Compatibility of the NIC adapter and the network activity LED:

NIC adapter	Network activity LED
OCP module	Support
PCIe NIC adapter	Not support

When an OCP module is installed, the network activity LED on the front I/O module helps you identify the network connectivity and activity. If no OCP module 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	<p>The server is disconnected from the network.</p> <p>Note: If the network activity LED is off when an OCP module is installed, check the network ports in the rear of your server to determine which port is disconnected.</p>

3 System ID button with system ID LED (blue)

Use this system ID button and the blue system ID LED to visually locate the server. Each time you press the system ID button, the state of the system ID LED changes. The LED 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 LED 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 (yellow)

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

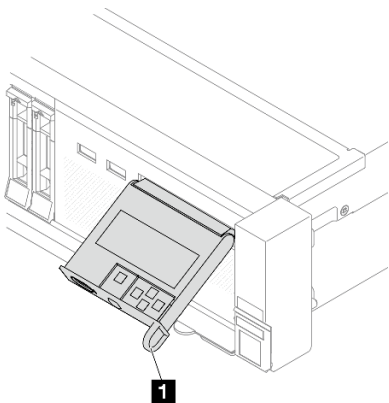
Status	Color	Description	Action
On	Yellow	<p>An error has been detected on the server. Causes might include but are not limited to the following errors:</p> <ul style="list-style-type: none"> • A fan failure • A memory error • A storage failure • A PCIe device failure • A power supply failure • A processor error • A system I/O board or processor board error 	<ul style="list-style-type: none"> • Check the Lenovo XClarity Controller event log and the system event log to determine the exact cause of the error. • Check if additional LEDs elsewhere in the server are also lit that will direct you to the source of the error. See “System LEDs and diagnostics display” on page 43. • Save the log if necessary.
Off	None	The server is off, or the server is on and is working correctly.	None.

Integrated diagnostics panel

The Integrated diagnostics panel is attached to the front of the server, while it allows quick access to system information such as errors, system status, firmware, network, and health information.

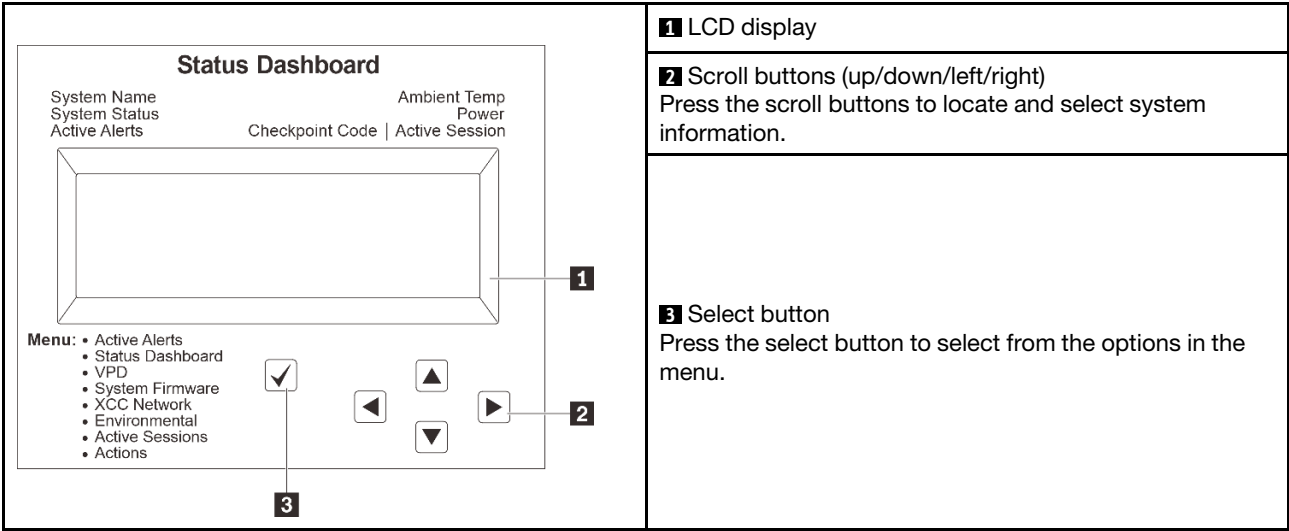
- [“Diagnostics panel location” on page 46](#)
- [“Diagnostics panel overview” on page 46](#)
- [“Options flow diagram” on page 47](#)
- [“Full menu list” on page 48](#)

Diagnostics panel location

	<p>1 The handle with which the panel can be pulled out and inserted into the server.</p> <p>Notes:</p> <ul style="list-style-type: none"> • 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.
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Diagnostics panel overview

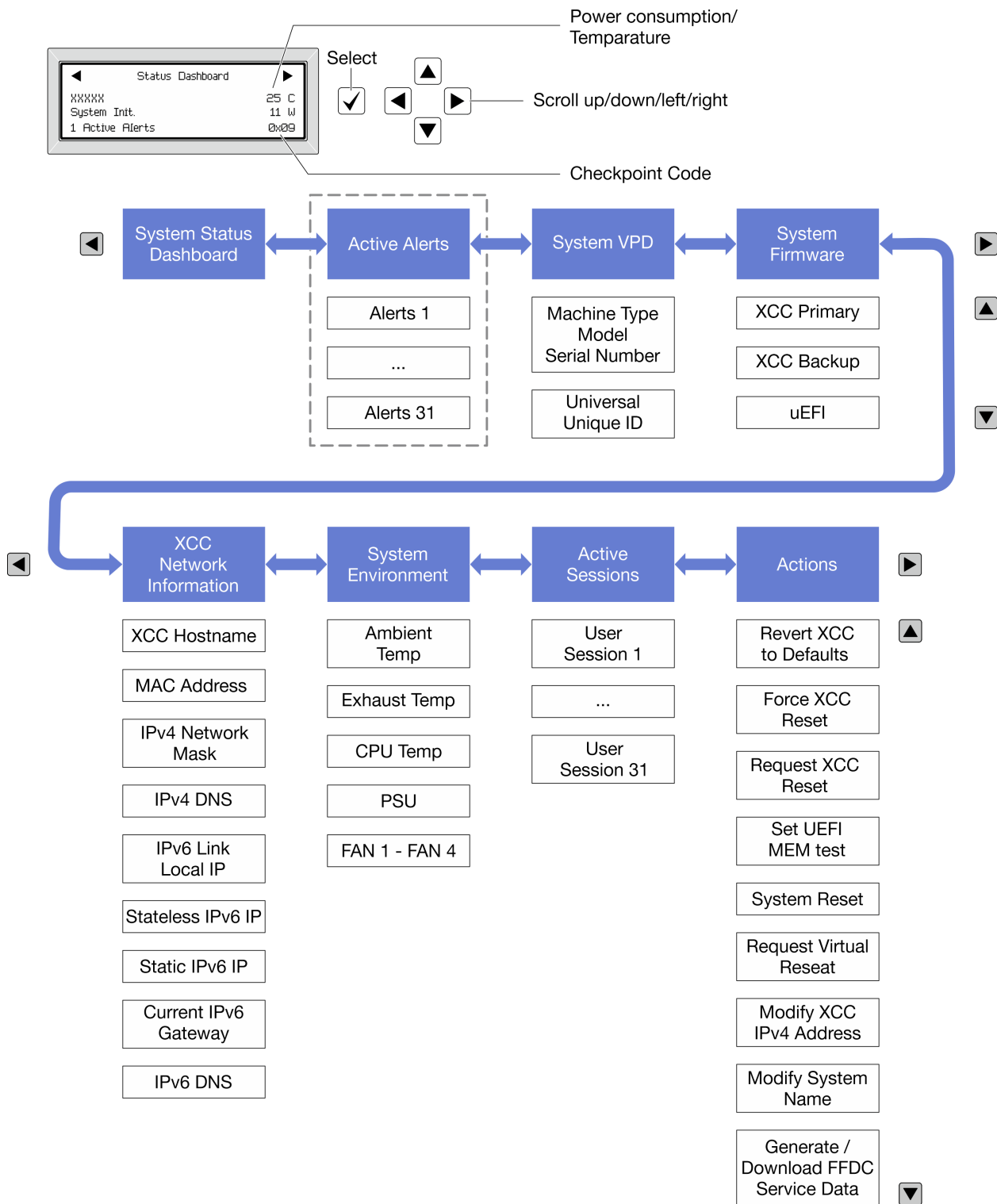
The diagnostics device consists of an LCD display and 5 navigation buttons.



Options flow diagram

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

Depending on the model, the options and entries on the LCD display might be different.

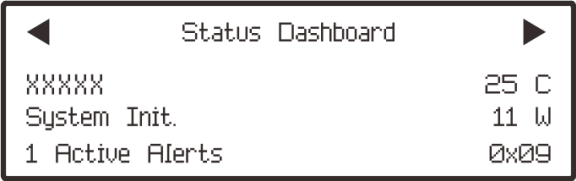


Full menu list

Following is the list of options available on the diagnostics panel or 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.

Depending on the model, the options and entries on the LCD display might be different.

Home Menu (System Status Dashboard)

Home Menu	Example
<ol style="list-style-type: none"> 1 System name 2 System status 3 Active alert quantity 4 Temperature 5 Power consumption 6 Checkpoint code 	

Active Alerts

Sub Menu	Example
<p>Home screen: Active error quantity</p> <p>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.</p>	<p>1 Active Alerts</p>
<p>Details screen:</p> <ul style="list-style-type: none"> • Error message ID (Type: Error/Warning/Information) • Occurrence time • Possible sources of the error 	<p>Active Alerts: 1</p> <p>Press ▼ to view alert details</p> <p>FQXSPPU009N(Error)</p> <p>04/07/2020 02:37:39 PM</p> <p>CPU 1 Status:</p> <p>Configuration Error</p>

System VPD Information

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

System Firmware

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

XCC Network Information

Sub Menu	Example
<ul style="list-style-type: none">XCC hostnameMAC addressIPv4 Network MaskIPv4 DNSIPv6 Link Local IPStateless IPv6 IPStatic IPv6 IPCurrent IPv6 GatewayIPv6 DNS <p>Note: Only the MAC address that is currently in use is displayed (extension or shared).</p>	XCC Network Information XCC Hostname: XCC-xxxx-SN MAC Address: xx:xx:xx:xx:xx:xx IPv4 IP: xx.xx.xx.xx IPv4 Network Mask: x.x.x.x IPv4 Default Gateway: x.x.x.x

System Environmental Information

Sub Menu	Example
<ul style="list-style-type: none">• Ambient temperature• Exhaust temperature• CPU temperature• PSU status• Spinning speed of fans by RPM	Ambient Temp: 24 C Exhaust Temp: 30 C CPU1 Temp: 50 C PSU1: Vin= 213 w Inlet= 26 C FAN1 Front: 21000 RPM FAN2 Front: 21000 RPM FAN3 Front: 21000 RPM FAN4 Front: 21000 RPM

Active Sessions

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

Actions

Sub Menu	Example
Several quick actions supported for users <ul style="list-style-type: none">• Revert XCC to Defaults• Force XCC Reset• Request XCC Reset• Set UEFI Memory Test• Request Virtual Reseat• Modify XCC Static IPv4 Address/Net mask/ Gateway• Modify System Name• Generate/Download FFDC Service Data	Request XCC Reset? This will request the BMC to reboot itself. Hold ✓ for 3 seconds

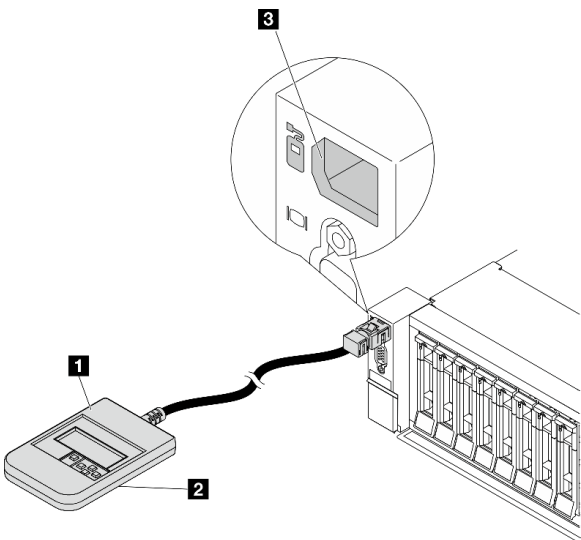
External diagnostics handset

The external diagnostics handset is an external device that can be connected to the server with a cable, and it allows quick access to system information such as errors, system status, firmware, network, and health information.

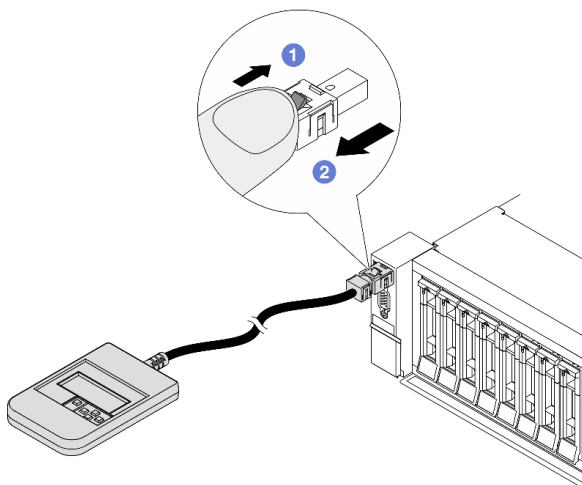
Note: The External Diagnostics Handset is an optional part that needs to be purchased separately.

- [“Location of the External Diagnostics Handset” on page 52](#)
- [“Diagnostics panel overview” on page 52](#)
- [“Options flow diagram” on page 54](#)
- [“Full menu list” on page 55](#)

Location of the External Diagnostics Handset

Location	Description
<p>The External Diagnostics Handset is connected to the server with an external cable.</p> 	1 External Diagnostics Handset
	2 Magnetic bottom With this component, the diagnostic handset can be attached to the top or side of the rack with hands spared for service tasks.
	3 External diagnostics connector This connector is located on the front of the server and is 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.

