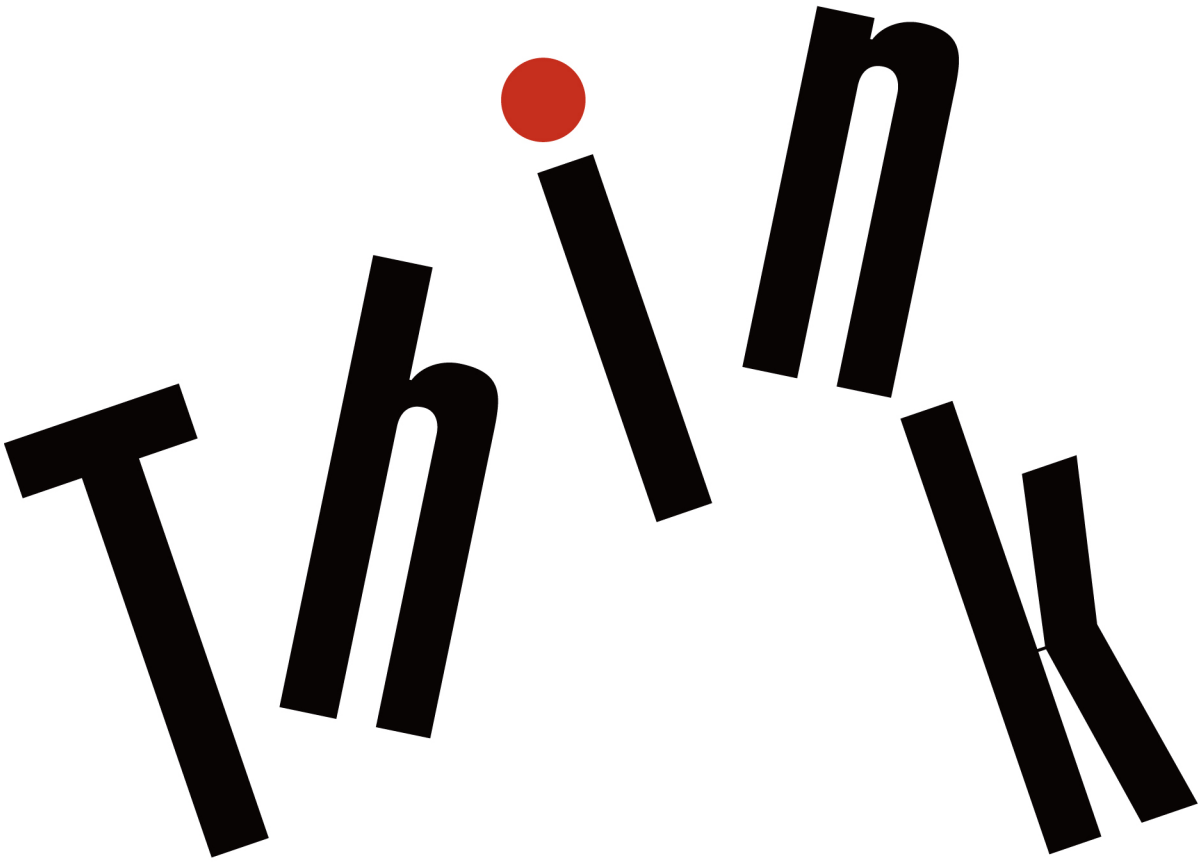
ThinkStation®

P320 Hardware Maintenance Manual



Lenovo™

Machine Types: 30BJ, 30BK, and 30BS

Note: Before using this information and the product it supports, be sure to read and understand the Chapter 1 “Read this first: Important safety information” on page 1 and Appendix G “Notices” on page 161.

Second Edition (June 2017)

Contents

About this manual

This manual provides service and reference information for ThinkStation® computers listed on the front cover.

Use this manual along with the advanced diagnostic tests to troubleshoot problems.

Important: This manual is intended only for trained service technicians who are familiar with ThinkStation computers. Use this manual along with the advanced diagnostic tests to troubleshoot problems effectively. Before servicing a ThinkStation computer, be sure to read and understand Chapter 1 “Read this first: Important safety information” on page 1.

Chapter 1. Read this first: Important safety information

This chapter contains the safety information that you must be familiar with.

Power cords and power adapters

Use only the power cords and power adapters supplied by the product manufacturer. Do not use the ac power cord for other devices.

The power cords shall be safety approved. For Germany, it shall be H05VV-F, 3G, 0.75 mm^2, or better. For other countries, the suitable types shall be used accordingly.

Never wrap a power cord around a power adapter or other object. Doing so can stress the cord in ways that can cause the cord to fray, crack, or crimp. This can present a safety hazard.

Always route power cords so that they will not be walked on, tripped over, or pinched by objects.

Protect power cord and power adapters from liquids. For instance, do not leave your power cord or power adapter near sinks, tubs, toilets, or on floors that are cleaned with liquid cleansers. Liquids can cause a short circuit, particularly if the power cord or power adapter has been stressed by misuse. Liquids also can cause gradual corrosion of power cord terminals and/or the connector terminals on a power adapter, which can eventually result in overheating.

Ensure that all power cord connectors are securely and completely plugged into receptacles.

Do not use any power adapter that shows corrosion at the ac input pins or shows signs of overheating (such as deformed plastic) at the ac input or anywhere on the power adapter.

Do not use any power cords where the electrical contacts on either end show signs of corrosion or overheating or where the power cord appears to have been damaged in any way.

Chapter 2. Product overview

This chapter provides basic information to help you get familiar with your computer.

Hardware locations

This section provides information about the locations of your computer hardware.

Front view

Note: The computer hardware might look slightly different from the illustration.

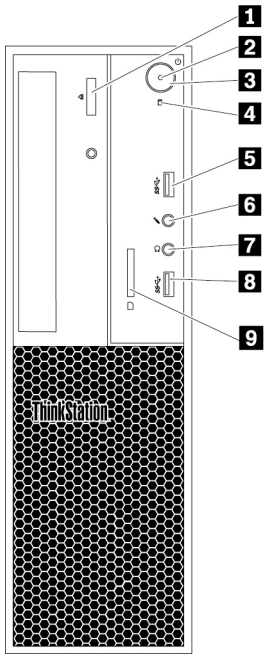


Figure 1. Front connectors, controls, and indicators

1 Optical-drive eject/close button	2 Power indicator
3 Power button	4 Storage drive activity indicator
5 USB 3.0 connector	6 Microphone connector
7 Headphone connector	8 USB 3.0 connector
9 Card reader (some models)	

1 Optical-drive eject/close button

Press the button to eject or close the tray of the optical drive.

2 Power indicator

When the power indicator is on, the computer is turned on.

3 Power button

Press the power button to turn on your computer. If your computer is unresponsive, you can turn off the computer by pressing and holding the power button for four or more seconds.

4 Storage drive activity indicator

This indicator shows the status of the internal storage drives (such as hard disk drives or solid-state drives).

On: The storage drives are active and data is being transferred.

Off (when the computer is powered on): no data is being transferred or the storage drives are not in use.

5 8 USB 3.0 connector

Use this connector to attach a USB-compatible device, such as a USB keyboard, mouse, storage drive, or printer.

6 Microphone connector

Use this connector to attach a microphone to your computer when you want to record sound or if you use speech-recognition software.

7 Headphone connector

Use this connector to attach a headphone to your computer.

9 Card reader (available on some models)

This is a 9-in-1 card reader. Used to insert a supported card-shaped storage medium to read the data on the medium.

Rear view

Some connectors on the rear of your computer are color-coded to help you determine where to connect the cables on your computer.

Note: The computer hardware might look slightly different from the illustration.

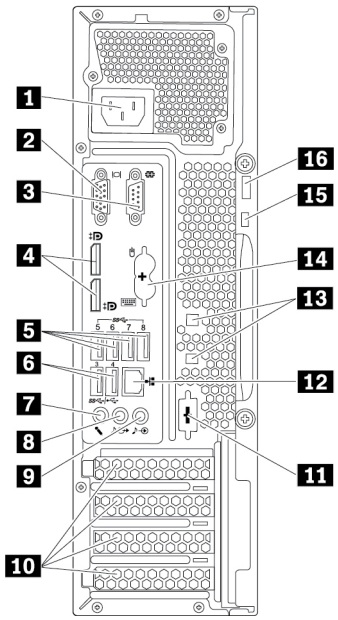


Figure 2. Rear panel

1 Power-cord connector	2 VGA connector
3 Serial connector	4 DisplayPort® connectors (2)
5 USB 3.0 connectors (4)	6 USB 2.0 connectors (2)
7 Microphone connector	8 Audio line-out connector
9 Audio line-in connector	10 PCIe card area*
11 Optional serial connector	12 Ethernet connector
13 Cable-lock slots (2)	14 PS/2 keyboard and mouse connectors (some models)
15 Security-lock slot	16 Padlock loop

Notes: * A discrete graphics card or a network adapter can be installed in the appropriate PCI-Express (PCIe) card slot. If such a card is installed, use the connectors on the card instead of the corresponding connectors on the computer to optimize the performance. Depending on your computer model, the preinstalled cards might vary. One or more graphics cards might be installed to provide the following connectors:

- Digital Visual Interface (DVI) connector
- DisplayPort® connector
- Mini DisplayPort® connector

1 Power-cord connector

Connect the power cord to your computer for power supply.

2 VGA connector

Used to attach a Video Graphics Array (VGA) monitor or other devices that use a VGA connector.

3 Serial connector

Use this connector to attach an external modem, a serial printer, or other devices that use a 9-pin serial connector.

4 DisplayPort connector (2)

Use this connector to attach a high-performance monitor, a direct-drive monitor, or other compatible devices.

5 USB 3.0 connectors (4)

Use this connector to attach a USB-compatible device, such as a USB keyboard, mouse, storage drive, or printer.

6 USB 2.0 connectors (2)

Use this connector to attach a USB-compatible device, such as a USB keyboard, mouse, storage drive, or printer.

7 Microphone connector

Use this connector to attach a microphone to your computer when you want to record sound or if you use speech-recognition software.

8 Audio line-out connector

The audio line-out connector is used to send audio signals from the computer to external devices, such as headphones.

9 Audio line-in connector

The audio line-in connector is used to receive audio signals from an external audio device, such as a stereo system. When you attach an external audio device, a cable connection is established between the audio line-out connector of the device and the audio line-in connector of the computer.

10 PCIe card area (different cards provide different connectors)

To improve the operating performance of your computer, you can install or replace Peripheral Component Interconnect Express (PCIe) cards in this area. Depending on your computer model, the cards installed in this area might vary.

Note: A discrete graphics card, a network interface card, or an audio card can be installed in the appropriate PCIe card slot. If such a card is installed, ensure that you use the connectors on the card instead of the corresponding connectors on the computer.

12 Ethernet connectors

Connect an Ethernet cable for a local area network (LAN).

Note: To operate the computer within Federal Communications Commission (FCC) Class B limits, use a Category 5 Ethernet cable.

13 Cable-lock slots (2)

Used to secure certain cables. See “Attaching a cable lock” on page 34.

14 PS/2 keyboard and mouse connector (available on some models)

Use this connector to attach a Personal System/2 (PS/2) keyboard or a PS/2 mouse.

15 Security-lock slot

Attach a Kensington-style cable lock to the security-lock slot to secure your computer. For more information, see “Attaching a Kensington-style cable lock” on page 33.

16 Padlock loop

Connect a padlock to secure your computer. For more information, see “Attaching a padlock” on page 33.

Computer components

Notes:

- Depending on the model, your computer might look slightly different from the illustration.
- To remove the computer cover, see “Preparing your computer and removing the computer cover” on page 69.

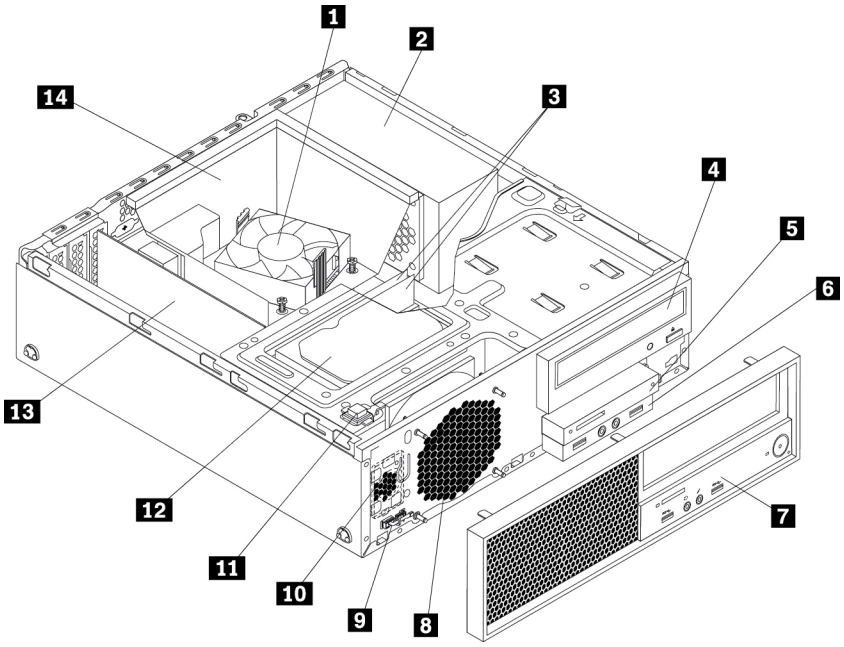


Figure 3. Component locations

1 Heat sink and fan assembly*	2 Power supply assembly
3 Memory modules*	4 Optical drive*
5 Card reader*	6 Front audio and USB assembly
7 Front bezel	8 System fan*
9 Thermal sensor	10 Internal speaker
11 Cover presence switch (Intrusion switch)*	12 Hard disk drive
13 PCIe card (some models)	14 Heat sink fan duct

* Configuration varies by computer models.

Major FRUs and CRUs

The following illustration shows the locations of the major FRUs and CRUs in the computer. To remove the computer cover, see “Preparing your computer and removing the computer cover” on page 69.

Note: Depending on the model, some of the following components might not be available.

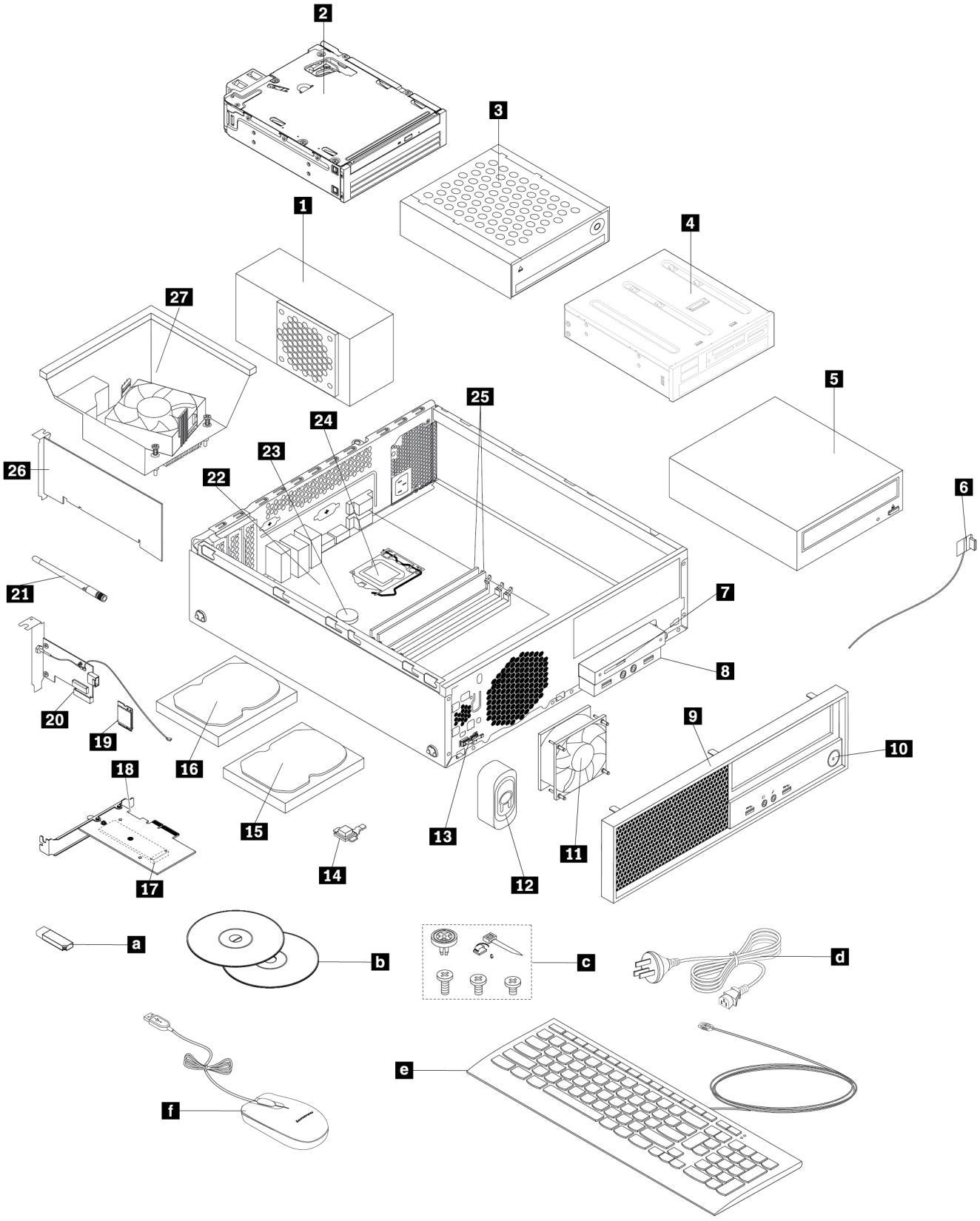


Figure 4. Major FRUs and CRUs

The following table lists the major FRUs shown in Figure 4 “Major FRUs and CRUs” on page 9 and identifies which FRUs are also self-service CRUs or optional-service CRUs.

Notes:

- Self-service CRUs: Parts to be installed or replaced by customer themselves.
- Optional-service CRUs: Parts can be installed or replaced by customers or technicians under certain terms of the applicable warranty service type for your country or region.
- Non-CRUs: Parts must be installed or replaced only by trained service technicians.

