ThinkStation P8
Linux User Guide

Read this first

Before using this documentation and the product it supports, ensure that you read and understand the following:

- *Safety and Warranty Guide*
- *Generic Safety and Compliance Notices*
- *Setup Guide*

Third Edition (September 2024)

Contents

Discover your Lenovo computer

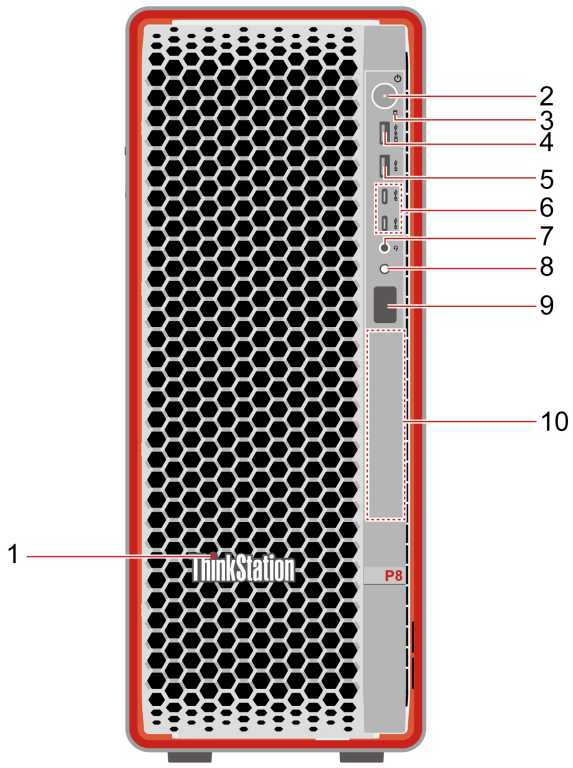
Thank you for choosing a Lenovo computer! We are dedicated to delivering the best solution to you.

Before starting your tour, please read the following information:

- Illustrations in this documentation might look different from your product.
- Depending on the model, some optional accessories, features, software programs, and user interface instructions might not be applicable to your computer.
- Documentation content is subject to change without notice. To get the latest documentation, go to https://pcsupport.lenovo.com.

Chapter 1. Overview

Front



Item	Description	Item	Description
1	ThinkStation® LED	2	Power button with indicator
3	Storage indicator	4	USB-A connector (USB 10Gbps, Always On USB)*
5	USB-A connector (USB 10Gbps)*	6	USB-C® connectors (USB 10Gbps)*
7	Headset connector	8	Diagnostic panel button
9	Diagnostic panel	10	Front-access storage bay

* for selected models

Note: For more information about the USB connector name update, see Appendix A “Notice for USB connector name update” on page 87.

Statement on USB transfer rate

Depending on many factors such as the processing capability of the host and peripheral devices, file attributes, and other factors related to system configuration and operating environments, the actual transfer rate using the various USB connectors on this device will vary and will be slower than the data rate listed in the connector name or below for each corresponding device.

USB device	Data rate (Gbit/s)
Thunderbolt™ 3	40
Thunderbolt 4	40

Power indicator

Show the system status of your computer.

- **On:** The computer is starting up or working.
- **Off:** The computer is off or in hibernation mode.
- **Blinking slowly:** The computer is in sleep mode.

Storage indicator

The storage indicator blinks when a storage drive is under reading or writing.

Always On USB feature

A USB connector with a battery icon supports the Always On USB feature. With the Always On USB feature enabled, the connector can charge a USB-compatible device when the computer is in sleep mode (S3), in hibernate mode (S4), or even off (S5).

To enable the Always On USB feature, do the following:

1. Enter the UEFI BIOS menu.
2. Click **Devices → USB Setup → USB Charging Port in S4/S5** to enable the Always On USB feature.

Diagnostic panel and diagnostic panel button

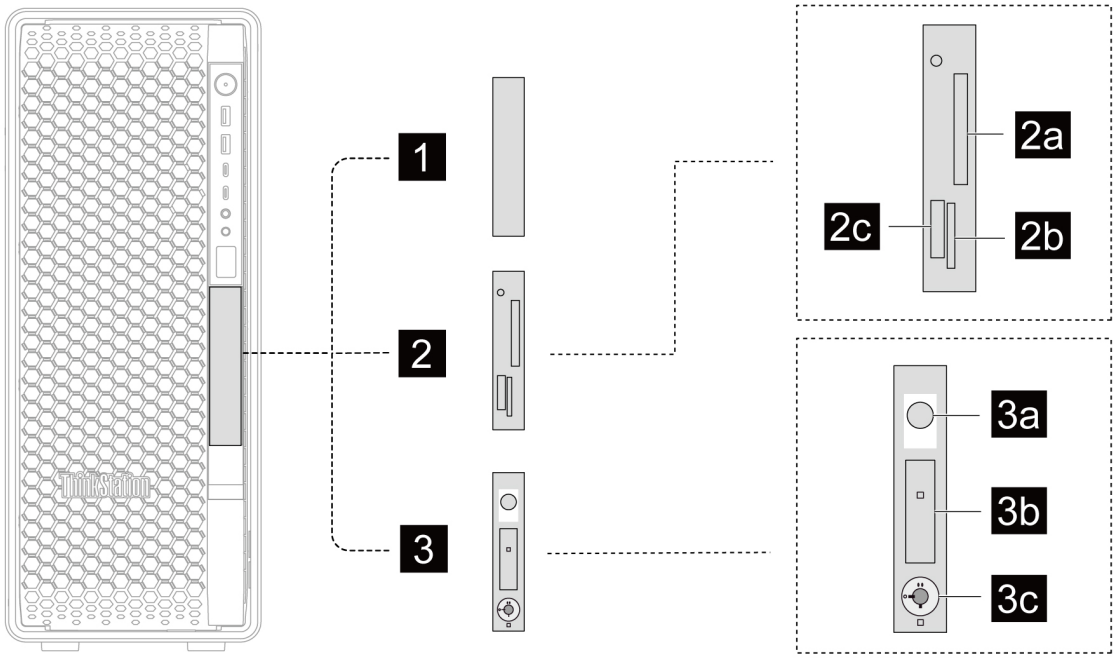
This computer can detect errors and display diagnostic information on the diagnostic panel.

Computer status	Diagnostic panel behavior	Diagnostic panel button function
No event	Off by default.	**Short press:** Turn on or turn off the diagnostic panel. The date and time will be displayed on the panel when it is turned on. The panel will turn off automatically if idle for three minutes.
Single event occurs	An error code and a QR code are automatically displayed.	**Long press (about 3 seconds):** Clear the event.
Multiple events occur	A list of error codes is automatically displayed.	**Short press:** Select an error event and check the corresponding QR code of the selected event. **Long press (about 3 seconds):** Clear the selected event.

To decode the error code, scan the QR code or go to https://www.thinkworkstationsoftware.com/codes.

Front-access storage bay

Depending on your computer model, one of the following devices is installed in the front-access storage bay.



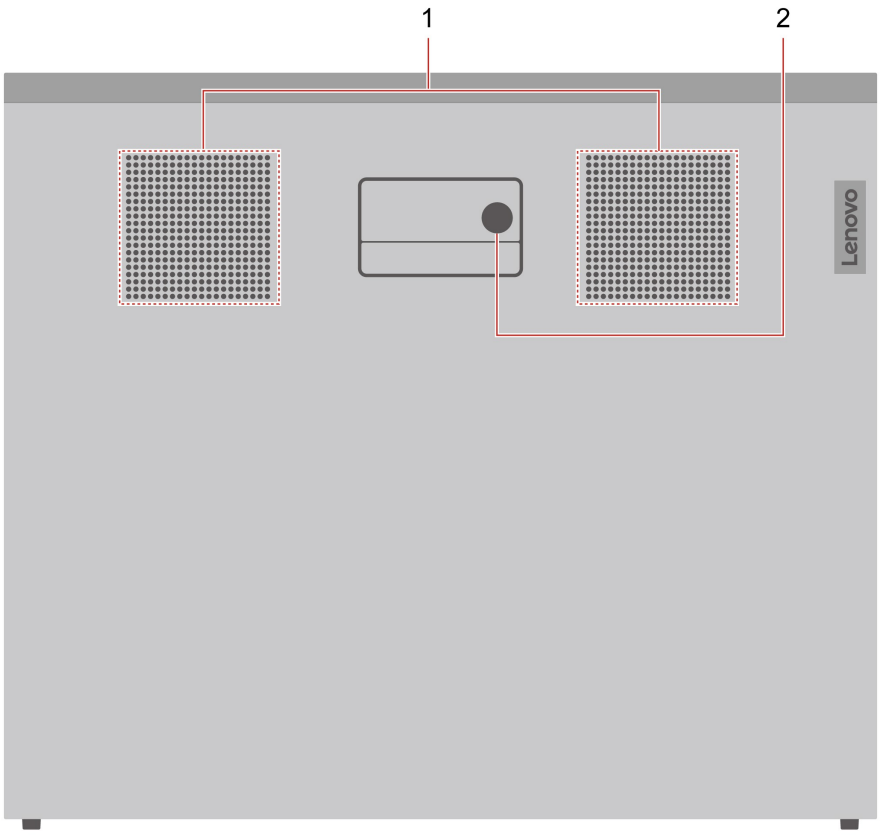
Name	Description
1 Blank bezel*	A dummy storage tray.
2 15-in-1 media card reader*	The 15-in-1 card reader with three card slots supports the following 15 types of cards. • 2a: CompactFlash™ Type I, CompactFlash™ Type II, Microdrive • 2b: SD™(Secure Digital), SDHC™(SD High Capacity), SDXC™(SD Extended Capacity), SD UHS-II (SD Ultra High Speed II), MultiMediaCard™ • 2c: Memory Stick™, Memory Stick Duo™, Memory Stick PRO™, Memory Stick PRO Duo™, Memory Stick PRO-HG Duo™, Memory Stick XC Duo, Memory Stick XC-HG Duo
3 NVMe storage tray*	The NVMe storage tray consists of the following parts. • 3a Eject button of M.2 SSD (solid-state drive) storage box • 3b M.2 SSD storage box • 3c Lock for M.2 SSD storage box **Note:** The M.2 SSD storage box is hot-swappable when NVMe RAID mode is disabled and the operating system of your computer does not reside on the M.2 SSD inside.

* for selected models

Related topics

- “USB specifications” on page 6
- “Use physical locks” on page 11
- “Use ThinkStation diagnostic tool” on page 80

Left



Item	Description	Item	Description
1	Side air vents	2	Lock for side cover*

* for selected models

Side ventilation notice

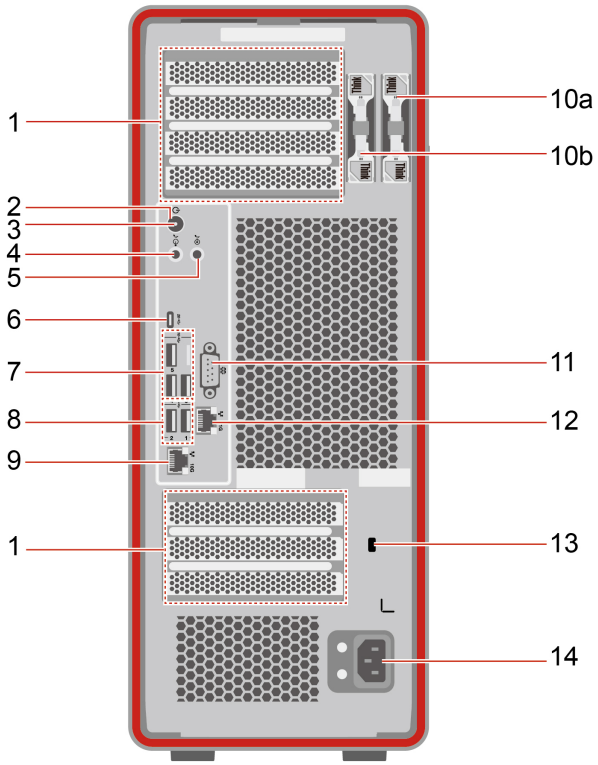
Pay attention to the following ventilation requirements when using your computer.

- To ensure heat dissipation, do not block air vents or place any objects within 4.5 cm (1.8 inches) or 1 rack unit from the left side cover.
- For rack-mounted systems, a rack spacer is recommended in the gap above the system.

Related topics

“Use physical locks” on page 11

Rear



Item	Description	Item	Description
1	PCIe card areas	2	Power button
3	Power indicator	4	Audio line-out connector
5	Audio line-in connector	6	USB-C connector (USB 20Gbps)
7	USB-A connectors (USB 10Gbps)	8	USB-A connectors (Hi-Speed USB)
9	Ethernet connector (10G)	10a	Key-nest for side cover
10b	Key-nest for M.2 SSD storage box	11	Serial connector*
12	Ethernet connector (1G)	13	Security-lock slot
14	Power cord connector		

* for selected models

Serial connector

Connect an external modem, a serial printer, or other devices that use a serial connector.

PCIe card areas

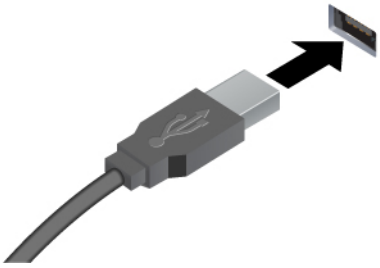
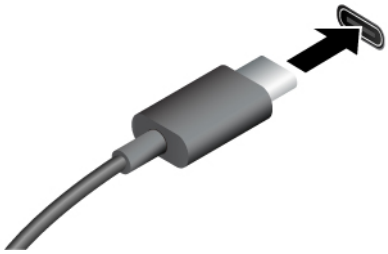
The video output connectors in PCIe areas might be HDMI™ connectors, DisplayPort™ connectors, or Mini DisplayPort™ connectors.

Related topics

- “USB specifications” on page 6
- “Connect to external displays” on page 9
- “Use physical locks” on page 11

USB specifications

Note: Depending on the model, some USB connectors might not be available on your computer.

Connector name	Description
 • USB-A connector (Hi-Speed USB) • 10 USB-A connector (USB 10Gbps)	Connect USB-A compatible devices, such as a USB-A keyboard, USB-A mouse, USB-A storage device, or USB-A printer.
 • 10 USB-C connector (USB 10Gbps) • 20 USB-C connector (USB 20Gbps)	• Charge USB-C compatible devices with the output voltage and current of 5 V and 3 A. • Connect to USB-C accessories to help expand your computer functionality. To purchase USB-C accessories, go to https://www.lenovo.com/accessories.

Platform specifications

Specification	Description
Dimensions	• Width: 175 mm (7 inches) • Height (with feet): 441 mm (18 inches) • Depth: 508 mm (20 inches)
Weight (without packaging)	Maximum configuration as shipped: 23 kg (51 lb)
Hardware configuration	1. Open the system menu from the top-right corner and click **Settings**. 2. Click **About**.
Power supply	• 1000-watt 92% power supply • 1400-watt 92% power supply

Specification	Description
Electrical input	• Input voltage: From 100 V ac to 240 V ac • Input frequency: 50/60 Hz
Microprocessor	To view the microprocessor information of your computer, enter **Settings** and click **About**.
Memory module	• Number of memory modules: 1, 2, 4, 6, or 8 • Memory module type: – DDR5-4800 (double data rate 5 at 4800 MT/s) ECC (error correction code) RDIMM (registered dual inline memory module) (16GB, 32GB, or 64GB) – DDR5-4800 ECC 3DS (3D stacking) RDIMM (128GB) **Note:** See “System memory speed” on page 8 for more details.
Storage device	• 3.5-inch HDD (hard disk drive)* • M.2 SSD (solid-state drive)* • U.2 or U.3 SSD* **Note:** Type `Disks` in the search box and use the **Disks** application to view the storage drive capacity of your computer. The storage drive capacity indicated by the system is less than the nominal capacity.
Video features	• Four PCIe x16 slots on the system board for installing graphics cards • Up to 16 external displays can be connected when four four-port graphics cards are installed
Expansion	• Internal storage drive cages* • Optional internal storage drive cage* • On-board M.2 SSD slots • PCIe slots • Memory slots • Front-access storage bay* **Note:** For detailed expansion rules, see “Expansion modules” on page 17.
Network features	• Bluetooth* • Ethernet LAN • Wireless LAN*

* for selected models

Operating environment

- Maximum altitude (without pressurization):
  - Operating: From 0 m (0 ft) to 3048 m (10 000 ft)
  - Storage: From 0 m (0 ft) to 12192 m (40 000 ft)
- Temperature:
  - Operating: From 10 °C (50 °F) to 35 °C (95 °F)
  - Storage: From -40 °C (-40 °F) to 60 °C (140 °F)
- Relative humidity:

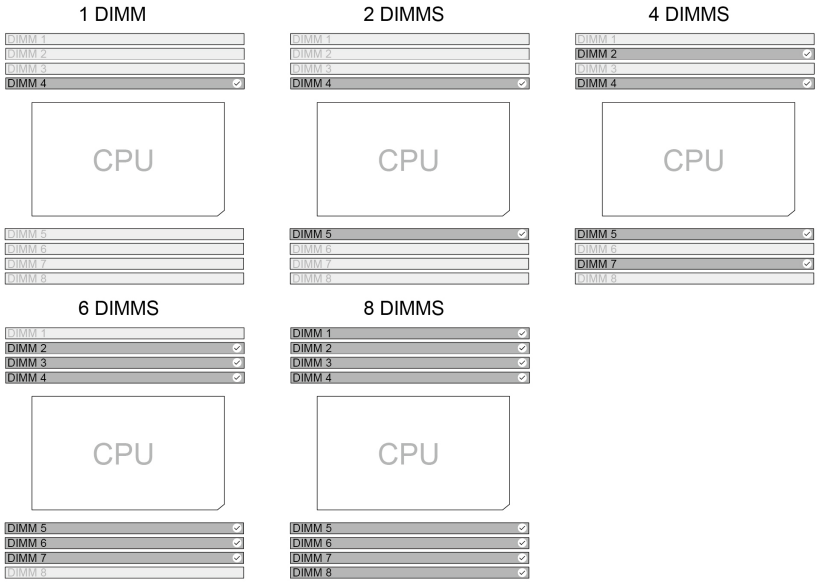
- Operating: 20%-80% (non-condensing)
- Storage: 10%-90% (non-condensing)

System memory speed

ThinkStation P8 comes with DDR5-4800 memory modules and will run up to 4800 MT/s.

To avoid unexpected frequency reduction, ensure that you install memory modules in a right way:

- Installed memory module quantity: 1 pc, 2 pcs, 4 pcs, 6 pcs, or 8 pcs
- Install memory modules of the same type, the same capacity, and the same DRAM densities.
- Install memory modules in the order shown in the following illustration.



Notes:

- The actual system memory speed depends on the microprocessor model. For example, your computer comes with 4800 MT/s memory modules, but the microprocessor only supports up to 4400 MT/s memory modules. Then the system memory speed will be no faster than 4400 MT/s. For microprocessor models supported in your computer, contact the Lenovo Customer Support Center.
- If you install memory modules of different speed, the actual system memory speed will be set to the lowest speed of all the memory modules.

Chapter 2. Get started

Initial setup

Ensure to follow the ventilation requirements in “Side ventilation notice” on page 4.

Step 1. Connect the cables of external displays and other necessary devices to appropriate connectors on the computer.

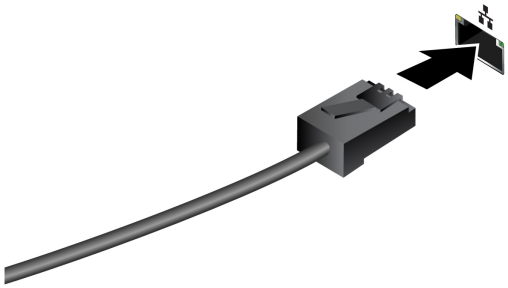
Step 2. Connect the power cord to the power cord connector on the computer and then connect it to a properly-grounded electrical outlet.

Step 3. Press the power button to turn on the computer.

Step 4. Follow the on-screen instructions to complete the setup procedures.

Step 5. Connect to a wired or wireless network.

- Wired network: Connect Ethernet cable of local network to the Ethernet connector on the computer.



- Wireless network: If your computer includes a wireless LAN module, you can connect your computer to Wi-Fi®networks.
  1. Open the system menu from the top-right corner and expand the Wi-Fi section of the menu.
  2. Click **Select Network**. A list of available wireless networks is displayed.
  3. Select a network available for connection. Provide required information, if needed.

Connect to external displays

Your computer has four PCIe x16 slots for installing graphics cards. You can connect to up to 16 wired displays when four four-port graphics cards are installed.

Before you start, configure graphics cards if necessary.

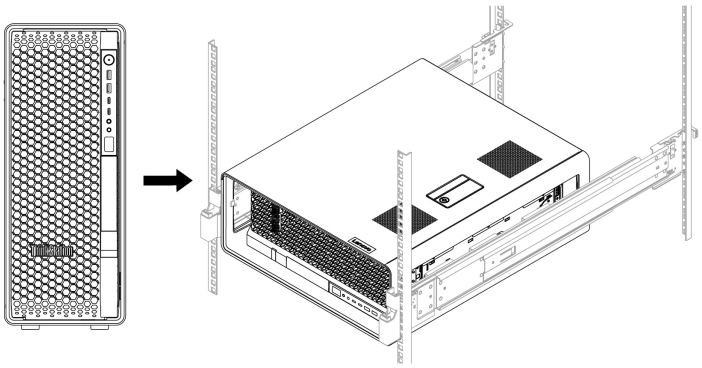
- Ensure to install graphics cards into PCIe x16 slots and follow “PCIe card installation rule” on page 68.
- Installation requirements may vary by graphics card type. See graphics card documentation for details.

To connect to an external display, do the following.

1. Connect one end of the display cable or adapter to the HDMI, Mini DisplayPort, DisplayPort, or other display ports on your computer.
2. Connect the other end of the cable or adapter to the external display.