Diagnostics panel overview

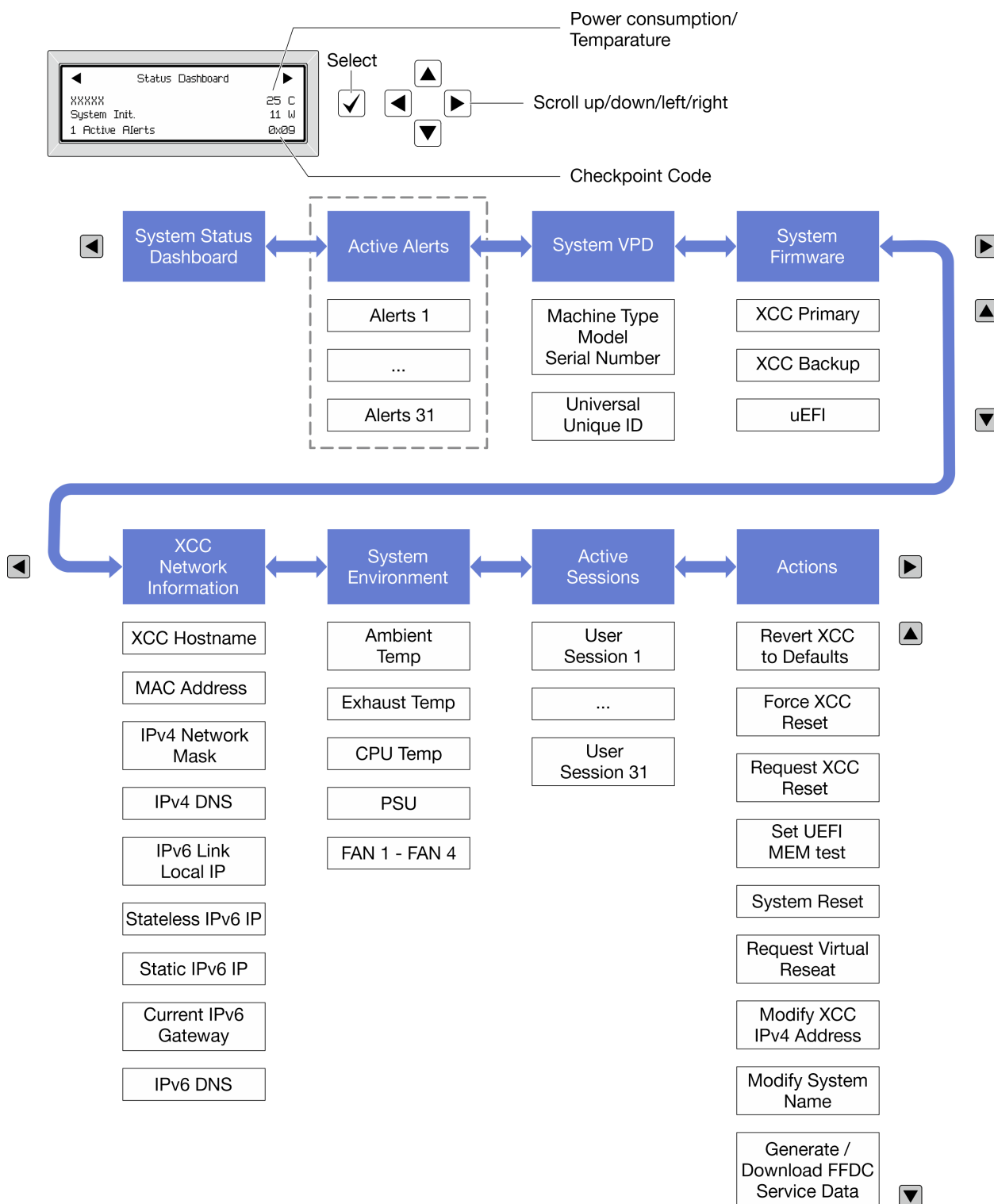
The diagnostics device consists of an LCD display and 5 navigation buttons.

<div data-bbox="201 214 727 634"><p>Status Dashboard</p><div><div>System Name</div><div>System Status</div><div>Active Alerts</div></div><div><div>Ambient Temp</div><div>Power</div><div>Checkpoint Code Active Session</div></div></div> <div data-bbox="240 319 682 495"></div> <div data-bbox="207 499 409 634"><p>Menu:</p><ul style="list-style-type: none">• Active Alerts• Status Dashboard• VPD• System Firmware• XCC Network• Environmental• Active Sessions• Actions</div> <div data-bbox="448 529 701 621"><div><input checked="" type="checkbox"/></div><div><div>◀</div><div>▶</div></div><div><div>▲</div><div>▼</div></div></div>
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Options flow diagram

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

Depending on the model, the options and entries on the LCD display might be different.

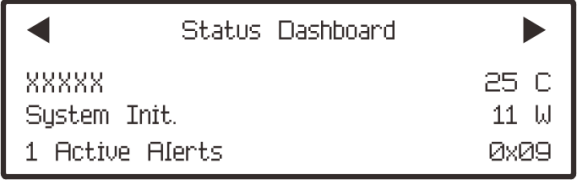


Full menu list

Following is the list of options available on the diagnostics panel or 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.

Depending on the model, the options and entries on the LCD display might be different.

Home Menu (System Status Dashboard)

Home Menu	Example
<ul style="list-style-type: none">1 System name2 System status3 Active alert quantity4 Temperature5 Power consumption6 Checkpoint code	 <p>The screenshot shows a menu titled "Status Dashboard" with left and right arrow navigation buttons. The menu items and their corresponding values are: "XXXXXX" (25 C), "System Init." (11 W), and "1 Active Alerts" (0x09).</p>

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: <ul style="list-style-type: none">• 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
<ul style="list-style-type: none">• Machine type and serial number• Universal Unique ID (UUID)	Machine Type: xxxx Serial Num: xxxxxx Universal Unique ID: xxxxxxxxxxxxxxxxxxxxxxxxxxxx

System Firmware

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

XCC Network Information

Sub Menu	Example
<ul style="list-style-type: none">XCC hostnameMAC addressIPv4 Network MaskIPv4 DNSIPv6 Link Local IPStateless IPv6 IPStatic IPv6 IPCurrent IPv6 GatewayIPv6 DNS <p>Note: Only the MAC address that is currently in use is displayed (extension or shared).</p>	XCC Network Information XCC Hostname: XCC-xxxx-SN MAC Address: xx:xx:xx:xx:xx:xx IPv4 IP: xx.xx.xx.xx IPv4 Network Mask: x.x.x.x IPv4 Default Gateway: x.x.x.x

System Environmental Information

Sub Menu	Example
<ul style="list-style-type: none"> Ambient temperature Exhaust temperature CPU temperature PSU status Spinning speed of fans by RPM 	Ambient Temp: 24 C Exhaust Temp: 30 C CPU1 Temp: 50 C PSU1: Vin= 213 w Inlet= 26 C FAN1 Front: 21000 RPM FAN2 Front: 21000 RPM FAN3 Front: 21000 RPM FAN4 Front: 21000 RPM

Active Sessions

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

Actions

Sub Menu	Example
Several quick actions supported for users <ul style="list-style-type: none"> Revert XCC to Defaults Force XCC Reset Request XCC Reset Set UEFI Memory Test Request Virtual Reseat Modify XCC Static IPv4 Address/Net mask/ Gateway Modify System Name Generate/Download FFDC Service Data 	Request XCC Reset? This will request the BMC to reboot itself. Hold ✓ for 3 seconds

Rear system LEDs

This topic provides information on the system ID LED and the system error LED on the rear of the server.

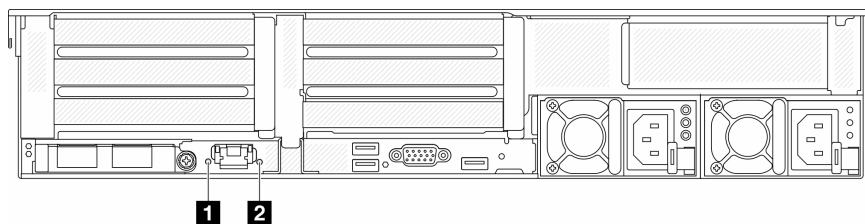


Figure 18. Rear system LEDs

LED	Description	Action
1 System ID LED (blue)	This LED helps you to visually locate the server.	A system ID button with LED is also located on the front of the server. You can press the system ID button to turn on/off or blink the front and rear ID LEDs.
2 System error LED (yellow)	LED on: an error has occurred.	Check system logs or internal error LEDs to identify the failed part. For more information, see “System error LED” on page .

XCC system management port LEDs

This topic provides information on LEDs of XCC system management port.

The following table describes the problems that are indicated by LEDs on XCC system management port.

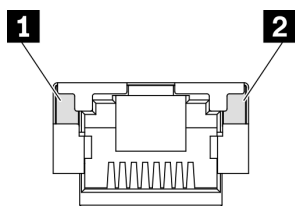


Figure 19. XCC system management port LEDs

LED	Description
1 Ethernet port link LED	Use this green LED to distinguish the network connectivity status: <ul style="list-style-type: none"> Off: The network link is disconnected. Green: The network link is established.
2 Ethernet port activity LED	Use this green LED to distinguish the network activity status: <ul style="list-style-type: none"> Off: The server is disconnected from a LAN. Green: The network is connected and active.

Power supply LEDs

This topic provides information about various power supply LED status and corresponding action suggestions.

The following minimal configuration is required for the server to start:

- One processor in socket 1
- One DIMM in slot 7
- One power supply
- One HDD/SSD drive, one M.2 drive, or one 7mm drive (if OS is needed for debugging)
- Five system fans

The following table describes the problems that are indicated by various combinations of the power-supply LEDs and the power-on LED and suggested actions to correct the detected problems.

Note: Depending on the power supply type, your power supply might look slightly different from the following illustration.

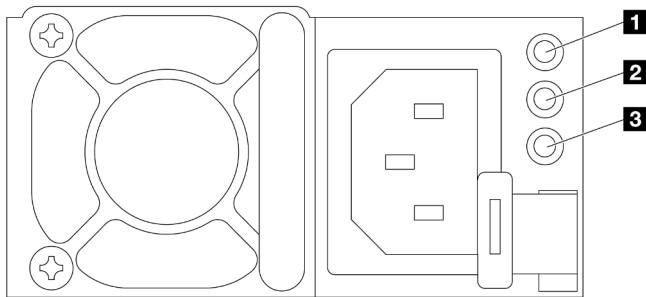


Figure 20. Power supply LEDs

LED	Description
1 Input status	<p>The input status LED can be in one of the following states:</p> <ul style="list-style-type: none"> Green: The power supply is connected to the input power source. Off: The power supply is disconnected from the input power source.
2 Output status	<p>The output status LED can be in one of the following states:</p> <ul style="list-style-type: none"> Off: The server is powered off, or the power supply is not working properly. If the server is powered on but the power output LED is off, replace the power supply. Green: The server is on and the power supply is working normally. Blinking green: The power supply is in 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 entire load. When the power load increases, the standby power supply will switch to active state to provide sufficient power to the server. <p>Zero-output mode can be disabled via Setup utility or Lenovo XClarity Controller web interface. If you disable zero-output mode, both power supplies will be in the active state.</p> <ul style="list-style-type: none"> Start the Setup utility, go to System Settings → Power → Zero Output and select Disable. Log in to the Lenovo XClarity Controller web interface, choose Server Configuration → Power Policy, disable Zero Output Mode, and then click Apply.
3 Power supply error LED	<ul style="list-style-type: none"> Off: The power supply is working normally Yellow: Dump the FFDC log from affected systems and escalate to next level for PSU data log reviewing.

System-board-assembly LEDs

The following illustrations show the light-emitting diodes (LEDs) on the system-board-assembly which contains the system I/O board and processor board.

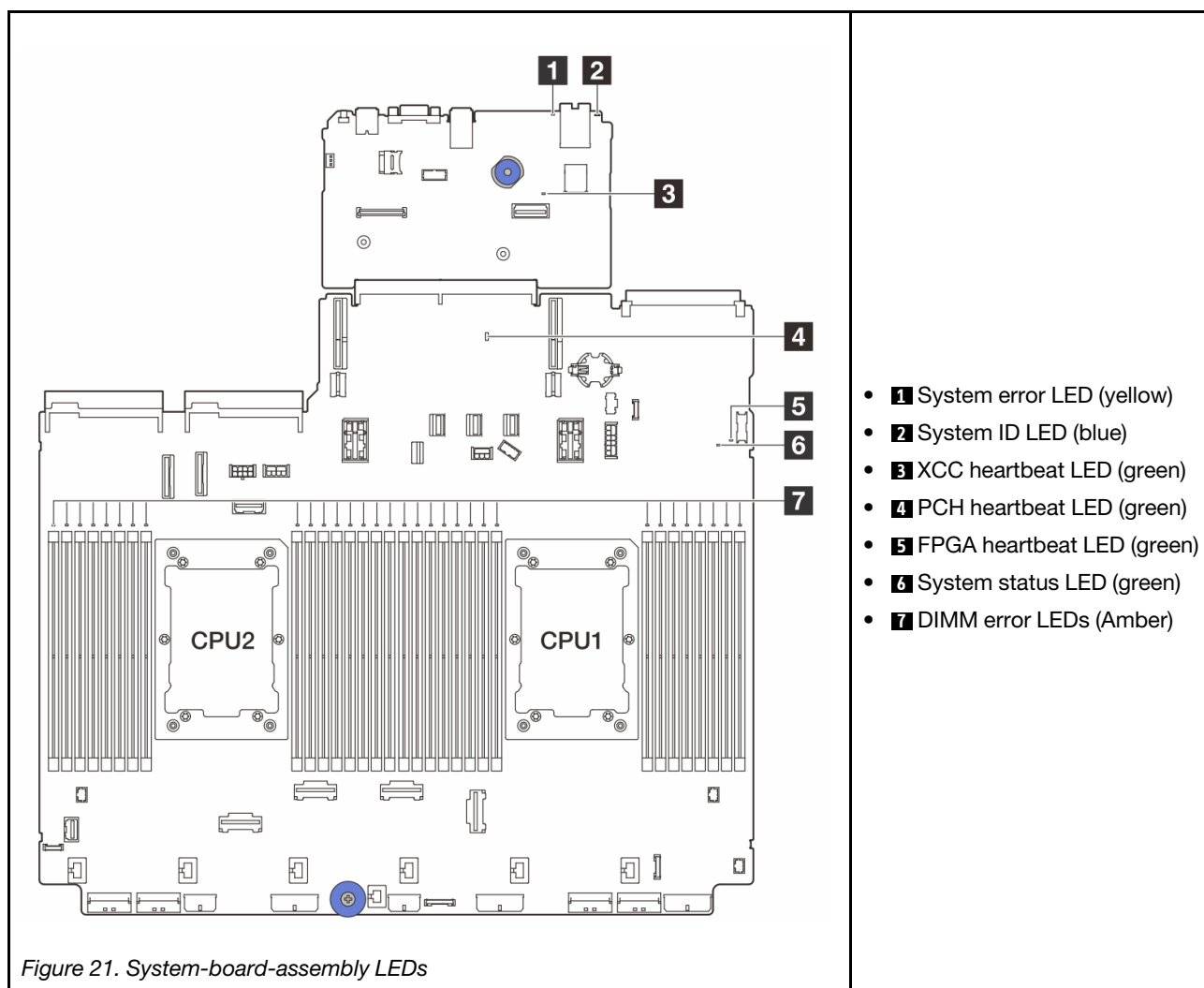


Table 30. System-board-assembly LEDs

LED	Description	Action
1 System error LED (yellow)	LED on: an error has occurred.	Check system logs or internal error LEDs to identify the failed part. For more information, see “System error LED” on page .
2 System ID LED (blue)	This LED helps you to visually locate the server.	A system ID button with LED is also located on the front of the server. You can press the system ID button to turn on/off or blink the front and rear ID LEDs.