Number	FRU description	Self-service CRU	Optional-service CRU
1	Power supply assembly	No	Yes
2	Slim Optical Drive Adapter or Multi-drive Conversion Kit (available on some models)	Yes	No
3	Front-access storage enclosure (available on some models)	Yes	No
4	5.25-inch flex module (available on some models)	Yes	No
5	Optical drive (available on some models)	Yes	No
6	Front Wi-Fi antenna (available on some models)	No	No
7	Card reader	No	No
8	Front audio and USB assembly	No	No
9	Front bezel	Yes	No
10	Power button	No	No
11	System fan	No	No
12	Internal speaker	No	No
13	Thermal sensor	No	No
14	Cover presence switch (also called intrusion switch, available on some models)	No	No
15	Hard disk drive or hybrid drive	Yes	No
16	Solid-state drive	Yes	No
17	M.2 solid-state drive (available on some models)	Yes	No
18	M.2 solid-state drive adapter (available on some models)	Yes	No
19	Wi-Fi card module (available on some models)	No	Yes
20	Wi-Fi adapter card (available on some models)	No	Yes
21	Rear Wi-Fi antenna (available on some models)	No	No
22	System board	No	No
23	Coin-cell battery	No	Yes
24	Microprocessor	No	No
25	Memory modules	Yes	No
26	PCIe card (available on some models)	Yes	No

Number	FRU description	Self-service CRU	Optional-service CRU
27	Heat sink and fan assembly	No	Yes
a	Lenovo factory recovery USB key	Yes	No
b	Lenovo recovery disc set	Yes	No
c	Miscellaneous parts kits	No	No
d	Power cord	Yes	No
e	Keyboard	Yes	No
f	Mouse	Yes	No

Parts on the system board

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

The following illustration shows the locations of the parts on the system board.

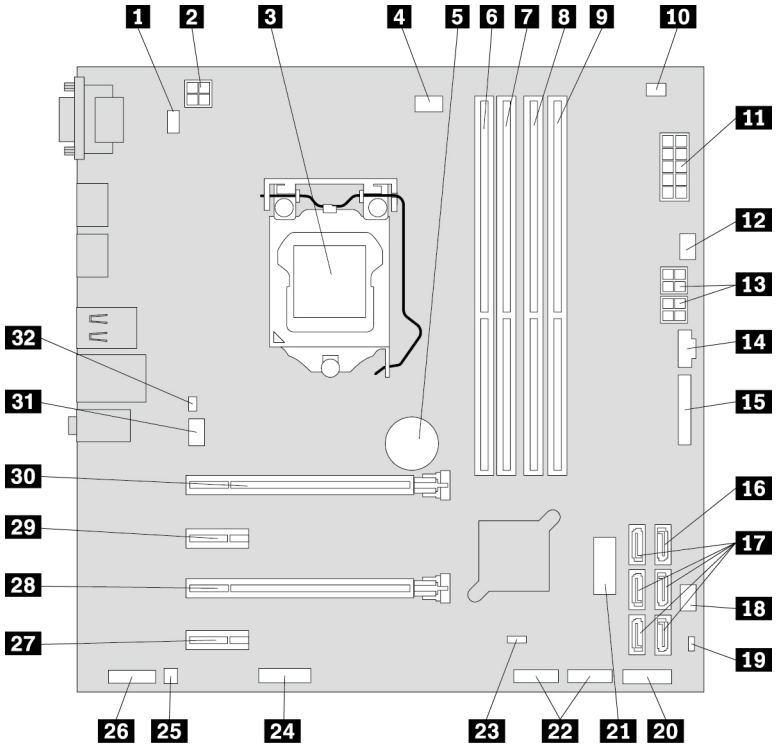


Figure 5. Parts on the system board

1 PS/2 keyboard and mouse connector	2 4-pin power connector
3 Microprocessor	4 Microprocessor fan connector
5 Battery	6 Memory slot 1 (DIMM1)
7 Memory slot 2 (DIMM2)	8 Memory slot 3 (DIMM3)
9 Memory slot 4 (DIMM4)	10 Thermal sensor connector
11 10-pin power connector	12 Hard-disk-drive fan connector

13 4-pin SATA power connectors	14 Thunderbolt™ connector
15 Parallel connector	16 eSATA connector
17 SATA connectors	18 Power fan connector
19 USB hardware disable header	20 Front bezel connector (for connecting LED indicators and the power button)
21 Front USB 3.0 connector (for connecting USB connectors on the front panel)	22 USB 2.0 connectors (for connecting front USB 2.0 connector, card reader connector, or Bluetooth connector)
23 Clear CMOS (Complementary Metal Oxide Semiconductor) /Recovery jumper	24 Serial (COM2) connector
25 Internal speaker connector	26 Front audio connector
27 PCIe x1 card slot 4	28 PCIe x4 card slot 3 (negotiable link width x4, x1)
29 PCIe x1 card slot 2	30 PCIe x16 card slot 1 (graphic card available on some models)
31 System fan connector	32 Cover presence switch connector (intrusion switch connector)

Internal storage drives

Internal drives are devices that your computer uses to read and store data. You can add drives to your computer to increase storage capacity and enable your computer to read other types of media. Internal drives are installed in bays.

When you install or replace an internal drive, note the type and size of the drive that each bay supports and correctly connect the required cables. Refer to the appropriate section in Chapter 8 “Hardware removal and installation” on page 69 for instructions on how to install or replace internal drives for your computer.

The following illustration shows the locations of the drive bays.

Note: The computer hardware might look slightly different from the illustrations.

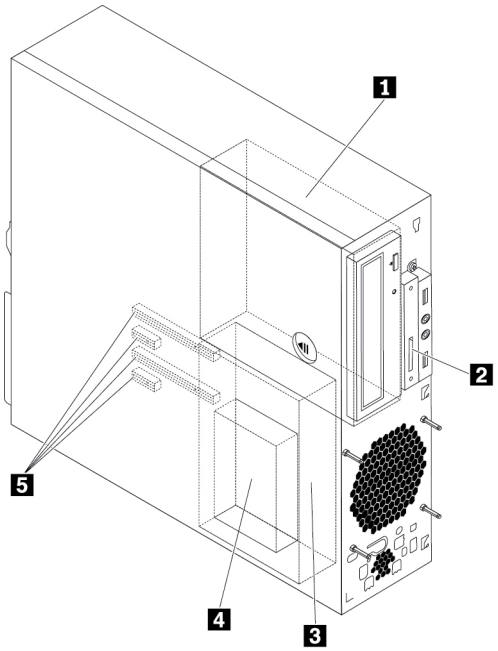


Figure 6. Drive bay locations

1 Optical-drive bay	2 Card-reader bay (available on some models)
3 Secondary hard-disk-drive bay	4 Primary hard-disk-drive bay
5 PCIe card slots (4)	

1 Optical-drive bay

The optical-drive bay supports the following devices. Depending on your computer model, one of them might be installed:

- Optical drive
- 5.25-inch flex module equipped with some or all of the following components:
  - Slim optical drive
  - Card reader (9-in-1)
  - eSATA connector
  - IEEE 1394 connector
  - Thunderbolt adapter kit
- Front-access storage enclosure
- Slim Optical Drive Adapter
- Multi-drive Conversion Kit

2 Card-reader bay (available on some models)

A card reader might be installed in this bay.

3 Secondary hard-disk-drive bay

A 2.5-inch hard disk drive or solid-state drive might be installed in this bay.

4 Primary hard-disk-drive bay

A 3.5-inch hard disk drive, 3.5-inch hybrid drive, or 2.5-inch solid-state drive might be installed in this bay.

5 PCIe card slots (4)

PCIe solid-state drives or other PCIe cards might be installed in the slots.

Machine type and model label

The machine type and model label identifies your computer. When you contact Lenovo for help, the machine type and model information helps support technicians to identify your computer and provide faster service.

The machine type and model label is attached on the front of your computer as shown.

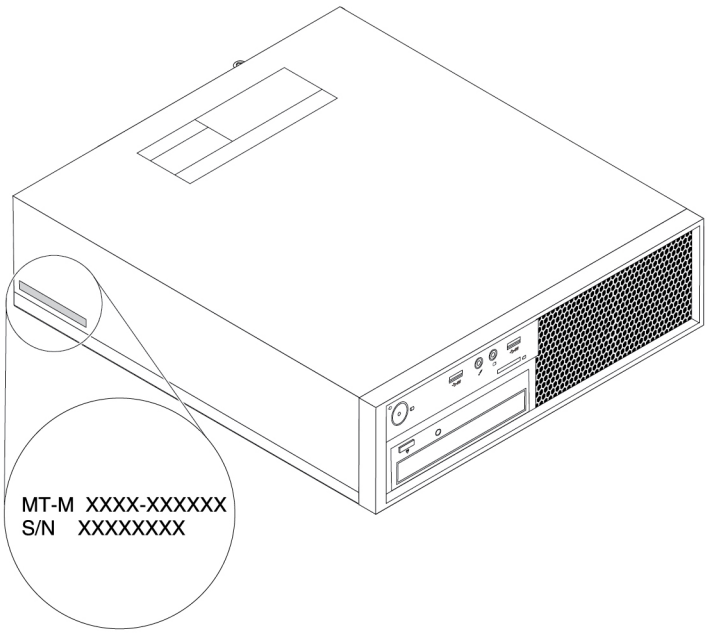


Figure 7. Machine type and model label

Computer features

For your specific computer model, some features might vary or not apply.

Information about your computer

- To view basic information (such as microprocessor and memory information) about your computer, do the following:
  1. Click the Start button to open the Start menu.
  2. Depending on your Microsoft® Windows® operating system version, do one of the following:
     - For Windows 7: Right-click **Computer**, and then click **Properties**.
     - For Windows 10: Click **Settings → System → About**.
- To view detailed information about the devices (such as the optical drive and network adapters) on your computer, do the following:

1. Depending on your Windows version, do one of the following:
   - For Windows 7: Click the Start button to open the Start menu. Right-click **Computer**, and then click **Properties**.
   - For Windows 10: Right-click the Start button to open the Start context menu.
2. Click **Device Manager**.
3. Locate and double-click your device in**Device Manager** to view device properties. Type the administrator password or provide confirmation if prompted.

Memory

Your computer supports up to four double data rate 4 (DDR4) error correction code (ECC) unbuffered dual inline memory modules (UDIMMs) and non-ECC UDIMMs.

Storage drives

Your computer supports the following storage drives:

- Card reader (9-in-1, available on some models)
- Optical drive (available on some models)
- Serial Advanced Technology Attachment (SATA) hard disk drive
- SATA hybrid drive (available on some models)
- SATA solid-state drive (available on some models)
- PCIe solid-state drive (M.2 solid-state drive) (available on some models)
- Intel ® Optane™ Memory (available on some models)

To view the amount of storage drive space, do the following:

1. Depending on your Windows version, do one of the following:
   - For Windows 7: Click the Start button to open the Start menu. Right-click **Computer**, and then click **Manage**.
   - For Windows 10: Right-click the Start button to open the Start context menu.
2. Click **Disk Management** and follow the instructions on the screen.

Video features

- Integrated graphics supports the following connectors on your computer:
  - DisplayPort connector
  - VGA connector
- Discrete graphics card installed in one of the PCIe x16 graphics card slots (available on some models) (the connectors vary by graphics card)

Audio features

- Integrated audio controller supports the following connectors and devices on your computer:
  - Audio line-in connector
  - Audio line-out connector
  - Headphone connector
  - Internal speaker
  - Microphone connector

- Discrete audio card installed in one of the PCIe card slots (available on some models) (the connectors vary by audio card)

Input/Output (I/O) features

- 100/1000 Mbps Ethernet connector
- Audio connectors (audio line-in connector, audio line-out connector, microphone connector, and headphone connector)
- Display connectors (DisplayPort connector, and VGA connector) (vary by graphics card)
- PS/2 keyboard connector
- PS/2 mouse connector
- Serial connectors
- USB connectors

Expansion

- Card reader bay (available on some models)
- Hard-disk-drive bays
- Memory slots
- Optical-drive bays
- PCIe x1 card slots
- PCIe x4 card slot (negotiable link width x4, x1)
- PCIe x16 card slot (graphic card available on some models)

Power supply

Your computer comes with one of the following power supplies:

- 210-watt automatic 85% voltage-sensing power supply
- 210-watt automatic 92% voltage-sensing power supply

Wireless features

Depending on your computer model, the following wireless features are supported:

- Wireless local area network (LAN)
- Bluetooth

System management features

- Ability to store power-on self-test (POST) hardware test results
- Desktop Management Interface (DMI)

  Desktop Management Interface provides a common path for users to access information about all aspects of a computer. The information includes the processor type, installation date, attached printers and other peripherals, power sources, and maintenance history.
- ErP LPS compliance mode

  The energy-related products directive (ErP) lowest power state (LPS) compliance mode reduces the consumption of electricity when your computer is in sleep or off mode.
- Intelligent Cooling Engine (ICE)

  The Intelligent Cooling Engine is a system thermal management solution that enables your computer to run with better thermal and acoustic performance. The ICE function also monitors the thermal performance of your computer to identify thermal problems.

- Intel® Standard Manageability (ISM)

  Intel Standard Manageability builds certain functionalities into computer hardware and firmware. Therefore, computers are less expensive for businesses and easier to monitor, maintain, update, upgrade, and repair.

- Intel Active Management Technology (Intel AMT)

  With specific Intel platform capabilities and third-party management and security applications, Intel Active Management Technology enables IT administrators or managed service providers to easily and remotely discover, repair, and protect their networked computing assets.

- Intel Matrix Storage Manager

  Intel Matrix Storage Manager is a device driver that provides support for SATA RAID 5 arrays on specific Intel chipset system boards to enhance hard disk performance.

- Preboot Execution Environment (PXE)

  Preboot Execution Environment enables you to start computers using a network interface. This manner is independent of starting computers from data storage devices (such as the hard disk drive) or installed operating systems.

- System Management (SM) basic input/output system (BIOS) and SM software

  The SM BIOS specification defines data structures and access methods in a BIOS. Therefore, a user or an application can store and retrieve information specific about the computer in question.

- Wake on LAN (WOL)

  Wake on LAN is an Ethernet computer networking standard that allows a computer to be turned on or woken up by a network message. The message is usually sent by a program running on another computer on the same local area network.

- Wake on Ring

  Wake on Ring, sometimes referred to as Wake on Modem, is a specification that allows supported computers and devices to resume from sleep or hibernation mode.

- Windows Management Instrumentation (WMI)

  Windows Management Instrumentation is a set of extensions to the Windows Driver Model. It provides an operating system interface through which instrumented components provide information and notification.

Security features

- Ability to enable and disable a device
- Ability to enable and disable USB connectors individually
- Antivirus program
- Computrace Agent software embedded in firmware
- Cover presence switch (also called intrusion switch)
- BIOS passwords and Windows accounts to deter unauthorized use of your computer
- Finger authentication (available on some models)
- Firewalls
- Startup sequence control
- Startup without a keyboard or mouse
- Support for a Kensington-style cable lock
- Support for a padlock
- Trusted Platform Module (TPM)

Preinstalled operating system

Your computer is preinstalled with Windows 7 or Windows 10 operating system. Additional operating systems might be identified by Lenovo as compatible with your computer. To determine if an operating system has been certified or tested for compatibility, check the Web site of the operating system provider.

Computer specifications

This section lists the physical specifications for your computer.

Dimensions

- Width: 100 mm (3.94 inches)
- Height: 339 mm (13.35 inches)
- Depth: 381 mm (15 inches)

Weight

Maximum configuration as shipped: 7.8 kg (17.2 lb)

Environment

- Air temperature:
  - Operating: From 10°C (50°F) to 35°C (95°F)
  - Storage in original shipping package: From -40°C (-40°F) to 60°C (140°F)
  - Storage without package: From -10°C (14°F) to 60°C (140°F)
- Humidity:
  - Operating: 20%–80% (non-condensing)
  - Storage: 20%–90% (non-condensing)
- Altitude:
  - Operating: From -15.2 m (-50 ft) to 3048 m (10 000 ft)
  - Storage: From -15.2 m (-50 ft) to 10 668 m (35 000 ft)

Electrical input

- Input voltage: From 100 V ac to 240 V ac
- Input frequency: 50/60 Hz

Programs

This section provides information about the programs on your computer.

Accessing a program on your computer

Note: For Windows 7, depending on your computer model, some of the Lenovo programs might be ready to be installed, so you must install them manually. Then, you can access and use these programs.

To access a program on your computer, do one of the following:

- From Windows Search:
  1. Depending on your Windows version, do one of the following:
     - For Windows 7: Click the Start button to open the Start menu, and then type the program name into the search box.

- For Windows 10: Type the program name into the search box next to the Start button.

2. In the search results, click the name of the desired program to launch the program.

- From the Start menu or Control Panel:
  1. Depending on your Windows version, do one of the following:
     - For Windows 7: Click the Start button to open the Start menu. If the program name is not displayed, click **All Programs** to display the program list. Then, click the name of the desired program to launch the program.
     - For Windows 10: Click the Start button to open the Start menu. Then, click the name of the desired program to launch the program.
  2. If the program name is not displayed on the Start menu, access the program from Control Panel.
     a. Click the Start button to open the Start menu.
     b. Depending on your Windows version, do one of the following:
        - For Windows 7: Click **Control Panel**.
        - For Windows 10: Click **Windows System → Control Panel**.
     c. View Control Panel by Large icons or Small icons, and then click the name of the desired program to launch the program.

Installing a program that is ready to be installed (Windows 7 only)

On the Windows 7 operating system, to install a program that is ready to be installed, do the following:

1. Open the Lenovo ThinkVantage® Tools program. See “Accessing a program on your computer” on page 18.
2. Click **View → Tiles** to view the program icons.
3. Follow the instructions under grayed-out icons to locate the icon for the desired program. Then, double-click the icon to install the program.

An introduction to Lenovo programs

This section provides information about the major Lenovo programs available on your operating system.

Note: Depending on your computer model, some of the following programs might not be available.