Rack-mounted chassis

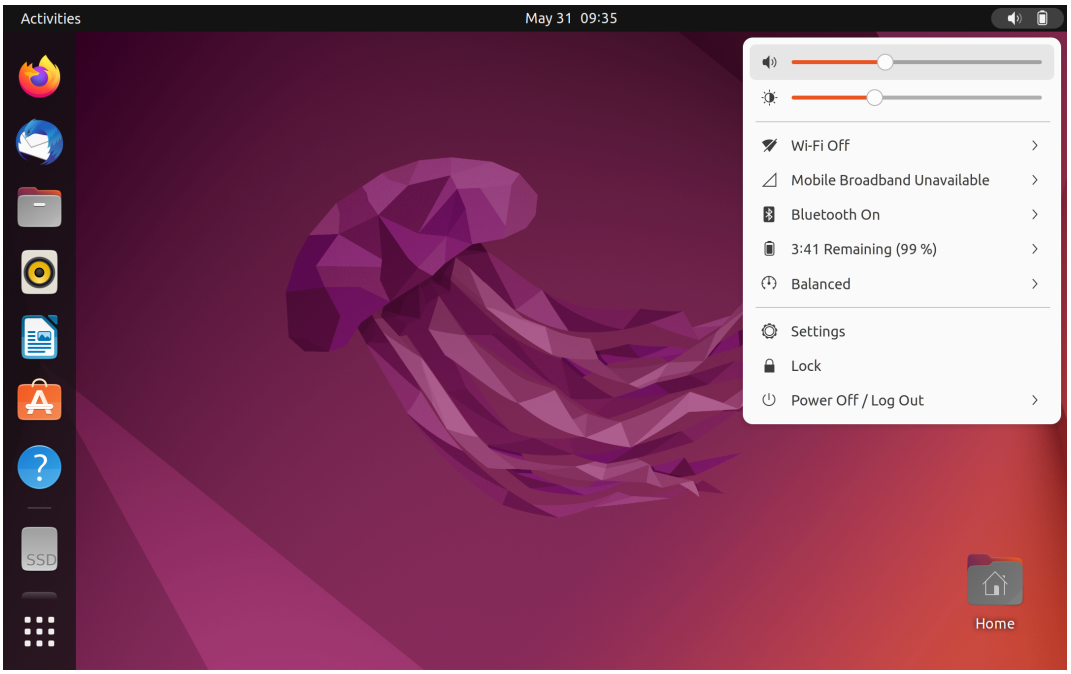
Your computer offers flexibility for both desktop and data center environments. With an easy-to-attach sliding rail kit, you can install the computer into a rack. You can buy the rail kit from Lenovo. It will come with a guide to help you install your computer into a rack.



Get started with Ubuntu Desktop

Learn the basics of Ubuntu and start working with it right away. For more information about Ubuntu, see the Ubuntu documentation site at: https://help.ubuntu.com/lts/ubuntu-help/index.html.

The Gnome desktop is installed by default and is designed to be simple and easy to use. Details on using Gnome are available by launching the Help application or online at https://help.gnome.org/users/.



Launch an app

- Press the Super key (with the Windows logo) or open the Activities menu on the top left and type in the name of the application you want to launch.
- Click the **Show Applications** button on the lower left, and select the application you want to launch.

Launch settings

Open the system menu from the top-right corner and click **Settings**.

Set the power plan

For ENERGY STAR® compliant computers, the following power plan takes effect when your computers have been idle for a specified duration:

- Turn off the display: After 5 minutes
- Put the computer to sleep: After 20 minutes

To awaken the computer from Sleep mode, press any key on your keyboard.

To set the power plan to achieve the best balance between performance and power saving:

1. Open the system menu from the top-right corner and click **Settings**.
2. Click **Power**.
3. Choose or customize a power plan of your preference.

Security solutions

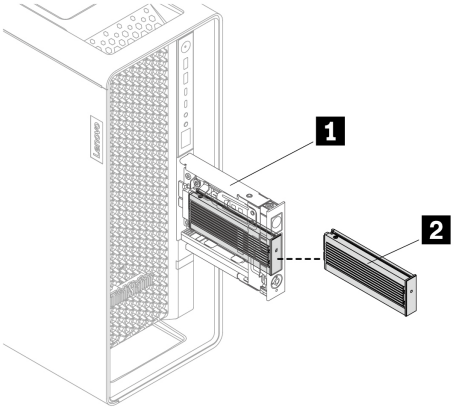
Lenovo values your information security. Your computer can be secured by physical locks, software solutions, and BIOS solutions. They can protect your computer from harm, theft, or unauthorized use.

Use physical locks

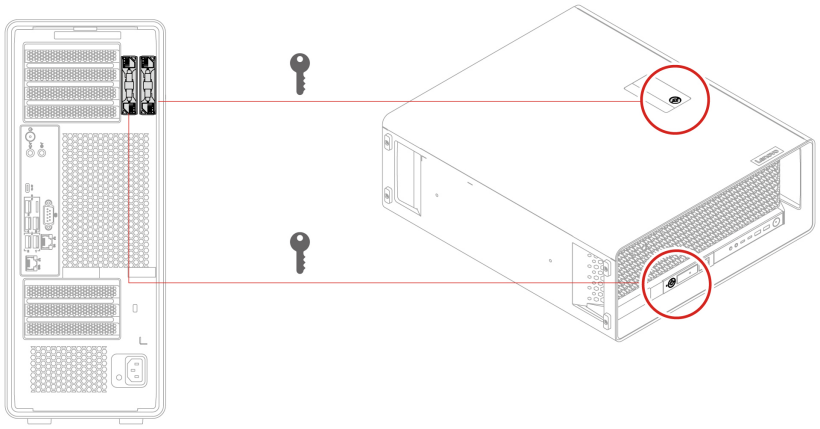
You can secure your computer and information by the following physical locks.

Locks for side cover and M.2 SSD storage box

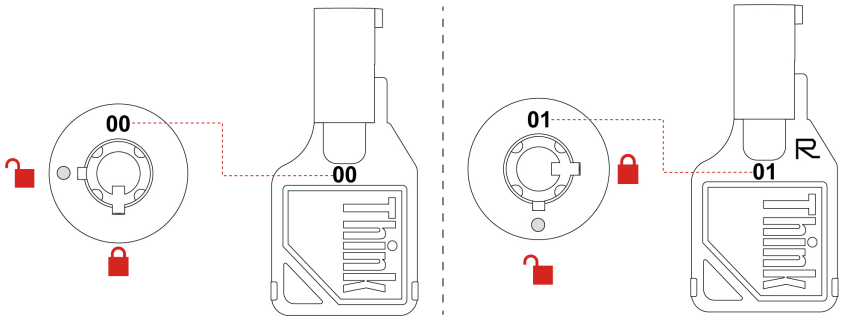
- **Function of locks**
  - Locks for side cover and M.2 SSD storage box prevent unauthorized access to the inside of your computer chassis or storage drive.
  - The M.2 SSD storage box(2) in the NVMe storage tray is hot-swappable when NVMe RAID mode is disabled and the operating system of your computer does not reside on the M.2 SSD inside. It means you can replace the M.2 SSD inside without even turning off your computer. Locking the M.2 SSD storage box can prevent unexpected removal.



- **Keys to locks**
  - The keys are attached to the rear panel. For security, store the keys in a secure place when you are not using them.

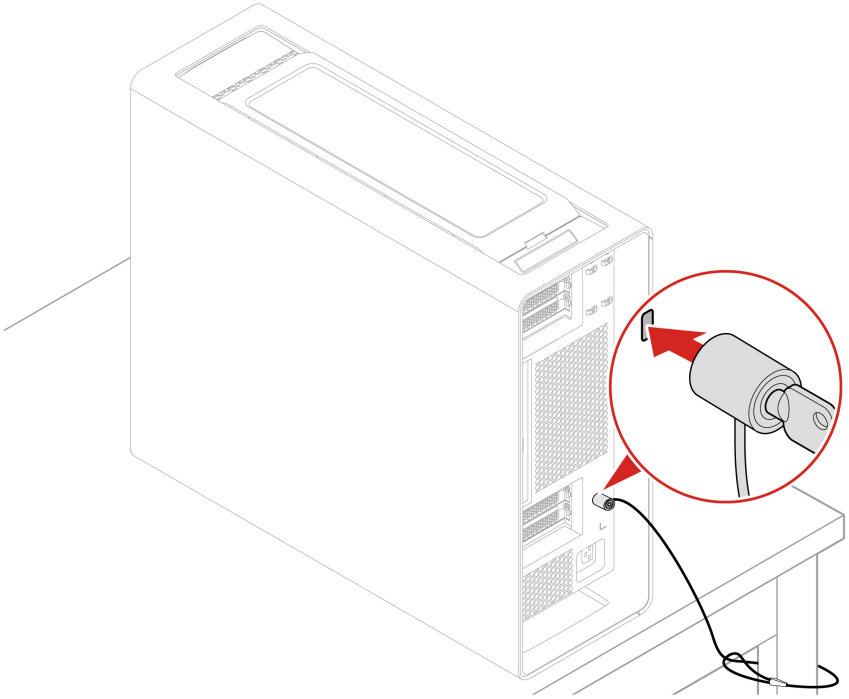


  - Keys carved with xx, such as **00**, **01**, **02**, or **03** can unlock the locks carved with the same numbers.
  - To unlock, turn the key clockwise to the position with a circle mark on the lock. To lock, turn the key counterclockwise.



Security lock

Lock your computer to a desk, table, or other fixtures through a security lock.



Note: You can purchase such a security lock from Lenovo if needed. But Lenovo makes no comments, judgments, or warranties about the function, quality, or performance of locking device produced by a third party.

Use BIOS security solutions

This section provides BIOS solutions to secure your computer and information.

Wipe the storage drive data

It is recommended that you wipe the storage drive data before recycling the storage drive or the computer.

To wipe the storage drive data:

1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
2. Select **Security → secure wipe → Enabled**.
3. Press F10 or Fn+F10 to save the changes and exit.
4. Restart the computer. When the logo screen is displayed, press F12 or Fn+F12.
5. Select **App Menu → secure wipe** and press Enter.
6. Select the storage drive you will wipe and click **NEXT**.
7. Select the entire storage drive or partition to wipe as desired.
8. Select the method as desired and click **NEXT**.
9. Click **Yes** to confirm your option when the prompting window is displayed.
10. If you have set a hard disk password for the storage drive, enter the password. Otherwise, set a temporary password following the on-screen instructions. Then, click **NEXT**. The wiping process begins.

    Note: Duration of the wiping process varies depending on the storage drive capacity.
11. Click **Reboot** when you are prompted to reset the system, and then one of the following will happen:

- If the system storage drive data is wiped, you will be prompted that no operating system is found.
- If the non-system storage drive data is wiped, the computer restarts automatically.

Cover presence switch

The cover presence switch prevents the computer from logging in to the operating system when the computer cover is not properly installed or closed.

To enable or disable the cover presence switch connector on the system board:

1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
2. Select **Security → Cover Tamper Detected** and press Enter.
3. Select **Enabled** or **Disabled** and press Enter.
4. Press F10 or Fn+F10 to save the changes and exit.

If the cover presence switch is enabled and the computer cover is not correctly installed or closed, an error message will be displayed when you turn on the computer. To bypass the error message and log in to the operating system, properly install and close the computer cover and disable the cover presence switch in the BIOS menu.

Smart USB Protection

The Smart USB Protection function is a security function that helps prevent data from being copied from the computer to USB storage devices connected to the computer. You can set the Smart USB Protection function to one of the following modes:

- **Disabled** (default setting): You can use the USB storage devices without limitation.
- **Read Only**: You cannot copy data from the computer to the USB storage devices. However, you can access data on the USB storage devices.
- **No Access**: You cannot access the USB storage devices from the computer.

To configure the Smart USB Protection function:

1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
2. Select **Security → Smart USB Protection** and press Enter.
3. Select the desired setting and press Enter.
4. Press F10 or Fn+F10 to save the changes and exit.

UEFI BIOS passwords

You can set passwords in UEFI (Unified Extensible Firmware Interface) BIOS (Basic Input/Output System) to strengthen the security of your computer.

Password types

You can set a power-on password, supervisor password, system management password, or hard disk password in UEFI BIOS to prevent unauthorized access to your computer. However, you are not prompted to enter any UEFI BIOS password when your computer resumes from sleep mode.

- Power-on password

  When a power-on password is set, you are prompted to enter a valid password each time the computer is turned on.
- Supervisor password

Setting a supervisor password deters unauthorized users from changing configuration settings. If you are responsible for maintaining the configuration settings of several computers, you might want to set a supervisor password.

When a supervisor password is set, you are prompted to enter a valid password each time you try to enter the BIOS menu.

If both the power-on password and supervisor password are set, you can enter either password. However, you must use your supervisor password to change any configuration settings.

- Hard disk password

  Setting a hard disk password prevents unauthorized access to the data on the storage drive. When a hard disk password is set, you are prompted to enter a valid password each time you try to access the storage drive.

  Note: After you set a hard disk password, your data on the storage drive is protected even if the storage drive is removed from one computer and installed in another.

- System management password (for selected models)

  You can enable the system management password to have the same authority as the supervisor password to control security related features. To customize the authority of the system management password through the UEFI BIOS menu:

  1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
  2. Select **Security → System Management Password Access Control**.
  3. Follow the on-screen instructions.

  If you have set both the supervisor password and the system management password, the supervisor password overrides the system management password.

Set, change, and remove a password

Before you start, print these instructions.

1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
2. Select **Security**.
3. Depending on the password type, select **Set Supervisor Password**, **Set Power-On Password**, **Set System Management Password**, or **Hard Disk Password** and press Enter.
4. Follow the on-screen instructions to set, change, or remove a password.
5. Press F10 or Fn+F10 to save the changes and exit.

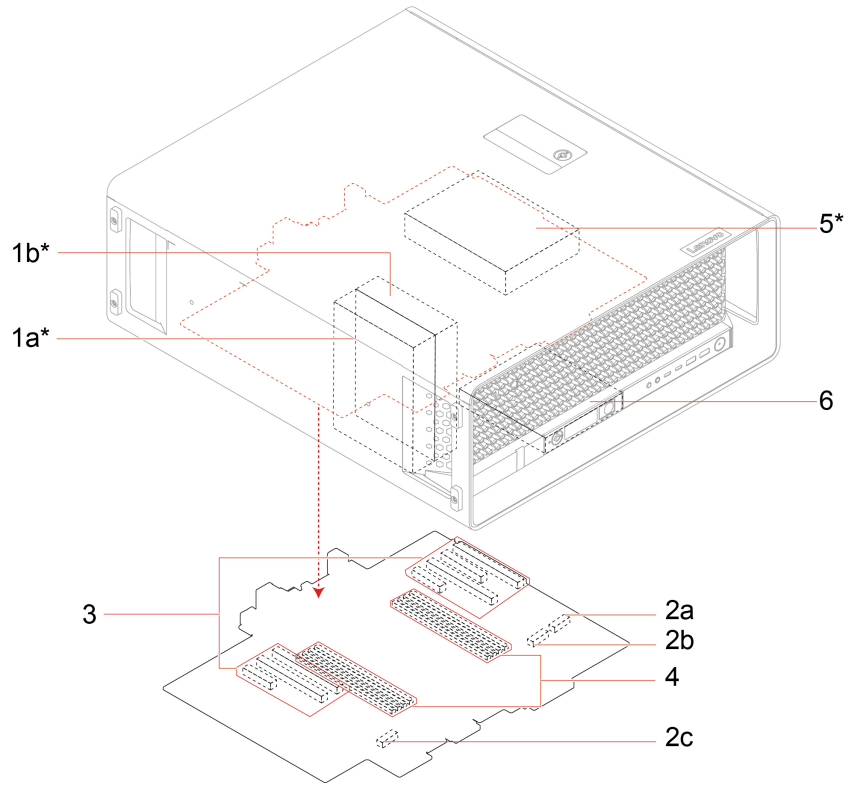
You should record your passwords and store them in a safe place. If you forget the passwords, contact a Lenovo-authorized service provider.

Note: If the hard disk password is forgotten, Lenovo cannot remove the password or recover data from the storage drive.

Chapter 3. Explore your computer

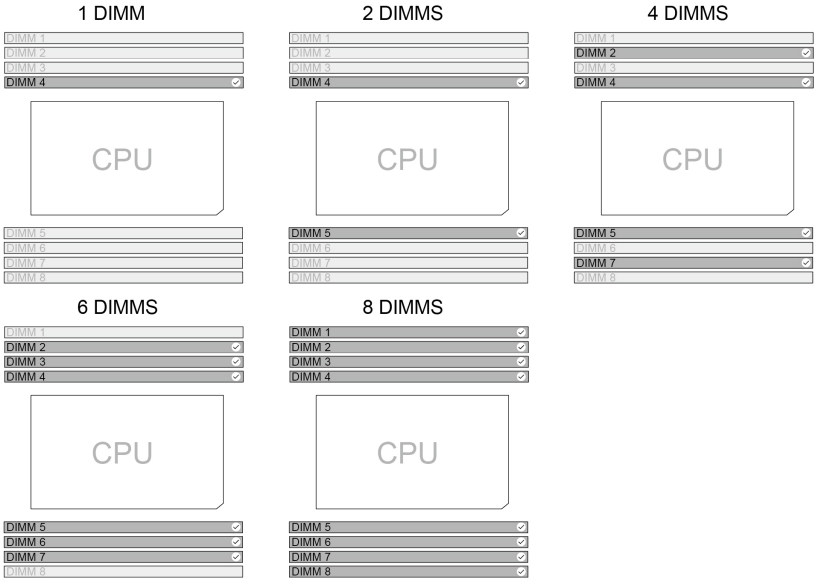
Expansion modules

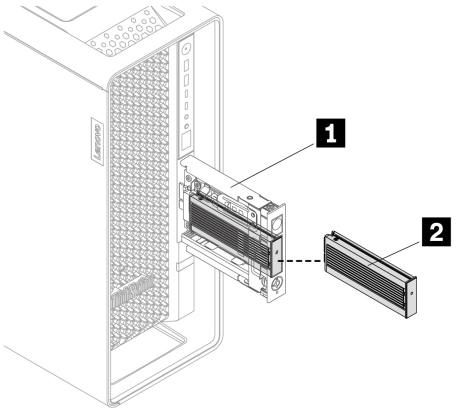
You can enhance your computer capacity and performance by adding various devices to the expansion modules. The following is a non-exhausting list of expansion rules for your reference. For the steps of replacing a part, see Chapter 5 “CRU replacement” on page 33.



* for selected models

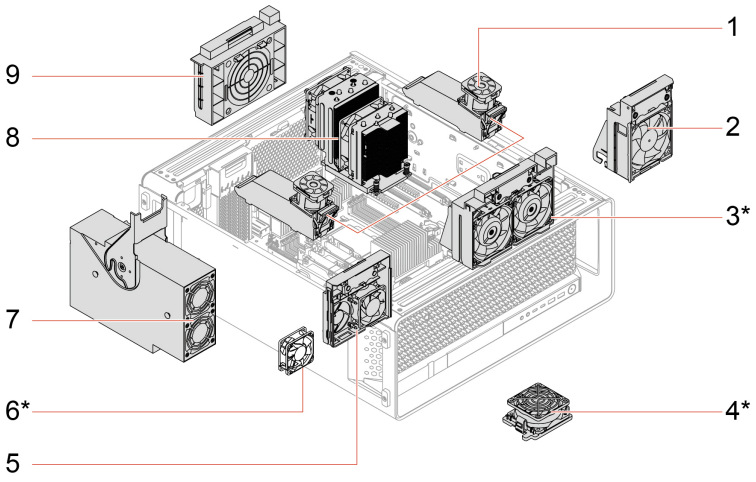
Location	Name	Expansion rules
1a, 1b	Internal storage drive cages*	• Each internal storage drive cage can support the following storage drives: – Up to one 3.5-inch HDD – Up to two M.2 SSD – Up to one U.2 or U.3 SSD • The storage drives installed in 1a and 1b should be the same. • Installation priority: 1a is the first and 1b is the second.
2a, 2b, 2c	On-board M.2 SSD slots	• Supported type: M.2 SSD (2280/22110) • Installation priority: 2a is the first, 2b is the second, and 2c is the third.

Location	Name	Expansion rules
3	PCIe slots	PCIe slot types and PCIe card installation priority are as follows. 3 Slot 1 – Gen5 x16 5 Slot 2 – Gen5 x8 1 Slot 3 – Gen5 x16 6 Slot 4 – Gen5 x8 2 Slot 5 – Gen5 x16 4 Slot 6 – Gen5 x16 7 Slot 7 – Gen4 x8 **Note:** See “PCIe card installation rule” on page 68 for more details.
4	Memory slots	• Supported memory module type: – DDR5-4800 ECC RDIMM (16GB, 32GB, or 64GB) – DDR5-4800 ECC 3DS RDIMM (128GB) • Supported memory module quantity: 1 pc, 2 pcs, 4 pcs, 6 pcs, or 8 pcs • Install memory modules of the same type, the same capacity, and the same DRAM densities. • Install memory modules in the order shown in the following illustration. 

Location	Name	Expansion rules
5	Optional internal storage drive cage*	The optional internal storage drive cage can support a 3.5-inch HDD when: • 1a and 1b are both occupied with 3.5-inch HDDs, and • the computer is not installed with NVIDIA Quadro SYNC II card or GeForce 40X0 graphics card.
6	Front-access storage bay	Depending on your computer model, one of the following devices can be installed in the front-access storage bay. • Blank bezel • 15-in-1 media card reader • NVMe storage tray (1) **Note:** The M.2 SSD storage box(2) in the NVMe storage tray is hot-swappable when NVMe RAID mode is disabled and the operating system of your computer does not reside on the M.2 SSD inside. 

Cooling system

The cooling system of your computer allows for unobstructed airflow. Illustrations and descriptions of the fans and heat sinks are as follows:



* for selected models

Item	Description	Item	Description
1	Memory fans and air ducts	2	Upper PCIe fan
3	Front fan*	4	Front-access storage fan*
5	Lower PCIe fan	6	Internal storage drive fan*
7	Power supply assembly fan	8	Microprocessor heat sink
9	Rear fan		

Note: To replace the fans and heat sinks, see “Fans” on page 71.