Table 30. System-board-assembly LEDs (continued)

LED	Description	Action
3 XCC heartbeat LED (green)	<p>The XCC heartbeat LED helps you identify the XCC status.</p> <ul style="list-style-type: none"> Blinking (about one flash per second) : XCC is working normally. Blinking at other speeds or always on: XCC is at the initial phase or is working abnormally. Off: XCC is not working. 	<ul style="list-style-type: none"> If the XCC heartbeat LED is always off or always on, do the following: <ul style="list-style-type: none"> If XCC cannot be access: <ol style="list-style-type: none"> Re-plug the power cord. Check and ensure that the system I/O board and the firmware and RoT security module are installed correctly. (Trained technician only) Reinstall them if needed. (Trained technician only) Replace the firmware and RoT security module. (Trained technician only) Replace the system I/O board. If XCC can be access, replace the system I/O board. If the XCC heartbeat LED is always blinking fast over 5 minutes, do the following: <ol style="list-style-type: none"> Re-plug the power cord. Check and ensure that the system I/O board and the firmware and RoT security module are installed correctly. (Trained technician only) Reinstall them if needed. (Trained technician only) Replace the firmware and RoT security module. (Trained technician only) Replace the system I/O board. If the XCC heartbeat LED is always blinking slow over 5 minutes, do the following: <ol style="list-style-type: none"> Re-plug the power cord. Check and ensure that the system I/O board and the firmware and RoT security module are installed correctly. (Trained technician only) Reinstall them if needed. If the problem remains, contact Lenovo Support.
4 PCH heartbeat LED (green)	<p>The PCH heartbeat LED helps you identify the PCH status.</p> <ul style="list-style-type: none"> Blinking (about one flash per second): system ME is working normally. Off: system ME is not working. 	<p>If the PCH heartbeat LED is always off or always on, do the following:</p> <ol style="list-style-type: none"> Check and ensure that the system I/O board and the firmware and RoT security module are installed correctly. (Trained technician only) Reinstall them if needed. Make sure the UEFI firmware has been flashed to the corresponding platform version. Update UEFI and XCC firmware to latest version. Check if there is ME error event triggered in system event log. If yes, and the above actions are done, replace the firmware and RoT security module. (Trained technician only) If it is still not working, replace the processor board.

Table 30. System-board-assembly LEDs (continued)

LED	Description	Action
5 FPGA heartbeat LED (green)	<p>The FPGA heartbeat LED helps you identify the FPGA status.</p> <ul style="list-style-type: none"> Blinking (about one flash per second): FPGA is working normally. On or off: FPGA is not working. 	<p>If FPGA heartbeat LED is always off or always on, do the following:</p> <ol style="list-style-type: none"> Replace the processor board. If the problem remains, contact Lenovo Support.
6 System status LED (green)	<p>The system status LED indicates the working status of the system.</p> <ul style="list-style-type: none"> Fast blinking (about four flashes per second): Power fault or is waiting for XCC power permission ready. Slow blinking (about one flash per second): Power off and is ready to be powered on (standby state). ON: Power on 	<ul style="list-style-type: none"> If the system status LED is blinking fast over 5 minutes and cannot power on, check the XCC heartbeat LED and follow the actions for the XCC heartbeat LED. If the system status LED remains off or is blinking fast (about four flashes per second) and the system error LED on the front panel is on (yellow), the system is in a power fault status. Do the following: <ol style="list-style-type: none"> Re-plug the power cord. Remove installed adapters/devices, one at a time, until you reach the minimal configuration for debugging. (Trained technician only) If the problem remains, capture FFDC log, and replace the processor board. If the problem still remains, contact Lenovo Support.
7 DIMM error LEDs (Amber)	LED on: an error has occurred to the DIMM the LED represents.	For more information, see “Memory problems” in the <i>User Guide</i> .

LEDs on the firmware and RoT security module

The following illustrations show the light-emitting diodes (LEDs) on the ThinkSystem V3 Firmware and Root of Trust Security Module (firmware and RoT security module).

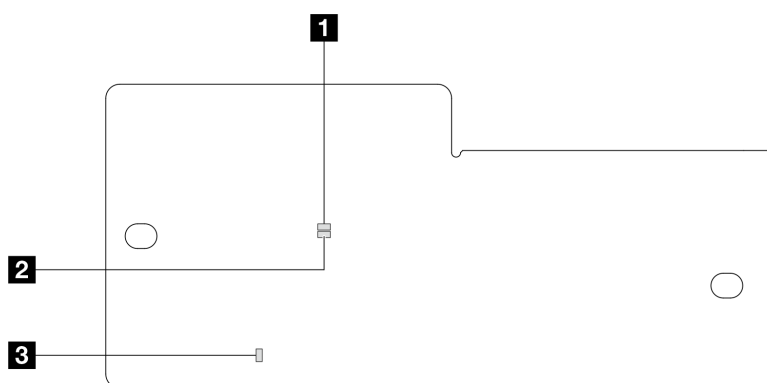


Figure 22. LEDs on the firmware and RoT security module

1 AP0 LED (Green)	2 AP1 LED (Green)	3 Fatal Error LED (Amber)
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Table 31. LEDs description

Scenario	AP0 LED	AP1 LED	Fatal Error LED	FPGA heart-beat LED	XCC heart-beat LED	Actions
RoT security module fatal firmware failure	Off	Off	On	N/A	N/A	Replace the firmware and RoT security module.
	Blink	N/A	On	N/A	N/A	Replace the firmware and RoT security module.
	Blink	N/A	On	On	N/A	Replace the firmware and RoT security module.
No system power (FPGA heartbeat LED off)	Off	Off	Off	Off	Off	<p>If the AC power is on, but the system board assembly does not have power, then:</p> <ol style="list-style-type: none"> 1. Check the power supply unit (PSU) or power interposer board (PIB) if any. If the PSU or PIB has any error, replace it. 2. If the PSU or PIB is good, do the following: <ol style="list-style-type: none"> a. Replace the system I/O board. b. Replace the processor board.
XCC firmware recoverable error	Blink	N/A	Off	N/A	N/A	Information only. No action is required.
XCC firmware is recovered from error	Blink	N/A	Off	N/A	N/A	Information only. No action is required.
UEFI firmware authentication failure	N/A	Blink	Off	N/A	N/A	Information only. No action is required.
UEFI firmware is recovered from authentication failure	N/A	On	Off	N/A	N/A	Information only. No action is required.
System is OK (FPGA heartbeat LED is On)	On	On	Off	On	On	Information only. No action is required.

Note: For locations of the FPGA LED and XCC heartbeat LED, see [“System-board-assembly LEDs” on page 59](#).

LED on the liquid detection sensor module

This topic provides information about the LED on the liquid detection sensor module.

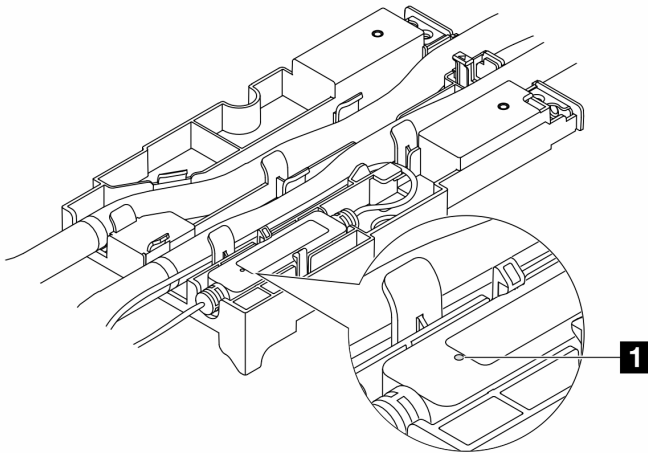


Figure 23. LED on the liquid detection sensor module

1 LED on the liquid detection sensor module	
Description	<ul style="list-style-type: none"> • Solid green: No coolant leakage detected. • Blinking green: Abnormal status detected.
Action	See “Coolant leak problems (Direct Water Cooling Module)” in <i>User Guide</i> or <i>Hardware Maintenance Guide</i> .

Chapter 3. Parts list

Identify each of the components that is available for your server with the parts list.

- “2.5-inch drive bay chassis” on page 65
- “3.5-inch drive bay chassis” on page 69

2.5-inch drive bay chassis

Use the parts list in this section to identify each of the components that are available for server models with 2.5-inch front drive bays.

For more information about ordering parts:

1. Go to <http://datacentersupport.lenovo.com> and navigate to the support page for your server.
2. Click **Parts**.
3. Enter the serial number to view a listing of parts for your server.

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

Note: Depending on the model, your server might look slightly different from the illustration. Some parts are available only on some models.

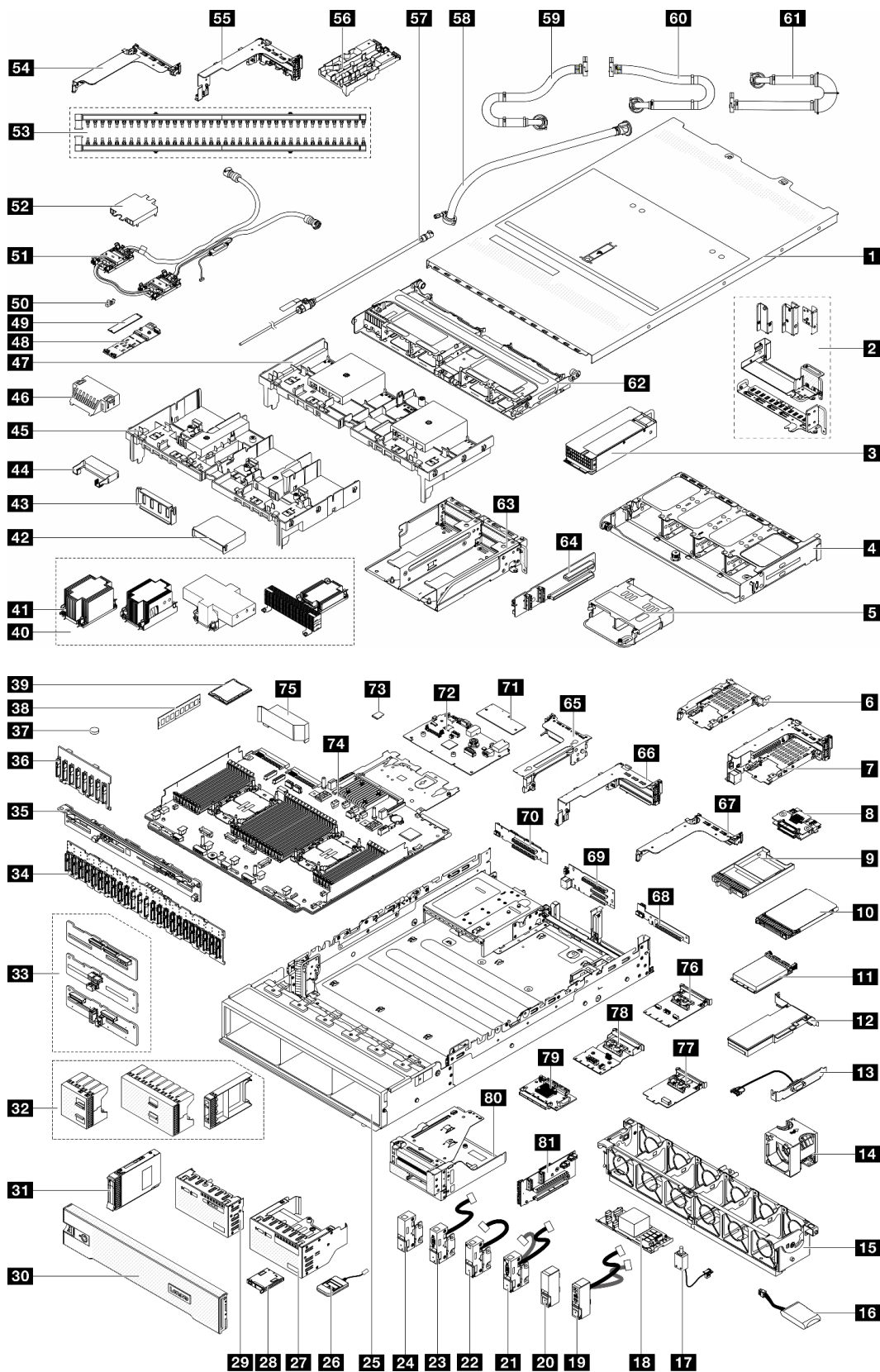


Figure 24. Server components (2.5-inch drive bay chassis)

The parts listed in the following table are identified as one of the following:

- **T1:** 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.
- **T2:** Tier 2 customer replaceable unit (CRU). You may install a Tier 2 CRU yourself or request Lenovo to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **F:** Field replaceable unit (FRU). FRUs must be installed only by trained service technicians.
- **C:** Consumable and Structural parts. Purchase and replacement of consumable and structural parts (components, such as a filler or bezel) is your responsibility. If Lenovo acquires or installs a structural component at your request, you will be charged for the service.