Fingerprint Manager Pro or ThinkVantage Fingerprint Software (Windows 7)	The Fingerprint Manager Pro or ThinkVantage Fingerprint Software program enables you to use a fingerprint reader. The integrated fingerprint reader provided on some keyboards enables you to enroll your fingerprint and associate it with your power-on password, hard disk password, and Windows password. As a result, fingerprint authentication can replace passwords and enable simple and secure user access.
Lenovo App Explorer (Windows 10)	Lenovo App Explorer enables you to quickly personalize your PC by helping you find, download, and install selected apps in a secure manner. It recommends popular, useful, and relevant apps from a curated catalog of over 2000 titles. There are no advertisements, hidden downloads, or software bundles. You’re free to choose only the apps that you want without being concerned about annoying or malicious add-ons.

Lenovo Companion (Windows 10)	Your computer's best features and capabilities should be easy to access and understand. With Lenovo Companion, they are. Use Lenovo Companion to do the following: • Optimize your computer's performance, monitor your computer's health, and manage updates. • Access your user guide, check warranty status, and view accessories customized for your computer. • Read how-to articles, explore Lenovo forums, and stay up-to-date on technology news with articles and blogs from trusted sources. Lenovo Companion is filled with exclusive Lenovo content to help you learn more about what you can do with your computer.
Lenovo PC Experience (Windows 7)	This program helps you work easily and securely by providing easy access to various programs. **Note:** This program cannot be found from the all program list or search box. To access this program, go to Control Panel. View Control Panel by Category, click **Hardware and Sound → Devices and Printers**, and then double-click the device with your computer name.
Lenovo ID (Windows 10)	The Lenovo ID program enables you to create and manage your Lenovo ID. With a Lenovo ID, you can connect to everything Lenovo through a single account. Use your Lenovo ID for quick and simple authentication and then enjoy the various services provided by Lenovo. Such services include online shopping, app download, personalized device support, special promotional offers, Lenovo forums, and so on.
Lenovo PowerENGAGE (Windows 7)	The Lenovo PowerENGAGE program provides power management function.
Lenovo Solution Center (Windows 7)	The Lenovo Solution Center program enables you to troubleshoot and resolve computer problems. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for maximum system performance.
Lenovo ThinkVantage Tools (Windows 7)	The Lenovo ThinkVantage Tools program provides easy access to various tools to help your work more easily and securely.
Recovery Media (Windows 7)	The Recovery Media program enables you to restore the contents of the hard disk drive to the factory-default settings.
System Update (Windows 7)	The System Update program provides regular access to the system updates for your computer, such as device driver updates, software updates, and BIOS updates. The program gathers information from the Lenovo Help Center about new updates for your computer, and then sorts and displays the updates for download and installation. You have complete control of which updates to download and install.

Chapter 3. Using your computer

This chapter provides information to help you use the various features provided by your computer.

Registering your computer

When you register your computer with Lenovo, you enter required information into a Lenovo database. The information enables Lenovo to contact you when there is a recall or other severe problem and provide quicker service when you call Lenovo for help. In addition, some locations offer extended privileges and services to registered users.

To register your computer with Lenovo, go to http://www.lenovo.com/register and follow the instructions on the screen.

Setting the computer volume

To set the computer volume, do the following:

1. Click the volume icon in the Windows notification area on the taskbar.

   Note: If the volume icon is not displayed in the Windows notification area, add the icon to the notification area. See the Windows help system.
2. Follow the instructions on the screen and the hover text to adjust the volume, mute the speaker, or unmute the speaker.

Using a disc

This section provides instructions on how to use a disc and the optical drive.

Guidelines about using the optical drive

When using the optical drive, follow these guidelines:

- Do not place the computer in a location where the drive is exposed to any of the following conditions:
  - High temperature
  - High humidity
  - Excessive dust
  - Excessive vibration or sudden shock
  - An inclined surface
  - Direct sunlight
- Do not insert any object other than a disc into the drive.
- Do not insert damaged discs into the drive. Warped, scratched, or dirty discs can damage the drive.
- Before moving the computer, remove the disc from the drive.

Handling and storing a disc

When handling and storing a disc, follow these guidelines:

- Hold the disc by its edges. Do not touch the surface of the side that is not labeled.

- To remove dust or fingerprints, wipe the disc with a clean, soft cloth from the center to the outside. Wiping the disc in a circular direction might cause loss of data.
- Do not write or stick paper on the disc.
- Do not scratch or mark the disc.
- Do not place or store the disc in direct sunlight.
- Do not use benzene, thinners, or other cleaners to clean the disc.
- Do not drop or bend the disc.

Playing and removing a disc

To play a disc, do the following:

1. With the computer on, press the eject/close button on the front of the optical drive. The tray slides out of the drive.
2. Insert a disc into the tray. Some optical drive has a snap hub in the center of the tray. If your drive has a snap hub, support the tray with one hand and then push the center of the disc until it snaps into place.
3. Press the eject/close button again or gently push the tray forward to close the tray. The disc player program starts automatically. For more information, refer to the help system of the disc player program.

To remove a disc from the optical drive, do the following:

1. With the computer on, press the eject/close button on the front of the optical drive. The tray slides out of the drive.
2. Carefully remove the disc from the tray.
3. Press the eject/close button again or gently push the tray forward to close the tray.

Note: If the tray does not slide out of the drive when you press the eject/close button, turn off your computer. Then, insert a straightened paper clip into the emergency-eject hole adjacent to the eject/close button. Use the emergency eject only in an emergency.

Recording a disc

If your optical drive supports recording, you can record a disc.

Recording a disc using Windows tools

To record a disc using Windows tools, do one of the following:

- Burn a disc using the AutoPlay window.
    1. Ensure that the disc is played automatically.
        a. Click the Start button to open the Start menu.
        b. Depending on your Windows version, do one of the following:
            – For Windows 7: Click **Control Panel**. View Control Panel by Large icons or Small icons, and then click **AutoPlay**.
            – For Windows 10: Click **Settings → Devices → AutoPlay**.
        c. Select or turn on **Use AutoPlay for all media and devices**.
    2. Insert a recordable disc into the optical drive that supports recording. The AutoPlay window opens.
    3. Follow the instructions on the screen.
- Burn a disc using Windows Media® Player.
    1. Insert a recordable disc into the optical drive that supports recording.

2. Open Windows Media Player. See “Accessing a program on your computer” on page 18.
3. Follow the instructions on the screen.

- Burn a disc from an ISO file.
  1. Insert a recordable disc into the optical drive that supports recording.
  2. Double-click the ISO file.
  3. Follow the instructions on the screen.

Recording a disc using preinstalled programs

To record a disc using preinstalled programs, do the following:

1. Insert a recordable disc into the optical drive that supports recording.
2. Open the PowerDVD Create, PowerProducer, or Power2Go program. See “Accessing a program on your computer” on page 18.
3. Follow the instructions on the screen.

Connecting to a network

This section provides instructions on how to connect to a network.

Connecting to an Ethernet LAN

You can connect your computer to an Ethernet LAN by connecting an Ethernet cable to the Ethernet connector.

DANGER

To avoid the risk of electrical shock, do not connect the telephone cable to the Ethernet connector.

Connecting to a wireless LAN

You can connect your computer to a wireless LAN without the use of an Ethernet cable but by means of radio waves only.

Note: The wireless LAN feature is available only on some models.

To establish a wireless-LAN connection, do the following:

1. Ensure that a wireless LAN is available and the wireless LAN feature on your computer is working.
2. Click the wireless-network-connection-status icon in the Windows notification area to display available wireless networks.

   Note: If the wireless-network-connection-status icon is not displayed in the Windows notification area, add the icon to the notification area. See the Windows help system.
3. Click a wireless LAN, and then click **Connect** to connect your computer to it. Provide required information if needed.

Connecting to a Bluetooth-enabled device

Bluetooth is a short-range wireless communications technology. Use Bluetooth to establish a wireless connection between your computer and another Bluetooth-enabled device within a distance of about 10 m (32.8 ft).

Note: The Bluetooth feature is available only on some models.

To connect to a Bluetooth-enabled device, do the following:

1. Turn on the Bluetooth feature of your computer. Ensure that the Bluetooth-enabled device is located within a distance of about 10 m (32.8 ft) from your computer.
2. Click the Bluetooth icon in the Windows notification area on the taskbar. Then, click **Add a Device** and follow the instructions on the screen.

   Note: If the Bluetooth icon is not displayed in the Windows notification area, add the icon to the notification area. See the Windows help system.

Chapter 4. You and your computer

This chapter provides information about accessibility, ergonomic, and cleaning and maintenance.

Arranging your workspace

Arrange your workspace to suit your needs and the kind of work you do. This section provides information about the factors that affect the way you arrange your workspace.

Glare and lighting

Position the monitor to minimize glare and reflections from overhead lights, windows, and other light sources. Reflected light from shiny surfaces can cause annoying reflections on your screen. When possible, place the monitor at right angles to windows and other light sources. If necessary, reduce overhead lighting by turning off lights or using lower wattage bulbs. If you install the monitor near a window, use curtains or blinds to block the sunlight. You can adjust the brightness and contrast controls on the monitor as the room lighting changes throughout the day.

Where it is impossible to avoid reflections or to adjust the lighting, an antiglare filter placed over the screen might be helpful. However, these filters might affect the clarity of the image on the screen; try them only after you have exhausted other methods of reducing glare.

Air circulation

Your computer produces heat. The computer has a fan that pulls in fresh air and forces out hot air through the air vents. Blocking the air vents can cause overheating, which might result in a malfunction or damage. Position the computer so that nothing blocks the air vents; usually, 51 mm (2 inches) of air space is sufficient. Ensure that the vented air is not blowing on people.

Electrical outlet locations and cable lengths

The following factors might determine the final placement of your computer:

- Locations of electrical outlets
- Length of power cords or power adapters
- Length of the cables that are connected to other devices

Comfort

Although no single working position is ideal for everyone, here are a few guidelines to help you find a position that suits you best. The following figure sets an example for your reference.

- Screen position: Keep the screen at a comfortable viewing distance, usually 51–61 cm (20–24 inches). Then, adjust the screen so that the top of the screen is at or slightly below eye level and you can view it without twisting your body.
- Chair position: Use a chair that gives you good back support and seat height adjustment. Use chair adjustments to best suit your desired posture.
- Head position: Keep your head and neck in a comfortable and neutral (vertical or upright) position.
- Arm and hand positions: Keep your forearms, wrists, and hands in a relaxed and neutral (horizontal) position. Type with a soft touch without pounding the keys.
- Leg position: Keep your thighs parallel to the floor and your feet flat on the floor or on a footrest.

Make minor modifications in your working posture to deter the onset of discomfort caused by long periods of working in the same position. Frequent short breaks from your work also help to prevent minor discomfort associated with your working posture.

Accessibility information

Lenovo is committed to providing users who have hearing, vision, and mobility limitations with greater access to information and technology. This section provides information about the ways these users can get the most out of their computer experience. You also can get the most up-to-date accessibility information from the following Web site:
http://www.lenovo.com/accessibility

Keyboard shortcuts

The following table contains keyboard shortcuts that can help make your computer easier to use.

Note: Depending on your keyboard, some of the following keyboard shortcuts might not be available.

Keyboard shortcut	Function
Windows logo key + U	Open Ease of Access Center
Right Shift for eight seconds	Turn on or turn off Filter Keys
Shift five times	Turn on or turn off Sticky Keys
Num Lock for five seconds	Turn on or turn off Toggle Keys
Left Alt+Left Shift+Num Lock	Turn on or turn off Mouse Keys
Left Alt+Left Shift+PrtScn (or PrtSc)	Turn on or turn off High Contrast

For more information, go to http://windows.microsoft.com/, and then perform a search using any of the following keywords: keyboard shortcuts, key combinations, and shortcut keys.

Ease of Access Center

Ease of Access Center on the Windows operating system enables you to configure your computer to suit your physical and cognitive needs.

To use Ease of Access Center, do the following:

1. Click the Start button to open the Start menu.
2. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Control Panel**. View Control Panel by Large icons or Small icons, and then click **Ease of Access Center**.

- For Windows 10: Click **Settings** ➙ **Ease of Access**.

3. Choose the appropriate tool by following the instructions on the screen.

Ease of Access Center mainly includes the following tools:

- Magnifier

  Magnifier is a useful utility that enlarges the entire screen or part of the screen so that you can see the items better.

- Narrator

  Narrator is a screen reader that reads aloud what is displayed on the screen and describes events such as error messages.

- On-Screen Keyboard

  To input data into your computer using a mouse, joystick, or other pointing devices instead of a physical keyboard, you can use On-Screen Keyboard.

- High Contrast

  High Contrast is a feature that heightens the color contrast of some text and images on your screen. As a result, those items are more distinct and easier to identify.

- Personalized keyboard

  Adjust keyboard settings to make your keyboard easier to use. For example, you can use your keyboard to control the pointer and type certain key combinations easier.

- Personalized mouse

  Adjust mouse settings to make your mouse easier to use. For example, you can change the pointer appearance and make it easier to manage windows with the mouse.

Speech Recognition

Speech Recognition enables you to control your computer by voice.

Using only your voice, you can start programs, open menus, click objects on the screen, dictate text into documents, and write and send e-mails. Everything you do with the keyboard and mouse can be done with only your voice.

To use Speech Recognition, do the following:

1. Click the Start button to open the Start menu.
2. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Control Panel**.
   - For Windows 10: Click **Windows System** ➙ **Control Panel**.
3. View Control Panel by Large icons or Small icons, and then click **Speech Recognition**.
4. Follow the instructions on the screen.

Screen-reader technologies

Screen-reader technologies are primarily focused on software program interfaces, help information systems, and various online documents. For additional information about screen readers, see the following:

- Using PDFs with screen readers:
  http://www.adobe.com/accessibility.html?promoid=DJGVE
- Using the JAWS screen reader:
  http://www.freedomscientific.com/jaws-hq.asp
- Using the NVDA screen reader:

http://www.nvaccess.org/

Screen resolution

You can make the text and images on your screen easier to read by adjusting the screen resolution of your computer.

To adjust the screen resolution, do the following:

1. Right-click a blank area on the desktop.
2. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Screen resolution**.
   - For Windows 10: Click **Display settings** → **Display**.
3. Follow the instructions on the screen.

Note: Setting the resolution too low might prevent some items from fitting on the screen.

Customizable item size

You can make the items on your screen easier to read by changing the item size.

- To change the item size temporarily, use the Magnifier tool in Ease of Access Center.
- To change the item size permanently, do the following:
  - Change the size of all the items on your screen.
    - For Windows 7:
      1. Right-click a blank area on the desktop.
      2. Click **Screen resolution** → **Make text and other items larger or smaller**.
      3. Follow the on-screen instructions to change the item size.
      4. Click **Apply**. This change will take effect the next time you log in to the operating system.
    - For Windows 10:
      1. Right-click a blank area on the desktop.
      2. Click **Display settings** → **Display**.
      3. Follow the on-screen instructions to change the item size. For some applications, your configuration might not take effect until you sign out and then sign in again.
  - Change the size of the items on a Web page.

    Press and hold Ctrl, and then press the plus-sign key (+) to enlarge or the minus-sign key (-) to reduce the text size.
  - Change the size of the items on the desktop or a window.

    Note: This function might not work on some windows.

    If your mouse has a wheel, press and hold Ctrl, and then scroll the wheel to change the item size.

Industry-standard connectors

Your computer provides industry-standard connectors that enable you to connect assistive devices.

For more information about the location and function of each connector, see “Hardware locations” on page 3.

TTY/TDD conversion modem

Your computer supports the use of a text telephone (TTY) or the telecommunications device for the deaf (TDD) conversion modem. The modem must be connected between your computer and a TTY/TDD telephone. Then, you can type a message on your computer and send it to the telephone.

Documentation in accessible formats

Lenovo provides electronic documentation in accessible formats, such as properly tagged PDF files or HyperText Markup Language (HTML) files. Lenovo electronic documentation is developed to ensure that visually impaired users can read the documentation through a screen reader. Each image in the documentation also includes adequate alternative text so that visually impaired users can understand the image when they use a screen reader.

Cleaning your computer

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1. Properly remove or install your computer cover. See Chapter 8 “Hardware removal and installation” on page 69.

CAUTION:
Remove any media from the drives and turn off all connected devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.

It is a good practice to clean your computer periodically to protect the surfaces and ensure trouble-free operation. Use only mild cleaning solutions and a damp cloth to clean the painted surfaces of the computer.

Dust buildup compounds problems associated with glare, so remember to clean the screen periodically. Wipe the screen surface gently with a soft, dry cloth, or blow on the screen to remove grit and other loose particles. Depending on the type of the screen, moisten a soft, lint-free cloth with an LCD cleaner or liquid glass cleaner and then wipe the screen surface.

Maintenance

With appropriate care and maintenance, your computer will serve you reliably. This section provides instructions on how to maintain your computer so that it can keep working in better condition.

Basic maintenance tips

Here are some basic points about keeping your computer functioning properly:

- Keep your computer in a clean, dry environment. Ensure that the computer rests on a flat, steady surface.
- Do not cover any of air vents. These air vents provide airflow to keep your computer from overheating.
- Keep food and drinks away from all parts of your computer. Food particles and spills might make the keyboard and mouse stick and unusable.
- Do not get the power switches or other controls wet. Moisture can damage these parts and cause an electrical hazard.
- Always disconnect a power cord by grasping the plug instead of the cord.

Good maintenance practices

By performing a few good maintenance practices, you can maintain good computer performance, protect your data, and be prepared in case of a computer failure.

- Empty your recycle bin on a regular basis.

- Use the disk defragmentation or disk optimization feature of your operating system occasionally to prevent performance problems caused by an excessive number of fragmented files.
- Clean out your Inbox, Sent Items, and Deleted Items folders in your e-mail application on a regular basis.
- Back up critical data regularly on removable media memory, such as discs and USB storage devices, and store the removable media in a safe location. The frequency of making backup copies depends on how critical the data is to you or your business.
- Back up your data on the storage drive regularly.
- Keep your computer software, device drivers, and operating system up-to-date.
- Keep a log book. Entries might include major software or hardware changes, device-driver updates, intermittent problems and what you did to resolve them, and other issues you might have experienced. The cause of a problem might be change in hardware, change in software, or any other actions that might have taken place. A log book can help you or a Lenovo technician determines the cause of a problem.
- Create Product Recovery discs.

Keeping your computer current

In most cases, it is a good practice to have the most up-to-date operating system update patches, software programs, and device drivers. This section provides instructions on how to get the latest updates for your computer.