UEFI BIOS

UEFI BIOS is the first program that the computer runs. When the computer turns on, the UEFI BIOS performs a self test to make sure that various devices in the computer are functioning properly.

Enter the UEFI BIOS menu

Turn on or restart the computer. When the logo screen is displayed, press F1 or Fn+F1 to enter the UEFI BIOS menu.

Note: If you have set UEFI BIOS passwords, enter the correct passwords when prompted. You also can select **No** or press Esc to skip the password prompt and enter the UEFI BIOS menu. However, you cannot change the system configurations that are protected by passwords.

Navigate the UEFI BIOS menu

Follow the on-screen instructions to navigate in the UEFI BIOS menu.

The table below introduces the available settings of the UEFI BIOS menu. You can follow the on-screen instruction to navigate in the UEFI BIOS menu.

Note: The UEFI BIOS menu might vary depending on system configurations.

Menu	Introduction
Main	This category provides the general product-related and firmware information including system summary, machine type, product serial number, UUID number, etc.
Devices	This category introduces how to configure various devices such as USB ports and audio controllers.
Advanced	This category provides advanced information about the computer such as the CPU features.
Main Power	This category introduces power and thermal management solutions.
Security	This category introduces various passwords, locks, and software to protect your computer.
Startup	This category introduces how to set the boot priority order.
Exit	This category introduces how to exit as you prefer.

You can go to Lenovo BIOS Simulator Center https://download.lenovo.com/bsco/index.html to explore the detailed settings by your product name.

Note: The Lenovo BIOS Simulator Center makes periodic updates of the settings. The UEFI BIOS simulator interface and description of settings might be different from that on your actual user interface.

Update UEFI BIOS

When you install a new program, device driver, or hardware component, you might need to update UEFI BIOS. You can update the BIOS from your operating system or a flash update disc (supported only on selected models).

Download and install the latest UEFI BIOS update package by one of the following methods:

- Using the built-in software update service:

  Ubuntu software update will check the LVFS site for any firmware updates and notify you when updates are available.
- From the Lenovo Support Web site:
  1. Go to https://pcsupport.lenovo.com.
  2. Download the flash BIOS update driver for the operating system version or the ISO image version (used to create a flash update disc). Then, download the installation instructions for the flash BIOS update driver you have downloaded.
  3. Print the installation instructions and follow the instructions to update the BIOS.

BMC card

This section provides information of the Baseboard Management Controller (BMC) card, including its functions, overview, setup, password management, and firmware update.

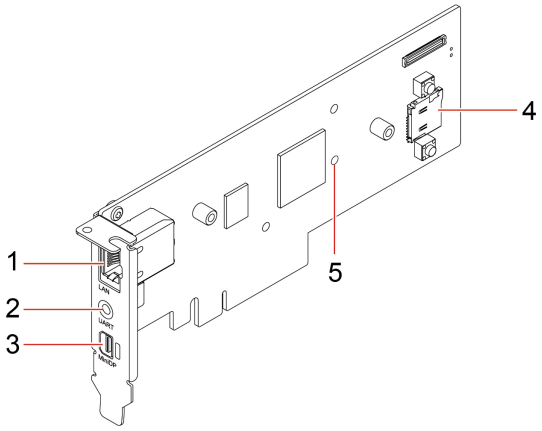
Functions of the BMC card

You can use the BMC card to manage your workstation through ThinkStation BMC remote management console, for example:

- View and monitor the following information:
  - Overall status
  - Relevant information of sensors
  - System inventory
- Access the following basic configurations:
  - Logs and reports
  - Configuration settings
- Access the following advanced configurations:
  - Video recording
  - Remote control
  - Virtual media configuration
  - Maintenance tasks, including backing up configuration items, restoring configuration files, updating firmware, and so on.

For details of ThinkStation BMC remote management console, access the following Web site: https://support.lenovo.com/docs/bmc_web_guide.

Overview of the BMC card

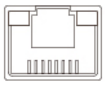
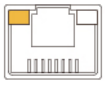
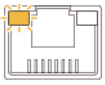
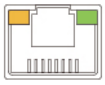
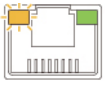
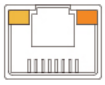
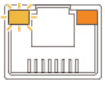


Item	Description	Item	Description
1	Ethernet connector	2	UART connector
3	Mini DisplayPort out connector	4	MicroSD slot
5	Firmware LED indicator		

Note: UART connector is disabled and reserved for future use.

Ethernet connector

Equipped with Ethernet controllers, the Ethernet connector (RJ-45) can transfer data at a speed of 10, 100, or 1000 Mbps.

LED status	Indication
	The Ethernet is not connected yet.
	The 10-Mbps Ethernet is connected, ready for transferring data.
	The 10-Mbps Ethernet is transferring data.
	The 100-Mbps Ethernet is connected, ready for transferring data.
	The 100-Mbps Ethernet is transferring data.
	The 1000-Mbps Ethernet is connected, ready for transferring data.
	The 1000-Mbps Ethernet is transferring data.

MicroSD slot

You can install a microSD card (capacity up to 2 TB) in the microSD slot as local media of BMC.

Firmware LED

When the LED status indicates ✳, it means the firmware works well.

When the LED is off, it means the firmware does not work. To solve the problem, do the following:

1. Ensure that the cable is correctly connected to the BMC card and to the system board.
2. Ensure that the BMC card is correctly installed.
3. If the LED is still off, replace the BMC card with a new one.

Set up the BMC card

Do the following to set up the BMC card.

Step 1. Connect your computer to a local network with an Ethernet cable through the Ethernet connector on the BMC card.

Note: Ensure that the host computer and client computers are in the same local area network.

Step 2. Connect power cables and turn on your computer. Wait at least 3 minutes for initial startup. You can view the startup process on the diagnostic LCD.

Step 3. Obtain the dynamic IP address (for example: `10.176.7.xxx`) from either client BIOS or router port management interface, and then log in to the BMC remote management console through a web browser (for example: `https://10.176.7.xxx/#login`).
For initial access, input your username (default: `admin`) and password (default: `admin`). It is mandatory to change your password once you log in.

Manage the BMC password

You can manage BMC passwords in the following methods to prevent unauthorized access to your computer.

- UEFI BIOS
- The BMC remote management console
- IPMI command

Update the BMC firmware

You can update the BMC firmware to the latest depending on your needs.

Step 1. Go to https://support.lenovo.com/docs/bmc_fw_ts_x576 and follow the on-screen instructions to select and download the corresponding firmware installation package.

Step 2. Log in to the BMC remote management console on the host computer.

Step 3. Click **Maintenance → Firmware Update** and select the latest firmware installation package you prepared.
The firmware will be updated automatically. Your BMC card will automatically restart when the firmware update is completed.

ThinkStation DASH support

DASH (desktop and mobile architecture for system hardware) is a set of specifications developed by DMTF, which aims to provide open standards based web service management for desktop and mobile client systems.

Profile list

Profile	Requirement
Base Desktop and Mobile	Mandatory
Profile Registration	Mandatory
Role Based Authorization	Mandatory
Simple Identity Management	Mandatory
Boot Control	Optional
CPU	Optional
Indicators	Optional
Physical Asset	Optional
Power State Management	Optional
Sensors	Optional
Software Inventory	Optional
System Memory	Optional
BIOS Management	Optional
DHCP Client	Optional
DNS Client	Optional
Ethernet Port	Optional
Host LAN Network Port	Optional
IP Interface	Optional
OS Status	Optional
Software Update	Optional
Text Console Redirection	Optional
USB Redirection	Optional
Record Log	Optional
SSH	Optional
Computer system	Optional

Note: KVM Redirection supports remote management in OS only, not in BIOS setup.

Enable DASH in BIOS

1. Select **Advanced → DASH Configuration → Enable** and press Enter.
2. Install Realtek Lan driver and DASH service.

3. Config DASH account and password with DASHConfigRT.

Chapter 4. RAID

What is RAID

Redundant Array of Independent Disks (RAID) is a technology that provides increased storage functions and reliability through redundancy. It also can improve data storage reliability and fault tolerance compared with single-drive storage systems. Data loss resulting from a drive failure can be prevented by reconstructing missing data from the remaining drives.

When a group of independent physical storage drives is set up to use RAID technology, they are in a RAID array. This array distributes data across multiple storage drives, but the array appears to the host computer as one single storage unit. Creating and using RAID arrays provides high performance, such as the expedited I/O performance, because several drives can be accessed simultaneously.

Configure RAID with RAIDXpert2 Configuration Utility

If your computer comes with the RAIDXpert2 Configuration Utility , you can follow the sections below to configure RAID.

Select RAID mode

You can select the SATA RAID mode or NVMe RAID mode to configure RAID with RAIDXpert2 Configuration Utility.

1. Do one of the following to select the SATA RAID mode or NVMe RAID mode:
   - SATA RAID mode:
     a. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
     b. Select **Devices → Storage Setup → Configure SATA as (AHCI/RAID)**.
     c. Select **RAID**.
   - NVMe RAID mode:
     a. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
     b. Select **Devices → NVMe Setup → NVMe RAID Mode (Enabled/Disabled)**.
     c. Select **Enabled**.
2. Press F10 or Fn+F10 to save the changes and exit.
3. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
4. Select **Devices → RAIDXpert2 Configuration Utility** to select drives and configure RAID.

Storage drive requirements for RAID levels

CAUTION:
Multiple operating systems are not supported on AMD-RAID Array. If the system is booted from an AMD-RAID bootable array, the first array in the Arrays section must be the bootable array. The system boots only from the first array in the Arrays section. Find the first array by viewing array details and checking the array number.

Your computer supports the following RAID levels:

- RAID 0: striped disk array
  - Provide the highest performance but no data redundancy. Data in the array is striped (distributed) across several disks.

  - Support 2-8 disks.
  - RAID 0 arrays are useful for holding information, such as the operating system paging file, where performance is extremely important but redundancy is not.
- RAID 1: mirrored disk array
  - Mirror data on a partition of one disk to another.
  - Support 2 disks.
  - RAID 1 arrays are useful when there are only two disks available and data integrity is more important than storage capacity.
- RAID 5: block-level striped disk array with distributed parity
  - Stripe data as well as parity, across all disks in the array.
  - Support 3-8 disks.
  - Offer exceptional read performance and redundancy.
- RAID 10: striped and mirrored disk array (a combination of RAID 0 and RAID 1)
  - Combine mirrors and stripe sets. RAID 10 allows multiple disk failures, up to 1 failure in each mirror that has been striped.
  - Support 4, 6, or 8 disks.
  - Offer better performance than a simple mirror because of the extra disks. Require twice the disk space of RAID 1 to offer redundancy.
- Volume (JBOD):
  - RAIDXpert2 Configuration Utility treats one or more disks or the unused space on a disk as a single array.
  - Support 1-8 disks.
  - Provide the ability to link-together storage from one or several disks, regardless of the size of the space on those disks. It is useful in scavenging space on disks unused by other disks in the array. It does not provide performance benefits or data redundancy. Disk failure will result in data loss.

Initialize disks

New disks and legacy disks must be initialized before they can be used to create an AMD-RAID array. Initialization writes AMD-RAID configuration information (metadata) to a disk.

CAUTION:

- **If a disk is part of an AMD-RAID array, the disk cannot be selected for initialization. To initialize the disk anyway, delete the AMD-RAID array. Data on the disk is deleted during initialization so ensure the correct disks are chosen to initialize.**
- **A legacy disk can contain valid data. When a legacy array is deleted, all data on the disk is lost.**

1. Enter the **RAIDXpert2 Configuration Utility** menu. Then, use the arrow keys to select **Physical Disk Management** and press Enter.
2. Use the arrow keys to select **Select Physical Disk Operations** and press Enter.
3. Use the arrow keys to select **Initialize Disk** and press Enter.
4. Select the disk(s) to initialize:
   a. Use the arrow keys to select a disk and press the Space Bar or Enter. Multiple disks can be selected using this method.
   b. Use the arrow keys to select **OK** and press Enter.
   c. Review the warning message. If you want to proceed, use the arrow keys to select **YES** and press Enter.

Note: The Initialization process takes about 10 to 15 seconds. During initialization, a complete re-scan of all channels is done automatically.

Create arrays

Arrays can be created after the disks are initialized:

1. Enter the **RAIDXpert2 Configuration Utility** menu. Then, use the arrow keys to select **Array Management** and press Enter.
2. Use the arrow keys to select **Create Array** and press Enter.
3. Use the arrow keys to select **Select RAID Level → RAID Level** and press Enter.

   Note: Some of the RAID levels might not be displayed because the number of installed storage drives varies.
4. Select the disks with which to create the array:
   a. Use the arrow keys to select **Physical Disks** and press Enter.
   b. Use the arrow keys to select desired disks and press the Space Bar or Enter.
   c. Use the arrow keys to select **Apply Changes** and press Enter.
5. Refer to the table below for the default cache tag size (CTS).

Array type	Default CTS
HDD Array	64k
SSD Array	64k
All NVMe Array	256k

6. Use the arrow keys to select **Read Cache Policy** and press Enter. Select the desired read cache policy and press Enter.
7. Use the arrow keys to select **Write Cache Policy** and press Enter. Select the desired write cache policy and press Enter.
8. Use the arrow keys to select **Create Array** and press Enter.

Delete arrays

CAUTION:

- **Deleting an array permanently destroys all data that is on the array. This action cannot be recalled and it is very unlikely the data can be recovered.**
- **Do not delete the first array listed in the Arrays section, if it is the AMD-RAID bootable array. Doing this deletes the operating system and AMD-RAID files.**

1. Enter the **RAIDXpert2 Configuration Utility** menu. Then, use the arrow keys to select **Array Management** and press Enter.
2. Use the arrow keys to select **Delete Arrays** and press Enter.
3. Select the array(s) to delete:
   a. Use the arrow keys to select the desired array or multiple arrays, then press the Space Bar or Enter to change the option to **Enabled** for deletion.
   b. If you want to select all of the arrays, use the arrow keys to select **Check all** and press Enter.
   c. Use the arrow keys to select **Delete Array** and press the Space Bar or Enter.
   d. Review the warning message. If you want to proceed, press the Space Bar or Enter.
   e. Use the arrow keys to select **Yes** to delete arrays.

View array details

This option displays the details of an array. Nothing can be changed using this menu option. It is for informational purposes only.

1. Enter the **RAIDXpert2 Configuration Utility** menu. Then, use the arrow keys to select **Array Management** and press Enter.
2. Use the arrow keys to select **Select Manage Array Properties** and press Enter.
3. Use the arrow keys to select **Select Array** and press Enter. Select the desired array and press **Enter**.
4. Use the arrow keys to select **View Associated Physical Disks** and press Enter.
5. Press the Space Bar to select one of the members of the Array.
6. Use the arrow keys to select **View Physical Disk Properties** and press Enter.
7. Information about the array is displayed below **Select Array header**:
   - Array number
   - RAID level
   - State
   - Size
   - Cache Tag Size
   - Cache settings
   - Associated physical disks
8. To view another array, press ESC twice and perform steps 2 through 7 again.
9. Press ESC to exit the main menu.

Configure RAID with MegaRAID Configuration Utility

To configure RAID with MegaRAID Configuration Utility, ensure that:

- A MegaRAID adapter is installed on your computer.
- The storage drives used for RAID configuration are connected to the installed MegaRAID adapter instead of the system board.

Storage drive requirements for RAID levels

Your computer supports the following RAID levels:

- RAID 0: striped disk array
  - Consists of at least two NVMe storage drives
  - Supported strip size: 64 KB, 128 KB, 256 KB, 512 KB, or 1 MB
  - Better performance without fault tolerance

  CAUTION:
  RAID 0 does not support any data redundancy. Use RAID 0 with caution. If a drive in the RAID 0 array fails, the data will be lost and there is no way to get it recovered.
- RAID 1: mirrored disk array
  - Consists of two or four NVMe storage drives
  - Improved read performance and 100% redundancy
- RAID 10: striped and mirrored disk array (a combination of RAID 0 and RAID 1)
  - Consists of four NVMe storage drives

  - Data being striped across storage drive groups
  - Provides both high data transfer rates and complete data redundancy
- RAID 5: block-level striped disk array with distributed parity
  - Consists of at least three NVMe storage drives
  - Supported strip size: 64 KB, 128 KB, 256 KB, 512 KB, or 1 MB
  - Better performance and fault tolerance
  - Available only on selected models of MegaRAID adapters
- RAID 6: block-level striped disk array with dual distributed parity
  - Consists of at least four NVMe storage drives
  - Supported strip size: 64 KB, 128 KB, 256 KB, 512 KB, or 1 MB
  - Better performance and fault tolerance that can stand up to loss of two storage drives
  - Available only on selected models of MegaRAID adapters

Create a RAID volume

Attention: All the existing data stored on the selected drives will be erased while the RAID volume is being created.

To create a RAID volume:

1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
2. Select **Devices → MegaRAID Configuration Utility** and press Enter.
3. Select **Main Menu** and press Enter.
4. Select **Configuration Management** and press Enter.
5. Select **Create Virtual Drive** and press Enter.
6. Select and configure the options one by one.
   a. **Select RAID Level**: You can set the RAID level to one of the following:
      - **RAID0**
      - **RAID1**
      - **RAID5**
      - **RAID6**
      - **RAID10**

      Note: Some of the RAID levels might not be displayed because the number of installed storage drives and the model of the MegaRAID adapter vary.
   b. **Select Drives From**: Select **Unconfigured capacity** or **Free capacity** depending on your needs and press Enter.
   c. **Select Drives**: Select a storage drive and press Enter. After selecting all storage drives for creating the RAID volume, select **Apply Changes** and press Enter. When promoted, select **Confirm** and press Enter. Then, select **Yes** and press Enter to save the storage drive selection. Finally, select **OK** and press Enter.
   d. **Virtual Drive Name**: You can type a preferred name for the volume name.
   e. **Strip Size** (if applicable): Select a strip size and press Enter.
7. Select **Save Configuration** and press Enter. When promoted, select **Confirm** and press Enter. Then, select **Yes** and press Enter to confirm the creation of the RAID volume.
8. Press F10 or Fn+F10 to save the changes and exit.

View the information about a RAID volume

To view the information about a RAID volume:

1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
2. Select **Devices → MegaRAID Configuration Utility** and press Enter.
3. Select **Main Menu** and press Enter.
4. Select **Virtual Drive Management** and press Enter.
5. Select a RAID volume and press Enter to view the detailed information.
6. Press F10 or Fn+F10 to save the changes and exit.

Virtual drive state

Virtual drive can be in one of the following states:

State	Display in the output of StorCLI commands	Virtual drive status
Optimal	**optl**	All members of the virtual drive are online.
Partially Degraded	**Pdgd**	The virtual drive is capable of sustaining more than one member drive's failure. Currently, only a RAID 6 or RAID 60 virtual drive can be partially degraded.
Degraded	**dgrd**	One or more member drives have failed. The virtual drive can no longer sustain a subsequent drive failure.
Offline	**OfLn**	One or more member drives have failed. Virtual drive data has lost.

CAUTION:
Continuously monitor the RAID volume status to save drives from undesired data loss. If there is any drive failure, remove the failing drive and install a new one.

Delete a RAID volume

Attention: All the existing data stored on the selected drives will be erased after you delete RAID volumes.

To delete a RAID volume:

1. Restart the computer. When the logo screen is displayed, press F1 or Fn+F1.
2. Select **Devices → MegaRAID Configuration Utility**.
3. Select **Main Menu** and press Enter.
4. Select **Virtual Drive Management** and press Enter.
5. Select the RAID volume that is not needed and press Enter.
6. Under **Operation**, select **Delete Virtual Drive** and press Enter.
7. Select **Go** and press Enter. When prompted, select **Confirm** and press Enter. Then, select **Yes** and press Enter to delete the RAID volume.
8. Press F10 or Fn+F10 to save the changes and exit.

Chapter 5. CRU replacement

Before CRU replacement

Before replacing hardware of your computer, read this section first. You will get to know what is CRU, the CRU list, system board connectors, and prerequisites for CRU replacement.

What is CRU

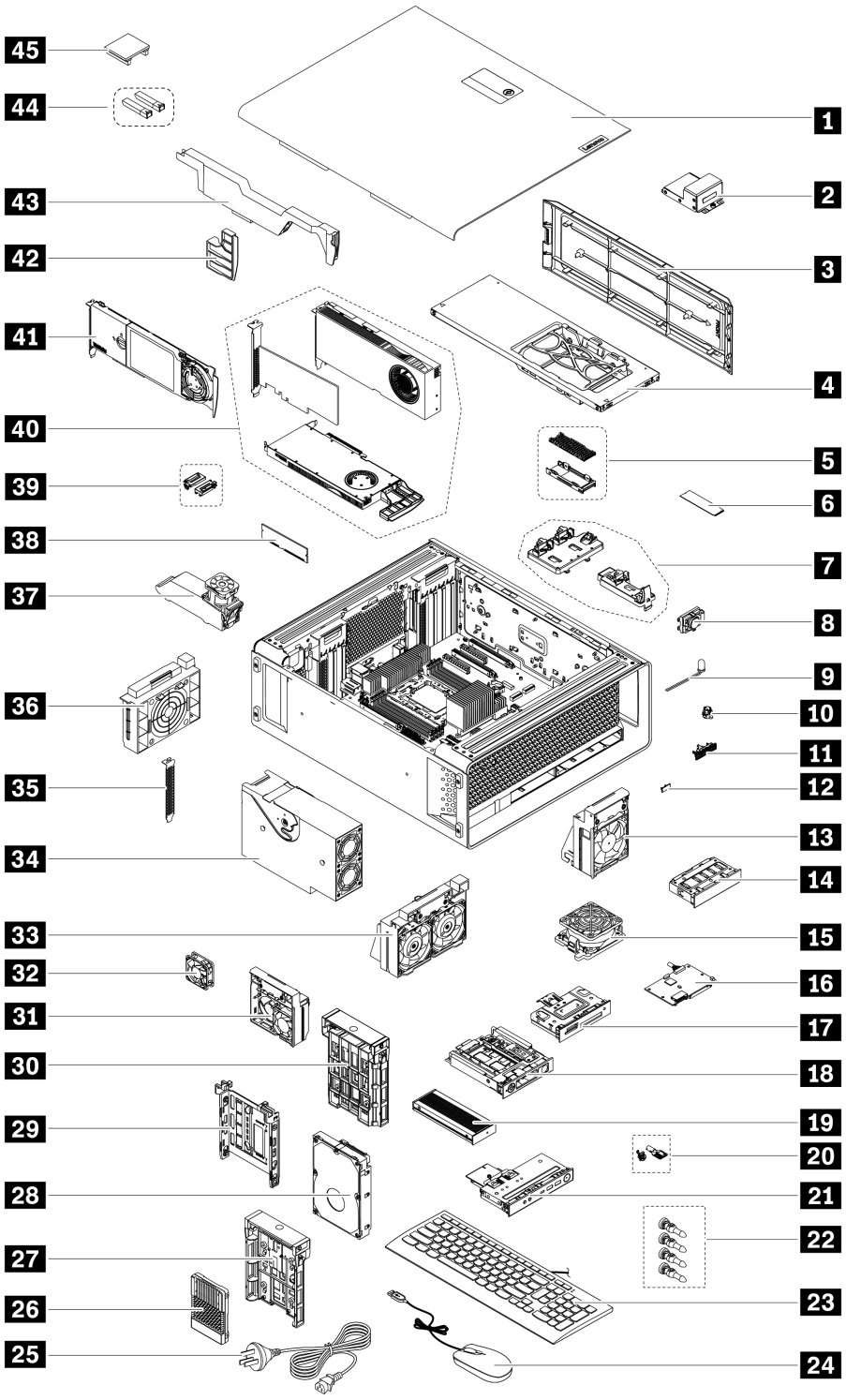
Customer Replaceable Units (CRUs) are parts that can be replaced by the customer. Lenovo computers contain the following types of CRUs:

- **Self-service CRUs:** Refer to parts that can be replaced easily by customer themselves or by trained service technicians at an additional cost.
- **Optional-service CRUs:** Refer to parts that can be replaced by customers with a greater skill level. Trained service technicians can also provide service to replace the parts under the type of warranty designated for the customer's machine.