Description	Type	Description	Type
1 Top cover	T1	2 Rear wall brackets	T1
3 Power supply unit	T1	4 Rear 8 x 2.5-inch drive cage	T1
5 Rear 4 x 2.5-inch drive cage	T1	6 7mm drive cage (1U)	T1
7 7mm drive cage (2FH + 7mm)	T1	8 7mm drive backplanes	T2
9 7mm drive bay filler	C	10 7mm drive	T1
11 OCP module	T1	12 PCIe adapter	T1
13 Serial port module	T1	14 System fan	T1
15 System fan cage	T1	16 RAID flash power module	T1
17 Intrusion switch	T1	18 CFF RAID adapter/expander	T2
19 Right rack latch with front I/O module	T1	20 Standard right rack latch	T1
21 Left rack latch with VGA and external diagnostics ports	T1	22 Left rack latch with external diagnostics port	T1
23 Left rack latch with VGA port	T1	24 Standard left rack latch	T1
25 Chassis	F	26 External diagnostics handset	T1
27 Front I/O module with integrated diagnostics panel	T1	28 Integrated diagnostics panel	T1
29 Front I/O module with front operator panel	T1	30 Security bezel	C
31 2.5-inch drive	T1	32 2.5-inch drive fillers (1-bay, 4-bay, or 8-bay)	C
33 Middle/Rear 4 x 2.5-inch drive backplane	T1	34 Front 24 x 2.5-inch expander backplane	T1
35 Rear 8 x 2.5-inch drive backplane	T1	36 Front 8 x 2.5-inch drive backplane	T1
37 CMOS battery (CR2032)	C	38 Memory module	T1
39 Processor	F	40 Heat sinks	F
41 Heat sink PEEK nuts	T2	42 Add-on air baffle (for GPU air baffle)	T1
43 Air baffle filler (for GPU air baffle)	C	44 Add-on air baffle (for GPU air baffle)	T1
45 GPU air baffle	T1	46 Air baffle filler (for standard air baffle)	C
47 Standard air baffle	T1	48 M.2 drive backplane	T2
49 M.2 drive	T1	50 M.2 retainer clip	T1
51 Direct water cooling module	F	52 Cold plate cover	C
53 Manifolds	FRU	54 1FH riser cage for DWCM	C

Description	Type	Description	Type
55 3FH riser cage for DWCM	C	56 Hose holder	C
57 Bleeder kit	FRU	58 42U in-row hose kit	FRU
59 42U/48U in-rack connection hose (return side)	FRU	60 48U in-rack connection hose (supply side)	FRU
61 42U in-rack connection hose (supply side)	FRU	62 Middle drive cage	T1
63 4LP riser 3/4 cage	T1	64 Riser 3/4 card	T1
65 Riser 3 cage	T1	66 Riser 1 or riser 2 cage	T1
67 1U riser cage	T1	68 Riser card (LP)	T1
69 Riser 1 or riser 2 card	T1	70 Riser 3 card	T2
71 Firmware and RoT security module	F	72 System I/O board	F
73 MicroSD card	T1	74 Processor board	F
75 PSU air baffle	T1	76 OCP enablement kit for vSphere DSE	T1
77 Management NIC adapter	T1	78 Rear OCP interposer card	T1
79 Front OCP interposer card	T1	80 Front adapter cage	T1
81 Riser 5 card	T2		

3.5-inch drive bay chassis

Use the parts list in this section to identify each of the components that are available for server models with 3.5-inch front drive bays.

For more information about ordering parts:

1. Go to <http://datacentersupport.lenovo.com> and navigate to the support page for your server.
2. Click **Parts**.
3. Enter the serial number to view a listing of parts for your server.

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

Note: Depending on the model, your server might look slightly different from the illustration. Some parts are available only on some models.

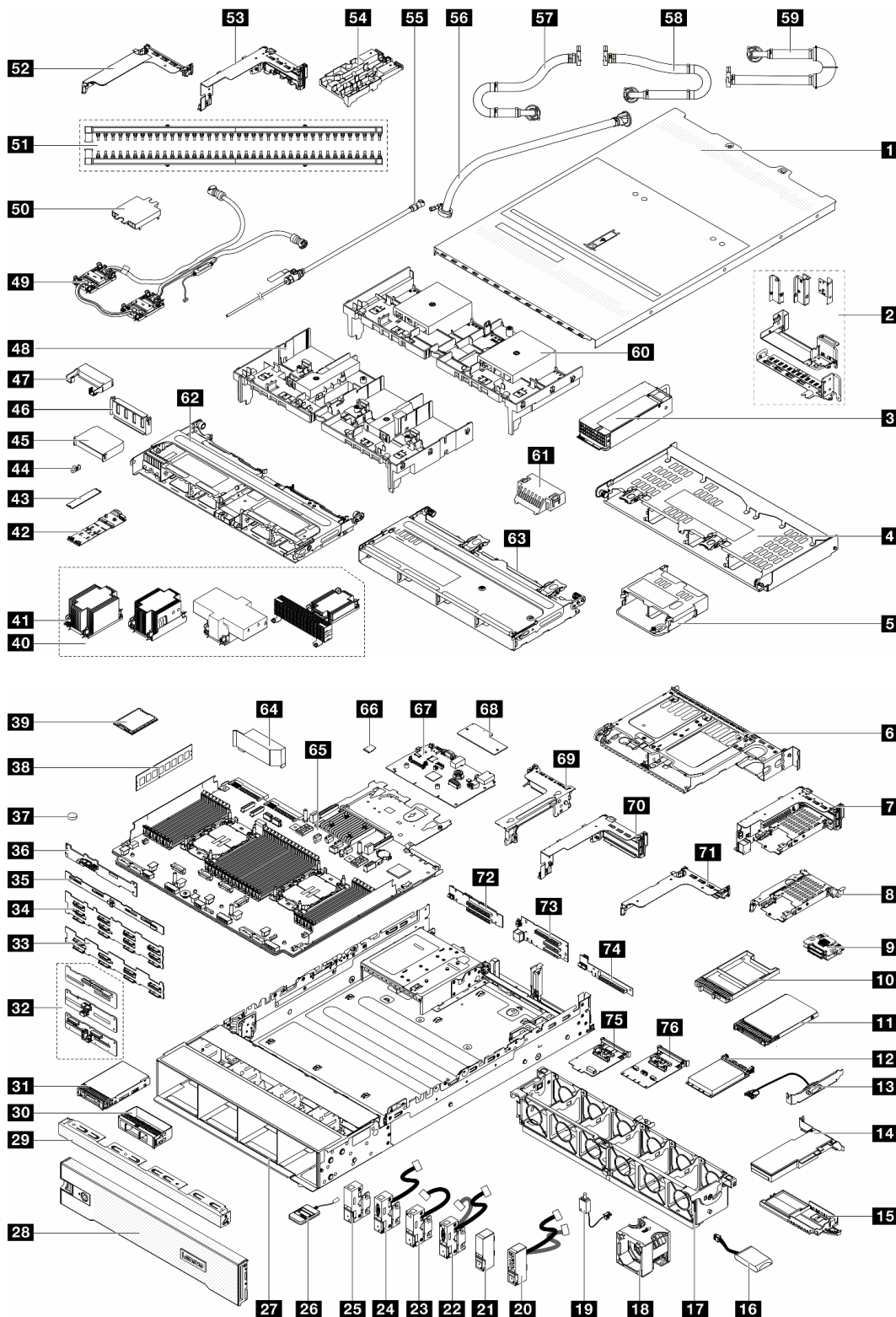


Figure 25. Server components (3.5-inch drive bay chassis)

The parts listed in the following table are identified as one of the following:

- **T1:** 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.

- **T2:** Tier 2 customer replaceable unit (CRU). You may install a Tier 2 CRU yourself or request Lenovo to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **F:** Field replaceable unit (FRU). FRUs must be installed only by trained service technicians.
- **C:** Consumable and Structural parts. Purchase and replacement of consumable and structural parts (components, such as a filler or bezel) is your responsibility. If Lenovo acquires or installs a structural component at your request, you will be charged for the service.

Description	Type	Description	Type
1 Top cover	T1	2 Rear wall brackets	T1
3 Power supply unit	T1	4 Rear 4 x 3.5-inch drive cage	T1
5 Rear 4 x 2.5-inch drive cage	T1	6 Rear 2 x 3.5-inch drive cage	T1
7 7mm drive cage (2FH + 7mm)	T1	8 7mm drive cage (1U)	T1
9 7mm drive backplanes	T2	10 7mm drive bay filler	C
11 7mm drive	T1	12 OCP module	T1
13 Serial port module	T1	14 PCIe adapter	T1
15 RAID flash power module holder	T1	16 RAID flash power module	T1
17 System fan cage	T1	18 System fan	T1
19 Intrusion switch	T1	20 Right rack latch with front I/O module	T1
21 Standard right rack latch	T1	22 Left rack latch with VGA and external diagnostic connector	T1
23 Left rack latch with external diagnostic connector	T1	24 Left rack latch with VGA	T1
25 Standard left rack latch	T1	26 External diagnostics handset	T1
27 Chassis	F	28 Security bezel	C
29 3.5-inch drive fillers (4-bay)	C	30 3.5-inch drive fillers (1-bay)	C
31 3.5-inch drive	T1	32 Middle/Rear 4 x 2.5-inch drive backplane	T1
33 Front 8 x 3.5-inch drive backplane	T1	34 Front 12 x 3.5-inch drive backplane	T1
35 Rear 4 x 3.5-inch drive backplane	T1	36 Rear 2 x 3.5-inch drive backplane	T1
37 CMOS battery (CR2032)	C	38 Memory module	T1
39 Processor	F	40 Heat sinks	F
41 Heat sink PEEK nuts	T2	42 M.2 drive backplane	T2
43 M.2 drive	T1	44 M.2 retainer clip	T1
45 Add-on air baffle (for GPU air baffle)	T1	46 Air baffle filler (for GPU air baffle)	C
47 Add-on air baffle (for GPU air baffle)	T1	48 GPU air baffle	T1
49 Direct water cooling module	F	50 Cold plate cover	C
51 Manifolds	FRU	52 1FH riser cage for DWCM	C
53 3FH riser cage for DWCM	C	54 Hose holder	C
55 Bleeder kit	FRU	56 42U in-row hose kit	FRU
57 42U/48U in-rack connection hose (return side)	FRU	58 48U in-rack connection hose (supply side)	FRU

Description	Type	Description	Type
59 42U in-rack connection hose (supply side)	FRU	60 Standard air baffle	T1
61 Air baffle filler (for standard air baffle)	C	62 Middle 8 x 2.5-inch drive cage	T1
63 Middle 4 x 3.5-inch drive cage	T1	64 PSU air baffle	T1
65 Processor board	F	66 MicroSD card	T1
67 System I/O board	F	68 Firmware and RoT security module	F
69 Riser 3 cage	T1	70 Riser 1 or riser 2 cage	T1
71 1U riser cage	T1	72 Riser 3 card	T1
73 Riser 1 or riser 2 card	T1	74 Riser card (LP)	T2
75 Management NIC adapter	T1	76 OCP enablement kit for vSphere DSE	T1

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 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 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 4. Unboxing and setup

Information in this section assists you on unboxing and setting up the server. When unboxing the server, check if the items in the package are correct, and learn where to find information of server serial number and Lenovo XClarity Controller access. Make sure to follow the instructions in [“Server setup checklist” on page 75](#) when setting up the server.

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:

- Server
- Rail installation kit*. Installation guide is provided in the package.
- Cable management arm*. Installation guide is provided in the package.
- Material box, including items such as power cords*, accessory kit, and printed documents.

Notes:

- Some of the items listed are available on select models only.
- Items marked with asterisk(*) are optional.

If any item is missing or damaged, contact your place of purchase. Ensure that you retain your proof of purchase and packing material. They might be required to receive warranty service.

Identify the server and access the Lenovo XClarity Controller

This section contains instruction on how to identify your server and where to find the Lenovo XClarity Controller access information.

Identifying your server

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

The illustration below shows the location of the ID label which contains the model number, machine type, and serial number of the server.

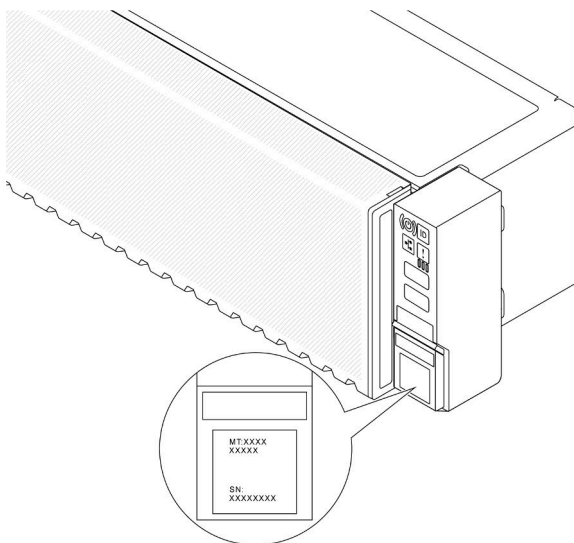


Figure 26. Location of the ID label

Lenovo XClarity Controller network access label

In addition, the Lenovo XClarity Controller (XCC) network access label is attached to the pull-out information tab in the front of the chassis, with MAC address accessible with a pull. After you receive the server, peel the XCC network access label away and store it in a safe place.