Getting the latest system updates

To get the latest system updates for your computer, ensure that your computer is connected to the Internet and do one of the following:

- Use the corresponding Lenovo program to get the system updates, such as device driver updates, software updates, and BIOS updates:
  - For Windows 7: Use the System Update program.
  - For Windows 10: Use the Lenovo Companion program.

  To open the System Update or Lenovo Companion program, see “Accessing a program on your computer” on page 18. For more information about using the program, refer to the help system of the program.
- Use Windows Update to get the system updates, such as security fixes, new versions of Windows components, and device driver updates.
  1. Click the Start button to open the Start menu.
  2. Depending on your Windows version, do one of the following:
     - For Windows 7: Click **Control Panel**. View Control Panel by Large icons or Small icons, and then click **Windows Update**.
     - For Windows 10: Click **Settings → Update & security → Windows Update**.
  3. Follow the instructions on the screen.

Note: The device drivers provided by Windows Update might not be tested by Lenovo. It is recommended that you get device drivers by using Lenovo programs or from the Lenovo Web site at http://www.lenovo.com/support.

Getting the latest system updates

To get the latest system updates for your computer, ensure that your computer is connected to the Internet and do one of the following:

- Use the corresponding Lenovo program to get the system updates, such as device driver updates, software updates, and BIOS updates:

- For Windows 7: Use the System Update program.
- For Windows 10: Use the Lenovo Companion program.

To open the System Update or Lenovo Companion program, see “Accessing a program on your computer” on page 18. For more information about using the program, refer to the help system of the program.

- Use Windows Update to get the system updates, such as security fixes, new versions of Windows components, and device driver updates.
  1. Click the Start button to open the Start menu.
  2. Depending on your Windows version, do one of the following:
     - For Windows 7: Click **Control Panel**. View Control Panel by Large icons or Small icons, and then click **Windows Update**.
     - For Windows 10: Click **Settings → Update & security → Windows Update**.
  3. Follow the instructions on the screen.

Note: The device drivers provided by Windows Update might not be tested by Lenovo. It is recommended that you get device drivers by using Lenovo programs or from the Lenovo Web site at http://www.lenovo.com/support.

Moving your computer

Before moving your computer, take the following precautions:

1. Back up your data on the storage drive.
2. Remove any media from the drives and turn off all connected devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
3. If you saved the original shipping cartons and packing materials, use them to pack the units. If you are using different cartons, cushion the units to avoid damage.

Moving your computer to another country or region

When you move your computer to another country or region, you must take local electrical standards into consideration. If the local electrical outlet style is different from the type you are using, use either an electrical plug adapter or a new power cord. To purchase such items, contact the Lenovo Customer Support Center. For a list of Lenovo Support phone numbers, go to http://www.lenovo.com/support/phone. If you cannot find the support telephone number for your country or region, contact your Lenovo reseller.

Chapter 5. Security

This chapter provides information about how to protect your computer from unauthorized use.

Locking your computer

This section provides instructions on how to lock your computer with the locking devices to keep your computer safe.

Attaching a padlock

Locking the computer cover helps prevent unauthorized people from gaining access to the inside of your computer. Your computer comes with a padlock loop so that the computer cover cannot be removed when a padlock is installed.

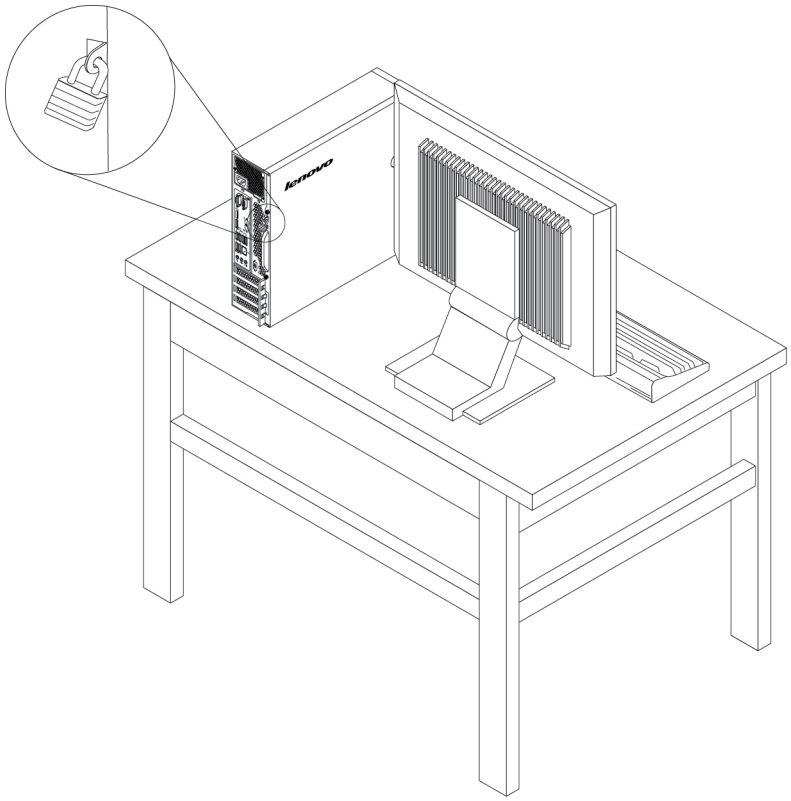


Figure 8. Padlock

Attaching a Kensington-style cable lock

You can use a Kensington-style cable lock to secure your computer to a desk, table, or other non-permanent fixture. The cable lock attaches to the security-lock slot at the rear of your computer. Depending on the type selected, the cable lock can be operated with a key or combination. The cable lock also locks the buttons used to open the computer cover. This is the same type of lock used with many notebook computers. You can order such a cable lock directly from Lenovo by searching for *Kensington* at:
http://www.lenovo.com/support

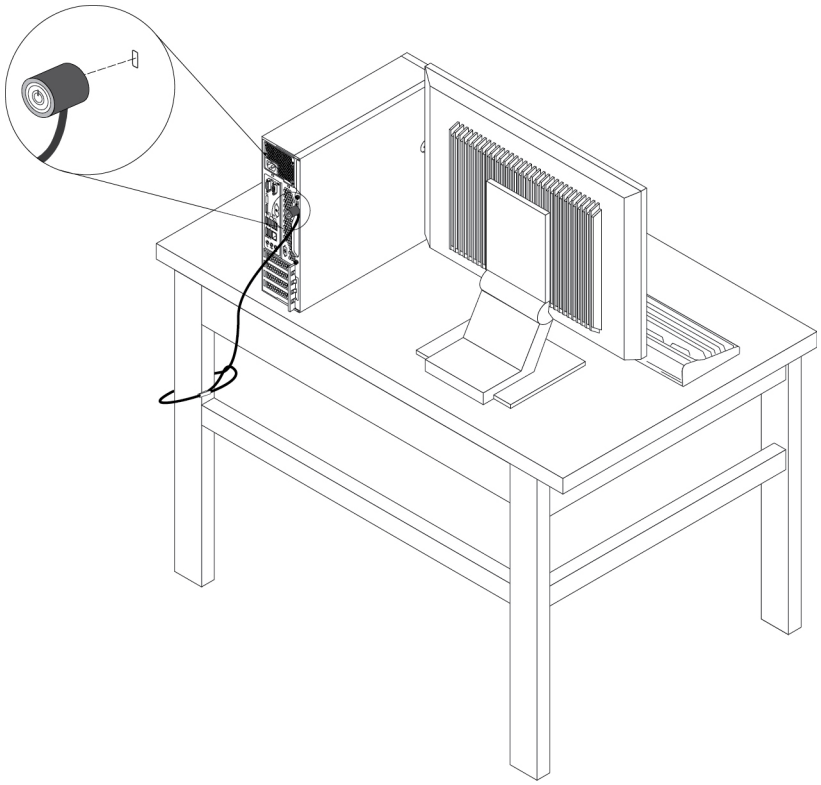


Figure 9. Kensington-style cable lock

Attaching a cable lock

A cable lock can be used to secure devices, such as the keyboard and the mouse, by locking the device cables to your computer. The cable lock attaches to the cable-lock slots on the rear of your computer.

To attach a cable lock, do the following:

1. Insert the clip **1** into the cable-lock slot **4**.
2. Pull the cables you want to lock through the dents in the cable lock.
3. Press the clip **2** into the cable-lock slot **3** until it snaps into position.

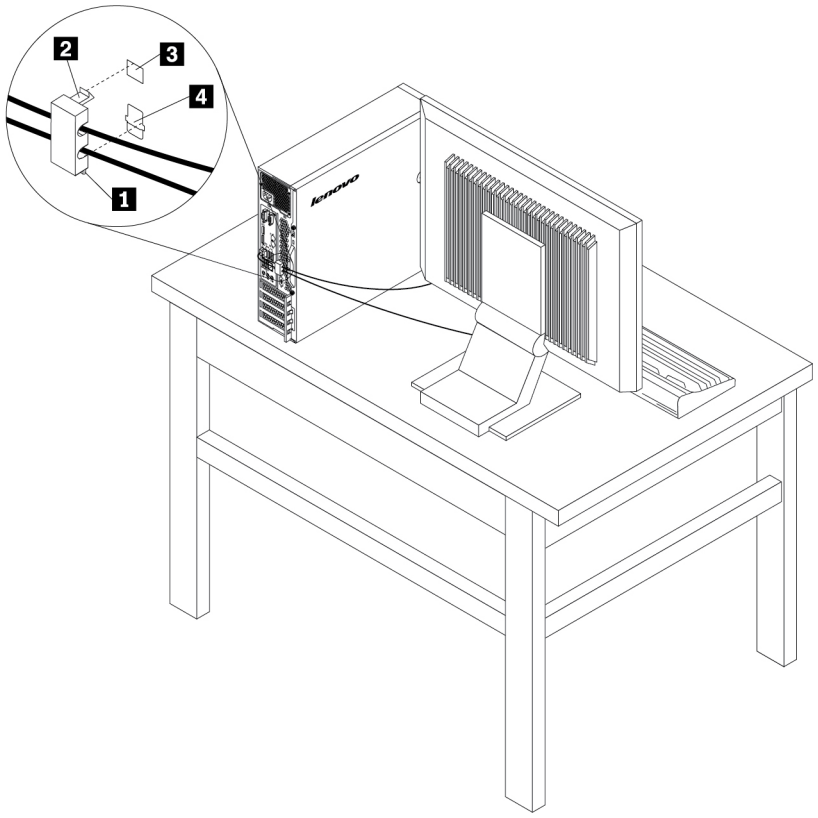


Figure 10. Cable lock

Viewing and changing security settings in the Setup Utility program

To view and change security settings in the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 39.
2. Select **Security**.
3. Follow the instructions on the right side of the screen to view and change security settings. You can refer to “Using the Setup Utility program” on page 39 to get basic information about some major security settings.
4. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Using passwords and Windows accounts

You can use BIOS passwords and Windows accounts to prevent unauthorized access to your computer and data. To use the BIOS passwords or the Windows accounts, do the following:

- To use BIOS passwords, see “Using BIOS passwords” on page 42.
- To use Windows accounts, do the following:
  1. Click the Start button to open the Start menu.
  2. Depending on your Windows version, do one of the following:
     - For Windows 7: Click **Control Panel** → **User Accounts**.
     - For Windows 10: Click **Settings** → **Accounts**.
  3. Follow the instructions on the screen.

Using fingerprint authentication

If your keyboard has a fingerprint reader, you can use fingerprint authentication to replace passwords for simple and secure user access. To use fingerprint authentication, first enroll your fingerprints and associate them with your passwords (such as the power-on password, hard disk password, and Windows password). Use the fingerprint reader and the fingerprint program to complete this procedure.

To use fingerprint authentication, do one of the following:

- For Windows 7: Use the Fingerprint Manager Pro or ThinkVantage Fingerprint Software program provided by Lenovo. To open the program, see “Accessing a program on your computer” on page 18. For more information about using the program, refer to the help system of the program.
- For Windows 10: Use the fingerprint tool provided by the Windows operating system. Click the Start button to open the Start menu, and then click **Settings → Accounts → Sign-in options**. Follow the instructions on the screen.

To use the fingerprint reader, refer to the documentation shipped with the fingerprint keyboard or located on the Lenovo Support Web site at http://www.lenovo.com/support/keyboards.

Using the cover presence switch

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

To use the cover presence switch, enable the cover-presence-switch connector on the system board first. To achieve this, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 39.
2. Select **Security → Chassis Intrusion Detection** and press Enter.
3. Select **Enabled** and press Enter.
4. To save settings and exit the Setup Utility program, press F10, select **Yes** in the window displayed, and press Enter. The cover-presence-switch connector on the system board is enabled.

   Note: For some keyboards, you might need to press Fn+F10 to exit the Setup Utility program.

The cover presence switch starts functioning. If the switch detects that the computer cover is not correctly installed or closed, an error message is displayed when you turn on the computer. To fix the error and log in to the operating system, do the following:

1. Properly install or close your computer cover. See Chapter 8 “Hardware removal and installation” on page 69.
2. Start and then exit the Setup Utility program. See “Starting the Setup Utility program” on page 39 and “Exiting the Setup Utility program” on page 44.

Using firewalls

A firewall can be hardware, software, or a combination of both depending on the level of security required. Firewalls work on a set of rules to determine which inbound and outbound connections are authorized. If your computer is preinstalled with a firewall program, it helps protect against computer Internet security threats, unauthorized access, intrusions, and Internet attacks. It also protects your privacy. For more information about how to use the firewall program, refer to the help system of your firewall program.

To use Windows Firewall, do the following:

1. Click the Start button to open the Start menu.
2. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Control Panel**.
   - For Windows 10: Click **Windows System → Control Panel**.
3. View Control Panel by Large icons or Small icons, and then click **Windows Firewall**.
4. Follow the instructions on the screen.

Protecting data against viruses

Your computer is preinstalled with an antivirus program to help you guard against, detect, and eliminate viruses.

Lenovo provides a full version of antivirus software on your computer with a free 30-day subscription. After 30 days, you must renew the license to continue receiving the antivirus software updates.

Note: Virus definition files must be kept up-to-date to guard against new viruses.

For more information about how to use your antivirus software, refer to the help system of your antivirus software.

Computrace Agent software embedded in firmware

The Computrace Agent software is an IT asset management and computer theft recovery solution. The software detects if changes have been made on the computer, such as hardware, software, or the computer call-in location. You might have to purchase a subscription to activate the Computrace Agent software.

Trusted Platform Module (TPM)

TPM is a secure cryptoprocessor that stores cryptographic keys, which in turn protects information stored in your computer.

Chapter 6. Advanced configuration

This chapter provides information to help you further configure the computer.

Using the Setup Utility program

The Setup Utility program is used to view and change the configuration settings of your computer. This section provides information about only the major configuration settings available in the program.

Note: The operating system settings might override any similar settings in the Setup Utility program.

Starting the Setup Utility program

To start the Setup Utility program, do the following:

1. Turn on or restart your computer.
2. Before Windows starts up, repeatedly press and release F1 or Fn+F1 (depending on the keyboard) until the Setup Utility program opens. If a BIOS password has been set, the Setup Utility program will not open until you enter the correct password. For more information, see “Using BIOS passwords” on page 42.

To view and change the configuration settings, follow the instructions on the right side of the screen. The keys used to perform various tasks are displayed at the bottom of the screen.

Changing the display language of the Setup Utility program

The Setup Utility program supports three display languages: English, French, and simplified Chinese.

To change the display language of the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 39.
2. From the main interface, locate **System Language**, and select the display language according to your needs.

Enabling or disabling a device

This section provides information about how to enable or disable user access to hardware devices (such as USB connectors or storage drives).

To enable or disable a device, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 39.
2. Select **Devices**.
3. Select the device you want to enable or disable and press Enter.
4. Select the desired setting and press Enter.
5. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Enabling or disabling the automatic power-on of your computer

The Automatic Power On item in the Setup Utility program provides various options for you to make your computer start up automatically.

To enable or disable the Automatic Power On features, do the following:

1. Start the Setup Utility program.
2. Select **Power → Automatic Power On** and press Enter.
3. Select the feature you want to enable or disable and press Enter.
4. Select the desired setting and press Enter.
5. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Enabling or disabling the ErP LPS compliance mode

Lenovo computers meet the eco-design requirements of the ErP Lot 3 regulation. For more information, go to:
http://www.lenovo.com/ecodeclaration

You can enable the ErP LPS compliance mode in the Setup Utility program to reduce the consumption of electricity when your computer is off or in sleep mode.

To enable or disable the ErP LPS compliance mode, do the following:

1. Start the Setup Utility program.
2. Select **Power → Enhanced Power Saving Mode** and press Enter.
3. Select **Enabled** or **Disabled** depending on your needs, and then press Enter. If you select **Enabled**, you also need to disable the Wake on LAN feature.
4. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

When the ErP LPS compliance mode is enabled, you can wake up your computer by doing one of the following:

- Press the power button.
- Enable the Wake Up on Alarm feature to make your computer wake up at a set time.
- Enable the After Power Loss feature to make your computer wake up when the power supply resumes after a sudden loss of electricity.

  To enable the After Power Loss feature, do the following:

  1. Start the Setup Utility program.
  2. Select **Power → After Power Loss** and press Enter.
  3. Select **Power On** and press Enter.
  4. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Switching between better acoustic and better thermal performance

You can adjust the acoustic and thermal performance of your computer through the **ICE Performance Mode** menu. Two choices are available:

- **Better Acoustic Performance** (default setting): This computer works with less noise at a normal thermal level.
- **Better Thermal Performance**: The computer works at a better thermal level with normal acoustic performance.

To switch between better acoustic performance and better thermal performance, do the following:

1. Start the Setup Utility program.
2. Select **Power → Intelligent Cooling Engine (ICE)** and press Enter.
3. Select **ICE Performance Mode** and press Enter.
4. Select **Better Acoustic Performance** or **Better Thermal Performance** as desired and press Enter.
5. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Enabling or disabling the system to record thermal alert logs

When the ICE thermal alert feature is enabled, if a critical thermal situation occurs, an alert log is written into the Windows system log. The alert log can help you identify thermal problems, such as malfunctioning fans, abnormally high temperature, or poor cooling performances.

To enable or disable the system to record thermal alert logs, do the following:

1. Start the Setup Utility program.
2. Select **Power → Intelligent Cooling Engine (ICE)** and press Enter.
3. Select **ICE Thermal Alert** and press Enter.
4. Select the desired setting and press Enter.
5. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Enabling or disabling the configuration change detection

With the configuration-change detection enabled, if the POST detects configuration changes of some hardware devices (such as storage drives or memory modules), an error message is displayed.