If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. For full details, see the Lenovo Limited Warranty documentation at:
https://www.lenovo.com/warranty/llw_02

CRU list

The following is the CRU list of your computer.



Number	Description	Self-service CRU	Optional-service CRU
1	Side cover	Yes	No
2	NVLINK retainer*	Yes	No
3	Top cover	Yes	No

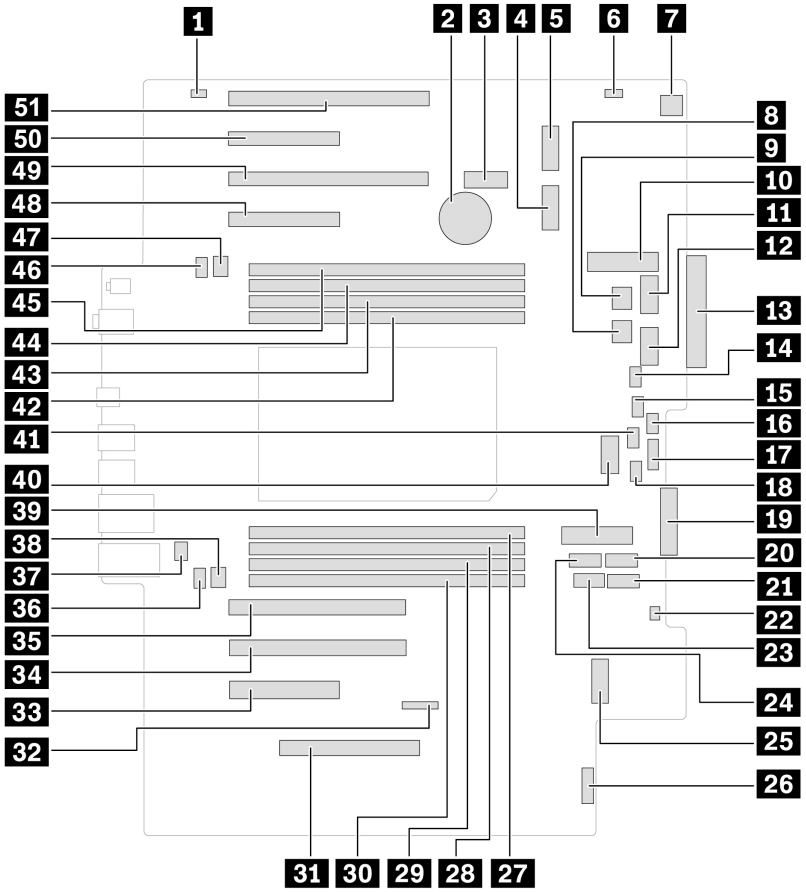
Number	Description	Self-service CRU	Optional-service CRU
4	Optional internal storage drive cage*	Yes	No
5	M.2 SSD heat sink kit*	Yes	No
6	M.2 SSD*	Yes	No
7	M.2 SSD holder*	Yes	No
8	Internal speaker	No	Yes
9	ThinkStation LED	Yes	No
10	ThinkStation LED holder	Yes	No
11	ThinkStation Logo badge	Yes	No
12	Computer ID badge	Yes	No
13	Upper PCIe fan	Yes	No
14	Blank bezel*	Yes	No
15	Front-access storage fan*	Yes	No
16	PCBA of 15-in-1 media card reader*	No	Yes
17	15-in-1 media card reader*	No	Yes
18	NVMe storage tray*	Yes	No
19	M.2 SSD storage box*	Yes	No
20	Locks and keys for side cover and M.2 SSD storage box	Yes	No
21	Front panel I/O assembly	No	Yes
22	Fan grommets*	Yes	No
23	Keyboard*	Yes	No
24	Mouse*	Yes	No
25	Power cord*	Yes	No
26	U.2 or U.3 SSD*	Yes	No
27	U.2 or U.3 SSD bracket*	Yes	No
28	HDD*	Yes	No
29	HDD bracket*	Yes	No
30	M.2 SSD bracket*	Yes	No
31	Lower PCIe fan	Yes	No
32	Internal storage drive fan*	Yes	No
33	Front fan*	Yes	No
34	Power supply assembly	Yes	No
35	PCIe bracket*	Yes	No
36	Rear fan	Yes	No
37	Memory fan and air duct	Yes	No
38	Memory module	Yes	No

Number	Description	Self-service CRU	Optional-service CRU
39	Wi-Fi antenna cover*	Yes	No
40	PCIe card*	Yes	No
41	M.2/U.2/U.3 SSD PCIe adapter*	Yes	No
42	Customized PCIe card extender*	Yes	No
43	Super capacitor module*	Yes	No
44	Fiber modules for NVIDIA ConnectX-6 Ethernet Adapter*	Yes	No
45	NVLINK bridge*	No	Yes

* for selected models

System board illustration

Note: The system board might look slightly different from the illustration.



Item	Item
1 Internal speaker connector	2 Coin-cell battery
3 Wi-Fi socket	4 M.2 SSD slot 2

Item	Item
5 M.2 SSD slot 1	6 Cover presence switch (intrusion switch) connector
7 Upper PCIe (slot1–4) fan connector	8 Internal storage drive cage power connector 1
9 Internal storage drive cage power connector 2	10 Internal storage drive cage slot 1
11 Graphics card power connector 1	12 Graphics card power connector 3
13 Front-panel I/O connector	14 Front fan connector
15 Front-access storage fan connector	16 Internal storage drive fan connector
17 Internal USB-A 2.0 connector	18 CPU fan connector 1
19 Front-access storage bay connector	20 SATA 3 connector
21 SATA 2 connector	22 ThinkStation LED connector
23 Internal USB-A 3.2 Gen 2 connector	24 SATA 1 connector
25 M.2 SSD slot 3	26 TCM connector
27 Memory slot 5 (DIMM 5)	28 Memory slot 6 (DIMM 6)
29 Memory slot 7 (DIMM 7)	30 Memory slot 8 (DIMM 8)
31 Power supply connector	32 BMC card connector
33 PCIe slot 7 - Gen 4 x 8	34 PCIe slot 6 - Gen 5 x 16
35 PCIe slot 5 - Gen 5 x 16	36 CPU fan connector 2
37 Serial port (COM) connector	38 Memory fan 2 connector
39 Internal storage drive cage slot 2	40 Graphics card power connector 2
41 Lower PCIe (slot5–7) fan connector	42 Memory slot 4 (DIMM 4)
43 Memory slot 3 (DIMM 3)	44 Memory slot 2 (DIMM 2)
45 Memory slot 1 (DIMM 1)	46 Memory fan 1 connector
47 Rear fan connector	48 PCIe slot 4 - Gen 5 x 8
49 PCIe slot 3 - Gen 5 x 16	50 PCIe slot 2 - Gen 5 x 8
51 PCIe slot 1 - Gen 5 x 16	

Prerequisites for hardware replacement

General prerequisites

Read *Generic Safety and Compliance Notices*.

Prerequisites for opening computer cover

- 

  During operation, some components become hot enough to burn the skin. Before you open the computer cover, remove any media from the drives, turn off the computer and connected devices, disconnect power, remove all cables and locking devices, and wait approximately 10 minutes until the computer is cool.

- Before reaching parts with cables, record the cable routing for future reference and then disconnect its cable from the system board.

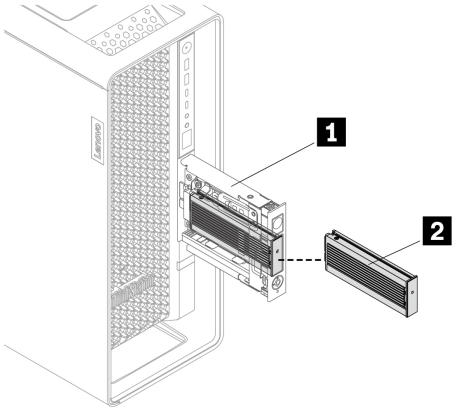
Prerequisites for storage drive replacement

Attention: The internal storage drive is sensitive. Inappropriate handling might cause damage and loss of data. When handling the internal storage drive, observe the following guidelines:

- Replace the internal storage drive only for repair. The internal storage drive is not designed for frequent changes or replacement.
- Before replacing the internal storage drive, make backup copy of all the data that you want to keep.
- Do not touch the contact edge of the internal storage drive. Otherwise, the internal storage drive might get damaged.
- Do not apply pressure to the internal storage drive.
- Do not make the internal storage drive subject to physical shocks or vibration. Put the internal storage drive on soft material, such as a cloth, to absorb physical shocks.

Prerequisites for hot-swappable M.2 SSD storage box replacement

For some computer models, an NVMe storage tray might be installed in the front-access storage bay. The M.2 SSD storage box(2) in the NVMe storage tray(1) can be hot-swappable, which means you can replace the M.2 SSD inside without even turning off your computer.



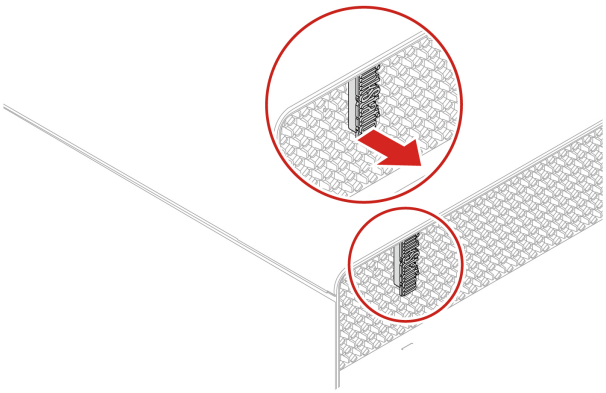
Attention: To avoid damage and loss of data, observe the following guidelines before replacing the hot-swappable M.2 SSD storage box:

- Ensure that NVMe RAID mode is disabled.
- Ensure that the operating system of your computer does not reside on the M.2 SSD inside the hot-swappable M.2 SSD storage box.
- Lock the M.2 SSD storage box to prevent unexpected removal. The keys are attached to the rear of the computer. For security, store the keys in a secure place.

ThinkStation logo badge

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

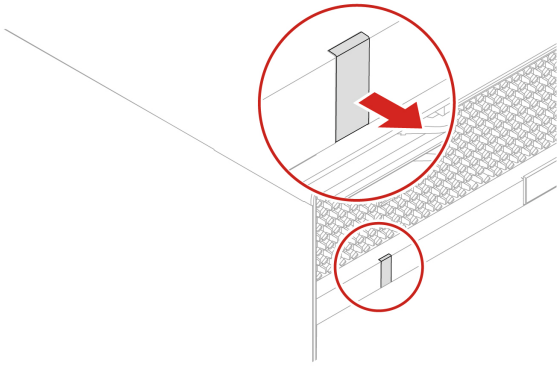
Removal steps



Computer ID badge

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

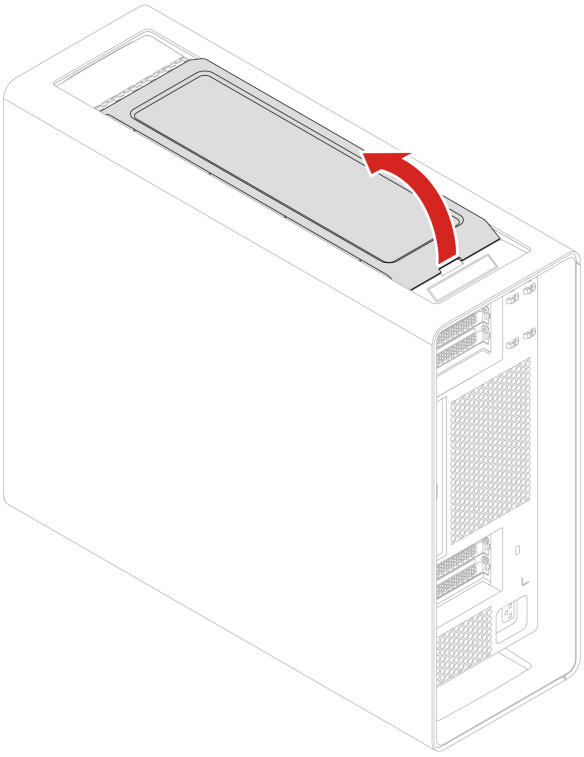
Removal steps



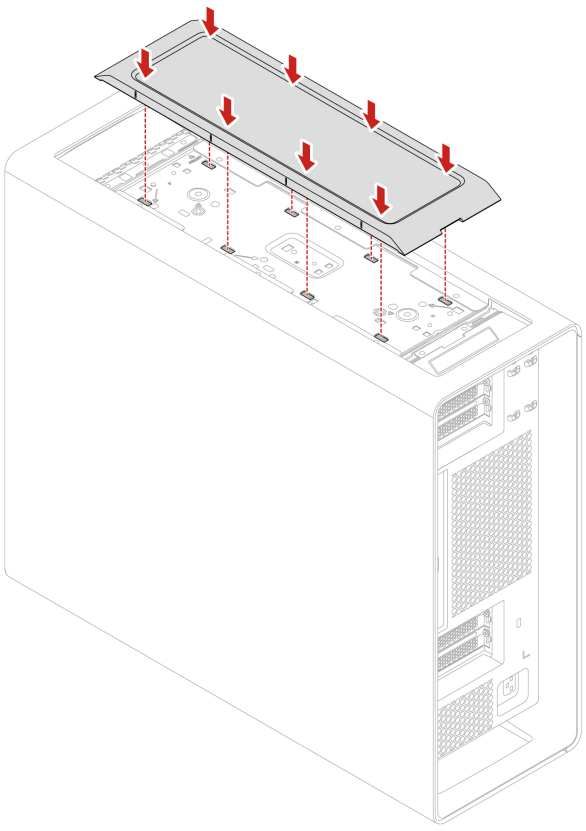
Top cover

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps



Installation steps

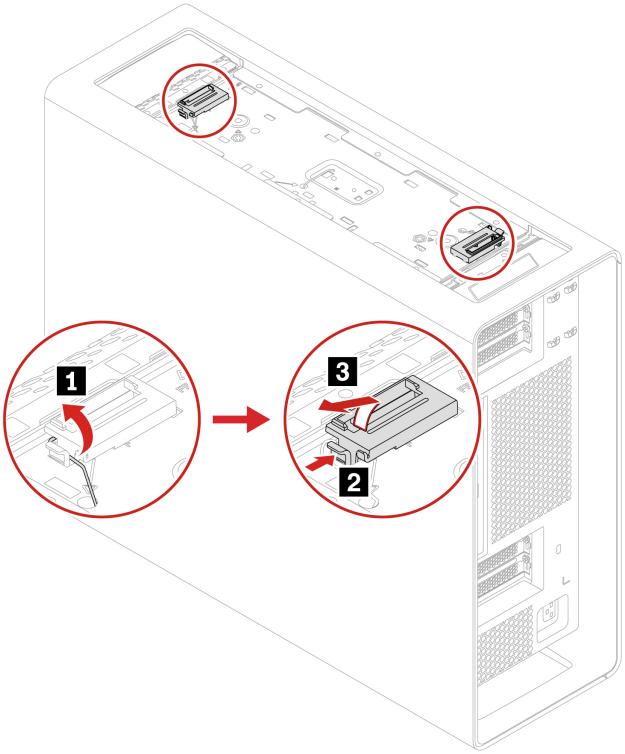


Wi-Fi antenna cover

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

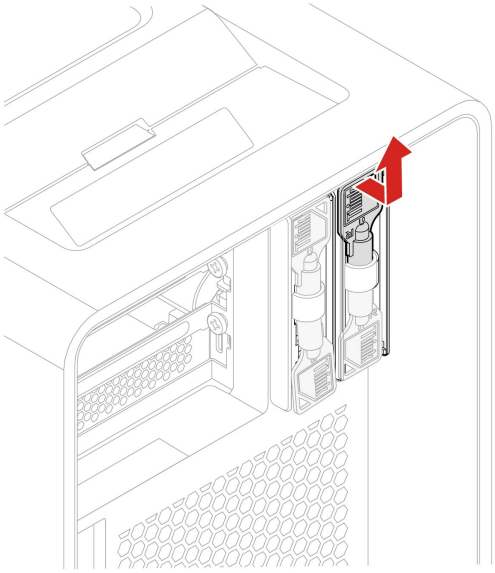
1. Remove the “Top cover” on page 39.
2. Remove the Wi-Fi antenna cover.



Keys for side cover and M.2 SSD storage box

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

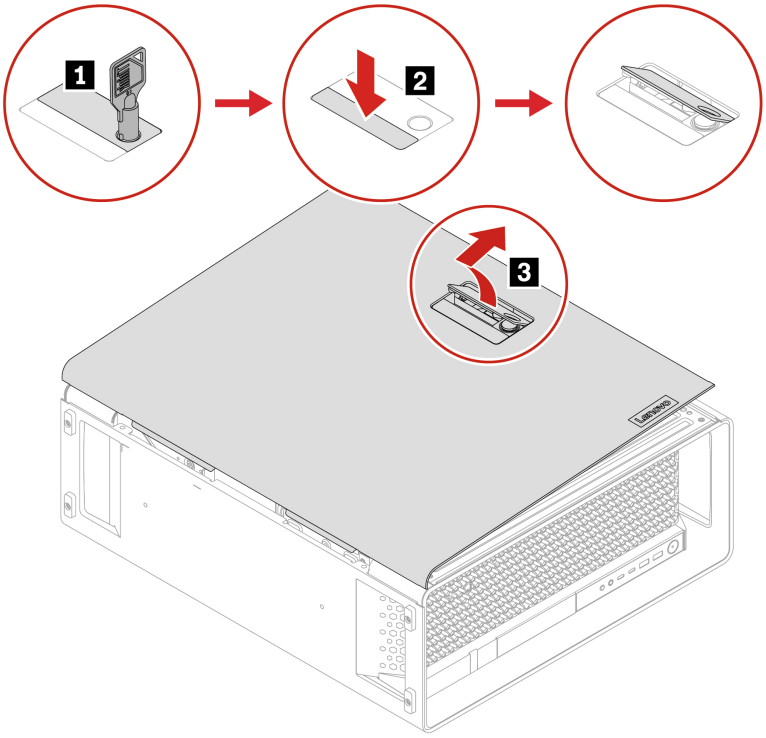


Side cover

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

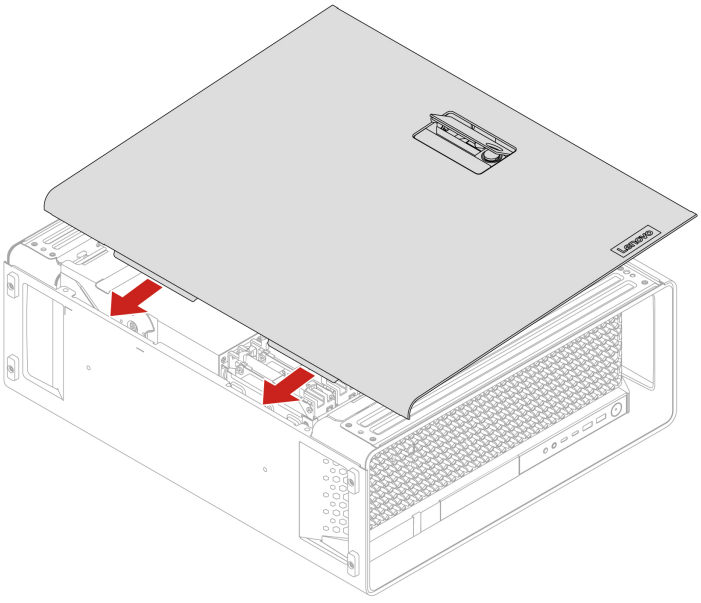
1. Remove the “Keys for side cover and M.2 SSD storage box” on page 41 (if available).
2. Lay the computer on its side for easier access to the side cover.
3. Remove the side cover.