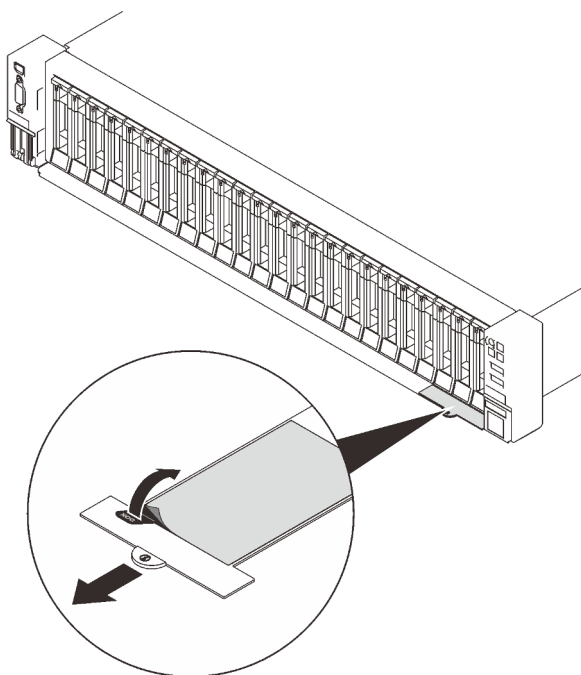


Figure 27. Lenovo XClarity Controller network access label on the pull-out information tab

Service Label and QR code

In addition, the system Service Label, which is on the top cover, provides a quick response (QR) code for mobile access to service information. You can scan the QR code with a mobile device using a QR code reader application and get quick access to the Service Information web page. The Service Information web

page provides additional information for parts installation and replacement videos, and error codes for solution support.

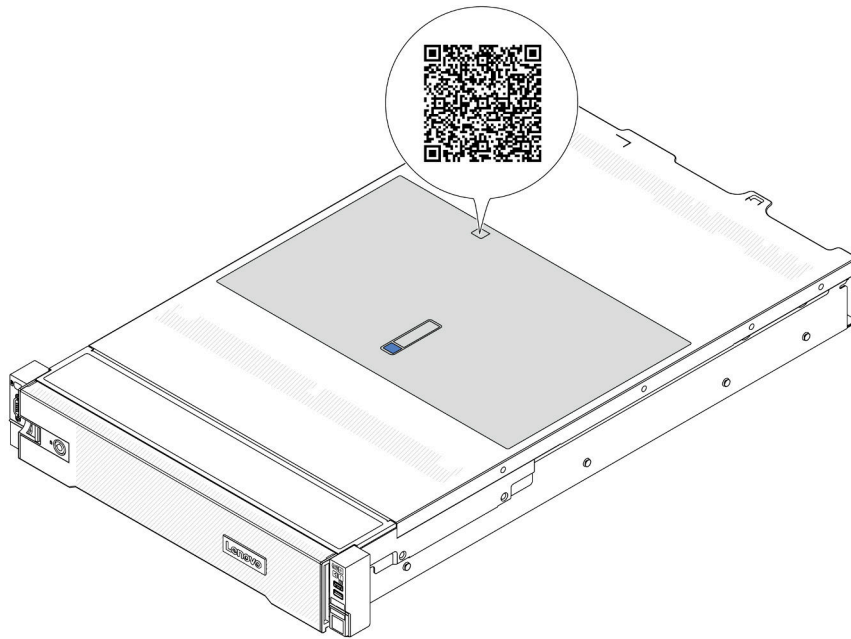


Figure 28. QR code

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.

Setup the server hardware

Complete the following procedures to setup the server hardware.

1. Unpack the server package. See [“Server package contents” on page 73](#).
2. Install any required hardware or server options. See the related topics in “Hardware replacement procedures” in *User Guide* or *Hardware Maintenance Guide*.
3. If necessary, install the rail and CMA to a standard rack cabinet. Follow the instruction in *Rail Installation Guide* and *CMA Installation Guide* that comes with the rail installation kit.
4. If necessary, install the server into a standard rack cabinet. See “Install the server to rack” in *User Guide* or *Hardware Maintenance Guide*.
5. Connect all external cables to the server. See [Chapter 2 “Server components” on page 19](#) for connectors locations.

Typically, you will need to connect the following cables:

- Connect server to the power source
- Connect server to the data network
- Connect the server to the storage device
- Connect the server to the management network

6. Power on the server.

Power button location and power LED are specified in:

- [Chapter 2 “Server components” on page 19](#)
- [“System LEDs and diagnostics display” on page 43.](#)

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 Lenovo XClarity Controller.

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. For details about accessing the management server processor, see “Opening and Using the XClarity Controller Web Interface” section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>.

7. Validate the server. Make sure that the power LED, Ethernet connector LED, and network LED are lit with green light, which means the server hardware was set up successfully.

See [“System LEDs and diagnostics display” on page 43](#) for more information on the LED indications.

Configure the system

Complete the following procedures to configure the system. For detailed instructions, refer to [Chapter 5 “System configuration” on page 77](#).

1. Set the network connection for the Lenovo XClarity Controller to the management network.
2. Update the firmware for the server, if necessary.
3. Configure the firmware for the server.

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>

4. Install the operating system.
5. Back up the server configuration.
6. Install the applications and programs for which the server is intended to be used.

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 Provisioning Manager to set the network connection.

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

1. Start the server.
2. Press the key specified in the on-screen instructions to display the Lenovo XClarity Provisioning Manager interface. (For more information, see the “Startup” section in the LXPM documentation compatible with your server at <https://pubs.lenovo.com/lxpm-overview/>.)
3. Go to **LXPM → UEFI Setup → BMC Settings** to 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.
4. Click **OK** to apply the setting and wait for two to three minutes.
5. Use an IPv4 or IPv6 address to connect Lenovo XClarity Controller.

Important: The Lenovo XClarity Controller is set initially with a user name of USERID and password of PASSW0RD (with a zero, not the letter O). This default user setting has Supervisor access. It is required to change this user name and password during your initial configuration for enhanced security.

- If no monitor is attached to the server, you can set the network connection through the Lenovo XClarity Controller interface. Connect an Ethernet cable from your laptop to XCC system management port on your server. For the location of the XCC system management port, see [Chapter 2 “Server components” on page 19](#).

Note: Make sure that you modify the IP settings on the laptop so that it is on the same network as the server default settings.

The default IPv4 address and the IPv6 Link Local Address (LLA) is provided on the Lenovo XClarity Controller Network Access label that is affixed to the Pull Out Information Tab. See [“Identify the server and access the Lenovo XClarity Controller” on page 73](#).

- If you are using the Lenovo XClarity Administrator Mobile app from a mobile device, you can connect to the Lenovo XClarity Controller through the Lenovo XClarity Controller USB connector on the server. For the location of the Lenovo XClarity Controller USB connector, see [Chapter 2 “Server components” on page 19](#).

Note: The Lenovo XClarity Controller USB connector mode must be set to manage the Lenovo XClarity Controller (instead of normal USB mode). To switch from normal mode to Lenovo XClarity Controller management mode, hold the ID button on the server for at least 3 seconds until its LED flashes slowly (once every couple of seconds). See [Chapter 2 “Server components” on page 19](#) for the location of the ID button.

To connect using the Lenovo XClarity Administrator Mobile app:

1. Connect the USB cable of your mobile device to the Lenovo XClarity Controller USB connector on the server.
2. On your mobile device, enable USB tethering.
3. On your mobile device, launch the Lenovo XClarity Administrator mobile app.
4. If automatic discovery is disabled, click **Discovery** on the USB Discovery page to connect to the Lenovo XClarity Controller.

For more information about using the Lenovo XClarity Administrator Mobile app, see:

https://pubs.lenovo.com/lxca/lxca_usemobileapp

Set USB port for Lenovo XClarity Controller connection

Before you can access the Lenovo XClarity Controller through the USB port, you need to configure the USB port for Lenovo XClarity Controller connection.

Server support

To see if your server supports accessing Lenovo XClarity Controller through the USB port, check one of the following:

- Refer to [Chapter 2 “Server components” on page 19](#).



- If there is a wrench icon on the USB port of your server, you can set the management USB port to connect to Lenovo XClarity Controller. It is also the only USB port that supports USB automation update of the firmware and RoT security module.

Setting the USB port for Lenovo XClarity Controller connection

You can switch the USB port between normal and Lenovo XClarity Controller management operation by performing one of the following steps.

- Hold the ID button for at least 3 second until its LED flashes slowly (once every couple of seconds). See [Chapter 2 “Server components” on page 19](#) for ID button location.
- From the Lenovo XClarity Controller management controller CLI, run the `usbfp` command. For information about using the Lenovo XClarity Controller CLI, see the “Command-line interface” section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>.
- From the Lenovo XClarity Controller management controller web interface, click **BMC Configuration → Network → USB Management Port Assignment**. For information about Lenovo XClarity Controller web interface functions, see the “Description of XClarity Controller functions on web interface” section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>.

Checking USB port current setting

You can also check the current setting of the USB port using the Lenovo XClarity Controller management controller CLI (`usbfp` command) or the Lenovo XClarity Controller management controller web interface (**BMC Configuration → Network → USB Management Port Assignment**). See the “Command-line

interface” and “Description of XClarity Controller functions on web interface” sections in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>.

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.

- Best practices related to updating firmware is available at the following site:
 - <http://lenovopress.com/LP0656>
- The latest firmware can be found at the following site:
 - <https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v3/downloads/driver-list/>
- You can subscribe to product notification to stay up to date on firmware updates:
 - <https://datacentersupport.lenovo.com/solutions/ht509500>

Update Bundles (Service Packs)

Lenovo typically releases firmware in bundles called Update Bundles (Service Packs). 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.

Update method terminology

- **In-band update.** The installation or update is performed using a tool or application within an operating system that is executing on the server’s core CPU.
- **Out-of-band update.** The installation or update is performed by the Lenovo XClarity Controller collecting the update and then directing the update to the target subsystem or device. Out-of-band updates have no dependency on an operating system executing on the core CPU. However, most out-of-band operations do require the server to be in the S0 (Working) power state.
- **On-Target update.** The installation or update is initiated from an installed operating system executing on the target server itself.
- **Off-Target update.** The installation or update is initiated from a computing device interacting directly with the server’s Lenovo XClarity Controller.
- **Update Bundles (Service Packs).** Update Bundles (Service Packs) are bundled updates designed and tested to provide the interdependent level of functionality, performance, and compatibility. Update Bundles (Service Packs) 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 Update Bundles (Service Packs) are also available.

Firmware updating tools

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

Tool	Update Methods Supported	Core System Firmware Updates	I/O Devices Firmware Updates	Drive Firmware Updates	Graphical user interface	Command line interface	Supports Update Bundles (Service Packs)
Lenovo XClarity Provisioning Manager (LXPM)	In-band ² On-Target	✓			✓		
Lenovo XClarity Controller (XCC)	In-band ⁴ Out-of-band Off-Target	✓	Selected I/O devices	✓ ³	✓		✓
Lenovo XClarity Essentials OneCLI (OneCLI)	In-band Out-of-band On-Target Off-Target	✓	All I/O devices	✓ ³		✓	✓
Lenovo XClarity Essentials UpdateXpress (LXCE)	In-band Out-of-band On-Target Off-Target	✓	All I/O devices		✓		✓
Lenovo XClarity Essentials Bootable Media Creator (BoMC)	In-band Out-of-band Off-Target	✓	All I/O devices		✓ (BoMC application)	✓ (BoMC application)	✓
Lenovo XClarity Administrator (LXCA)	In-band ¹ Out-of-band ² Off-Target	✓	All I/O devices		✓		✓
Lenovo XClarity Integrator (LXCI) for VMware vCenter	Out-of-band Off-Target	✓	Selected I/O devices		✓		
Lenovo XClarity Integrator (LXCI) for Microsoft Windows Admin Center	In-band Out-of-band On-Target Off-Target	✓	All I/O devices		✓		✓

Tool	Update Methods Supported	Core System Firmware Updates	I/O Devices Firmware Updates	Drive Firmware Updates	Graphical user interface	Command line interface	Supports Update Bundles (Service Packs)
Lenovo XClarity Integrator (LXCI) for Microsoft System Center Configuration Manager	In-band On-Target	✓	All I/O devices		✓		✓
Notes: <ol style="list-style-type: none"> For I/O firmware updates. For BMC and UEFI firmware updates. Drive firmware update is only supported by the tools and methods below: <ul style="list-style-type: none"> XCC Bare Metal Update (BMU): In-band, and requires system reboot. Lenovo XClarity Essentials OneCLI: <ul style="list-style-type: none"> For drives supported by ThinkSystem V2 and V3 products (legacy drives): In-band, and does not require system reboot. For drives supported only by ThinkSystem V3 products (new drives): Staging to XCC and complete the update with XCC BMU (In-band, and requires system reboot.). Bare Metal Update (BMU) only. 							

• **Lenovo XClarity Provisioning Manager**

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

Note: By default, the Lenovo XClarity Provisioning Manager Graphical User Interface is displayed when you start the server and press the key specified in the on-screen instructions. If you have changed that default to be the text-based system setup, you can bring up the Graphical User Interface from the text-based system setup interface.

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

“Firmware Update” section in the LXPM documentation compatible with your server at <https://pubs.lenovo.com/lxpm-overview/>

• **Lenovo XClarity Controller**

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

Notes:

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

For additional information about configuring Ethernet over USB, see:

“Configuring Ethernet over USB” section in the XCC documentation version compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>

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

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

“Updating Server Firmware” section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>

- **Lenovo XClarity Essentials OneCLI**

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

For additional information about using Lenovo XClarity Essentials OneCLI to update firmware, see:

https://pubs.lenovo.com/lxce-onecli/onecli_c_update

- **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 Update Bundles (Service Packs) update packages and individual updates. Update Bundles (Service Packs) contain firmware and device driver updates for Microsoft Windows and for Linux.

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

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

- **Lenovo XClarity Essentials Bootable Media Creator**

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

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

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

- **Lenovo XClarity Administrator**

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

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

https://pubs.lenovo.com/lxca/update_fw

- **Lenovo XClarity Integrator offerings**

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

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

<https://pubs.lenovo.com/lxci-overview/>

Configure the firmware

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

Important: Lenovo does not recommend setting option ROMs to **Legacy**, but you can conduct this setting if necessary. Note that this setting prevents UEFI drivers for the slot devices from loading, which may cause negative side effects to Lenovo software, such as LXCA, OneCLI, and XCC. These side effects include but

are not limited to the inability to determine adapter card details, such as model name and firmware levels. For example, "ThinkSystem RAID 930-16i 4GB Flash" may be displayed as "Adapter 06:00:00". In some cases, the functionality on a specific PCIe adapter may not be enabled properly.