To enable or disable the configuration change detection, do the following:

1. Start the Setup Utility program.
2. Select **Security → Configuration Change Detection** and press Enter.
3. Select the desired setting and press Enter.
4. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

To bypass the error message and log in to the operating system, do one of the following:

- Press F2 or Fn+F2 (depending on the keyboard settings).
- Start and then exit the Setup Utility program.

Changing the BIOS settings before installing a new operating system

BIOS settings vary by operating system. Change the BIOS settings before installing a new operating system.

To change the BIOS settings, do the following:

1. Start the Setup Utility program.
2. From the main interface, select **Exit → OS Optimized Default** and press Enter.
3. Depending on the operating system to be installed, do one of the following:
   - To install the Windows 10 (64-bit) operating system, select **Enabled** and press Enter.
   - To install an operating system other than Windows 10 (64-bit), select **Disabled** and press Enter.

4. Select **Yes** in the window displayed and press Enter to confirm your selection.
5. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Using BIOS passwords

By using the Setup Utility program, you can set passwords to prevent unauthorized access to your computer and data.

You do not have to set any passwords to use your computer. However, using passwords improves computer security. If you decide to set any passwords, read the following topics.

Password types

The following types of passwords are available in the Setup Utility program:

- 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. The computer cannot be used until the valid password is entered.

- Administrator password

  Setting an administrator 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 an administrator password.

  When an administrator password is set, you are prompted to enter a valid password each time you try to access the Setup Utility program. The Setup Utility program cannot be accessed until a valid password is entered.

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

- Hard disk password

  Setting a hard disk password prevents unauthorized access to the data on the internal storage drive (such as a hard disk 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.

  Notes:

  – Even if the storage drive is removed from one computer and installed in another, the hard-disk password is still valid.
  – If the hard disk password is forgotten, there is no way to reset the password or recover data from the storage drive.

Password considerations

A password can be any combination of up to 64 alphabetic and numeric characters. For security reasons, it is recommended to use a strong password that cannot be easily compromised.

Note: The Setup Utility program passwords are case-sensitive.

To set a strong password, consider the following guidelines:

- Have at least eight characters in length
- Contain at least one alphabetic character and one numeric character
- Not be your name or your user name
- Not be a common word or a common name
- Be significantly different from your previous passwords

Setting, changing, or deleting a password

To set, change, or delete a password, do the following:

1. Start the Setup Utility program.
2. Select **Security**.
3. Depending on the password type, select **Set Power-On Password**, **Set Administrator Password**, or **Hard Disk Password** and press Enter.
4. Follow the instructions on the right side of the screen to set, change, or delete a password.

   Note: A password can be any combination of up to 64 alphabetic and numeric characters.
5. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Erasing lost or forgotten passwords (clearing CMOS)

This section provides instructions on how to erase lost or forgotten passwords, such as a user password.

Note: The instructions in this section do not apply to the hard disk password.

To erase a lost or forgotten password, do the following:

1. Remove any media from the drives and turn off all connected devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover.
3. Locate the Clear Complementary Metal Oxide Semiconductor (CMOS) /Recovery jumper on the system board.
4. Move the jumper from the standard position (pin 1 and pin 2) to the maintenance position (pin 2 and pin 3).
5. Reinstall the computer cover and connect the power cord.
6. Turn on the computer and leave it on for approximately 10 seconds. Then, turn off the computer by holding the power button for approximately five seconds.
7. Repeat step 1 and step 2.
8. Move the Clear CMOS /Recovery jumper back to the standard position (pin 1 and pin 2).
9. Reinstall the computer cover and connect the power cord.

Selecting a startup device

If your computer does not start up from the expected device, you can either change the startup device sequence or select a temporary startup device.

Changing the startup device sequence permanently

To change the startup device sequence permanently, do the following:

1. Depending on the type of the storage device, do one of the following:
   - If the storage device is internal, go to step 2.
   - If the storage device is a disc, ensure that your computer is turned on. Then, insert the disc into the optical drive.
   - If the storage device is an external device other than a disc, connect the storage device to the computer.
2. Start the Setup Utility program.

3. Select **Startup**.
4. Follow the instructions on the right side of the screen to change the startup device sequence.
5. To save settings and exit the Setup Utility program, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed, and press Enter.

Selecting a temporary startup device

Note: Not all discs and storage drives are bootable.

To select a temporary startup device, do the following:

1. Depending on the type of the storage device, do one of the following:
   - If the storage device is internal, go to step 2.
   - If the storage device is a disc, ensure that your computer is turned on. Then, insert the disc into the optical drive.
   - If the storage device is an external device other than a disc, connect the storage device to the computer.
2. Turn on or restart the computer. Before Windows starts up, repeatedly press and release F12 or Fn+F12 (depending on the keyboard settings) until Startup Device Menu is displayed.
3. Select the desired storage device and press Enter. The computer then starts up from the device you select.

If you want to select a permanent startup device, select **Enter Setup** on Startup Device Menu and press Enter to start the Setup Utility program.

Exiting the Setup Utility program

To exit the Setup Utility program, do one of the following:

- If you want to save the new settings, press F10 or Fn+F10 (depending on the keyboard settings). Then, select **Yes** in the window displayed and press Enter.
- If you do not want to save the new settings, select **Exit → Discard Changes and Exit** and press Enter. Then, select **Yes** in the window displayed and press Enter.

Updating and recovering the BIOS

The BIOS is the first program that the computer runs when you turn on the computer. The BIOS initializes the hardware components and loads the operating system and other programs.

Updating the BIOS

When you install a new program, hardware device, or device driver, you might be informed to update the BIOS. You can update the BIOS from your operating system or a flash update disc (available only on some models).

To update the BIOS, do the following:

1. Go to http://www.lenovo.com/support.
2. To update the BIOS from your operating system, download the flash BIOS update driver according to your operating system version. To update the BIOS from a flash update disc, download the ISO image version (used to create a flash update disc). Then, download the installation instructions for the flash BIOS update driver.
3. Print the installation instructions you download and follow the instructions to update the BIOS.

Note: If you want to update the BIOS from a flash update disc, the installation instructions might not provide the instructions on how to record the update disc.

Recovering from a BIOS update failure

To recover from a BIOS update failure, do the following:

1. Remove any media from the drives and turn off all connected devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover.
3. Locate the Clear CMOS /Recovery jumper on the system board. .
4. Remove any parts and cables that impede your access to the Clear CMOS /Recovery jumper.
5. Move the jumper from the standard position (pin 1 and pin 2) to the maintenance position (pin 2 and pin 3).
6. Reinstall the parts and cables that were removed.
7. Reinstall the computer cover and reconnect any cables that were disconnected.
8. Turn on the computer and insert the BIOS update disc into the optical drive. Wait a few minutes. The recovery process begins. After the recovery process is completed, your computer will shut down automatically.

   Note: If the computer does not start up from the disc, select the disc as the startup device.
9. Repeat steps 1–4.
10. Move the Clear CMOS /Recovery jumper back to the standard position (pin 1 and pin 2).
11. Repeat step 6 and step 7. Then, turn on your computer.

BIOS level

An incorrect BIOS level can cause false errors and unnecessary FRU replacement. Use the following information to determine the currently installed BIOS level, the latest BIOS level available, and where to obtain the latest BIOS level.

- To determine the currently installed BIOS level, start the Setup Utility program and view the **BIOS Revision Level** on the Main page.
- Sources for obtaining the latest BIOS level available
  - Lenovo support Web site: http://www.lenovo.com/support
  - Lenovo Customer Support Center
  - Levels 1 and 2 Support

To update the BIOS, see “Updating and recovering the BIOS” on page 44.

Note: BIOS settings vary by operating system. Change the BIOS settings before installing a new operating system. See “Changing the BIOS settings before installing a new operating system” on page 41.

Configuring RAID

This chapter provides information about how to configure Redundant Array of Independent Disks (RAID) for your computer.

RAID Level

Your computer must have the minimum number of SATA hard disk drives installed for the supported level of RAID below:

- RAID Level 0 – Striped disk array
  - Two hard disk drives minimum
  - Better performance without fault tolerance
- RAID Level 1 – Mirrored disk array
  - Two hard disk drives minimum
  - Improved read performance and 100% redundancy

To install a secondary hard disk drive, refer to “Secondary hard disk drive” on page 113.

Configuring the system BIOS to enable SATA RAID functionality

This section describes how to configure the system BIOS to enable SATA RAID functionality.

Note: Use the arrow keys on the keyboard to make selections.

To enable SATA RAID functionality, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 39.
2. Select **Devices → ATA Drive Setup**.
3. Select **Configure SATA as** and press Enter.
4. Select **RAID** and press Enter.
5. Press F10 or Fn+F10 (depending on the keyboard) to save the new settings and exit the Setup Utility program.

Creating RAID volumes

To create RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility during the computer startup.
2. Use the up and down arrow keys to select **Create RAID Volume** and press Enter.
3. Type a proper RAID Volume name in the **Name** field and press Tab.
4. Use the arrow keys to select a RAID level in the **RAID Level** field and press Tab.
5. If appropriate, use the arrow keys to select a Stripe Size in the **Stripe Size** field and press Tab.
6. Type a volume size in the **Capacity** field and press Tab.
7. Press Enter to initiate volume creation.
8. When prompted, press Y to accept the warning message and create the volume.
9. Return to step 2 to create additional RAID volumes, or select **Exit** and press Enter.
10. Press Y when prompted to confirm the exit.

Deleting RAID volumes

To delete RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility during the computer startup.
2. Use the up and down arrow keys to select **Delete RAID Volume** and press Enter.
3. Use the arrow keys to select the RAID volume to be deleted and press Delete.
4. When prompted, press Y to confirm the deletion of the selected RAID volume. Deleting a RAID volume will reset the hard disk drives to non-RAID.

5. After deleting a RAID volume, you can:
   - Return to step 2 to delete additional RAID volumes.
   - See “Creating RAID volumes” on page 46 for RAID volume creation.
   - Use the up and down arrow keys to select **Exit** and press Enter.

Resetting disks to non-RAID

To reset your hard disk drives to non-RAID, do the following:

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility during the computer startup.
2. Use the up and down arrow keys to select **Reset Disks to Non-RAID** and press Enter.
3. Use the arrow keys and the space key to mark individual physical hard disk drives to be reset, and then press Enter to complete the selection.
4. When prompted, press Y to confirm the reset action.
5. After resetting your hard disk drives to non-RAID, you can:
   - See “Deleting RAID volumes” on page 46 for RAID volume deletion.
   - See “Creating RAID volumes” on page 46 for RAID volume creation.
   - Use the up and down arrow keys to select **Exit** and press Enter.

Chapter 7. Troubleshooting, diagnostics, and recovery

This chapter provides solutions to resolve your computer problems. Follow the steps in the basic procedure for resolving computer problems, which helps you make good use of the troubleshooting, diagnostics, and recovery information.

Basic procedure for resolving computer problems

It is recommended that you use the following procedure to resolve computer problems you are experiencing:

1. Ensure that:
   a. The cables for all connected devices are connected correctly and securely.
   b. All connected devices that require ac power are connected to properly grounded, functioning electrical outlets.
   c. All connected devices are enabled in the BIOS settings of your computer.

   If these actions do not resolve your problem, continue with the next step.
2. Use an antivirus program to see if your computer has been infected by a virus. If the program detects a virus, remove the virus. If the antivirus program does not resolve your problem, continue with the next step.
3. Go to the Toubleshooting topic and follow the instructions for the type of problem you are experiencing. If these troubleshooting instructions do not resolve your problem, continue with the next step.
4. Run the diagnostic program. If the diagnostic program does not resolve your problem, continue with the next step.
5. Recover your operating system.
6. If none of these actions solve your problem, contact the Lenovo Customer Support Center. For a list of Lenovo Support phone numbers, go to http://www.lenovo.com/support/phone.

Service checkout and symptom-to-FRU index

This chapter provides information about general service checkout and symptom-to-FRU index.

Service checkout

Attention: The drives in the computer you are servicing might have been rearranged or the drive startup sequence changed. Be extremely careful during write operations such as copying, saving, or formatting. Data or programs can be overwritten if you select an incorrect drive.

General error messages appear if a problem or conflict is found by a program, the operating system, or both. For an explanation of these messages, refer to the information supplied with that software package.

Before replacing any FRUs, ensure that the latest level of BIOS is installed on the system. A down-level BIOS might cause false errors and unnecessary replacement of the system board. For more information about how to determine and obtain the latest level BIOS, see “BIOS level” on page 45.

Use the following procedure to help determine the cause of the problem:

1. Turn off the computer and all external devices.
2. Check all cables and power cords.
3. Set all display controls to the middle position.

4. Turn on all external devices.
5. Turn on the computer.
   - Look for displayed error codes.
   - Listen for beep codes.
   - Look for readable instructions or a main menu on the display.

   If you *did not* receive the correct response, proceed to step 6 on page 50.

   If you *do* receive the correct response, proceed to step 7 on page 50.
6. Look at the following conditions and follow the instructions:
   - If you hear beep codes during POST, go to “Beep symptoms” on page 52.
   - If the computer displays a POST error, go to “POST error codes” on page 52.
   - If the computer hangs and no error is displayed, continue at step step 7 on page 50.
7. Run the Diagnostic programs. See “UEFI diagnostic program” on page 65.
   - If you receive an error, replace the part that the diagnostic program calls out.
   - If the test stops and you cannot continue, replace the last device tested.

Problem determination tips

Due to the variety of hardware and software combinations that can be encountered, use the following information to assist you in problem determination. If possible, have this information available when requesting assistance from Service Support and Engineering functions.

- Machine type and model
- Processor or hard disk drive upgrades
- Failure symptom
  - Do diagnostics indicate a failure?
  - What, when, where, single, or multiple systems?
  - Is the failure repeatable?
  - Has this configuration ever worked?
  - If it has been working, what changes were made prior to its failing?
  - Is this the original reported failure?
- Diagnostics version
  - Type and version level
- Hardware configuration
  - Print (print screen) configuration currently in use
  - BIOS level
- Operating system software
  - Type and version level

Notes: To eliminate confusion, identical systems are considered identical only if they:

1. Are the exact machine type and models
2. Have the same BIOS level
3. Have the same adapters/attachments in the same locations
4. Have the same address jumpers/terminators/cabling
5. Have the same software versions and levels

6. Have the same Diagnostic Diskettes (version)
7. Have the same configuration options set in the system
8. Have the same setup for the operating system control files

Comparing the configuration and software set-up between “working and non-working” systems will often lead to problem resolution.

Symptom-to-FRU index

The Symptom-to-FRU index lists error symptoms and possible causes. The most likely cause is listed first. Always begin with “Service checkout” on page 49. This index can also be used to help you decide which FRUs to have available when servicing a computer. If you are unable to correct the problem using this index, go to “Undetermined problems” on page 56.

Notes:

- The Symptom-to-FRU index is not specific to any machine type and are applicable to all ThinkStation computers.
- If you have both an error message and an incorrect audio response, diagnose the error message first.
- If you cannot run the diagnostic tests or you get a diagnostic error code when running a test, but did receive a POST error message, diagnose the POST error message first.
- If you did not receive any error message, look for a description of your error symptoms in the first part of this index.

Hard disk drive boot error

A hard disk drive boot error can have the following causes.

Error	FRU/Action
The start-up drive is not in the boot sequence in configuration.	Check the configuration and ensure that the start-up drive is in the boot sequence.
No operating system installed on the boot drive.	Install an operating system on the boot drive.
The boot sector on the startup drive is corrupted.	The drive must be formatted. Do the following: 1. Attempt to back up the data on the failing hard disk drive. 2. Using the operating system programs, format the hard disk drive.
The drive is defective.	Replace the hard disk drive.

Power supply problems

If you suspect a power problem, use the following procedures.

Check/Verify	FRU/Action
Check the following for proper installation. • Power cord • On/Off switch connector • On/Off switch power supply connector • System board power supply connectors • Microprocessor connection	Reseat connectors
Check the power cord for continuity.	Power cord
Check the power-on switch for continuity.	Power-on switch

Beep symptoms

Beep symptoms are tones or a series of tones separated by pauses (intervals without sound) during POST.

The following table describes the beep symptoms.

Beep symptom	FRU/Action
2 short beeps: common POST error	Common POST error code. See the detailed failure information in “POST error codes” on page 52.
3 short and 1 long beeps: DRAM memory error	Perform the following actions in order: 1. Make sure that the memory modules are properly seated in the memory slots. 2. Replace the memory modules. 3. Replace the system board (for trained service personnel only).
4 long beeps: insufficient shadow RAM resources for option ROM (error code: 8998) or PCIe/PCI MMIO (memory mapped input/output) resources (error code: 8999)	See the detailed failure information in “POST error codes” on page 52.
2 long and 3 short beeps: graphics card error	Perform the following actions in order: 1. Make sure that the graphics cards are properly seated in the slots. 2. Replace the graphics cards. 3. Replace the system board (for trained service personnel only).

POST error codes

Each time you turn on the system, it performs a series of tests that check the operation of the system and some options. This series of tests are called the *Power-On Self-Test*, or *POST*. POST checks the following operations:

- Some basic system-board operations
- Memory operation
- Video operation
- Whether the boot drive is working

If the POST detects a problem, an error message appears on the screen. A single problem might cause several error messages to appear. When you correct the cause of the first error message, the other error messages probably will not appear on the screen the next time.

Error code	POST error message	Description/Action
0135	CPU fan failure System fan failure Power fan failure Front fan failure Rear fan failure Auxiliary fan failure ODD fan failure	This error message is displayed when a fan fails and the system might be overheating. Press F10 to exit.
0211	Keyboard not found	This error message is displayed when no keyboard is detected.
0164	Memory size decreased	This error message is displayed when the memory size is decreased. Press F10 to exit.
1762	SATA device configuration change has occurred	This error message is displayed when a hard disk drive change or an optical drive change has been made. Press F10 to exit.
1820	More than one external fingerprint reader is attached. Turn off and remove all but the reader that you set up within your main operating system.	This error message is displayed when more than one external fingerprint reader is connected to the computer. Turn off and remove all but the reader that you set up within your main operating system.
1962	No operating system found. Boot sequence will automatically repeat.	This error occurs only after the POST is completed. Press any key to repeat boot sequence.