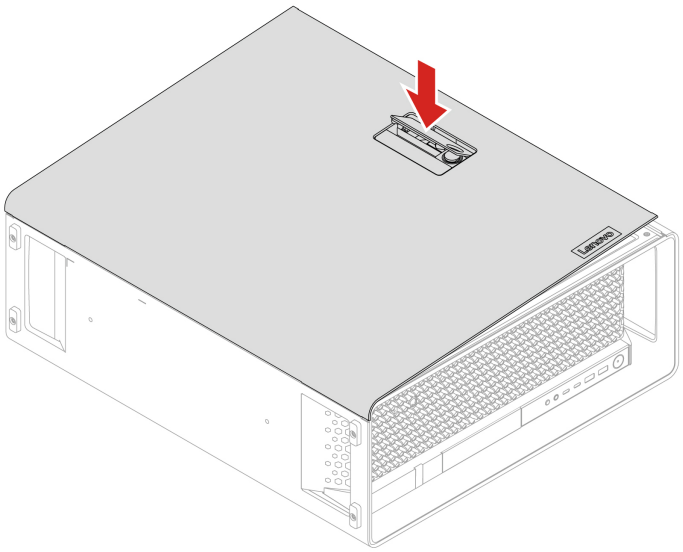


Notes:

- The lock for side cover and the unlocking step are for selected models.
- The key is attached at the rear of the computer.

Installation steps



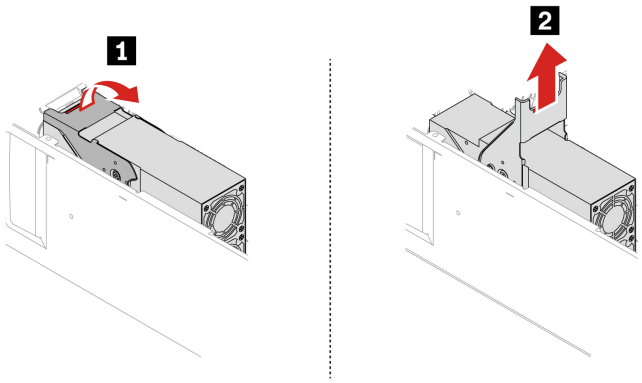


Power supply assembly

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.
2. Remove the power supply assembly.



Storage drives

By reading this section, you will learn to replace storage drives in your computer. For their types, locations, and rules, see “Expansion modules” on page 17.

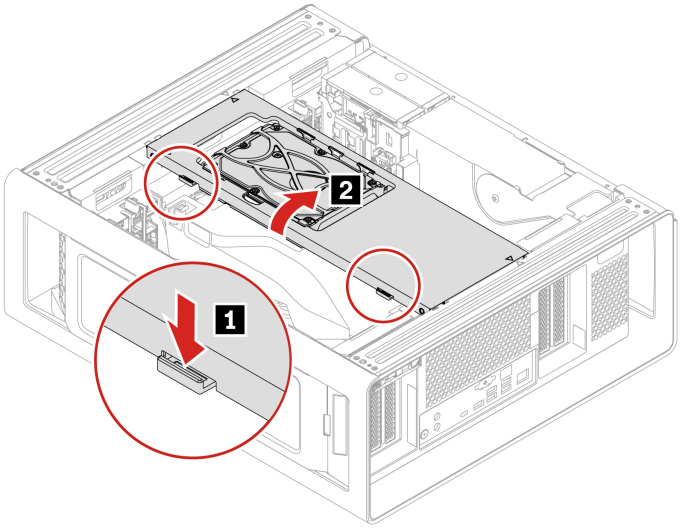
Optional internal storage drive cage

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.

2. Remove the optional internal storage drive cage.

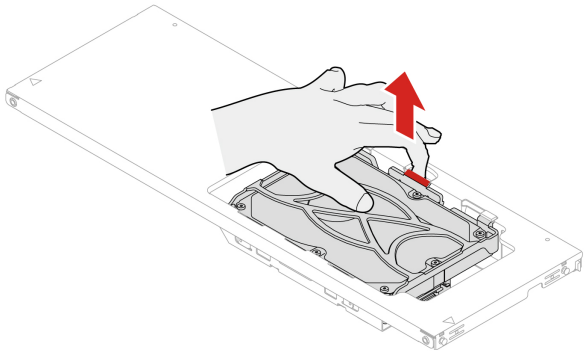


HDD in optional internal storage drive cage

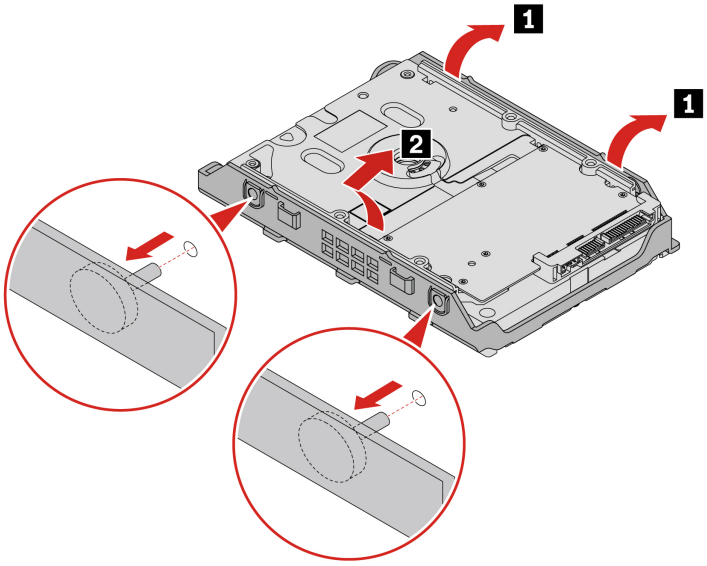
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts, if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
2. Remove the HDD with its bracket from the optional internal storage drive cage.



3. Remove the HDD from its bracket.



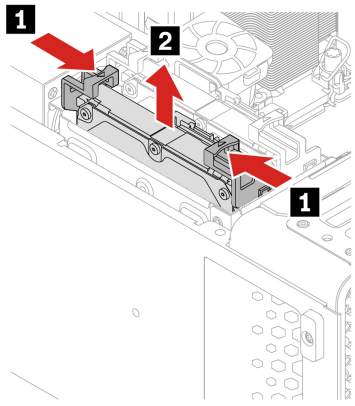
Note: When the computer is installed with NVIDIA Quadro SYNC II card or GeForce 40X0 graphics card, do not install 3.5-inch HDD in the optional internal storage drive cage.

HDD in the internal storage drive cage

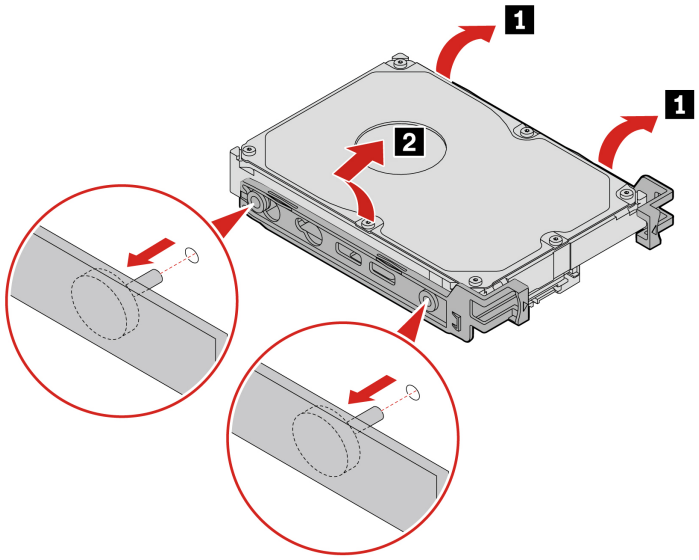
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.
2. Remove the HDD with its bracket from the internal storage drive cage.



3. Remove the HDD from its bracket.

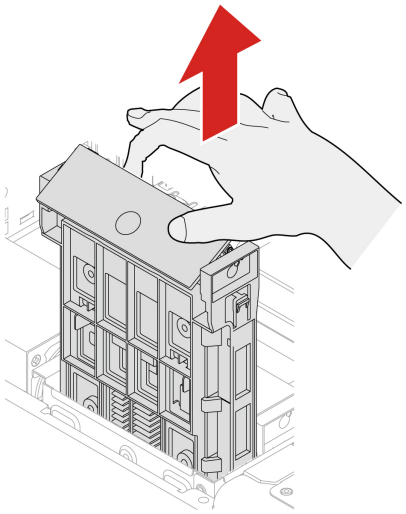


U.2 or U.3 SSD in the internal storage drive cage

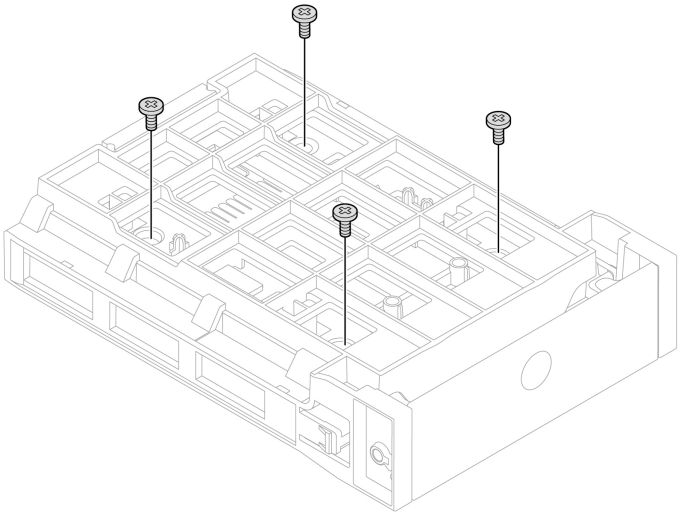
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

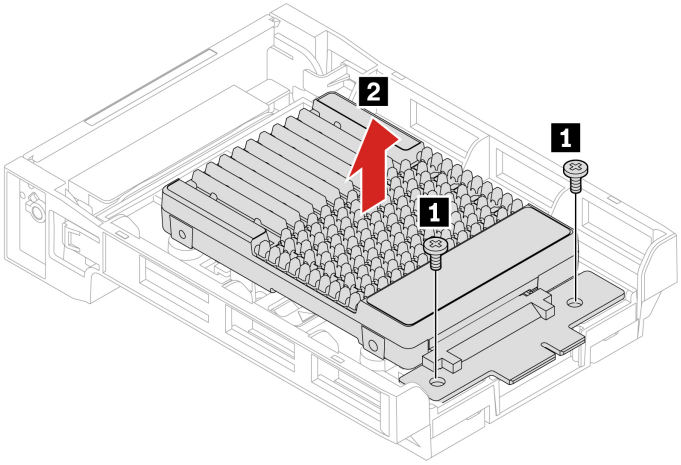
1. Remove the “Side cover” on page 42.
2. Remove the U.2 or U.3 SSD with its bracket from the internal storage drive cage.



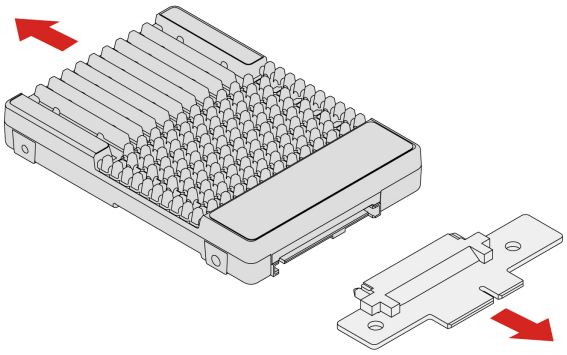
3. Remove the U.2 or U.3 SSD from its bracket.



Screw specification	Quantity	Torque
M3 x 3.75 mm, Zn coated, black	4	5.0 ± 0.5 lb/in



Screw specification	Quantity	Torque
M3 x 2 mm, Zn coated, blue	2	5.0 ± 0.5 lb/in

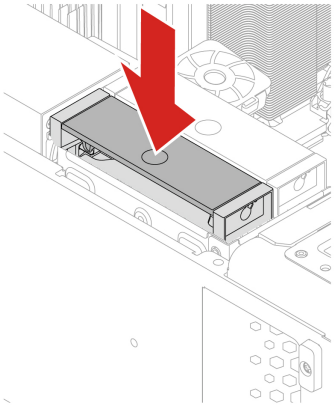


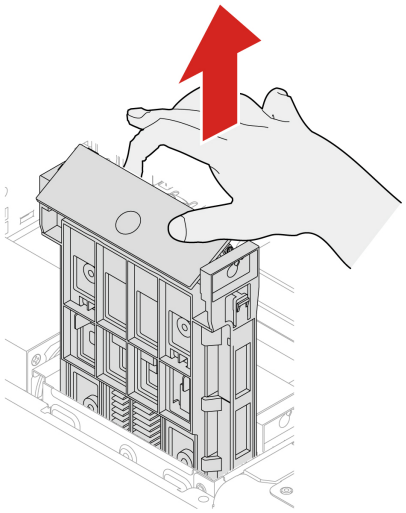
M.2 SSD bracket in internal storage drive cage

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.
2. Remove the M.2 SSD bracket from the chassis.



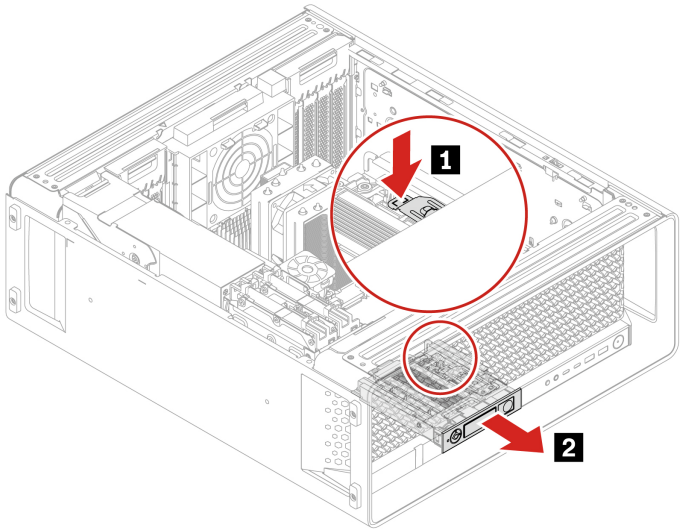


Device in the front-access storage bay

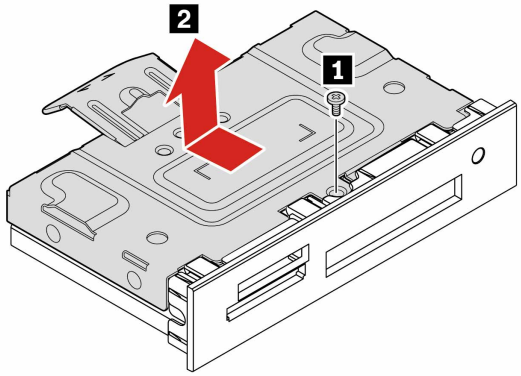
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

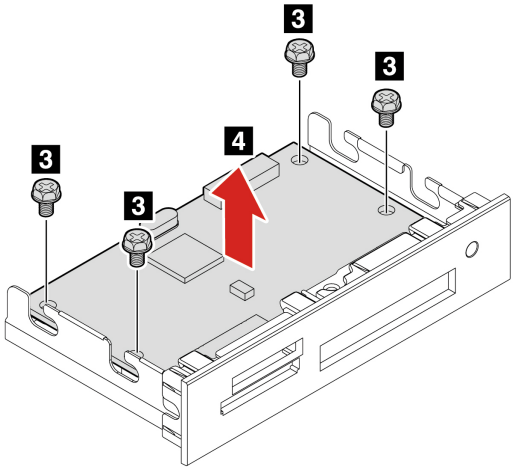
1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
   c. “Front fan” on page 71
   d. “Front-access storage fan” on page 73
2. Remove the device in the front-access storage bay, which can be an NVMe storage tray, a 15-in-1 media card reader, or a blank bezel.
   - NVMe storage tray / 15-in-1 media card reader:



PCBA of 15-in-1 media card reader:

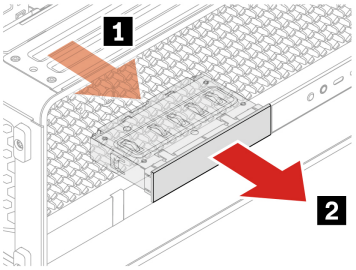


Screw specification	Quantity	Torque
M3 x 4 mm, Zn coated, blue	1	3.0 ± 0.5 lb/in



Screw specification	Quantity	Torque
M3 x 5 mm, Ni coated, black	4	5.0 ± 0.5 lb/in

- Blank bezel:

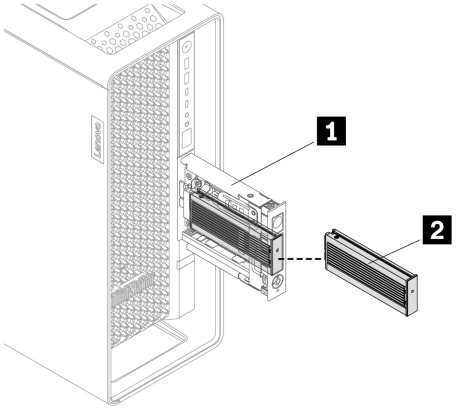


M.2 SSD storage box in NVMe storage tray

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

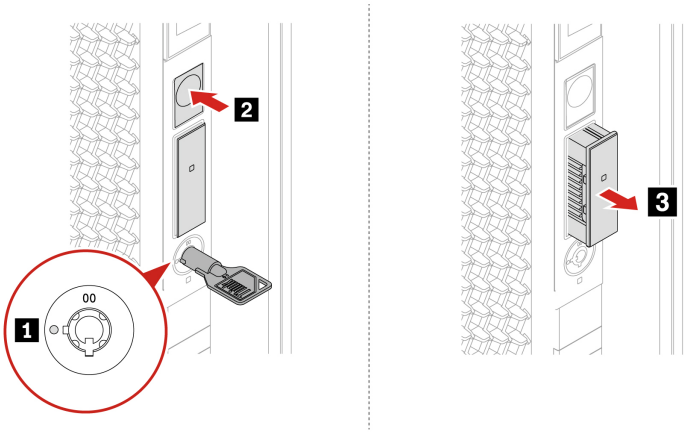
Notes:

- 1 NVMe storage tray
- 2 M.2 SSD storage box



Removal steps

1. Remove the “Keys for side cover and M.2 SSD storage box” on page 41 (if available).
2. Remove the M.2 SSD storage box.



Notes:

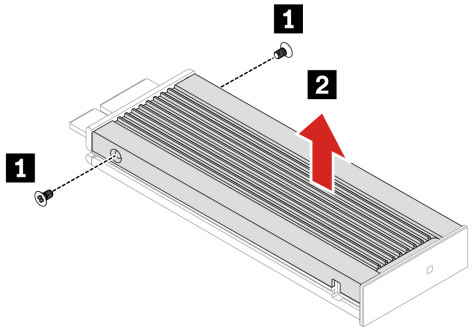
- The lock for M.2 SSD storage box and the unlocking step are for selected models.
- The key is attached at the rear of the computer.

M.2 SSD in M.2 SSD storage box

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

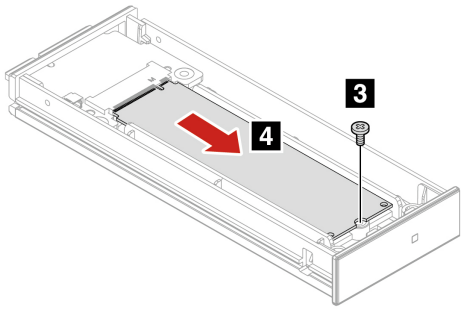
Removal steps

1. Remove the “M.2 SSD storage box in NVMe storage tray” on page 51.
2. Remove the M.2 SSD heatsink kit.



Screw specification	Quantity	Torque
M2 x 3.6 mm, Zn coated, blue	2	1.5± 0.2 lb/in

3. Remove the M.2 SSD.

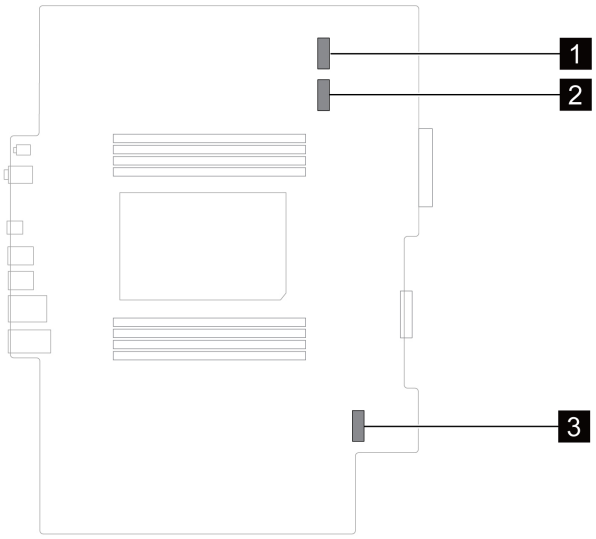


Screw specification	Quantity	Torque
M2 x 4.5 mm, Zn coated, black	1	1.5± 0.2 lb/in

On-board M.2 SSD

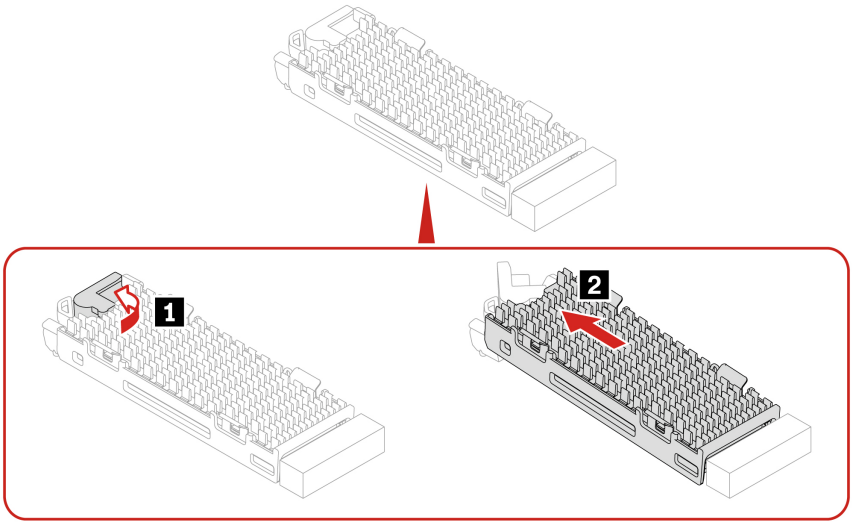
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Install the on-board M.2 SSDs in the following order.