- **Lenovo XClarity Provisioning Manager (LXPM)**

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

Notes: The Lenovo XClarity Provisioning Manager provides a Graphical User Interface to configure a server. The text-based interface to system configuration (the Setup Utility) is also available. From Lenovo XClarity Provisioning Manager, you can choose to restart the server and access the text-based interface. In addition, you can choose to make the text-based interface the default interface that is displayed when you start LXPM. To do this, go to **Lenovo XClarity Provisioning Manager → UEFI Setup → System Settings → <F1>Start Control → Text Setup**. To start the server with Graphic User Interface, select **Auto** or **Tool Suite**.

See the following documentations for more information:

- Search for the LXPM documentation version compatible with your server at <https://pubs.lenovo.com/lxpm-overview/>
- *UEFI User Guide* at <https://pubs.lenovo.com/uefi-overview/>

- **Lenovo XClarity Essentials OneCLI**

You can use the config 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:

https://pubs.lenovo.com/lxce-onecli/onecli_c_settings_info_commands

- **Lenovo XClarity Administrator**

You can quickly provision and pre-provision all of your servers using a consistent configuration. Configuration settings (such as local storage, I/O adapters, boot settings, firmware, ports, and Lenovo XClarity Controller and UEFI settings) are saved as a server pattern that can be applied to one or more managed servers. When the server patterns are updated, the changes are automatically deployed to the applied servers.

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

https://pubs.lenovo.com/lxca/server_configuring

- **Lenovo XClarity Controller**

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

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

"Configuring the Server" section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>

Memory module configuration

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

Information about optimizing memory performance and configuring memory is available at the Lenovo Press website:

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

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

https://dcsc.lenovo.com/#/memory_configuration

Enable Software Guard Extensions (SGX)

Intel® Software Guard Extensions (Intel® SGX) operates under the assumption that the security perimeter includes only the internals of the CPU package, and leaves the DRAM untrusted.

Complete the following steps to enable SGX.

- Step 1. **Make sure** to refer to “Memory module installation rules and order” section in the *User Guide* or *Hardware Maintenance Guide*, which specifies whether your server supports SGX and lists the memory module population sequence for SGX configuration. (DIMM configuration must be at least 8 DIMMs per socket to support SGX.)
- Step 2. Restart the system. Before the operating system starts up, press the key specified in the on-screen instructions to enter the Setup Utility. (For more information, see the “Startup” section in the LXPM documentation compatible with your server at <https://pubs.lenovo.com/lxpm-overview/>.)
- Step 3. Go to **System settings → Processors → UMA-Based Clustering** and disable the option.
- Step 4. Go to **System settings → Processors → Total Memory Encryption (TME)** and enable the option.
- Step 5. Save the changes, then go to **System settings → Processors → SW Guard Extension (SGX)** and enable the option.

RAID configuration

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 website:

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

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

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

Intel VROC

Enabling Intel VROC

Before setting up RAID for NVMe drives, follow the below steps to enable VROC:

1. Restart the system. Before the operating system starts up, press the key specified in the on-screen instructions to enter the Setup Utility. (For more information, see the “Startup” section in the LXPM documentation compatible with your server at <https://pubs.lenovo.com/lxpm-overview/>.)
2. Go to **System settings → Devices and I/O Ports → Intel® VMD technology → Enable/Disable Intel® VMD** and enable the option.
3. Save the changes and reboot the system.

Intel VROC configurations

Intel offers various VROC configurations with different RAID level and SSD support. See the following for more details.

Notes:

- Supported RAID levels varies by model. For the RAID level supported by SR650 V3, see [Technical specifications](#).
- For more information about acquiring and installing the activation key, see <https://fod.lenovo.com/lkms>.

Intel VROC configurations for PCIe NVMe SSDs	Requirements
Intel VROC Standard	<ul style="list-style-type: none"> • Supports RAID levels 0, 1, and 10 • Requires an activation key
Intel VROC Premium	<ul style="list-style-type: none"> • Supports RAID levels 0, 1, 5, and 10 • Requires an activation key
Bootable RAID	<ul style="list-style-type: none"> • RAID 1 only • 5th Gen Intel® Xeon® Scalable processors (formerly codenamed as Emerald Rapids, EMR)
Intel VROC configurations for SATA SSDs	Requirements
Intel VROC SATA RAID	<ul style="list-style-type: none"> • Supports RAID levels 0, 1, 5, and 10.

Deploy the operating system

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

Available operating systems

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

Complete list of available operating systems: <https://lenovopress.com/osig>.

Tool-based deployment

- **Multi-server**

Available tools:

- Lenovo XClarity Administrator

https://pubs.lenovo.com/lxca/compute_node_image_deployment

- Lenovo XClarity Essentials OneCLI

https://pubs.lenovo.com/lxce-onecli/onecli_r_uxspi_proxy_tool

- Lenovo XClarity Integrator deployment pack for SCCM (for Windows operating system only)

https://pubs.lenovo.com/lxci-deploypack-sccm/dpsccm_c_endtoend_deploy_scenario

- **Single-server**

Available tools:

- Lenovo XClarity Provisioning Manager

“OS Installation” section in the LXPM documentation compatible with your server at <https://pubs.lenovo.com/lxpm-overview/>

- Lenovo XClarity Essentials OneCLI

https://pubs.lenovo.com/lxce-onecli/onecli_r_uxspi_proxy_tool

- Lenovo XClarity Integrator deployment pack for SCCM (for Windows operating system only)

https://pubs.lenovo.com/lxci-deploypack-sccm/dpsccm_c_endtoend_deploy_scenario

Manual deployment

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

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

Back up the server configuration

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

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

- **Management processor**

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

“Backing up the BMC configuration” section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>.

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:

https://pubs.lenovo.com/lxce-onecli/onecli_r_save_command

- **Operating system**

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

Enable Intel® On Demand

A processor is equipped with various computing capabilities. Basic capabilities are available at the initial processor installation, while others remain inactivated. As development environment and tasks evolve,

computing demands may accelerate and require leverage of the previously inactivated processor capabilities. In such cases, user can select desired processor capabilities and activate them through Intel On Demand feature—a feature that allows user to customize processor capabilities according to environment and tasks at hand. The following section specifies system hardware and software requirement, Intel On Demand enabling and transferring procedures, and list of processor capabilities.

This documentation includes the following sections:

- “Supported processor” on page 87
- “Installation tool” on page 87
- Procedures for “Enabling Intel On Demand Features” on page 88
- Procedures for “Transferring Intel On Demand Features” on page 89
- XCC and LXCE OneCLI instructions for:
 - “Reading PPIN” on page 89
 - “Installing Intel On Demand to processor” on page 91
 - “Acquiring and uploading Intel On Demand State Report” on page 92
 - “Checking the Intel On Demand features installed in a processor” on page 94

Note: Depending on the model, the XCC Web GUI layout may be slightly different from the illustrations in this document.

Supported processor

Intel On Demand is only supported by Intel On Demand capable processors. For more information on Intel On Demand capable processors supported by SR650 V3, see <https://lenovopress.lenovo.com/lp1601-thinksystem-sr650-v3-server>.

Note: All processors in a system must be installed with identical Intel On Demand feature.

Installation tool

Intel On Demand can be installed via Lenovo XClarity Controller (XCC) and Lenovo XClarity Essentials OneCLI (LXCE OneCLI). After confirming that your processor supports Intel On Demand, you also need to make sure the XCC and LXCE OneCLI installed in your system supports installing Intel On Demand.

1. Check if Lenovo XClarity Controller (XCC) supports installing Intel On Demand (two methods provided):

- **Via XCC WebGUI**

Go to **BMC Configuration → License**, if there is a section named **On Demand Capabilities for Intel CPU** in the page, it indicates that current XCC supports installing Intel On Demand, otherwise you need to update XCC firmware to the latest version to ensure it supports installing Intel On Demand.

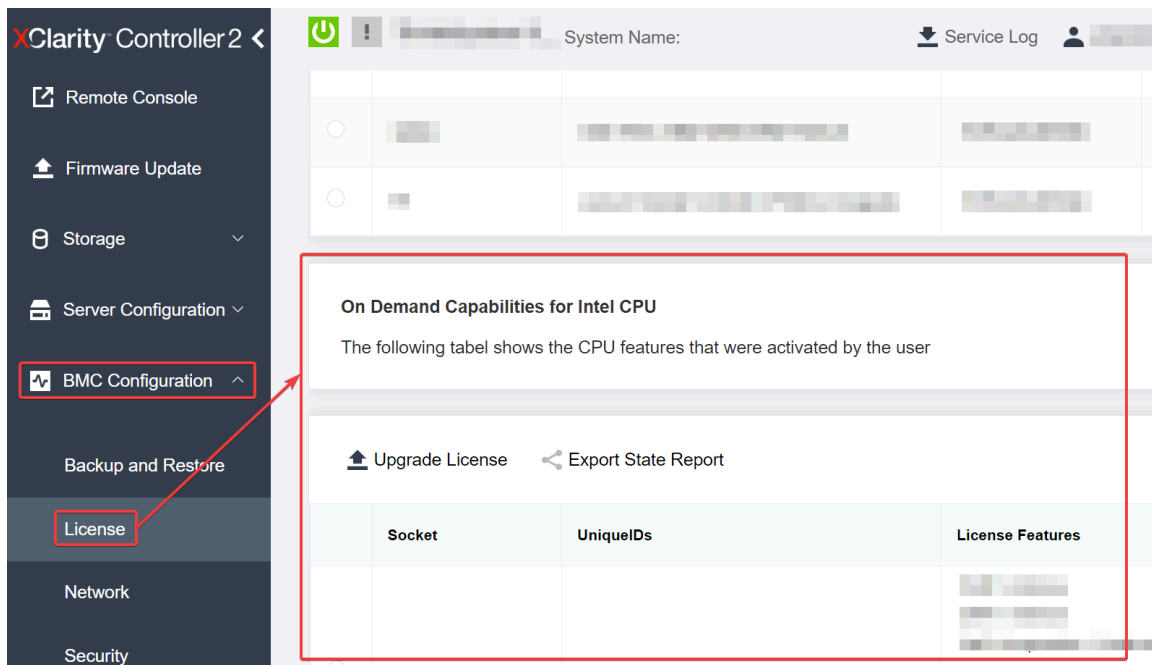


Figure 29. On Demand Capabilities for Intel CPU in XCC Web GUI

- **Via XCC REST API**

- Use the **GET** method with the following Request URL:
GET https://bmc_ip/redfish/v1/LicenseService/Licenses/
- In the response JSON object, the Members field includes the API such as `/redfish/v1/LicenseService/Licenses/CPUX_OnDemandCapability`, where X is the CPU numbering, it indicates that current XCC supports installing Intel On Demand, otherwise you need to update XCC firmware to the latest version to ensure it supports installing Intel On Demand.

For example:

```
"Members": [
  {
    "@odata.id": "/redfish/v1/LicenseService/Licenses/CPU1_OnDemandCapability"
  },
  {
    "@odata.id": "/redfish/v1/LicenseService/Licenses/CPU2_OnDemandCapability"
  },
]
```

- Check if LXCE OneCLI supports installing Intel On Demand

- LXCE OneCLI version must be at 4.2.0 or above.

Enabling Intel On Demand Features

- Select the Intel On Demand features that meets your workload needs, see [“Intel On Demand Features” on page 95](#).
- After completing ordering the features, you will receive Authorization Code via e-mail.
- PPIN is a mandatory information for enabling the features. Read the PPIN of the processor that is to be installed with the features. See [“Reading PPIN” on page 89](#).
- Go to <https://fod.lenovo.com/lkms> and input the Authorization Code to acquire the Activation Key.
- In the website, input Machine Type, Machine serial number, and PPIN.
- The website will generate the Activation Key. Download the Activation Key.

7. Install the features to the processor with the Activation Key via XCC or LXCE OneCLI. See [“Installing Intel On Demand to processor” on page 91](#).

Note: If more than one Activation Keys are acquired, it is mandatory to install them in the sequential order they were acquired. For example, start with installing the first acquired key, and proceed with the second acquired key, and so on.

8. AC cycle the server.
9. (Optional) Upload Intel On Demand State Report. See [“Acquiring and uploading Intel On Demand State Report” on page 92](#).

The State Report represents the current configuration state of the Intel On Demand capable processors. Lenovo accepts State Reports from customers to calibrate the current state of the Intel On Demand capable processors.

10. To see the features installed in a processor, see [“Checking the Intel On Demand features installed in a processor” on page 94](#).

For reference, see https://pubs.lenovo.com/lenovo_fod.

Transferring Intel On Demand Features

After replacing a processor, you may need to transfer the features from the defective processor to the new processor. Complete the following steps to transfer features to new processor.

1. Before removing the defective processor from the system, read the PPIN of the defective processor. See [“Reading PPIN” on page 89](#).
2. After installing the new processor, read the PPIN of the new processor. See [“Reading PPIN” on page 89](#).
3. Go to <https://fod.lenovo.com/lkms> and input the PPIN of the defective processor. (Input PPIN in the UID section.)
4. Select the features to be transferred.
5. Input the PPIN of the new processor.
6. The website will generate the new Activation Key. Download the new Activation Key. See [“Installing Intel On Demand to processor” on page 91](#).
7. Install the features to the new processor with the new Activation Key via XCC or LXCE OneCLI.
8. AC cycle the server.
9. (Optional) Upload Intel On Demand State Report. See [“Acquiring and uploading Intel On Demand State Report” on page 92](#).

The State Report represents the current configuration state of the Intel On Demand capable processors. Lenovo accepts State Reports from customers to calibrate the current state of the Intel On Demand capable processors.

10. To see the features installed in a processor, see [“Checking the Intel On Demand features installed in a processor” on page 94](#).

For reference, see https://pubs.lenovo.com/lenovo_fod.