8998	Not enough shadow RAM resources for OPTION ROM, not all devices initialized. Suggest to remove some add-on cards, or change to UEFI mode in BIOS setup.	This error message is displayed when the shadow RAM resources for option ROM are insufficient. If the legacy option ROM is insufficient, remove some add-in cards. For the system that supports UEFI, set UEFI as the first priority or disable CSM in BIOS setup.
8999	Not enough PCIe/PCI MMIO resources. Currently only one video card is enabled. Remove some PCIe cards, or enter BIOS Setup and enable “Above 4GB Decode”	This error message is displayed when the PCIe/PCI MMIO (memory mapped input/output) resources are insufficient. For the 32-bit operating system, remove some add-in cards. For the 64-bit operating system, enable **Above 4 GB Decode** in BIOS setup.

Miscellaneous error conditions

Message/Symptom	**FRU/Action**
Changing display colors	**Display/Monitor**
Computer will *not* power-off. See “Hard disk drive boot error” on page 51.	1. Power Switch 2. System Board 3. Riser card, if installed.
Computer will *not* RPL from server	1. Ensure that the network is in startup sequence as the first device or the first device after diskette. 2. Ensure that the network adapter is enabled for RPL. 3. Network adapter (Advise network administrator of new MAC address)
Computer will *not* perform a Wake On LAN® (if applicable)	1. Check the power supply and signal cable connections to the network adapter. 2. Ensure that the operating system settings are set to enable Wake on LAN. 3. Ensure that the Wake On LAN feature is enabled in Setup/Configuration (see “Starting the Setup Utility program” on page 39) 4. Ensure that the network administrator is using the correct MAC address. 5. Ensure no interrupt or I/O address conflicts. 6. Network adapter (advise network administrator of new MAC address)
Dead computer. See “Hard disk drive boot error” on page 51.	1. Power Supply 2. System Board

Message/Symptom	FRU/Action
Diskette drive in-use light remains on or does not light when drive is active.	1. Diskette Drive 2. System Board 3. Diskette Drive Cable
Blank screen except for flashing cursor.	1. System Board 2. Primary Hard Disk Drive 3. Hard Disk Drive Cable
Incorrect memory size during POST	1. Run the Memory tests. 2. Memory Module 3. System Board
"Insert a Diskette" icon appears with a known-good diagnostics diskette in the first 3.5-inch diskette drive.	1. System Board 2. Diskette Drive Cable 3. Network Adapter
Intensity or color varies from left to right of characters and color bars	1. Display 2. Video adapter (if present) 3. System Board
No power or fan not running	1. See “Hard disk drive boot error” on page 51.
Non-system disk or disk error-type message with a known-good diagnostic diskette.	1. Diskette Drive 2. System Board 3. Diskette Drive Cable
Other display symptoms not listed above (including blank or illegible display)	1. Display 2. System Board
Power-on indicator or hard disk drive in-use light not on, but computer works correctly	1. Power switch/LED assembly 2. System Board
Printer problems	1. Printer 2. System Board
Program loads from the hard disk with a known-good diagnostics diskette in the first 3.5-inch diskette drive	1. Run the Setup Utility program and check the Startup sequence. 2. Diskette Drive 3. Diskette Drive Cable 4. System Board 5. Power Supply
RPL computer cannot access programs from its own hard disk.	1. If the network administrator is using LCCM Hybrid RPL, check the startup sequence: a. **First device - network** b. **Second device - hard disk** 2. Hard disk drive

Message/Symptom	FRU/Action
RPL computer does not RPL from server	1. Check the startup sequence. 2. Check the network adapter LED status.
Serial or parallel connector device failure (system board connector)	1. External Device Self-Test OK? 2. External Device 3. Cable 4. System Board
Serial or parallel connector device failure (adapter connector)	1. External Device Self-Test OK? 2. External Device 3. Cable 4. Alternate Adapter 5. System Board
Some or all keys on the keyboard do not work	1. Keyboard 2. Keyboard Cable 3. System Board

Undetermined problems

This section provides instructions on how to find out the failing devices or adapters.

1. Turn off the computer.
2. Remove or disconnect the following components (if installed) one at a time.
   a. External devices (modem, printer, or mouse)
   b. Any adapters
   c. Memory modules
   d. Extended video memory
   e. External Cache
   f. External Cache RAM
   g. Hard disk drive
   h. Diskette drive
3. Turn on the computer to retest the system.
4. Repeat steps 1 through 3 until you find the failing device or adapter.

If all devices and adapters have been removed, and the problem continues, replace the system board. See “System board” on page 119.

Troubleshooting

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

Use the troubleshooting information to find solutions to problems that have definite symptoms.

Startup problems

The computer does not start up when you press the power button.

Solutions:

Ensure that:

- The power cord is correctly connected to the rear of the computer and to a working electrical outlet.
- If your computer has a secondary power switch on the rear of the computer, ensure that it is switched on.
- The power indicator on the front of the computer is on.
- The computer voltage matches the voltage available at the electrical outlet for your country or region.

The operating system fails to start up.

Solution:

Ensure that the startup device sequence set in the Setup Utility program includes the device where the operating system resides. Usually, the operating system is on the internal storage drive.

The computer beeps multiple times before the operating system starts up.

Solution:

Ensure that no keys are stuck.

Audio problems

The audio cannot be heard on the Windows operating system.

Solutions:

- If you are using powered external speakers that have an On/Off control, ensure that:
  - The On/Off control is set to the **On** position.
  - The speaker power cable is connected to a properly grounded, functional ac electrical outlet.
- If your external speakers have a volume control, ensure that the volume is not set too low.
- Click the volume icon in the Windows notification area on the taskbar. Ensure that the mute speakers settings are not selected and none of the volume settings is set too low.

  Note: If the volume icon is not displayed in the Windows notification area, add the icon to the notification area. See the Windows help system.
- For some computers that have a front audio panel, ensure that the volume is not set too low.
- Ensure that your external speakers (and headphones, if used) are connected to the correct audio connectors on the computer. Most speaker cables are color-coded to match the connectors.

  Note: When external-speaker or headphone cables are connected to the audio connectors, the internal speaker, if present, is disabled. In most cases, if an audio adapter is installed in one of the expansion slots, the audio function built into the system board is disabled. Therefore, you must use the audio connectors on the audio adapter.
- Ensure that the program you are running is designed for use on the Windows operating system. If the program is designed to run in DOS, the program does not use the Windows sound feature. The program must be configured to use Sound Blaster Pro or Sound Blaster emulation.
- Ensure that the audio device drivers are correctly installed.

The sound comes from one of the external speakers.

Solutions:

- Ensure that the speaker cable is inserted completely into the connector on the computer.
- Depending on your Windows version, do one of the following:
  - For Windows 7: Click the volume icon in the Windows notification area on the taskbar. Then, click the speaker icon on top of the volume control.
  - For Windows 10: Right-click the volume icon in the Windows notification area on the taskbar. Then, click **Open Volume Mixer** and select the desired speaker.

  Click the **Levels** tab and ensure that the Balance settings are set correctly.

  Note: If the volume icon is not displayed in the Windows notification area, add the icon to the notification area. See the Windows help system.

CD or DVD problems

A CD or DVD does not work.

Solutions:

- Ensure that the power cable and signal cable are securely connected to the drive.
- Ensure that the disc is inserted correctly, with its label up.
- Ensure that the disc you are using is clean. To remove dust or fingerprints, wipe the disc clean with a soft cloth from the center to the outside. Wiping a disc in a circular motion might cause loss of data.
- Ensure that the disc you are using is not scratched or damaged. Try inserting another disc that you know is good. If you cannot read from a known-good disc, you might have a problem with your optical drive or the cabling to your optical drive.
- If you have multiple CD or DVD drives installed (or a combination of CD and DVD drives), try inserting the disc into the other drive. In some cases, only one of the drives is connected to the audio subsystem.

A bootable recovery medium, such as the Product Recovery CD, cannot be used to start your computer.

Solution:

Ensure that the CD or DVD drive is set as the top priority of the Boot Priority Order in the Setup Utility program.

Note: On some computer models, the startup sequence is permanently set and cannot be changed.

A black screen is displayed instead of the DVD video.

Solutions:

- Restart the DVD player program.
- Try a lower screen resolution or color depth.
- Close any open files, and then restart the computer.

A DVD movie does not play.

Solutions:

- Ensure that the disc surface is clean and not scratched.

- Check the disc or package for regional coding. You might need to purchase a disc with coding for the region where you are using your computer.

No audio or only an intermittent audio comes out while a DVD movie is playing.

Solutions:

- Check the volume control settings on your computer and on your speakers.
- Ensure that the disc surface is clean and not scratched.
- Check all cable connections to and from the speakers.
- Use the DVD menu for the video to select a different audio track.

The playback is slow or choppy.

Solutions:

- Disable any background programs, such as AntiVirus or Desktop Themes.
- Ensure that video resolution is lower than 1152 x 864 pixels.

A message indicating invalid disc or no disc found is displayed.

Solutions:

- Ensure that the disc is in the drive with the shiny side of the disc facing down.
- Ensure that video resolution is lower than 1152 x 864 pixels.
- Ensure that the DVD or CD is inserted into an appropriate optical drive. For example, do not insert a DVD into a CD-only drive.

Intermittent problems

Intermittent problems refer to the problems occur only occasionally and are difficult to repeat.

Solutions:

- Ensure that all cables and cords are securely connected to the computer and attached devices.
- Ensure that when the computer is on, the fan grill is not blocked (there is air flow around the grill), and the fans are working. If airflow is blocked or the fans are not working, the computer might overheat.
- If Small Computer System Interface (SCSI) devices are installed, ensure that the last external device in each SCSI chain is terminated correctly. For more information, see your SCSI documentation.

Storage drive problems

Some or all storage drives are missing from the Setup Utility program.

Solutions:

- Ensure that the signal cables and power cables for all the storage drives are connected correctly.
- If the computer is installed with SAS storage drives, ensure that the AVAGO MegaRAID SAS adapter is correctly connected.

The computer cannot start up from the correct storage drive or the message “No Operating System Found” is displayed.

Solutions:

- Ensure that the signal cables and power cables for all the storage drives are connected correctly.

- Ensure that the computer starts up from the correct storage drive. Set the storage drive, on which the operating system resides, as the first startup device in the Setup Utility program.

Note: In rare cases, the storage drive with the operating system might get corrupted or damaged. If this problem occurs, replace the storage drive.

Ethernet LAN problems

The computer cannot connect to an Ethernet LAN.

Solutions:

- Connect the cable from the Ethernet connector to the RJ45 connector of the hub.
- Enable the Ethernet LAN feature in the Setup Utility program. Refer to “Using the Setup Utility program” on page 39.
- Enable the Ethernet LAN adapter.
  1. Click the Start button to open the Start menu.
  2. Depending on your Windows version, do one of the following:
     - For Windows 7: Click **Control Panel**.
     - For Windows 10: Click **Windows System** → **Control Panel**.
  3. View Control Panel by Large icons or Small icons, and then click **Network and Sharing Center** → **Change adapter settings**.
  4. Right-click the Ethernet LAN adapter icon and click **Enable**.
- Update or reinstall the Ethernet LAN driver. See “Keeping your computer current” on page 30.
- Install all networking software that is necessary for your network environment. Check with your LAN administrator for the necessary networking software.
- Set the same duplex for the switch port and the adapter. If you configured the adapter for full duplex, ensure that the switch port is also configured for full duplex. Setting the wrong duplex mode might degrade performance, cause data loss, or result in lost connections.

When a Gigabit Ethernet model computer is used at a speed of 1000 Mbps, the Ethernet LAN connection fails or errors occur.

Solution:

Connect the network cable to the Ethernet connector using Category 5 wiring and a 100 BASE-T hub/switch (not 100 BASE-X).

A Gigabit Ethernet model computer should connect to the network at a speed of 1000 Mbps but at only a speed of 100 Mbps.

Solutions:

- Try another cable.
- Set the link partner to auto-negotiate.
- Set the switch to be 802.3ab-compliant (gigabit over copper).

The Wake On LAN feature does not work.

Solution:

Enable the Wake On LAN feature in the Setup Utility program. Refer to “Using the Setup Utility program” on page 39.

Wireless LAN problem

Note: The wireless LAN feature is available only on some models.

The wireless LAN feature does not work.

Solutions:

- Enable the wireless LAN feature in the Setup Utility program. Refer to “Using the Setup Utility program” on page 39.
- For Windows 10, enable the wireless LAN feature in Windows Settings. Click the Start button to open the Start menu, and then click **Settings → Network & Internet → Wi-Fi**. Turn on the Wi-Fi feature.
- Enable the wireless LAN adapter.
  1. Click the Start button to open the Start menu.
  2. Depending on your Windows version, do one of the following:
     - For Windows 7: Click **Control Panel**.
     - For Windows 10: Click **Windows System → Control Panel**.
  3. View Control Panel by Large icons or Small icons, and then click **Network and Sharing Center → Change adapter settings**.
  4. Right-click the wireless LAN adapter icon and click **Enable**.
- Update or reinstall the wireless LAN driver. See “Keeping your computer current” on page 30.

Bluetooth problems

Note: The Bluetooth feature is available only on some models.

The Bluetooth feature does not work.

Solutions:

- Enable the Bluetooth feature in the Setup Utility program. Refer to “Using the Setup Utility program” on page 39.
- Enable the Bluetooth devices. Depending on your Windows version, do one of the following:
  - For Windows 7:
    1. Click the Start button to open the Start menu. Right-click **Computer**, and then click **Properties**.
    2. Click **Device Manager**. Type the administrator password or provide confirmation if prompted.
    3. Expand **Bluetooth Radios** to display the Bluetooth devices. Then, right-click each Bluetooth device and then Click **Enable**.
    4. Expand **Network adapters**. Then, right-click each Bluetooth device and then Click **Enable**.
  - For Windows 10:
    1. Right-click the Start button to open the Start context menu.
    2. Click **Device Manager**. Type the administrator password or provide confirmation if prompted.
    3. Expand **Bluetooth** to display the Bluetooth devices. Then, right-click each Bluetooth device and then Click **Enable device**.
    4. Expand **Network adapters**. Then, right-click each Bluetooth device and then Click **Enable device**.
- Turn on the Bluetooth radio on Windows 10. Do the following:
  1. Click the Start button to open the Start menu.
  2. Click **Settings → Devices → Bluetooth & other devices**.
  3. Turn on the **Bluetooth** switch to enable the Bluetooth feature.

- Update or reinstall the Bluetooth driver. See “Keeping your computer current” on page 30.

No sound comes from the Bluetooth headset or headphones.

Solution:

Set the Bluetooth headset or headphones as the default device.

1. Exit the application that uses the sound device (for example, Windows Media Player).
2. Right-click the volume icon in the Windows notification area on the taskbar.

   Note: If the volume icon is not displayed in the Windows notification area, add the icon to the notification area. See the Windows help system.
3. Click **Playback devices**.
4. If you are using the Headset profile, select **Bluetooth Hands-free Audio**, and then click **Set Default**. If you are using the AV profile, select **Stereo Audio**, and then click **Set Default**.
5. Click **OK**.

Performance problems

Excessive fragmented files exist on the storage drives.

Solution:

Use the Windows disk defragmentation or disk optimization feature to clean up the files.

Note: Depending on the volume of the storage drives and amount of data stored on the storage drives, the disk-defragmentation process might take up to several hours.

1. Close any open programs and windows.
2. Click the Start button to open the Start menu.
3. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Computer**.
   - For Windows 10: Click **Windows System → File Explorer → This PC**.
4. Right-click your C drive and then click **Properties**.
5. Click the **Tools** tab.
6. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Defragment now**.
   - For Windows 10: Click **Optimize**. Select the desired drive and then click **Optimize**.
7. Follow the instructions on the screen.

The free storage drive space is insufficient.

Solutions:

Free up the storage drive space.

- Clean out your Inbox, Sent Items, and Deleted Items folders from your e-mail application.
- Clean up your C drive.
  1. Click the Start button to open the Start menu.
  2. Depending on your Windows version, do one of the following:

   - For Windows 7: Click **Computer**.
   - For Windows 10: Click **Windows System** → **File Explorer** → **This PC**.
3. Right-click your C drive and then click **Properties**.
4. Check the amount of free space, and then click **Disk Cleanup**.
5. A list of unnecessary file categories is displayed. Select each file category you want to delete, and then click **OK**.

- Turn some Windows features off or remove some unnecessary programs.
  1. Click the Start button to open the Start menu.
  2. Depending on your Windows version, do one of the following:
     - For Windows 7: Click **Control Panel**.
     - For Windows 10: Click **Windows System** → **Control Panel**
  3. View Control Panel by Large icons or Small icons, and then click **Programs and Features**.
  4. Do one of the following:
     - To turn some Windows features off, click **Turn Windows features on or off**. Follow the instructions on the screen.
     - To remove some unnecessary programs, select the program you want to remove, and then click **Uninstall/Change** or **Uninstall**.

The free memory space is insufficient.

Solutions:

- Right-click a blank area on the taskbar and open Task Manager. Then, end some tasks you are not performing.
- Install additional memory modules. To purchase memory modules, go to: http://www.lenovo.com

Serial connector problem

USB device problems

A USB device cannot be accessed.

Solutions:

- Connect the USB cable from the USB connector to the USB device. If the USB device has its own power cord, connect the power cord to a grounded electrical outlet.
- Turn on the USB device and keep the device online.
- Install any device drivers or programs supplied with the USB device. Refer to the documentation that comes with the USB device for more information.
- Disconnect and reconnect the USB connector to reset the USB device.

The Windows 7 operating system cannot be installed from an external optical drive or an external USB device.

Solution:

Go to https://support.lenovo.com/us/en/documents/ht104142 for more information.

Software and driver problems

For some programs, dates cannot be sorted in correct order.

Solution:

Some programs developed before the year 2000 use only the last two digits of a year to sort dates, assuming the first two digits are 19. Consequently, dates cannot be sorted in correct order nowadays. Check with your software manufacturer to see if any updates are available. Many software manufacturers make updates available from the World Wide Web.

Some programs do not work as expected.