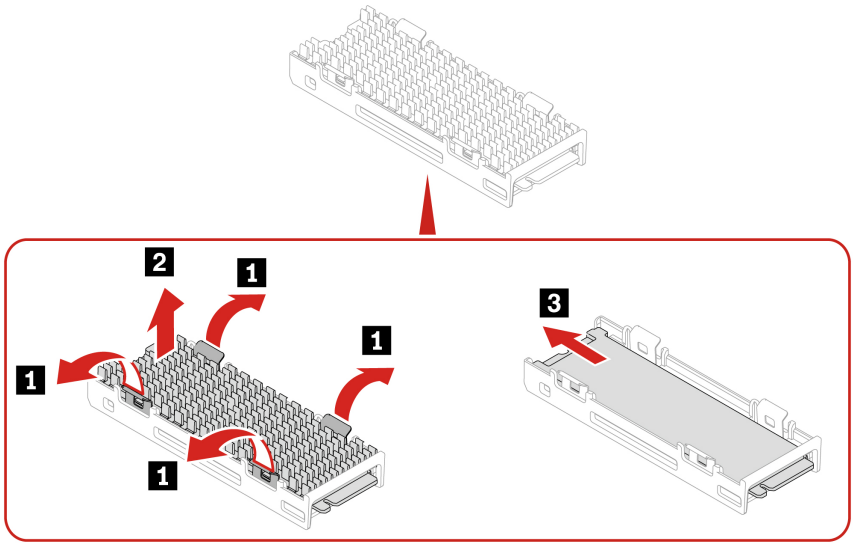


Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
2. Remove the M.2 SSD with its heatsink kit.

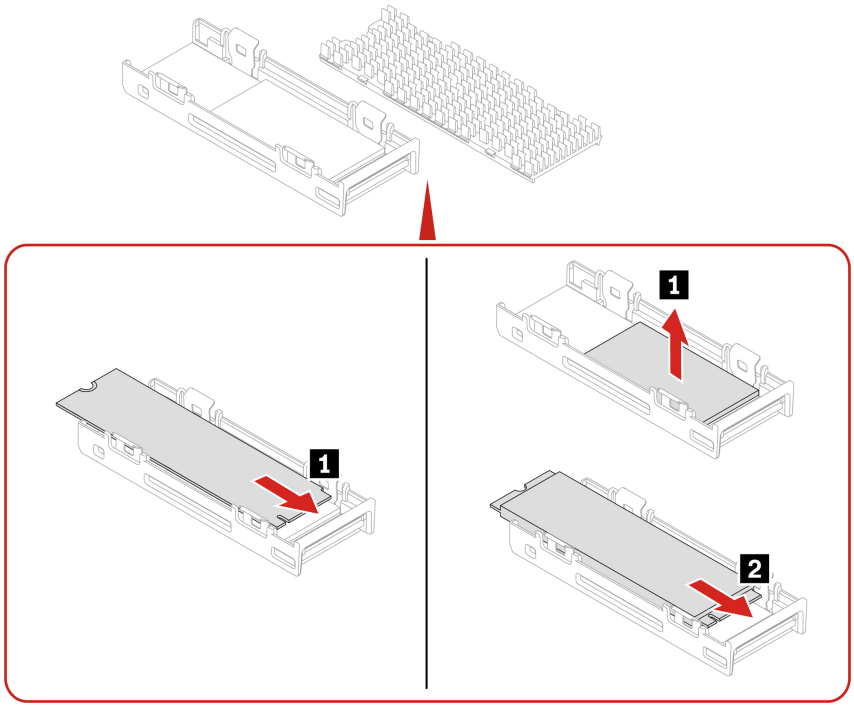


3. Remove the M.2 SSD from its heatsink kit.

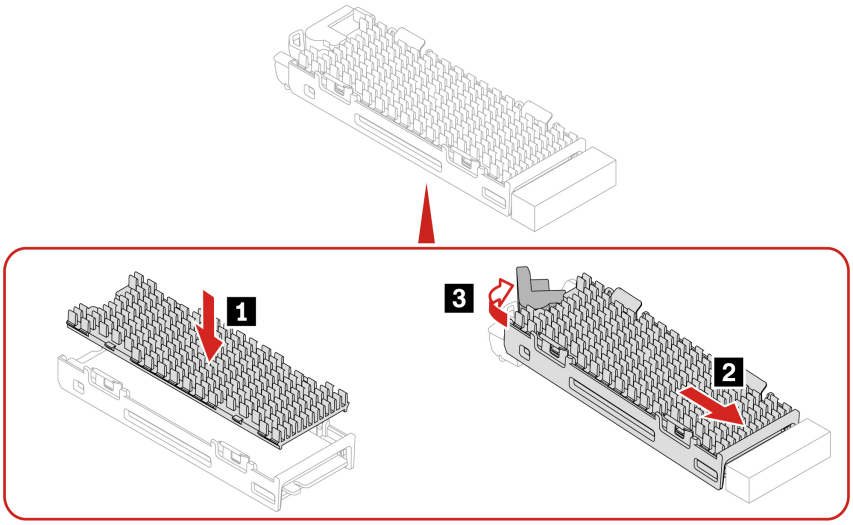


Installation steps

1. Install the M.2 SSD to its heatsink kit.



2. Install the M.2 SSD with its heatsink kit.

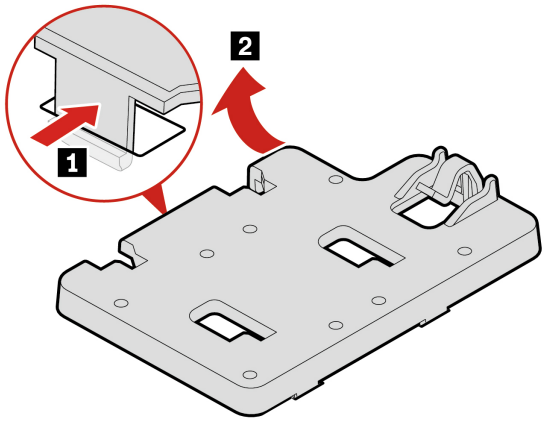


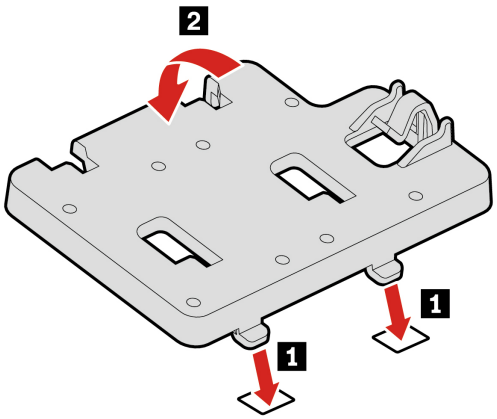
On-board M.2 SSD holder

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

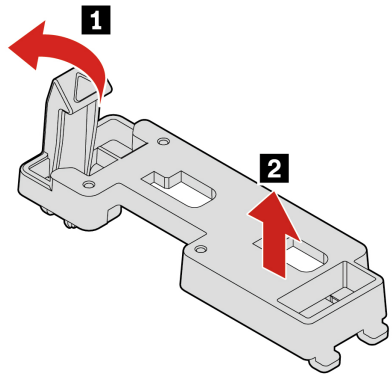
Replacement steps

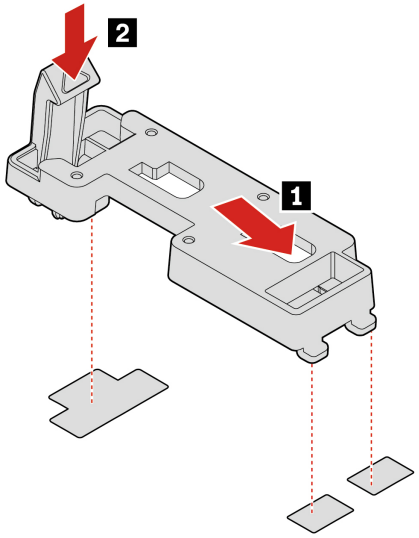
1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
   c. “Front fan” on page 71
   d. “Lower PCIe fan and internal storage drive fan” on page 73
   e. “On-board M.2 SSD” on page 53
2. Replace the on-board M.2 SSD holder.
   - Type 1





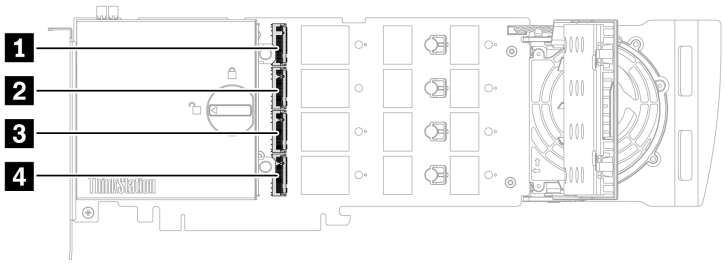
- Type 2





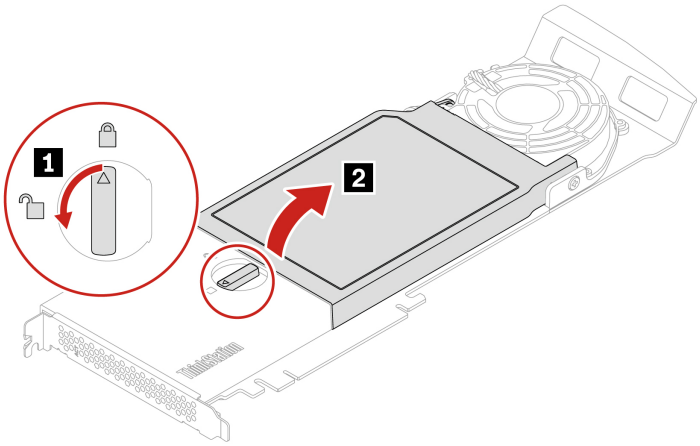
M.2 SSD in a PCIe adapter

- Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.
- Install M.2 solid-state drives in the following order as shown:

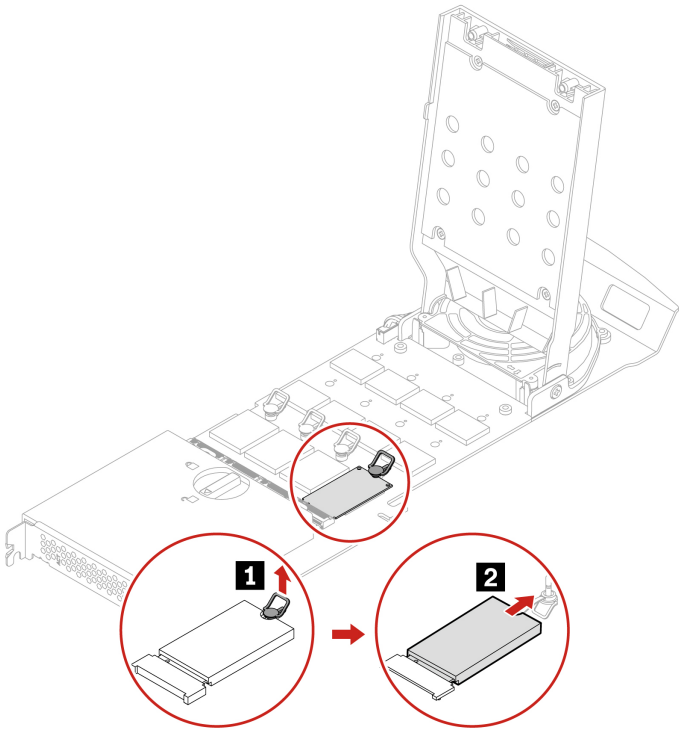


Replacement steps

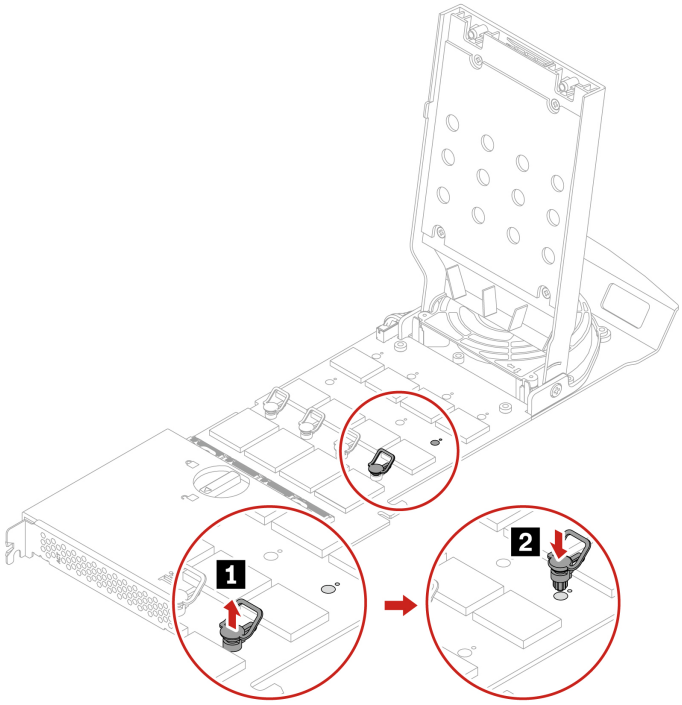
1. Remove the left side cover. See “Side cover” on page 42.
2. Remove the M.2 SSD PCIe adapter from the PCIe card slot. See “Full-length PCIe card” on page 67.
3. Open the cover.



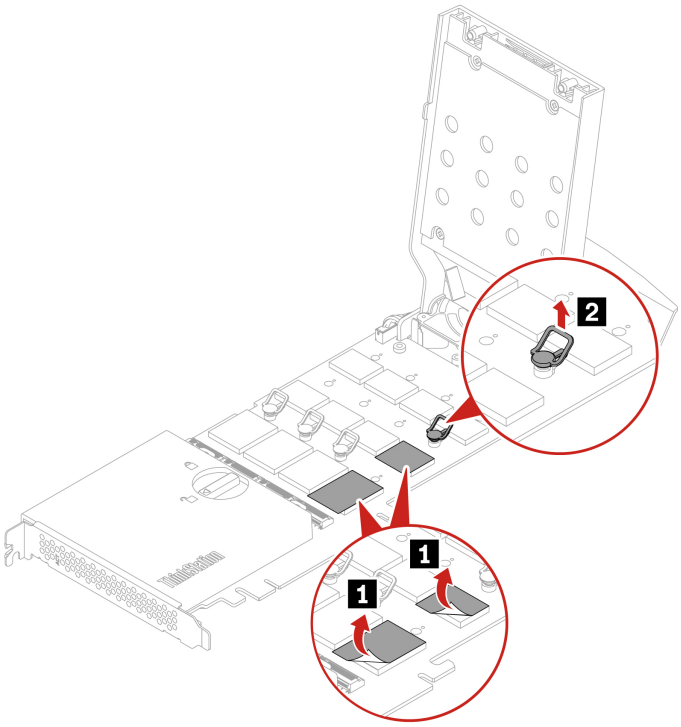
4. Remove the SSD.



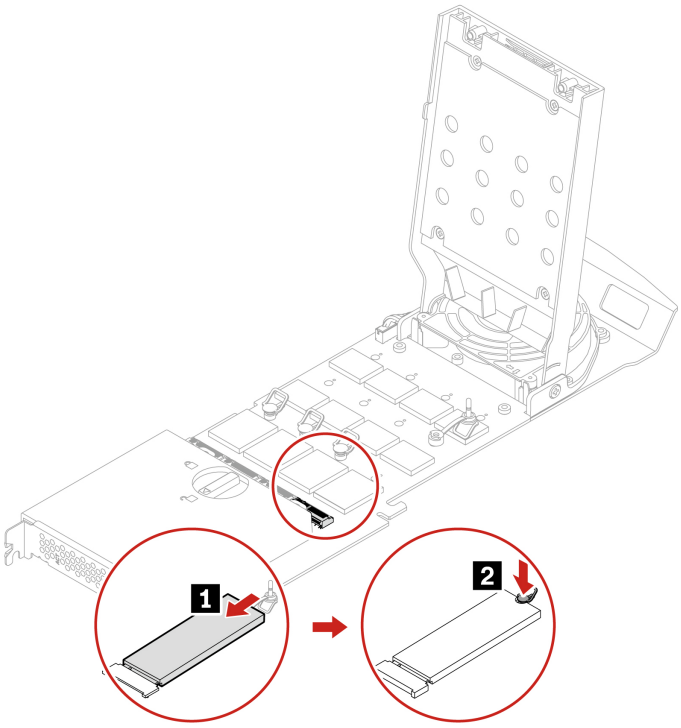
5. If necessary, move the retention latch to an appropriate location to suit the length of the new M.2 SSD.



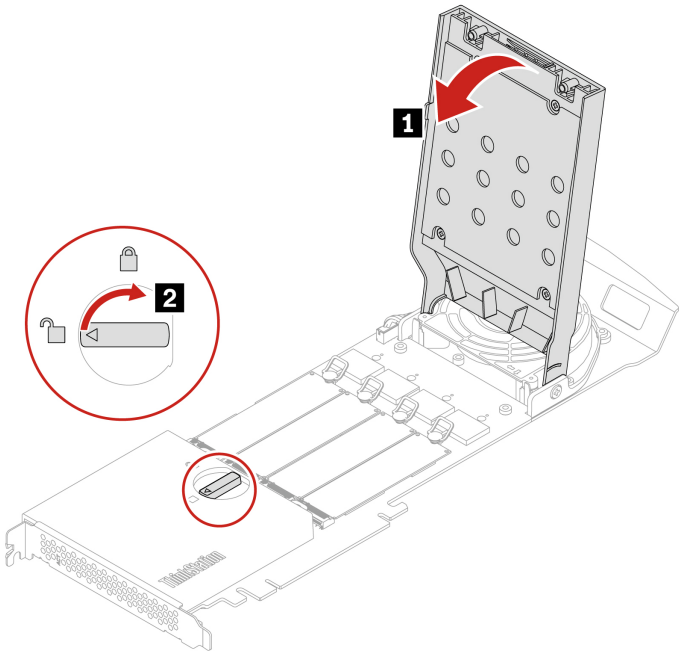
6. Remove the film and release the latch.



7. Install a new SSD.



8. Close the cover.



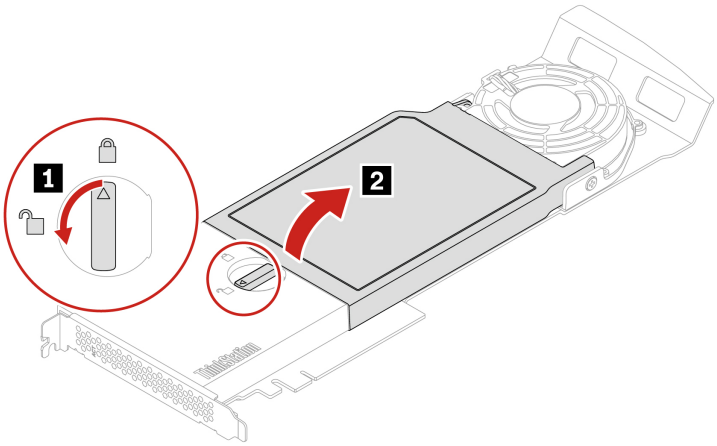
9. Install the M.2 SSD PCIe adapter in a PCIe x 16 card slot on the system board. See “System board illustration” on page 36.
10. Reinstall all removed parts. Then, reconnect the power cord and all disconnected cables to the computer.

U.2 or U.3 SSD in a PCIe adapter

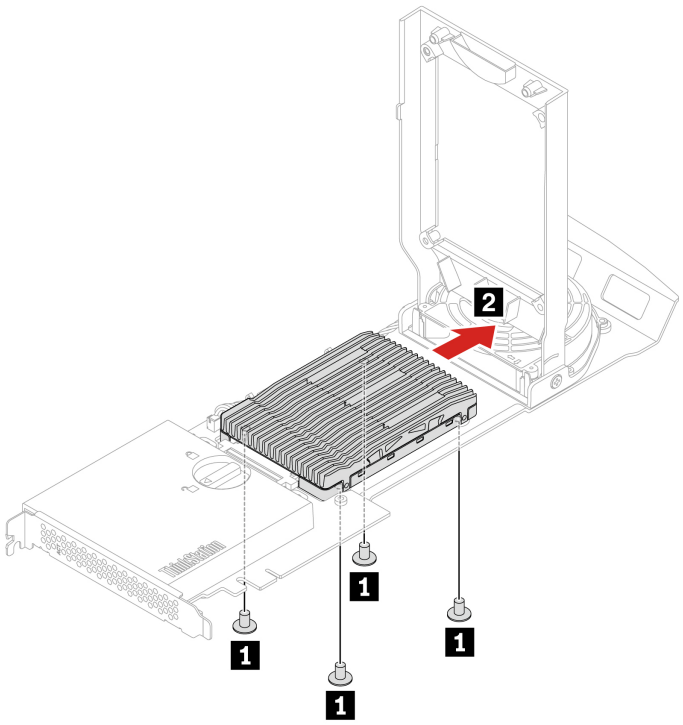
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Replacement steps

1. Remove the left side cover. See “Side cover” on page 42.
2. Remove the U.2 or U.3 SSD PCIe adapter from the PCIe card slot. See “Full-length PCIe card” on page 67.
3. Open the cover.