Reading PPIN

Protected Processor Inventory Number, or PPIN, is a mandatory information for enabling Intel On Demand. PPIN can be read via XCC Web GUI, XCC REST API, and LXCE OneCLI. See the following for more information.

Reading PPIN via XCC Web GUI

Open XCC Web GUI, go to **Inventory page → CPU tab → Expand → PPIN**

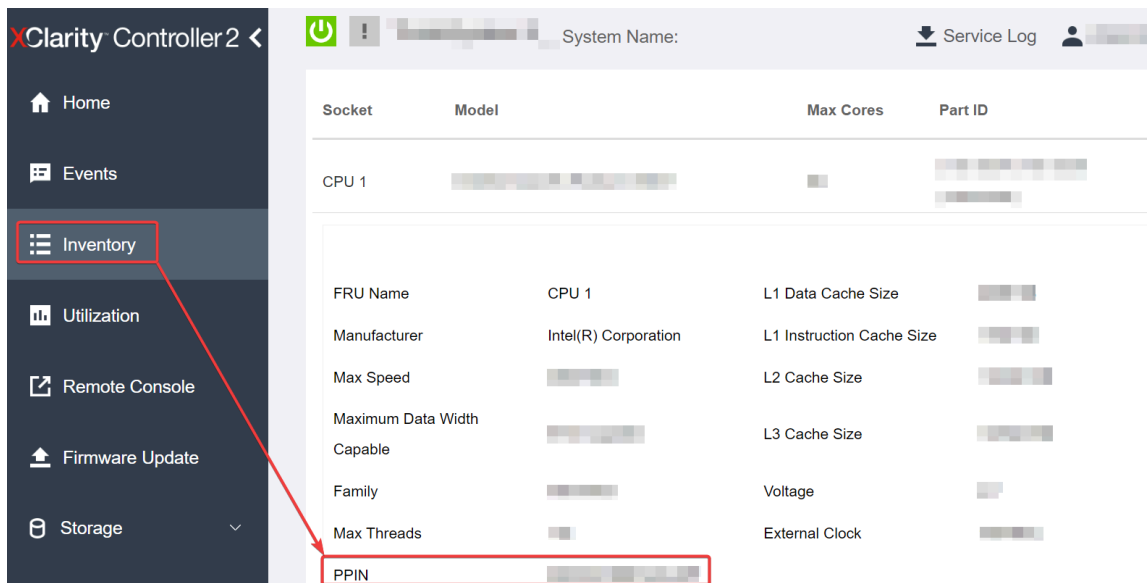


Figure 30. Reading PPIN via XCC Web GUI

Reading PPIN via XCC REST API

1. Use the **GET** method with the following Request URL:
GET https://bmc_ip/redfish/v1/Systems/1/Processors
For example:
GET https://bmc_ip/redfish/v1/Systems/1/Processors
2. In the response JSON object, the Members field shows reference link to an element of processor resource.

For example:

```
"Members":[
{
  @odata.id: "/redfish/v1/Systems/1/Processors/1"
},
{
  @odata.id: "/redfish/v1/Systems/1/Processors/2"
}
],
```
3. Select the processor you need to read the PPIN from. Use the **GET** method with the following Request URL, where x is the CPU numbering:
GET https://bmc_ip/redfish/v1/Systems/1/Processors/x
For example, to read Processor 1 PPIN, see the following:
GET https://bmc_ip/redfish/v1/Systems/1/Processors/1
4. In the response JSON object, the ProcessorId field shows the ProtectedIdentificationNumber field, which is the PPIN info of the requested CPU.

For example:

```
"ProcessorId":{
  "ProtectedIdentificationNumber":"1234567890xxxyyy"
},
```

Reading PPIN via LXCE OneCLI

Input the following command:

```
OneCli.exe fod showppin -b XCC_USER:XCC_PASSWORD@XCC_HOST
```

The output shows PPIN information. For example:

Machine Type: 7D75

Serail Number: 7D75012345

FoD PPIN result:

```
=====
| Socket ID |          PPIN          |
| Processor 1 | 1234567890xxxxyyy |
| Processor 2 | 9876543210zzzyyy |
=====
```

Installing Intel On Demand to processor

Install Intel On Demand features to the processor with the Activation Key downloaded from the <https://fod.lenovo.com/lkms> via XCC Web GUI, XCC REST API or LXCE OneCLI.

Use XCC Web GUI to install Intel On Demand

1. Open XCC Web GUI, go to **BMC Configuration → License → On Demand Capabilities for Intel CPU → Upgrade License → Browse → Import** to upload the Activation Key

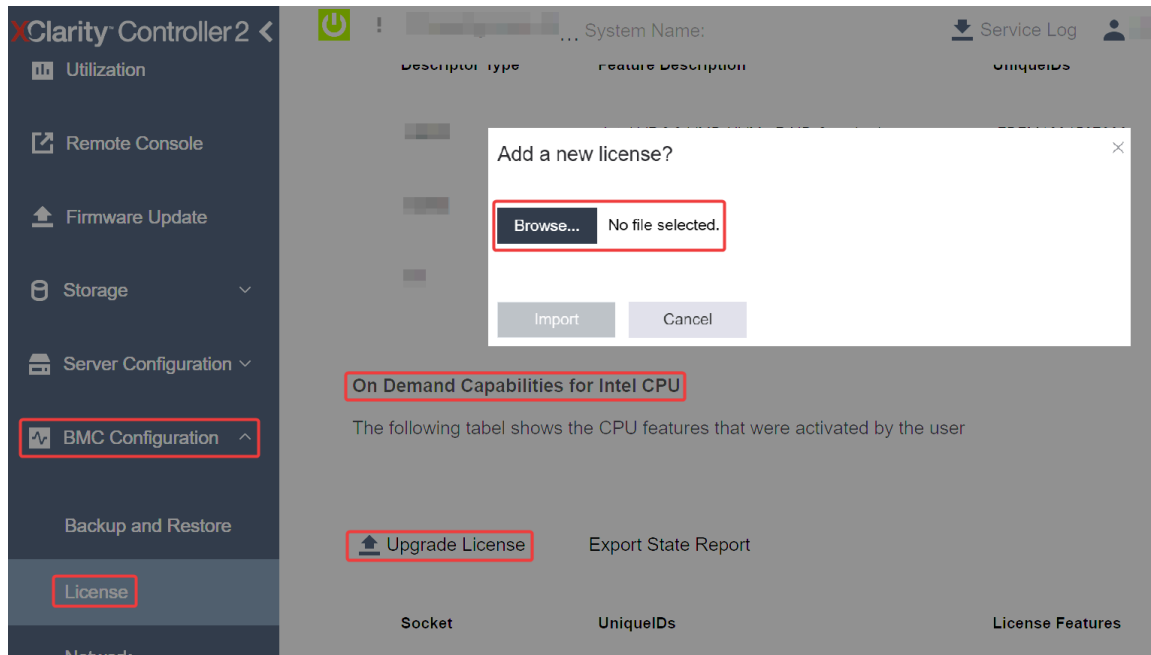


Figure 31. Uploading Activation Key via XCC Web GUI

2. If the installation is successful, the Web GUI will show a pop-up window with the message “License key upgraded successfully. The features will be activated on the processor after system power cycle”.

Otherwise, see “[Enable Intel® On Demand Troubleshooting](#)” on page 96.

Use XCC REST API to install Intel On Demand

1. Use the **POST** method with the following Request URL:
POST https://bmc_ip/redfish/v1/LicenseService/Licenses
2. Transfer Activation Key to base64 string at first and fill it into the LicenseString field as POST data.

```
{
  "LicenseString": ""
}
```
3. If the installation is successful, XCC REST API show the message “License key upgraded successfully. The features will be activated on the processor after system power cycle”.

Otherwise, see “[Enable Intel® On Demand Troubleshooting](#)” on page 96.

Use LXCE OneCLI to install Intel On Demand

Input the following command, where <key_file> specifies the Activation Key:
OneCli.exe fod install --keyfile <key_file>

If successfully installed, the response will show:
Successfully install key

Call Lenovo support if the response shows the following:
Failed to install key

Acquiring and uploading Intel On Demand State Report

After completing enabling or transferring Intel On Demand, acquire and upload the State Report via XCC Web GUI, XCC REST API, and LXCE OneCLI. See the following for more information.

Use XCC Web GUI to upload State Report

1. Open XCC Web GUI, go to **BMC Configuration → License → On Demand Capabilities for Intel CPU → Choose CPU → Export State Report**

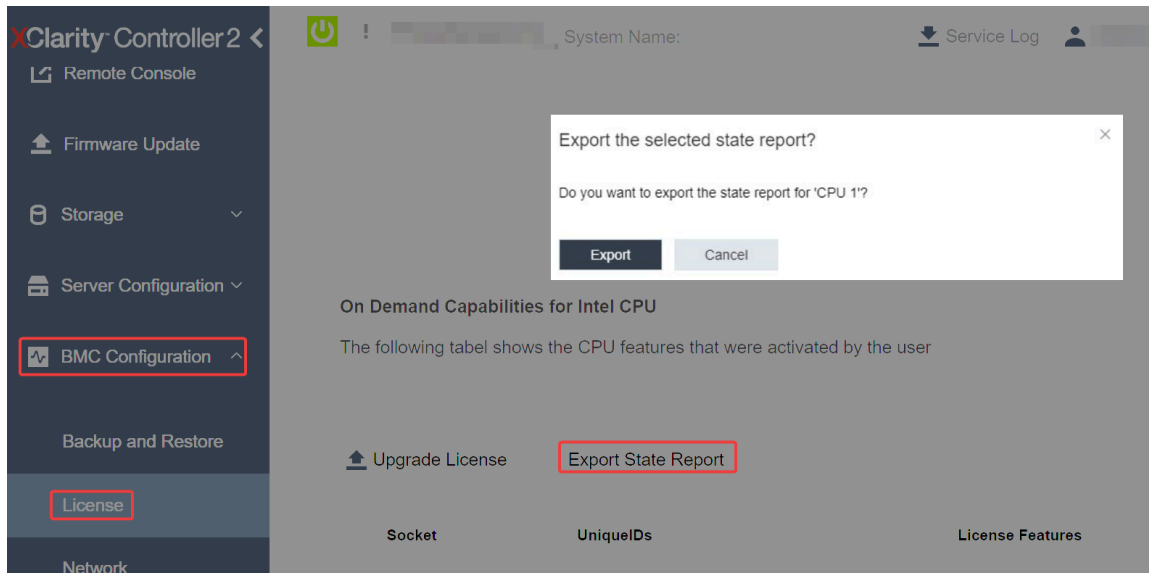


Figure 32. Export State Report via XCC Web GUI

2. Upload State Report via “On Demand Feedback” section in <https://fod.lenovo.com/lkms>.

Use XCC REST API to upload State Report

1. Use the **GET** method with the following Request URL to retrieve CPU State Report API, where X is the CPU numbering:
GET https://bmc_ip/redfish/v1/LicenseService/Licenses/CPUX_OnDemandCapability
For example, to retrieve CPU 1 State Report API, see the following:
GET https://bmc_ip/redfish/v1/LicenseService/Licenses/CPU1_OnDemandCapability
2. In the response JSON object, the response of the target field of the `LenovoLicense.ExportStateReport` field is the CPU State Report API, where X is the CPU numbering:

```
"Actions": {  
  "Oem": {  
    "#LenovoLicense.ExportStateReport": {
```

```

        "title": "ExportStateReport",
        "target": "/redfish/v1/LicenseService/Licenses/CPUX_OnDemandCapability/Actions/Oem/LenovoLicense.ExportStateReport"
    }
},

```

In the following example, the response of the target field is the CPU 1 State Report API. Copy the CPU 1 State Report API.

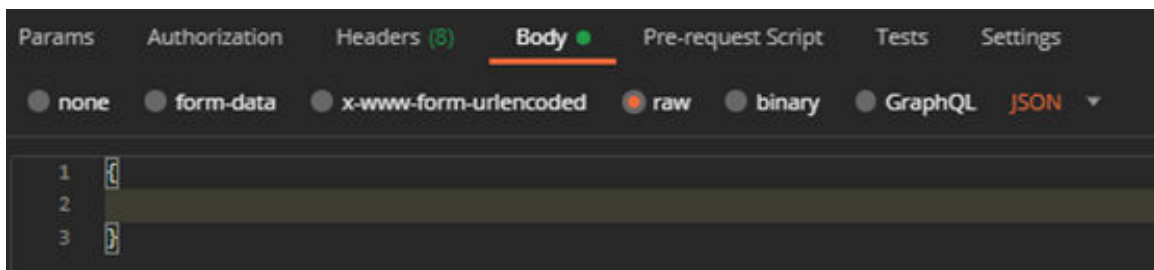
```

    "Actions": {
        "Oem": {
            "#LenovoLicense.ExportStateReport": {
                "title": "ExportStateReport",
                "target": "/redfish/v1/LicenseService/Licenses/CPU1_OnDemandCapability/Actions/Oem/LenovoLicense.ExportStateReport"
            }
        }
    },

```

3. Retrieve the State Report.

- Use the **POST** method with the following Request URL with CPU State Report API to retrieve the State Report, where X is the CPU numbering:
 POST https://bmc_ip/redfish/v1/LicenseService/Licenses/CPUX_OnDemandCapability/Actions/Oem/LenovoLicense.ExportStateReport
 For example, to retrieve CPU 1 State Report, see the following:
 POST https://bmc_ip/redfish/v1/LicenseService/Licenses/CPU1_OnDemandCapability/Actions/Oem/LenovoLicense.ExportStateReport
- Use an empty JSON object as POST data. When using API tool such as Postman, fill an empty JSON object in **Body** → **Raw** → **JSON**, fill a NULL object '{}' in a JSON file.