Solutions:

1. Check whether the problem is caused by a program.
   a. Ensure that the software is compatible with your computer. Refer to the information supplied with the software for more information.
   b. Verify that other software works properly on your computer.
   c. Verify that the software you are using works on another computer.
2. If the problem is caused by a program:
   - Refer to the printed documentation that comes with the program or the help system of the program for troubleshooting information.
   - Update the program. See “Keeping your computer current” on page 30.
   - Uninstall the program and then reinstall it. To download a program that is preinstalled on your computer, go to http://www.lenovo.com/support and follow the instructions on the screen.

A device does not work properly due to device driver problems.

Solution:

Update the device driver. See “Keeping your computer current” on page 30.

Diagnosing problems

Many computer problems can be solved without outside assistance. If you experience a problem with your computer, the first place to start is the troubleshooting information in your computer documentation. If you suspect a software problem, see the documentation, including readme files and help information systems, that come with the operating system or program. ThinkStation notebook computers come with a set of diagnostic programs that you can use to help you identify hardware problems.

Diagnosing problems with Lenovo Solution Center on the Windows 7 operating system

Lenovo Solution Center is preinstalled on your computer and also is available for download at:

http://www.lenovo.com/diags

Notes:

- If you are using another Windows operating system rather than the Windows 7, you can find the latest information about diagnostics for your computer at:

  http://www.lenovo.com/diagnose
- If you are unable to isolate and repair the problem yourself after running Lenovo Solution Center, save and print the log files created by the program. You need the log files when you speak to a Lenovo technical support representative.

Lenovo Solution Center enables you to troubleshoot and resolve computer problems. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for optimal system performance.

When you are setting up your computer, the Lenovo Solution Center program prompts you to create recovery media. You can use the recovery media to restore the storage drive to the factory default settings.

For additional information, see the Lenovo Solution Center help system.

Diagnosing problems with Lenovo Companion on the Windows 10 operating system

Lenovo Companion is preinstalled on your computer and also is available for download at:

https://shop.lenovo.com/us/en/accessories/software/apps/lenovo-apps/companion/

Note: If you are unable to isolate and repair the problem yourself after running Lenovo Companion, save and print the log files created by the program. You need the log files when you speak to a Lenovo technical support representative.

Lenovo Companion supports the hardware scan function. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for optimal system performance.

The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. You can get the latest technical information and download device drivers and updates from the Lenovo Support Web site at:

http://www.lenovo.com/support

For additional information, see the Lenovo Companion help system.

UEFI diagnostic program

A UEFI diagnostic program is preinstalled on the computer. It enables you to test memory modules and internal storage devices, view system information, and check and recover bad sectors on internal storage devices.

To run the UEFI diagnostic program, do the following:

1. Turn on the computer. If the computer cannot be turned on, go to “Basic procedure for resolving computer problems” on page 49. If an error code is displayed, go to “Symptom-to-FRU index” on page 51 for error code descriptions and troubleshooting hints.
2. Repeatedly press and release the F10 key when turning on the computer. The main screen of the UEFI diagnostic program is displayed.
3. Follow the instructions on the screen to use the diagnostic program.

The options on the main screen are as follows:

Table 1. Items on the main screen of the UEFI diagnostic program

DIAGNOSTICS	TOOLS
• LCD test • Memory - Quick test • Memory - Extended test • Motherboard test • PCI-e test • Storage - Quick test	• System information • Recover bad sectors tool • Generate configuration file • Execute from configuration file • Exit application

Recovery information

This section provides instructions on how to recover your operating system.

Note: If a device does not work correctly after recovering the operating system, update the device driver. See “Keeping your computer current” on page 30.

Recovery information for Windows 7

To recover your Windows 7 operating system, use the following solutions:

- Use Windows recovery solutions.
  - Use System Restore to restore system files and settings to an earlier point.
    1. Click the Start button to open the Start menu.
    2. Click **Control Panel**. View Control Panel by Large icons or Small icons, and then click **Recovery** → **Open System Restore**.
    3. Follow the instructions on the screen.
  - Use the Windows recovery environment by doing one of the following:
    - After several consecutive failed boot attempts, the Windows recovery environment might start automatically. Follow the instructions on the screen to choose the appropriate recovery solution.
    - Turn on or restart your computer. Then, repeatedly press and release F8 or Fn+F8 (depending on the keyboard settings) until the Advanced Boot Options window opens. Select **Repair Your Computer**, press Enter, and follow the instructions on the screen to choose the appropriate recovery solution.
- Use the recovery medium you created earlier with the Recovery Media Creator program to restore only the C drive or the entire storage drive to the factory-default settings.
  1. Select the recovery medium as the startup device.
  2. Follow the instructions on the screen to choose the appropriate recovery solution.
- Use the recovery disc set provided by Lenovo to restore the entire storage drive to the factory-default settings.
  - If your computer comes with the recovery disc set, follow the instructions shipped with the disc set.
  - If your computer does not come with the recovery disc set, contact the Lenovo Customer Support Center to order a recovery disc set.

Recovery information for Windows 10

To recover your Windows 10 operating system, use the following solutions:

- Use Windows recovery solutions.
  - Use recovery solutions in Windows Settings.

1. Click the Start button to open the Start menu.
2. Click **Settings → Update & security → Recovery**.
3. Follow the instructions on the screen to choose the appropriate recovery solution.

– Use System Restore to restore system files and settings to an earlier point.
1. Click the Start button to open the Start menu.
2. Click **Windows System → Control Panel**.
3. View Control Panel by Large icons or Small icons, and then click **Recovery → Open System Restore**.
4. Follow the instructions on the screen.

– Use the File History tool to restore your files from a backup.

Note: If you use the File History tool to restore your files from a backup, ensure that you backed up your data earlier with the tool.

1. Click the Start button to open the Start menu.
2. Click **Windows System → Control Panel**.
3. View Control Panel by Large icons or Small icons, and then click **File History → Restore personal files**.
4. Follow the instructions on the screen.

– Use the Windows recovery environment by doing one of the following:
  – After several consecutive failed boot attempts, the Windows recovery environment might start automatically. Follow the instructions on the screen to choose the appropriate recovery solution.
  – Select the recovery medium you created earlier with the Windows tool as the startup device. Then, follow the instructions on the screen to choose the appropriate recovery solution.

- Use the recovery USB key provided by Lenovo to restore the entire storage drive to the factory-default settings.
  – If your computer comes with the recovery USB key, follow the instructions shipped with the USB key.
  – If your computer does not come with the recovery USB key, contact the Lenovo Customer Support Center to order a recovery USB key.

Chapter 8. Hardware removal and installation

This chapter provides instructions on how to remove and install hardware for your computer.

Handling static-sensitive devices

Do not open the static-protective package containing the new part until the defective part has been removed and you are ready to install the new part. Static electricity, although harmless to you, can seriously damage computer components and options.

When you handle options and other computer components, take these precautions to avoid static-electricity damage:

- Limit your movement. Movement can cause static electricity to build up around you.
- Always handle options and other computer components carefully. Handle PCI/PCIe cards, memory modules, system boards, and microprocessors by the edges. Never touch any exposed circuitry.
- Prevent others from touching the options and other computer components.
- Touch the static-protective package containing the part to a metal expansion-slot cover or other unpainted metal surface on the computer for at least two seconds. This reduces static electricity from the package and your body before you install or replace a new part.
- When possible, remove the new part from the static-protective package, and install it directly in the computer without setting the part down. When this is not possible, place the static-protective package on a smooth, level surface and place the part on the package.
- Do not place the part on the computer cover or other metal surface.

Preparing your computer and removing the computer cover

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

CAUTION:

Avoid contact with hot components inside the computer. During operation, some components become hot enough to burn the skin. Before you open the computer cover, turn off the computer, disconnect power, and wait approximately 10 minutes for the components to cool.

Before installing or removing any hardware component in your computer, do the following to prepare your computer and remove the computer cover:

1. Remove any media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Unlock any locking device that secures the computer cover. See “Locking your computer” on page 33.
3. Remove the two screws that secure the computer cover.
4. Press the cover-release button on the side of the computer and slide the cover to the rear of the computer to remove the cover.

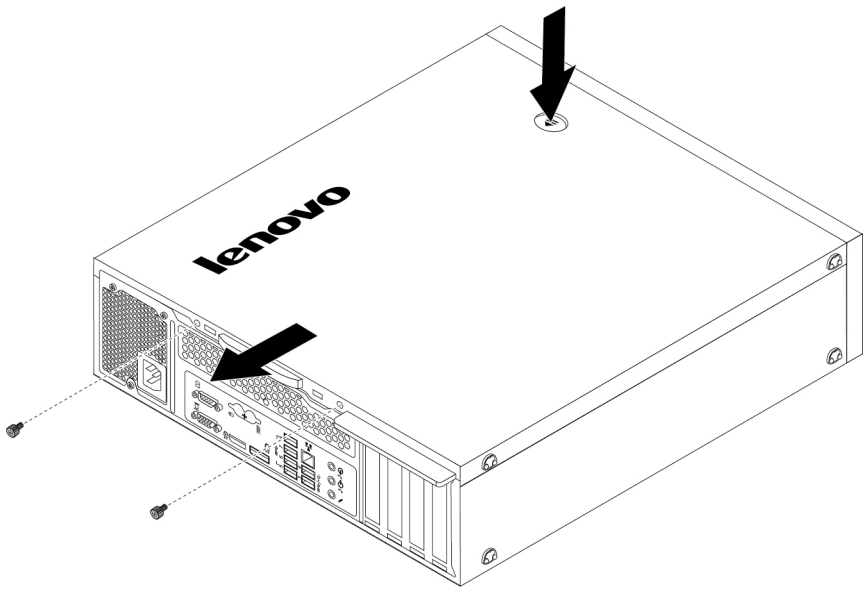


Figure 11. Removing the computer cover

Installing or replacing hardware

This section provides instructions on how to install or replace hardware for your computer. You can expand the capabilities of your computer and maintain your computer by installing or replacing hardware.

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

Notes:

- Depending on your computer model, some of the hardware parts in this section might not be available.
- Use computer parts provided only by Lenovo.
- When installing or replacing an option, use the appropriate instructions in this section along with the instructions that come with the option.
- In most areas of the world, Lenovo requires the return of the defective CRU. Information about this will come with the CRU or will come a few days after the CRU arrives.

External options

You can connect external options to your computer, such as external speakers, a printer, or a scanner. For some external options, you must install additional software in addition to making the physical connection. When installing an external option, see “Front view” on page 3 and “Rear view” on page 4 to identify the required connector. Then, use the instructions that come with the option to help you make the connection and install any software or device drivers that are required for the option.

Front bezel

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

To remove and reinstall the front bezel, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.

2. Release the three plastic tabs on the top of the front bezel and pivot the front bezel outward to remove it from the computer.

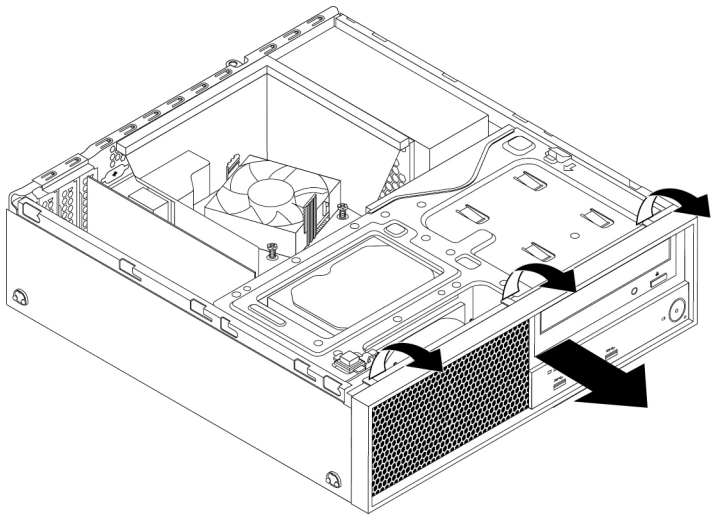


Figure 12. Removing the front bezel

3. To reinstall the front bezel, first align the three plastic tabs on the bottom of the front bezel with the corresponding holes in the chassis. Then pivot the front bezel inward until it snaps into position.

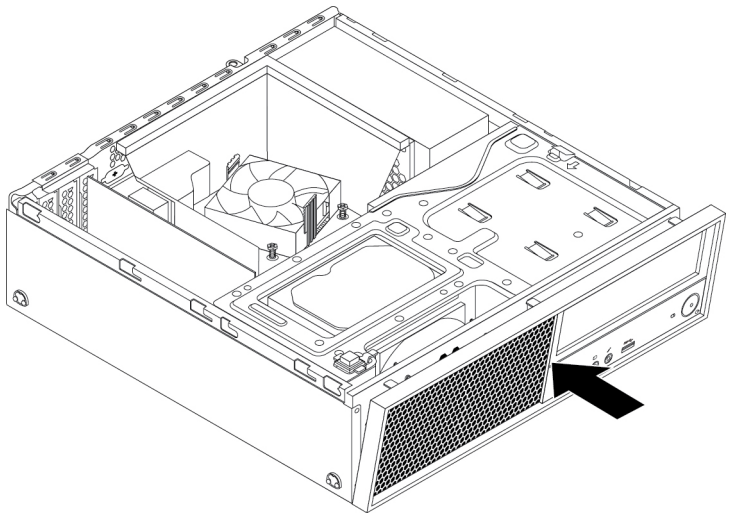


Figure 13. Reinstalling the front bezel

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

PCIe card

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

Your computer has two PCIe x1 card slots, one PCIe x4 card slot (negotiable link width x4, x1), and one PCIe x16 graphics card slot.

To install or replace a PCIe card, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Rotate the PCIe card retainer to the open position. Depending on whether you are installing or replacing a PCIe card, do one of the following:
   - If you are installing a PCIe card, remove the appropriate metal slot cover.
   - If you are replacing an old PCIe card, grasp the old card and gently pull it out of the slot.

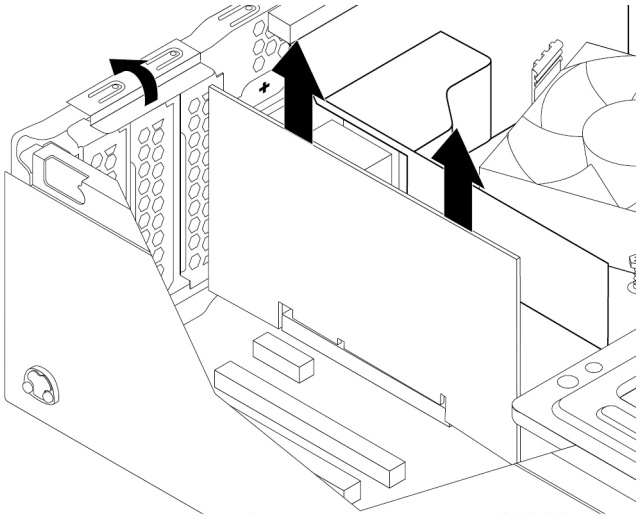


Figure 14. Removing a PCIe card

Notes:

– The card fits tightly into the slot. If necessary, alternately move each side of the card a small amount until the card is removed from the slot.

– If the card is held in place by a retaining latch, disengage the card retaining latch on the PCIe card slot. Then grasp the card and gently pull it out of the slot.

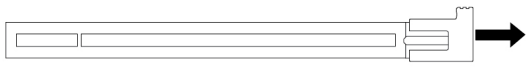


Figure 15. Disengaging the card retaining latch

3. Remove the new PCIe card from its static-protective package.
4. Install the new card into the appropriate slot on the system board. See “Parts on the system board” on page 11. Rotate the PCIe card retainer to the closed position.

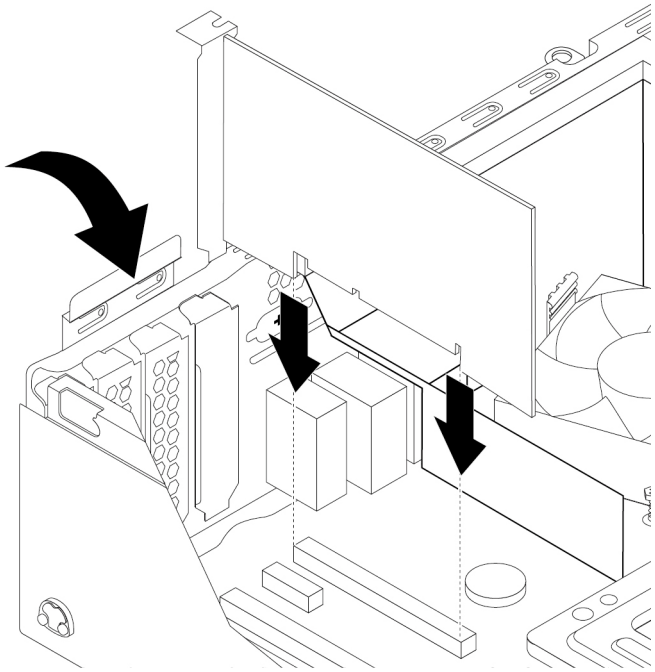


Figure 16. Installing a PCIe card

Note: If you are installing a PCIe x16 graphics card, ensure that the memory-slot retaining clips are closed before you install the card to avoid any interference during the installation.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

M.2 solid-state drive

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

The instructions on how to install or replace a M.2 solid-state drive also apply to the Intel Optane memory. Before replacing the Intel Optane memory, ensure that you disable the Intel Optane memory from the Intel Rapid Storage Technology (Intel RST) Console. Otherwise, all data on the storage drive will be lost. For more information, see instructions on https://www.intel.com/content/www/us/en/support/memory-and-storage/intel-optane-memory/000023989.html.

To install or replace an M.2 solid-state drive, do the following:

Note: The instructions on how to install or replace a M.2 solid-state drive also applies to the Intel Optane Memory.

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Lay the computer on its side for easier access to the system board.
3. Depending on whether you are installing or replacing an M.2 solid-state drive, do one of the following:
   - If you are replacing an M.2 solid-state drive, do the following:
     a. Locate and remove the M.2 solid-state drive adapter. See “PCIe card” on page 71.

b. The heat sink is secured by two mounting studs. Pinch the clips of the studs inward 1 and push the studs upward 2 to release the heat sink. Then, lift the heat sink off the M.2 solid-state drive adapter 3.