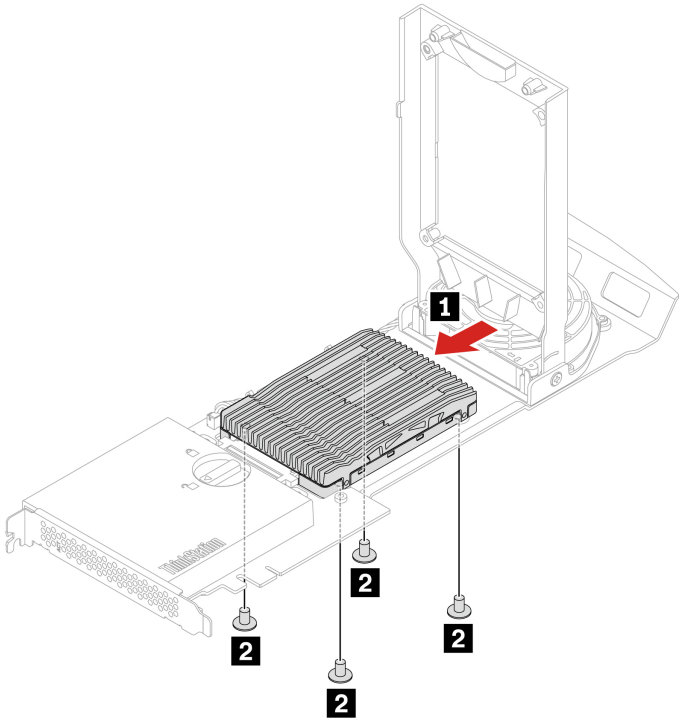


4. Remove the SSD.



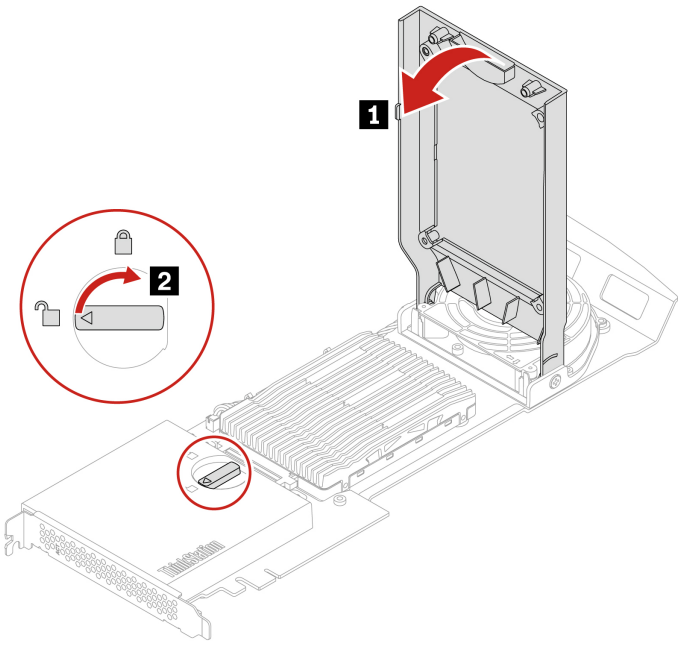
Screw specification	Quantity	Torque
M3 x 5 mm, Zn coated, black	4	5.0 ± 0.5 lb/in

5. Install a new SSD.



Screw specification	Quantity	Torque
M3 x 5 mm, Zn coated, black	4	5.0 ± 0.5 lb/in

6. Close the cover.



7. Install the U.2 or U.3 SSD PCIe adapter in a PCIe x 16 card slot on the system board. See “System board illustration” on page 36.
8. Reinstall all removed parts. Then, reconnect the power cord and all disconnected cables to the computer.

PCIe cards

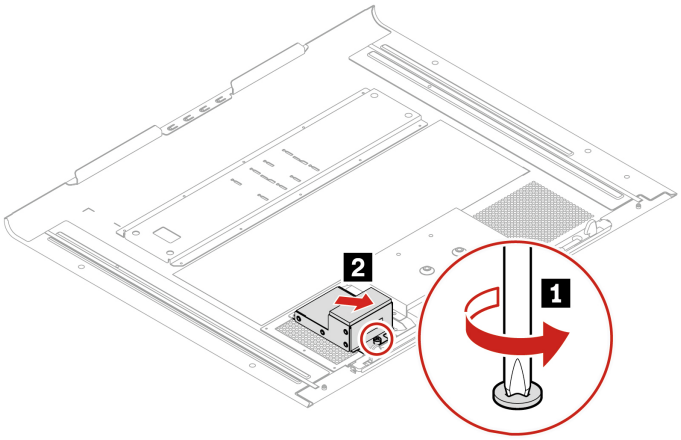
By reading this section, you will learn to replace PCIe cards, including graphics cards, in your computer.

NVLINK retainer

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.
2. Remove the NVLINK retainer.



Screw specification	Quantity	Torque
M3 x 5 mm, Ni coated, black	1	5.0 ± 0.5 lb/in

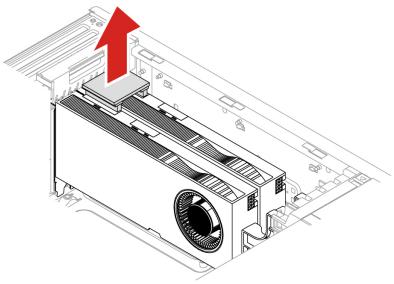
Note: The screw cannot be removed from the NVLINK retainer.

NVLINK bridge

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.
2. Remove the NVLINK bridge.

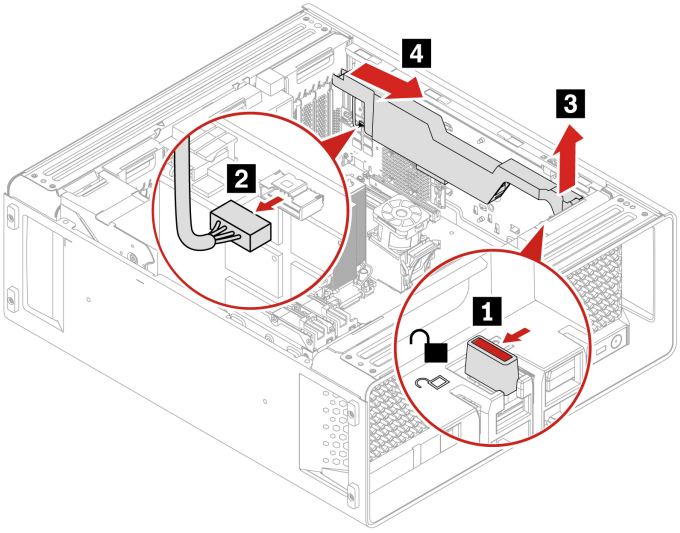


Super capacitor module

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

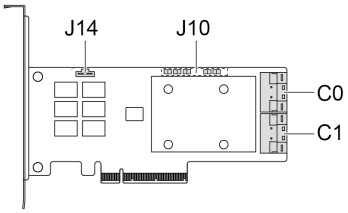
Removal steps

1. Remove the “Side cover” on page 42.
2. Remove the super capacitor module.



Installation notice

When installing the super capacitor module, connect the super capacitor module cable to the J14 connector on the RAID card.

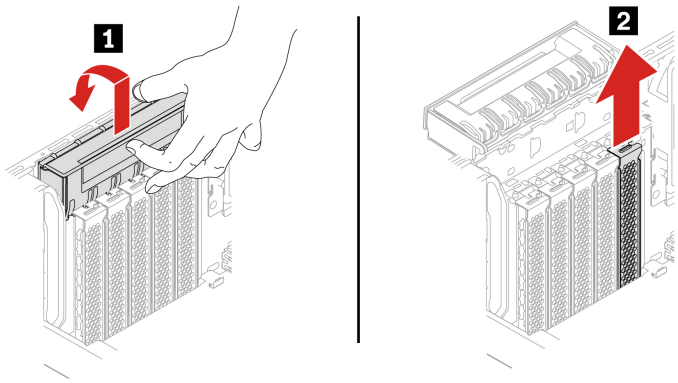


PCIe card bracket

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.
2. Open the handle and remove the PCIe card bracket.

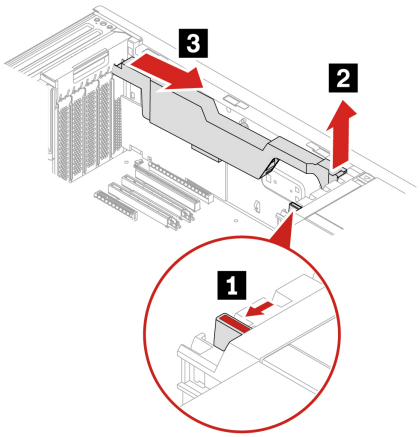


Half-length PCIe card

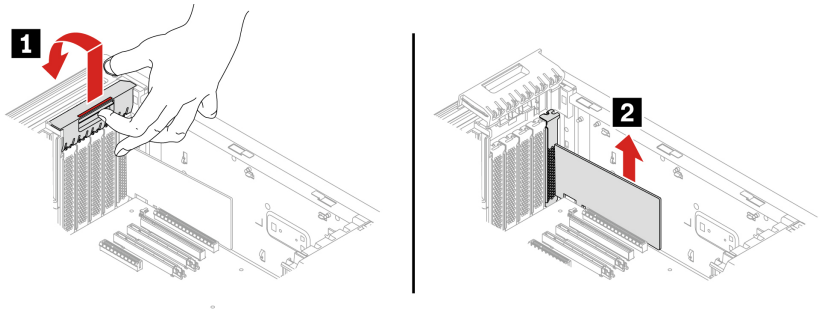
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

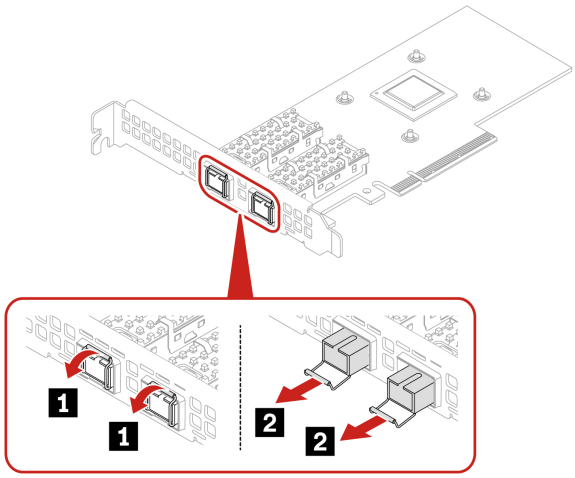
1. Remove the “Side cover” on page 42.
2. Remove the PCIe card.
   a. Remove the PCIe card retainer. The PCIe card retainer is only available on some PCIe cards.



   b. Open the handle and remove the PCIe card. The card might fit tightly into the slot. If necessary, alternately move each side of the card a small amount until the card is removed from the slot.



   c. For NVIDIA ConnectX-6 Ethernet Adapter card, the following fiber modules can be removed.

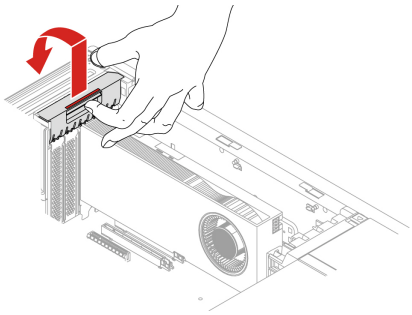


Full-length PCIe card

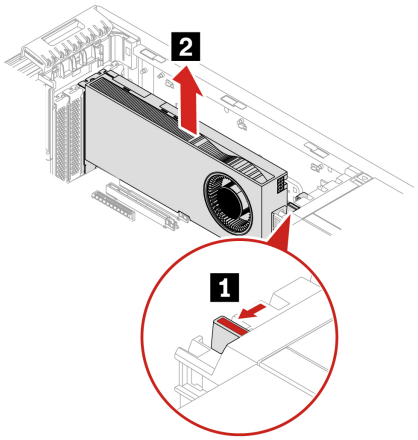
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the “Side cover” on page 42.
2. Remove the PCIe card.
   a. Open the handle.



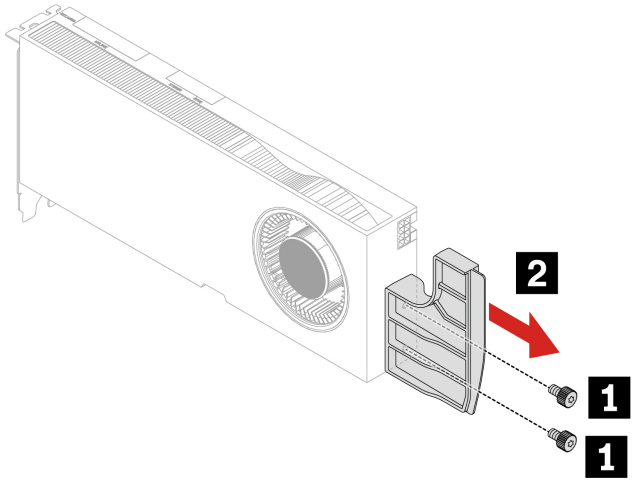
   b. Remove the PCIe card. The card might fit tightly into the slot. If necessary, alternately move each side of the card a small amount until the card is removed from the slot.



c. Remove the PCIe card extender if needed.

Notes:

- For computer models with GFX RTX 4000 Ada, the graphics card and the PCIe card extender work as a CRU assembly. Do not try to remove the extender.
- For computer models with double-width or wider graphics cards (such as NVIDIA RTX 6000 Ada and GeForce RTX 40X0), the PCIe card extender is a customized CRU part. You can remove it according to the following illustration.
- If you want to install a double-width or wider graphics card, install the customized PCIe card extender first.



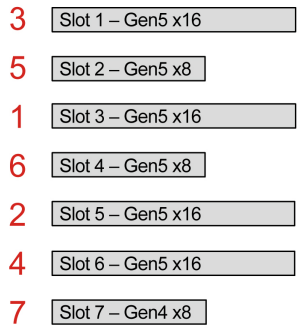
Screw specification	Quantity	Torque
M3 x 5.5 mm, Ni coated, black	2	3-3.5 lb/in

PCIe card installation rule

Before installing the PCIe card, you need to remove “PCIe card bracket” on page 65.

Install PCIe cards according to the following order and the special installation rules for certain PCIe cards.

- **Installation order**



- **Special installation rules for certain PCIe cards**

PCIe card	Installation rule
NVIDIA GeForce RTX 40X0 graphics card	Install in Slot 1.
Two RTX A6000 graphics cards with NVLink	Install in Slot 1 and Slot 3.
AMD Radeon PRO W7900 graphics card	Install in Slot 1 or Slot 5 (Slot 1 is prior to Slot 5).
M.2/U.2/U.3 SSD PCIe adapter, NVIDIA ConnectX-6 Ethernet adapter	Install in Slot 5, Slot 1, or Slot 6.
BMC PCIe adapter	Install in Slot 7.

Cable connection

Note: The connectors on the cards or system board might look slightly different from the illustrations.

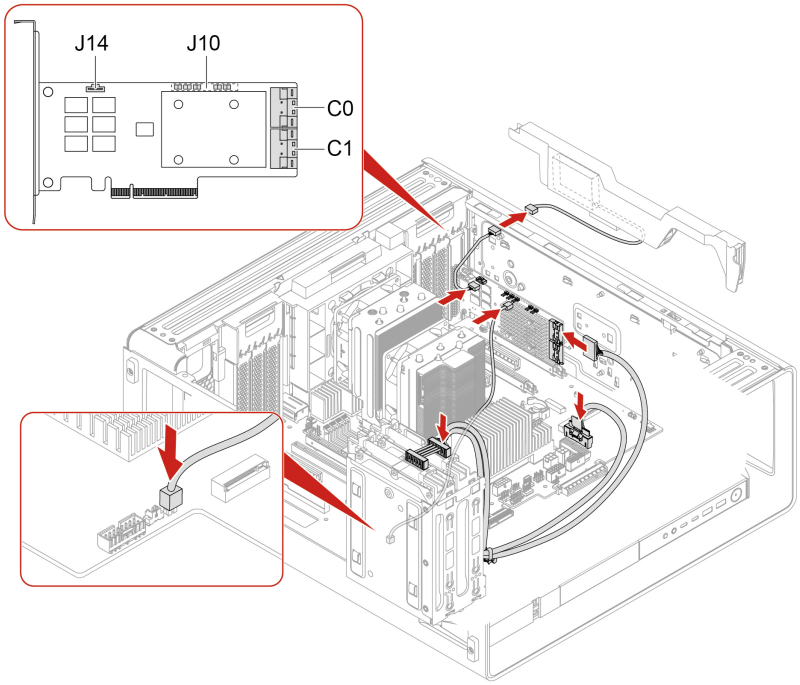


Figure 1. Cable connection for BCM9560 RAID AIC

Notes:

- C0 connector priority is higher than C1 connector.
- Internal storage drive cage priority: 1a, 1b, and 5. See “Expansion modules” on page 17.

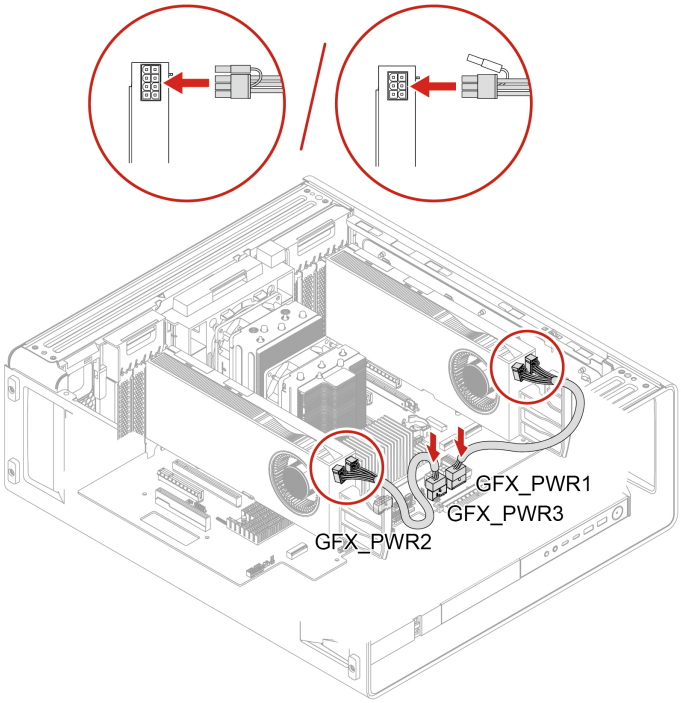


Figure 2. GFX GV100/RTX A5000/RTX A4000 Aux power connection

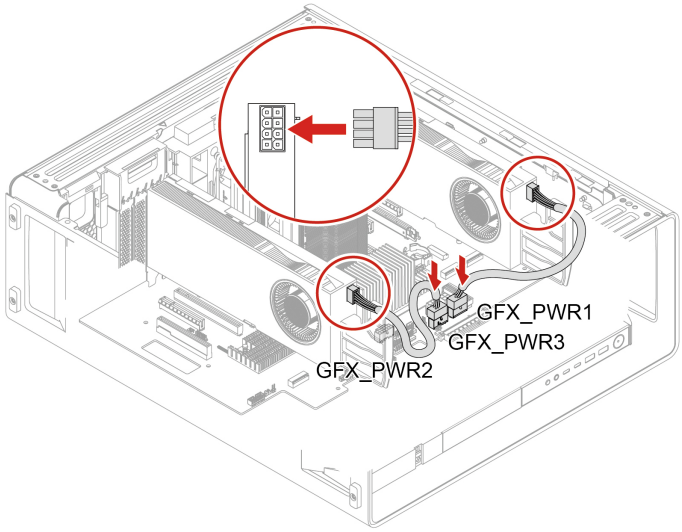


Figure 3. GFX RTX A6000 Aux power connection

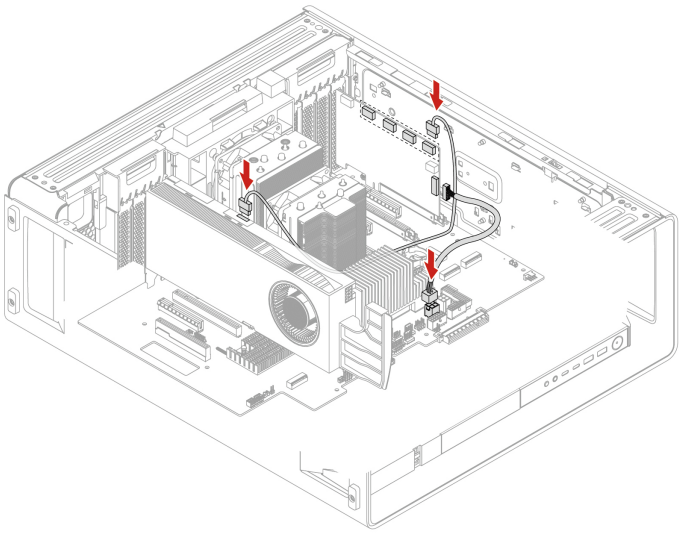


Figure 4. Cable connection for NVIDIA Quadro SYNC II card

Fans

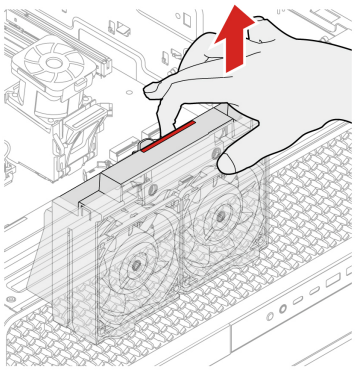
By reading this section, you will learn to replace the fans in your computer.

Front fan

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
2. Remove the front fan.

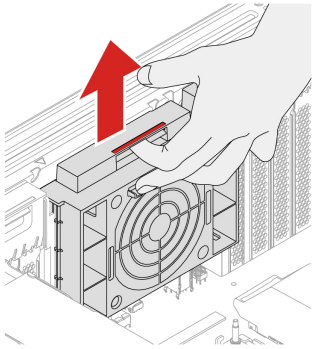


Rear fan

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
2. Remove the rear fan.

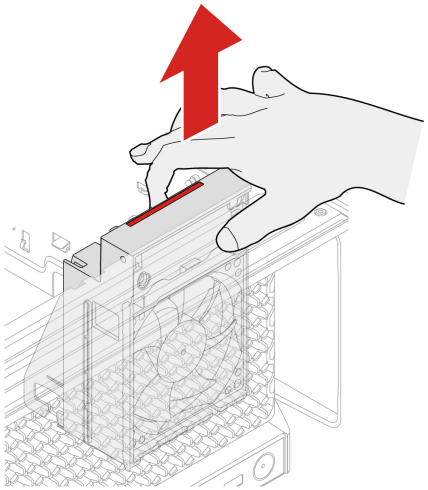


Upper PCIe fan

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
   c. “Front fan” on page 71
2. Remove the upper PCIe fan.