4. In the response, retrieve the State Report in the stateReports field.

```

{
  "stateReports": [
    {
      "syntaxVersion": "1.0",
      "timestamp": "",
      "objectId": "",
      "hardwareComponentData": [
        {
          "hardwareId": {
            "type": "PPIN",
            "value": ""
          },
          "stateCertificate": {
            "pendingCapabilityActivationPayloadCount": ,
            "value": ""
          },
          "hardwareType": "CPU"
        }
      ]
    }
  ]
}

```

5. Upload State Report via “On Demand Feedback” section in <https://fod.lenovo.com/lkms>.

Use LXCE OneCLI to upload State Report

1. Acquire State Report with the following command:
`OneCli.exe fod exportreport -b XCC_USER:XCC_PASSWORD@XCC_HOST`
2. Upload State Report with the following command:
`OneCli.exe fod uploadreport --file CPU1_XXXXXX_StateReport.json --kmsid KMS_USER:KMS_PASSWORD`

Where:

CPU1_XXXXXX_StateReport.json is the file name downloaded from the **fod exportreport** command in Step 1.

KMS_USER and KMS_PASSWORD are your ID and password on the <https://fod.lenovo.com/lkms>.

Checking the Intel On Demand features installed in a processor

You can check the Intel On Demand features installed in a processor via XCC Web GUI, XCC REST API, and LXCE OneCLI. See the following for more information.

Note: If the processor has not been installed with any license, it would not appear in the **On Demand Capabilities for Intel CPU** section in XCC Web GUI.

Use XCC Web GUI to check the Intel On Demand features installed in a processor

Go to **BMC Configuration → License → On Demand Capabilities for Intel CPU → Choose CPU → License Features**, where the installed features are listed.

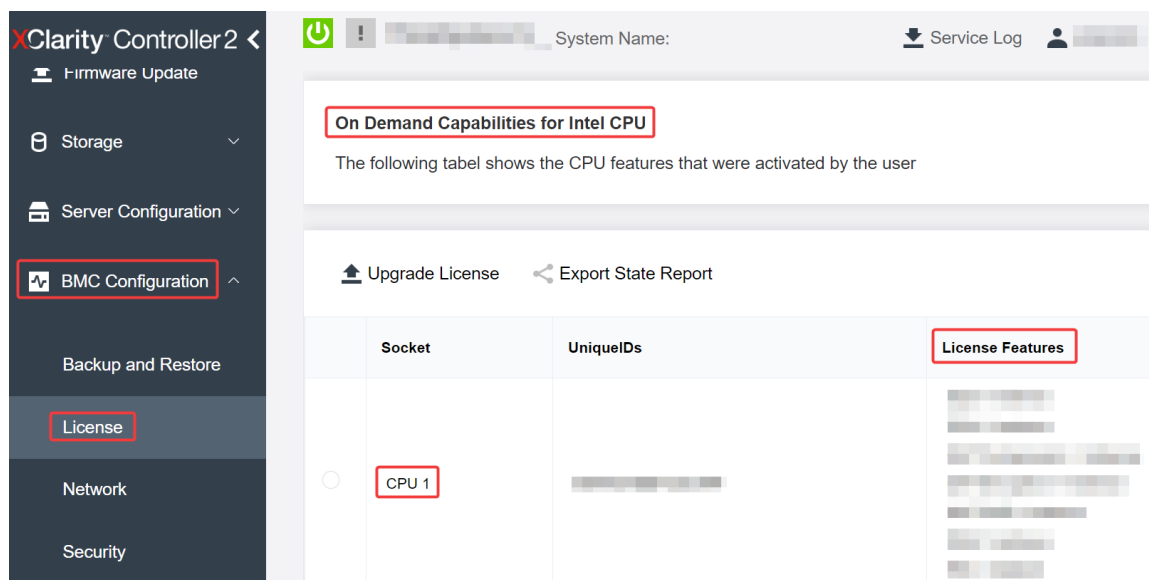


Figure 33. Checking the Intel On Demand features installed in a processor in XCC Web GUI

Use XCC REST API to check the Intel On Demand features installed in a processor

1. Use the **GET** method with the following Request URL to retrieve Intel On Demand features installed on CPU X, where X is the CPU numbering:
`GET https://bmc_ip/redfish/v1/LicenseService/Licenses/CPUX_OnDemandCapability`
For example, to retrieve Intel On Demand features installed on CPU 1, see the following:
`GET https://bmc_ip/redfish/v1/LicenseService/Licenses/CPU1_OnDemandCapability`
2. In the response JSON object, the FeatureList field contains the Intel On Demand features installed in this processor.

```

    "Oem": {
      "Lenovo": {
        "FeatureList": []
        "@odata.type": ""
      }
    },

```

Use LXCE OneCLI to check the Intel On Demand features installed in a processor

1. Check installed features with the following command:
OneCli.exe fod report -b XCC_USER:XCC_PASSWORD@XCC_HOST
2. The output shows all license, including Intel On Demand features. For example:

FoD Reports result:

Feature Type	Key ID	Status	Description Feature List	User Reminding	Expired Date
N/A	CPU1_OnDemandCapability	StandbyOffline	DSA 4 instances, IAA 4 instances	N/A	N/A
N/A	CPU2_OnDemandCapability	Enabled	DSA 4 instances, IAA 4 instances	N/A	N/A
004a	XCC2_Platinum	Enabled	Lenovo XClarity Controller 2 Platinum Upgrade	N/A	N/A

Succeed.

Intel On Demand Features

Intel On Demand features are listed below. Supported features vary by product, for more information, see <https://lenovopress.lenovo.com/lp1601-thinksystem-sr650-v3-server>.

Features

- **Intel Quick Assist Technology (Intel QAT)¹**

Intel® QAT which helps free up processor cores by offloading encryption, decryption, and compression so systems can serve a larger number of clients or use less power. With Intel QAT, 4th gen Intel Xeon Scalable processors are the highest performance CPUs that can compress and encrypt in a single data flow.

- **Intel Dynamic Load Balancer (Intel DLB)²**

Intel DLB is a hardware managed system of queues and arbiters connecting producers and consumers. It is a PCI device envisaged to live in the server CPU uncore and can interact with software running on cores, and potentially with other devices.

- **Intel Data Streaming Accelerator (Intel DSA)¹**

Intel DSA drives high performance for storage, networking, and data-intensive workloads by improving streaming data movement and transformation operations. Designed to offload the most common data movement tasks that cause overhead in data center-scale deployments, Intel DSA helps speed up data movement across the CPU, memory, caches, all attached memory, storage, and network devices.

- **Intel In Memory Accelerator (Intel IAA)¹**

Intel IAA helps run database and analytics workloads faster, with potentially greater power efficiency. This built-in accelerator increases query throughput and decreases the memory footprint for in-memory database and big data analytics workloads. Intel IAA is ideal for in-memory databases, and source databases.

- **Intel Software Guard Extensions (Intel SGX) 512 GB³**

Intel® SGX offers hardware-based memory encryption that isolates specific application code and data in memory. Intel SGX allows user-level code to allocate private regions of memory, called enclaves, which are designed to be protected from processes running at higher privilege levels.

References

- ¹*Achieve Performance Advantage with Intel oneAPI, AI Tools, and 4th Gen Intel® Xeon® Scalable Processors Featuring Built-in Accelerator Engines*, (n.d.). Intel. <https://www.intel.com/content/www/us/en/developer/articles/technical/performance-advantage-with-xeon-and-oneapi-tools.html>
- ²*Intel® Dynamic Load Balancer*, (2023, May 23) Intel. <https://www.intel.com/content/www/us/en/download/686372/intel-dynamic-load-balancer.html>
- ³*Intel® Software Guard Extensions (Intel® SGX)*, (n.d.) Intel. <https://www.intel.com/content/www/us/en/architecture-and-technology/software-guard-extensions.html>

Enable Intel® On Demand Troubleshooting

Refer to the table below for Intel On Demand installation error messages and user actions.

Table 32. Intel On Demand installation messages and user actions

Message	User Action
License key upgraded successfully. The features will be activated on the processor after system power cycle.	You can activate Intel On Demand after performing one system power cycle.
The activation key format is invalid	Check if you have uploaded the correct Activation Key file. If the error persists, contact Lenovo support.
Invalid processor PPIN in Activation key	Contact Lenovo support.
The license was installed in the processor already	You have already installed this activation key. Check if the activation key you uploaded is correct.
Not enough NMRAM space in the processor	Contact Lenovo support.
Internal error	Contact Lenovo support.
Cold reset needed before next provisioning	If you want to continue installing an activation key, perform a system power cycle at first.
Unable to provision LAC due to FEH error	Contact Lenovo support.
Unable to import license in shutdown state, please try again after power on.	Power on the system before installing Intel On Demand.
Unable to import license due to On Demand Capabilities information is in progress. Please try again later.	If you want to continue installing an activation key, try again later.

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: 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 online help 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:

<https://pubs.lenovo.com/>

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. (See the following links) 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.
 - Drivers and software downloads
 - <https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v3/downloads/driver-list/>
 - Operating system support center
 - <https://datacentersupport.lenovo.com/solutions/server-os>
 - Operating system installing instructions
 - <https://pubs.lenovo.com/thinksystem#os-installation>
- If you have installed new hardware or software in your environment, check <https://serverproven.lenovo.com> to make sure that the hardware and software are supported by your product.
- Refer to “Problem Determination” in *User Guide* or *Hardware Maintenance Guide* for instructions on isolating and solving issues.

- Go to <http://datacentersupport.lenovo.com> and check for information to help you solve the problem.

To find the Tech Tips available for your server:

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

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

- Check Lenovo Data Center Forum at https://forums.lenovo.com/t5/Datacenter-Systems/ct-p/sv_eg to see if someone else has encountered a similar problem.

Gathering information needed to call Support

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

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

- Hardware and Software Maintenance agreement contract numbers, if applicable
- Machine type number (Lenovo 4-digit machine identifier). Machine type number can be found on the ID label, see “[Identify the server and access the Lenovo XClarity Controller](#)” on page 73.
- 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**

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

- **Lenovo XClarity Controller**

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

- For more information about using the web interface to collect service data, see the “Backing up the BMC configuration” section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>.

- For more information about using the CLI to collect service data, see the “XCC `ffdc` command” section in the XCC documentation compatible with your server at <https://pubs.lenovo.com/lxcc-overview/>.

- **Lenovo XClarity Administrator**

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

You can find more information about setting up automatic problem notification within the Lenovo XClarity Administrator at https://pubs.lenovo.com/lxca/admin_setupcallhome.

- **Lenovo XClarity Essentials OneCLI**

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

To obtain service data, you can run the `getinfor` command. For more information about running the `getinfor`, see https://pubs.lenovo.com/lxce-onecli/onecli_r_getinfor_command.

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/supportphonenumberlist> for your region support details.

Appendix B. Documents and supports

This section provides handy documents, driver and firmware downloads, and support resources.

Documents download

This section provides introduction and download link for handy documents.

Documents

Download the following product documentations at:

https://pubs.lenovo.com/sr650-v3/pdf_files

- **Rail Installation Guides**
 - Rail installation in a rack
- **User Guide**
 - Complete overview, system configuration, hardware components replacing, and troubleshooting.

Selected chapters from *User Guide*:

 - **System Configuration Guide** : Server overview, components identification, system LEDs and diagnostics display, product unboxing, setting up and configuring the server.
 - **Hardware Maintenance Guide** : Installing hardware components, cable routing, and troubleshooting.
- **Messages and Codes Reference**
 - XClarity Controller, LXPM, and UEFI events
- **UEFI Manual**
 - UEFI setting introduction

Note: SR650 V3 configured with Direct Water Cooling Module (DWCM) can be installed in the ThinkSystem Heavy Duty Full Depth Rack Cabinets. For ThinkSystem Heavy Duty Full Depth Rack Cabinets User Guide, see [ThinkSystem Heavy Duty Full Depth Rack Cabinets User Guide](#).

Support websites

This section provides driver and firmware downloads and support resources.

Support and downloads

- Drivers and Software download website for ThinkSystem SR650 V3
 - <https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v3/downloads/driver-list/>
- Lenovo Data Center Forum
 - https://forums.lenovo.com/t5/Datacenter-Systems/ct-p/sv_eg
- Lenovo Data Center Support for ThinkSystem SR650 V3
 - <https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v3>
- Lenovo License Information Documents
 - <https://datacentersupport.lenovo.com/documents/Invo-eula>

- Lenovo Press website (Product Guides/Datasheets/White papers)
 - <http://lenovopress.com/>
- Lenovo Privacy Statement
 - <https://www.lenovo.com/privacy>
- Lenovo Product Security Advisories
 - https://datacentersupport.lenovo.com/product_security/home
- Lenovo Product Warranty Plans
 - <http://datacentersupport.lenovo.com/warrantylookup>
- Lenovo Server Operating Systems Support Center website
 - <https://datacentersupport.lenovo.com/solutions/server-os>
- Lenovo ServerProven website (Options compatibility lookup)
 - <https://serverproven.lenovo.com>
- Operating System Installation Instructions
 - <https://pubs.lenovo.com/thinksystem#os-installation>
- Submit an eTicket (service request)
 - <https://support.lenovo.com/servicerequest>
- Subscribe to Lenovo Data Center Group product notifications (Stay up to date on firmware updates)
 - <https://datacentersupport.lenovo.com/solutions/ht509500>

Appendix C. Notices

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Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

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Important notes

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

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

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

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

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

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

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

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

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:

https://pubs.lenovo.com/important_notices/

Taiwan Region 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	○	○	○	○	○	○
機械組零件	—	○	○	○	○	○
空氣傳動設備	—	○	○	○	○	○
冷卻組零件	—	○	○	○	○	○
內存模組	—	○	○	○	○	○
處理器模組	—	○	○	○	○	○
電纜組零件	—	○	○	○	○	○
電源供應器	—	○	○	○	○	○
儲備設備	—	○	○	○	○	○
印刷電路板	—	○	○	○	○	○
<p>備考1. “超出0.1 wt %” 及 “超出0.01 wt %” 係指限用物質之百分比含量超出百分比含量基準值。</p> <p>Note1 : “exceeding 0.1wt%” and “exceeding 0.01 wt%” indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition.</p> <p>備考2. “○” 係指該項限用物質之百分比含量未超出百分比含量基準值。</p> <p>Note2 : “○” indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.</p> <p>備考3. “—” 係指該項限用物質為排除項目。</p> <p>Note3 : The “-” indicates that the restricted substance corresponds to the exemption.</p>						

Taiwan Region import and export contact information

Contacts are available for Taiwan Region 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
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