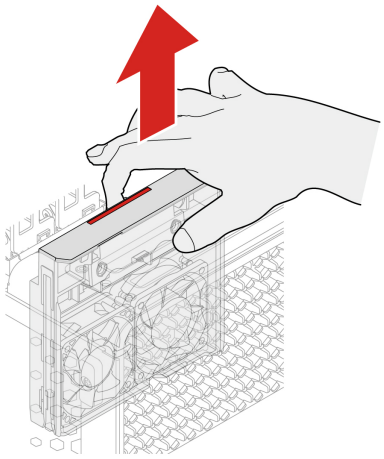


Lower PCIe fan and internal storage drive fan

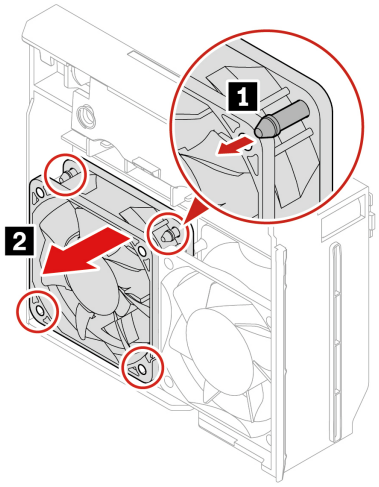
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
   c. “Front fan” on page 71
2. Remove the lower PCIe fan and internal storage drive fan together.



3. Remove the internal storage drive fan.

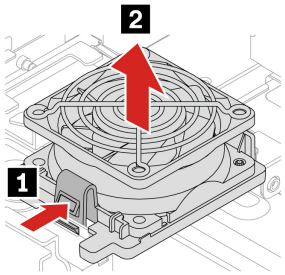


Front-access storage fan

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
2. Remove the front-access storage fan.

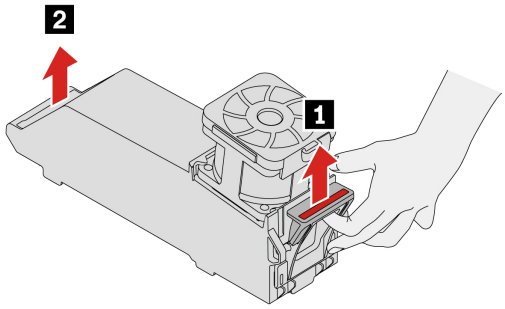


Memory fan and air duct

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

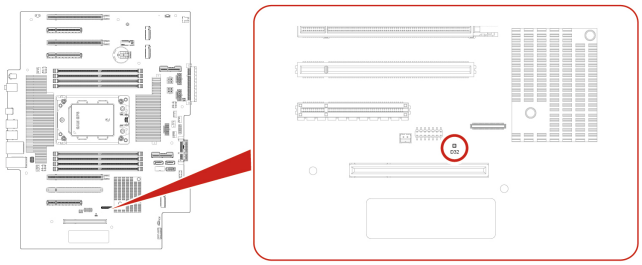
Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
2. Remove the memory fan and air duct.



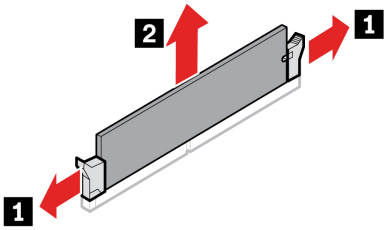
Memory module

- Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.
- Do not replace the memory module until the LED indicator on the system board goes off. It indicates that the system is completely discharged of electricity.

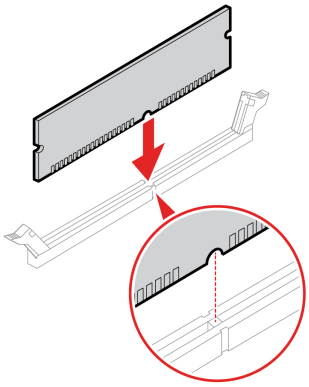


Removal steps

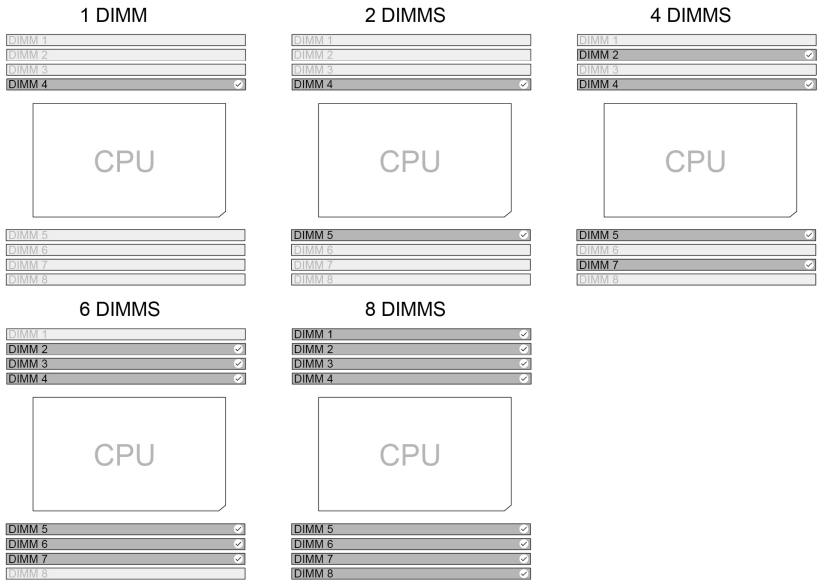
1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
   c. “Memory fan and air duct” on page 74



Installation steps



Note: Ensure that you install memory modules in the order shown in the following illustration.

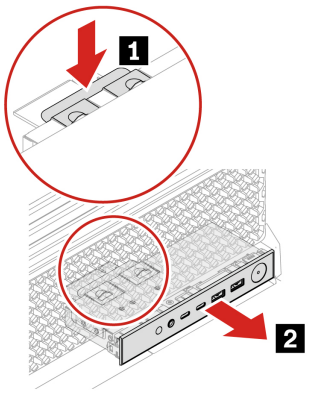


Front panel I/O assembly

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
   c. “Front fan” on page 71
   d. “Upper PCIe fan” on page 72
2. Remove the front panel I/O assembly.



ThinkStation LED and holder

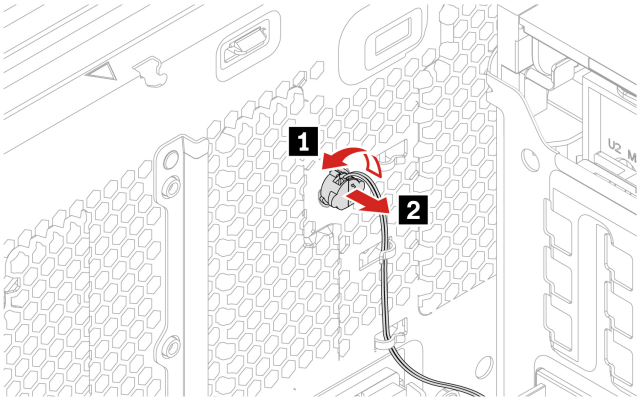
Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

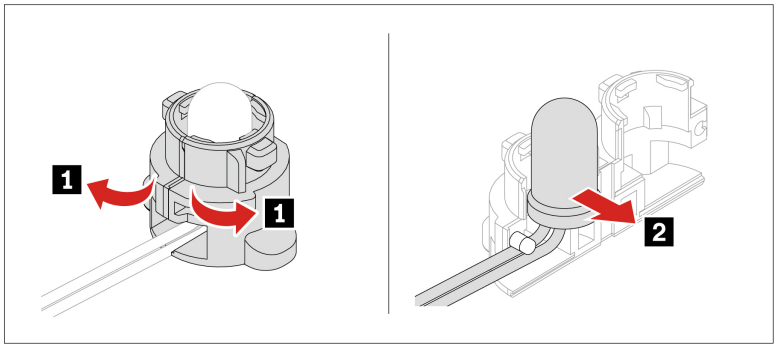
1. Remove the following parts if any:

a. “Side cover” on page 42
b. “Optional internal storage drive cage” on page 44
c. “Front fan” on page 71
d. “Lower PCIe and internal storage drive fan” on page 73

2. Remove the ThinkStation LED.



3. Remove the ThinkStation LED holder.

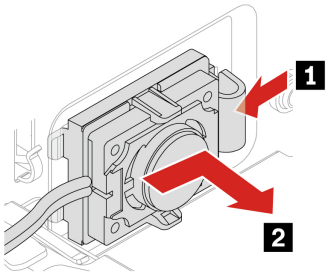


Internal speaker

Before you start, ensure that you have read “Prerequisite for CRU replacement” on page 37.

Removal steps

1. Remove the following parts if any:
   a. “Side cover” on page 42
   b. “Optional internal storage drive cage” on page 44
   c. “Front fan” on page 71
   d. “Rear fan” on page 71
   e. “Lower PCIe and internal storage drive fan” on page 73
2. Remove the internal speaker.


1
2

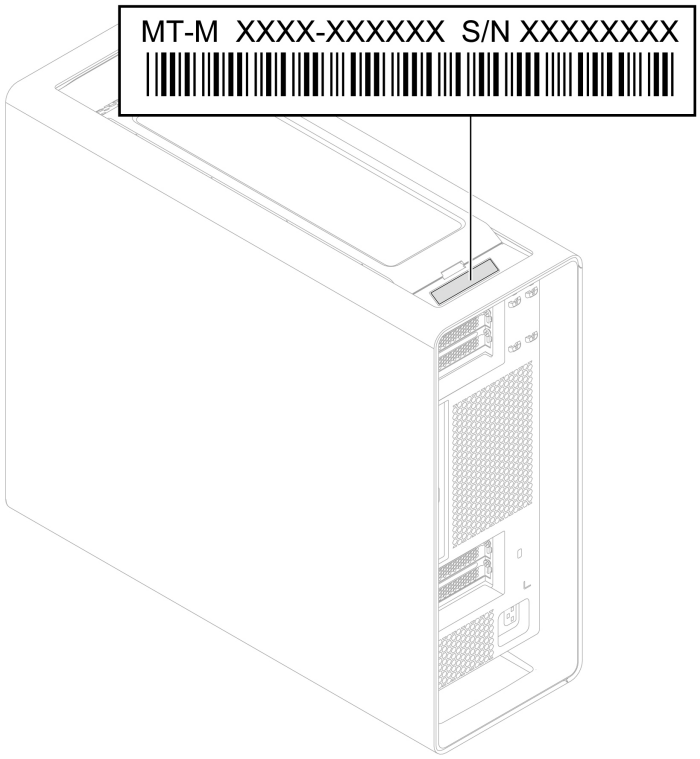
Chapter 6. Help and support

Find your serial number

This topic helps you find computer serial number.

You can find your serial number via:

- Open the Terminal and type `sudo dmidecode -t system | grep Serial`.
- Machine-type and serial-number label of your computer (shown as below illustration).



Diagnose and troubleshoot your computer

This section provides introduction to a set of diagnostics and troubleshooting tools at Lenovo Support Web site. They can help you diagnose common software and hardware issues.

The following table lists these diagnostics tools and the recommended conditions for each tool.

Diagnostics tool	Recommended scenario
Troubleshoot and diagnose at Lenovo Support Web site	You want to have an online troubleshooting or scan of hardware and drivers on your computer.
Use ThinkStation diagnostic tool	You want to use diagnostic solutions to test hardware components and report operating-system-controlled settings that interfere with the correct operation of your computer.

Troubleshoot and diagnose at Lenovo Support Web site

Lenovo provides two different diagnosing solutions to help you identify and resolve problems on your computer.

Step 1. Go to https://www.pcsupport.lenovo.com/ and enter your product name in the search box.

Step 2. Click **Troubleshoot & Diagnose** and select the option that fits your need.

Notes:

- Before launching any automatic diagnosing process, a pop-up window will be prompted to install Lenovo Service Bridge. Lenovo Service Bridge helps to connect your computer with Lenovo diagnosing tools.
- Lenovo Support Web site makes periodic updates of the sections to keep improving your experience with your computer. The Web site interface and descriptions of sections might be different from that on your actual interface.

- If you are unaware of what problem your computer goes with, it is recommended that you select **Easy** and follow on-screen instructions to get your firmware updated and obtain the hardware status.
- If you have identified the problem on your computer, you can select **Custom** and follow on-screen instructions to resolve the problem.

If solutions can not resolve problems on your computer, you can follow on-screen instructions to submit an e-ticket or contact Lenovo for professional assistance.

Use ThinkStation diagnostic tool

When an error message pops up in the notification area, a four-digit error code is displayed on the diagnostic panel (for selected models) on the front panel, or the diagnostic indicator on the front panel turns on, do one of the following:

- If ThinkStation Diagnostics can be launched properly:
  1. Click the error message or the ThinkStation Diagnostics icon to launch the program.
  2. All events are logged locally in the program. Locate the related event and view the event log to find possible solutions.
  3. Record the four-digit error code displayed on the diagnostic panel (for selected models) or in ThinkStation Diagnostics, and then decode the error at https://www.thinkworkstationsoftware.com/codes.

  Note: You can download ThinkStation Diagnostics at https://pcsupport.lenovo.com/lenovodiagnosticsolutions/downloads.
- If your computer does not function:
  1. Use your smartphone to scan the QR code displayed on the diagnostic panel to open https://www.thinkworkstationsoftware.com/codes.
  2. Decode the error according to the four-digit error code displayed on the diagnostic panel.

For more information, go to https://www.thinkworkstationsoftware.com/diags.

Call Lenovo

If you have tried to correct the problem yourself and still need help, you can call Lenovo Customer Support Center.

Before you contact Lenovo

Prepare the needed information before you contact Lenovo.

1. Record the problem symptoms and details:
   - What is the problem? Is it continuous or intermittent?
   - Any error message or error code?
   - What operating system are you using? Which version?
   - Which software applications were running at the time of the problem?
   - Can the problem be reproduced? If so, how?
2. Record the system information:
   - Product name.
   - Machine type and “serial number” on page 79.

Lenovo Customer Support Center

During the warranty period, you can call Lenovo Customer Support Center for help.

Telephone numbers

For a list of the Lenovo Support phone numbers for your country or region, go to:
https://pcsupport.lenovo.com/supportphonelist

Note: Phone numbers are subject to change without notice. If the number for your country or region is not provided, contact your Lenovo reseller or Lenovo marketing representative.

Services available during the warranty period

- Problem determination - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- Lenovo hardware repair - If the problem is determined to be caused by Lenovo hardware under warranty, trained service personnel are available to provide the applicable level of service.
- Engineering change management - Occasionally, there might be changes that are required after a product has been sold. Lenovo or your reseller, if authorized by Lenovo, will make selected Engineering Changes (ECs) that apply to your hardware available.

Services not covered

- Replacement or use of parts not manufactured for or by Lenovo or nonwarranted parts
- Identification of software problem sources
- Configuration of UEFI BIOS as part of an installation or upgrade
- Changes, modifications, or upgrades to device drivers
- Installation and maintenance of network operating systems (NOS)
- Installation and maintenance of programs

For the terms and conditions of the Lenovo Limited Warranty that apply to your Lenovo hardware product, see *Safety and Warranty Guide* that comes with your computer.

Self-help resources

Use the following self-help resources to learn more about the computer and troubleshoot problems.

Resources	How to access?
Lenovo Support Web Site	https://pcsupport.lenovo.com
Tips	https://www.lenovo.com/tips
Lenovo Community	https://forums.lenovo.com
Accessibility information	https://www.lenovo.com/accessibility
Ubuntu help information	https://help.ubuntu.com/lts/ubuntu-help/index.html

Purchase accessories or additional services

This topic provides instructions on how to purchase accessories or additional services.

Accessories

Lenovo has a number of hardware accessories and upgrades to help expand the functionalities of your computer. Accessories include memory modules, storage devices, network cards, power adapters, keyboards, mice, and so on.

To shop at Lenovo, go to https://www.lenovo.com/accessories.

Additional services

During and after the warranty period, you can purchase additional services from Lenovo at https://pcsupport.lenovo.com/warrantyupgrade.

Service availability and service names might vary by country or region.

Accessibility features

Lenovo is committed to making information technology accessible to everyone, including those with hearing, vision, or mobility limitations. Lenovo supports accessibility features in the following ways to help all users better engage with Lenovo products.

Accessible documentation

Lenovo documentation is designed to meet users' accessibility needs. Users can read the documentation with assistance as needed. For example:

- Text and images are in high contrast. Color contrast can enhance the visual experience. In this mode, all contents are highlighted to be more visible.
- Text is logical and readable. Images are also readable with alternative text provided. A screen reader can enhance the hearing or listening experience. In this mode, all contents are clearer and easier to understand.
- Text is large and clear, making it easier to read. A magnifier can enlarge the text to improve readability.

For more information, watch the video at:
https://support.lenovo.com/docs/pc_pub_accessibility

Accessible product design

Lenovo product design also supports accessibility features.

Note: The accessibility features vary by product. Depending on the product model, some accessibility features listed below might not be applicable to the product. To get the most up-to-date accessibility

information for the product, go to https://www.lenovo.com/accessibility. For additional support from Lenovo, users can find phone numbers for their country or region from https://support.lenovo.com/supportphonelist.

- **Keyboards**

  Lenovo keyboards support various accessibility features. For example:

  - Consistent layout of keyboards for easier use
  - Tactile markings on some keys for easier identification
  - Appropriate spacing between keys for typing efficiency
  - Sufficient contrast of keys, controls, and labels for better visibility
  - On-screen notification or lighted notification for some keys for ease of use
  - Keys and controls that can be reached and operated using one hand and require minimal dexterity for ease of use

- **Industry-standard connectors**

  The industry-standard connectors on Lenovo products enable better compatibility with peripheral devices.

- **Operating systems**

  The accessibility features of the operating systems can be configured to assist users in the following ways:

  - Vision features make the screen contents easier to see.
  - Hearing features make the screen contents easier to hear.
  - Interaction features make the product easier to control.

  To access the accessibility features of the Ubuntu or Fedora operating system, go to **Settings → Accessibility**.

Certification-related information

Product name: ThinkStation P8

Machine types: 30HF, 30HH, and 30HJ

Further compliance information related to your product is available at https://www.lenovo.com/compliance.

Compliance information

For more compliance information, refer to *Regulatory Notice* at https://pcsupport.lenovo.com and *Generic Safety and Compliance Notices* at https://pcsupport.lenovo.com/docs/generic_notices.

Supplemental information about the Ubuntu operating system

In limited countries or regions, Lenovo offers customers an option to order computers with the preinstalled Ubuntu® operating system.

If the Ubuntu operating system is available on your computer, read the following information before you use the computer. Ignore any information related to Windows-based programs, utilities, and Lenovo preinstalled applications in this documentation.

Access the Lenovo Limited Warranty

This product is covered by the terms of the Lenovo Limited Warranty (LLW), version L505-0010-02 08/2011. You can view the LLW in a number of languages from the following Web site. Read the Lenovo Limited Warranty at:
https://www.lenovo.com/warranty/llw_02

The LLW also is preinstalled on the computer. To access the LLW, go to the following directory:

```
/opt/Lenovo
```

If you cannot view the LLW either from the Web site or from your computer, contact your local Lenovo office or reseller to obtain a printed version of the LLW.

Access the Ubuntu help system

The Ubuntu help system provides information about how to use the Ubuntu operating system. To access the help system from Home Screen, move your pointer to the Launch bar, and then click the **Help** icon. If you cannot find the **Help** icon from the Launch bar, click the **Search** icon on the bottom left, and type Help to search it.

To learn more about the Ubuntu operating system, go to:
https://www.ubuntu.com

Get support information

If you need help, service, technical assistance, or more information about the Ubuntu operating system or other applications, contact the provider of the Ubuntu operating system or the provider of the application. If you need the service and support for hardware components shipped with your computer, contact Lenovo. For more information about how to contact Lenovo, refer to the *User Guide* and *Safety and Warranty Guide*.

To access the latest *User Guide* and *Safety and Warranty Guide*, go to:
https://pcsupport.lenovo.com

Access open-source information

This device includes software made publicly available by Lenovo, including software licensed under the General Public License and/or the Lesser General Public License (the open source software).

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You may send your request in writing to the address below accompanied by a check or money order for $15 to:

Lenovo Legal Department
Attn: Open Source Team / Source Code Requests
8001 Development Dr.
Morrisville, NC 27560

Please include the version of the OS and the version of the Linux Kernel pre-shipped on this Device as part of your request. Be sure to provide a return address.

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To view additional information regarding licenses, acknowledgments and required copyright notices for the open source software shipped on your Device, go to `/usr/share/doc/*/copyright`.

Appendix A. Notice for USB connector name update

The USB Implementers Forum published a revision of the guideline for USB connector names in September, 2022. Lenovo follows the revised guideline and updates USB connector names accordingly. You can refer to the table below for naming update details.

Current name	Previous name
USB-A connector (Hi-Speed USB)	USB-A 2.0 connector
USB-A connector (USB 5Gbps)	USB-A 3.2 Gen 1 connector
USB-A connector (USB 10Gbps)	USB-A 3.2 Gen 2 connector
USB-A connector (USB 5Gbps, Always On USB)	Always on USB-A 3.2 Gen 1 connector
USB-A connector (USB 10Gbps, Always On USB)	Always on USB-A 3.2 Gen 2 connector
USB-C connector (USB 5Gbps)	USB-C (3.2 Gen 1) connector
USB-C connector (USB 10Gbps)	USB-C (3.2 Gen 2) connector
USB-C connector (USB 20Gbps)	USB 3.2 Gen 2x2
USB-C connector (USB4 20Gbps)	USB 4 Gen 2x2
USB-C connector (USB4 40Gbps)	USB-C (USB 4) connector
USB-C connector (Thunderbolt 3)	USB-C (Thunderbolt 3) connector
USB-C connector (Thunderbolt 4)	USB-C (Thunderbolt 4) connector

Appendix B. Notices and trademarks

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https://pcsupport.lenovo.com

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