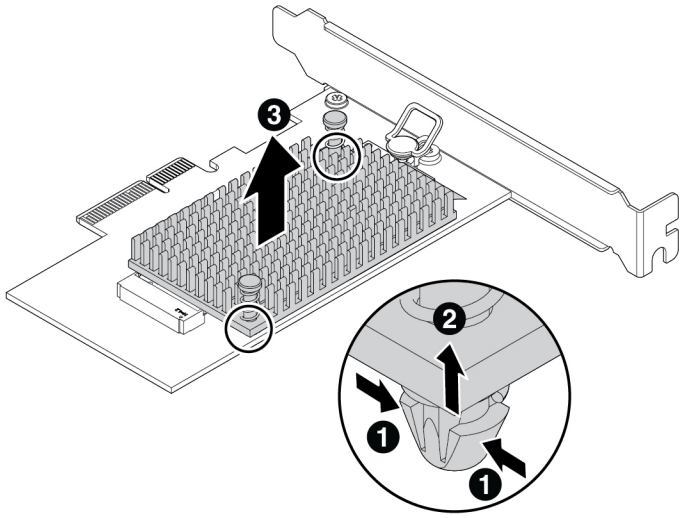


Figure 17. Removing the heat sink from the M.2 solid-state drive adapter

c. The M.2 solid-state drive is secured by a retention latch. Pull the handle of the retention latch outward to release the M.2 solid-state drive. Then, gently pull the M.2 solid-state drive out of the M.2 slot.

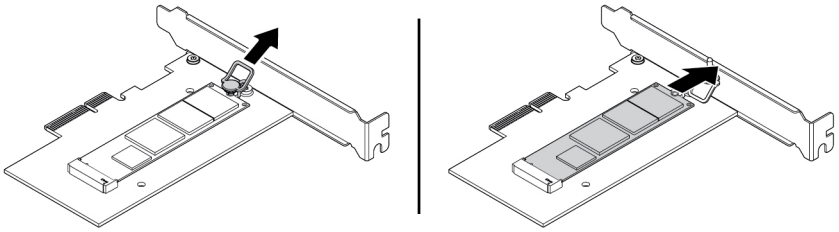


Figure 18. Removing the M.2 solid-state drive

- If you are installing an M.2 solid-state drive, pull outward the handle of the retention latch in the M.2 solid-state drive adapter.

4. Ensure that a thermal pad is placed in position on the M.2 solid-state drive adapter.

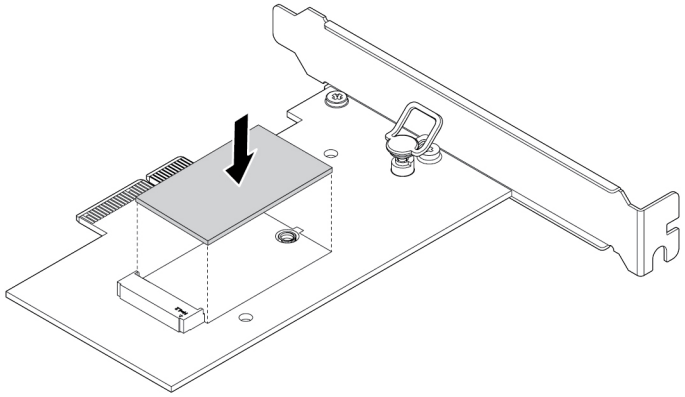


Figure 19. Installing the thermal pad

5. Insert the new M.2 solid-state drive into the M.2 slot. Then, insert the plug of the retention latch into the hole to secure the new drive.

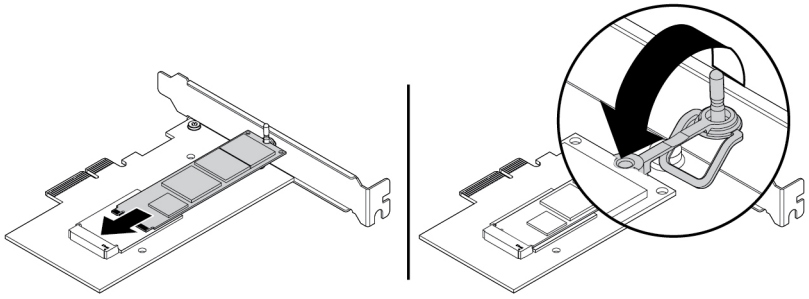


Figure 20. Installing the M.2 solid-state drive

6. Position the heat sink on the M.2 solid-state drive adapter. Ensure that the two mounting studs in the heat sink are aligned with the holes in the M.2 solid-state drive adapter. Then, push the mounting studs downward to secure the heat sink to the adapter.

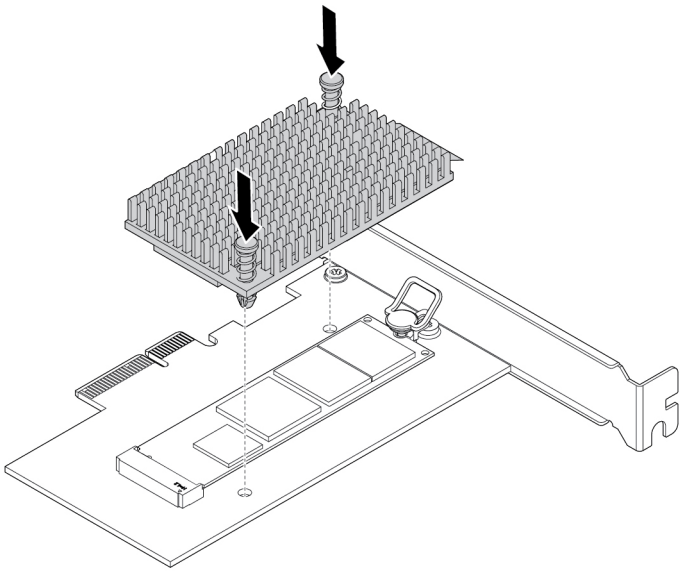


Figure 21. Installing the heat sink

7. Install the M.2 solid-state drive adapter into the appropriate PCIe card slot on the system board. See “PCIe card” on page 71.

   Note: It is recommended that you install the M.2 solid-state drive adapter into the PCIe x4 card slot. See “Parts on the system board” on page 11.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Coin-cell battery

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

Your computer has a special type of memory that maintains the date, time, and settings for built-in features. A coin-cell battery keeps this information active when you turn off the computer.

The coin-cell battery normally requires no charging or maintenance throughout its life; however, no coin-cell battery lasts forever. If the coin-cell battery fails, the date, time, and configuration information (including passwords) are lost. An error message is displayed when you turn on the computer.

Refer to the “Lithium coin-cell battery notice” in the *Safety, Warranty, and Setup Guide* for information about replacing and disposing of the coin-cell battery.

To replace the coin-cell battery, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Locate the coin-cell battery. See “Parts on the system board” on page 11.
3. Remove the old coin-cell battery.

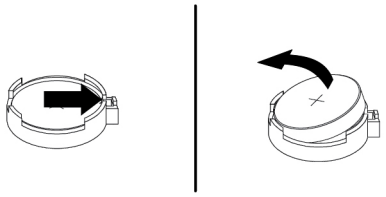


Figure 22. Removing the old coin-cell battery

4. Install a new coin-cell battery.

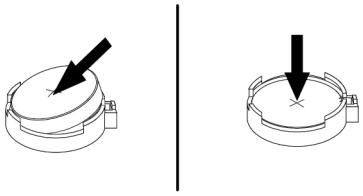


Figure 23. Installing a new coin-cell battery

5. Reinstall the computer cover and connect the cables. See “Completing the parts replacement” on page 139.

   Note: When the computer is turned on for the first time after replacing the coin-cell battery, an error message might be displayed. This is normal after replacing the coin-cell battery.
6. Turn on the computer and all attached devices.
7. Use the Setup Utility program to set the date, time, and any passwords. See “Using the Setup Utility program” on page 39.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Memory module

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

Your computer has four memory slots for installing or replacing DDR4 UDIMMs that provide up to a maximum of 64 GB system memory.

When installing or replacing a memory module, use 4 GB, 8 GB, or 16 GB DDR4 UDIMMs in any combination up to a maximum of 64 GB. Do not mix any combination of ECC UDIMMs and non-ECC UDIMMs into the same computer.

Note: Always install the memory modules in the alphabetic order as shown.

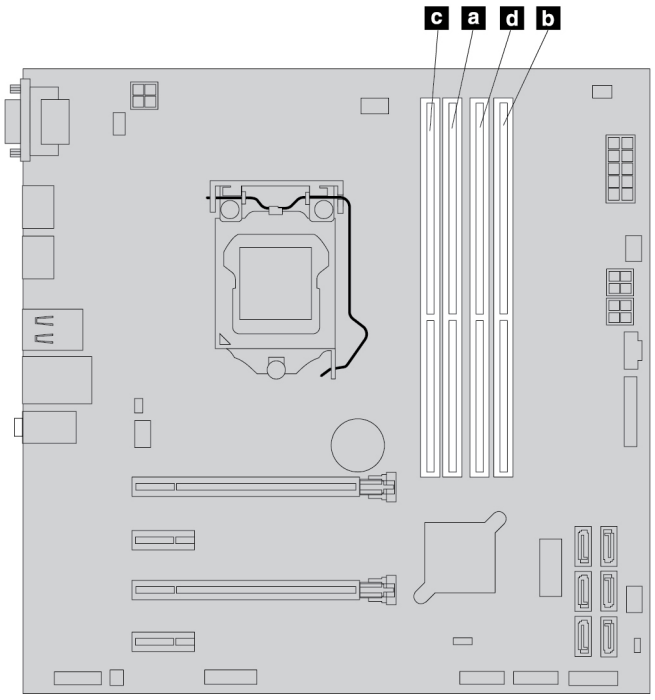


Figure 24. Memory module installation order

To install or replace a memory module, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Lay the computer on its side for easier access to the system board.
3. Locate the memory slots. See “Parts on the system board” on page 11.
4. Remove any parts that might prevent your access to the memory slots. Depending on your computer model, you might need to remove the PCIe x16 graphics card for easier access to the memory slots. See “PCIe card” on page 71.
5. Depending on whether you are installing or replacing a memory module, do one of the following:
   - If you are replacing an old memory module, open the retaining clips and gently pull the memory module out of the memory slot.

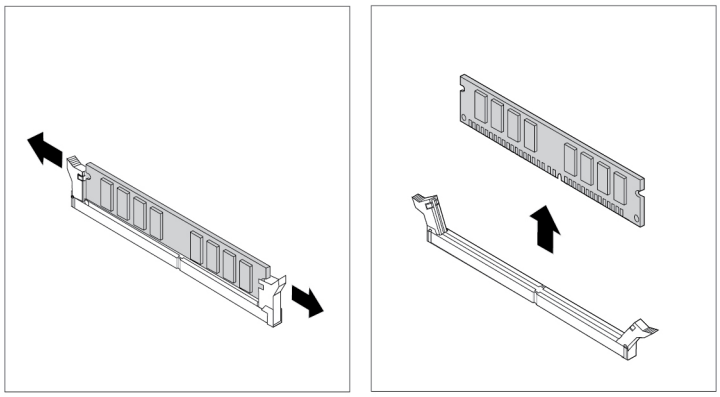


Figure 25. Removing a memory module

- If you are installing a memory module, open the retaining clips of the memory slot into which you want to install the memory module.

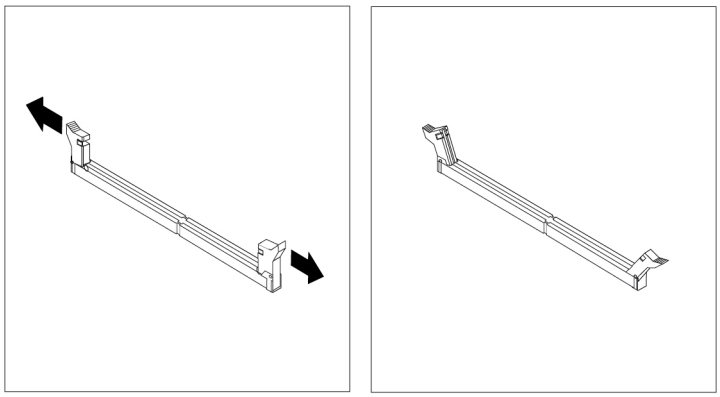


Figure 26. Opening the retaining clips

6. Position the new memory module over the memory slot. Ensure that the notch 1 on the memory module is aligned with the key 2 in the slot. Push the memory module straight down into the slot until the retaining clips completely close.

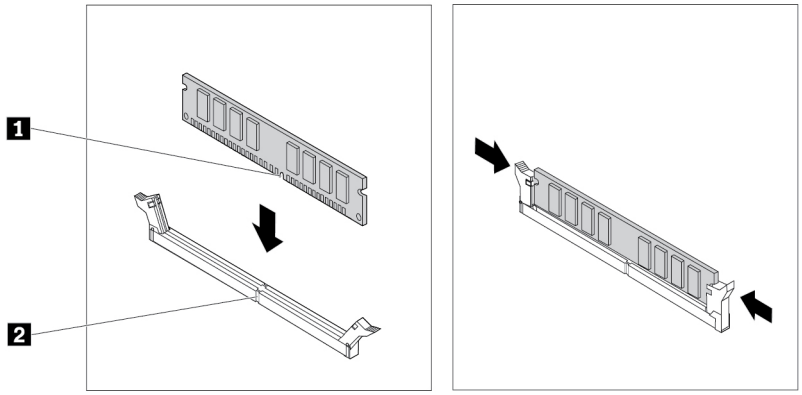


Figure 27. Installing a memory module

7. Reinstall the PCIe x16 graphics card if you have removed it.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Optical drive

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

For some computer models, the optical-drive bay might be installed with a device such as an optical drive, a 5.25-inch flex module, a front access storage enclosure, a slim optical drive adapter, or a multi-drive Conversion Kit.

This section provides instructions on how to install or replace an optical drive. For any other device in the optical-drive bay, the installation or replacement procedure is similar.

To install or replace an optical drive, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Press the release tab 1 as shown and pivot the drive bay assembly upward.

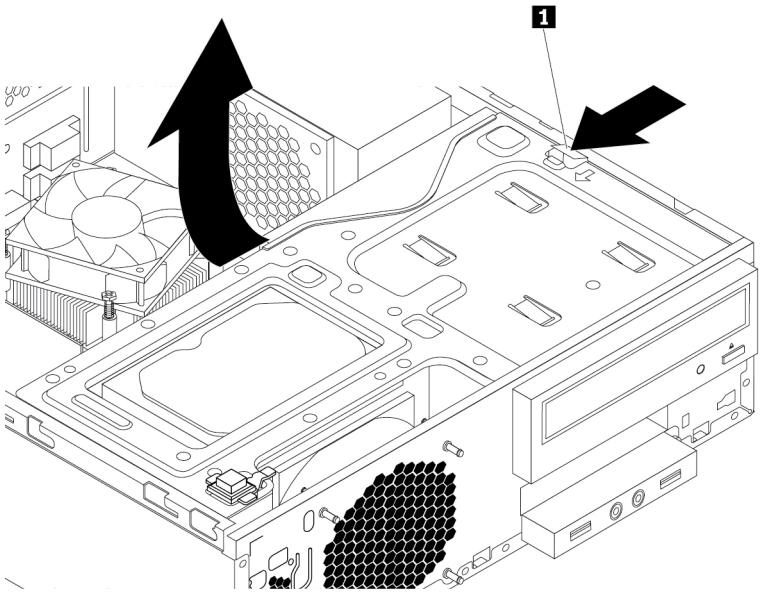


Figure 28. Pivoting the drive bay assembly upward

4. Depending on whether you are installing or replacing an optical drive, do one of the following:
   - If you are installing a new optical drive, do the following:
     a. Remove the metal static shield from the bay.
     b. Locate the optical-drive retainer from the left side of the computer. Push the optical-drive retainer downwards to unlock the retainer. Then lift the optical-drive retainer out of the chassis.
   - If you are replacing an optical drive, do the following:
     a. Disconnect all cables from the rear of the optical drive.
     b. Press the optical-drive lock **1** on the right side of the drive bay assembly and slide the optical drive out of the rear of the bay. Then remove the optical-drive retainer from the left side of the optical drive.

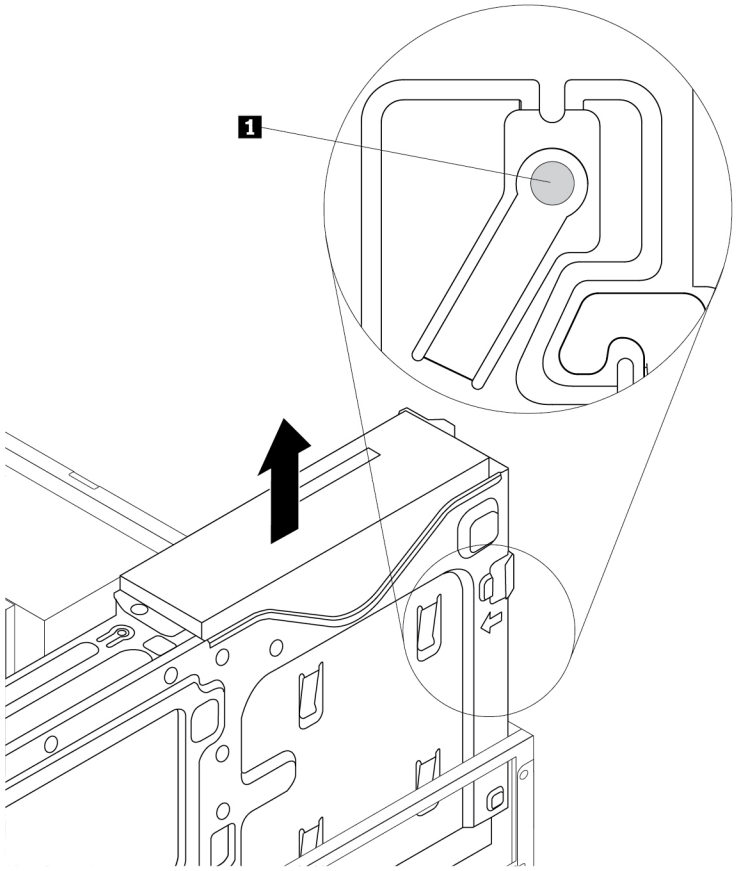


Figure 29. Removing the optical drive

5. Install the optical-drive retainer on the side of the new optical drive.

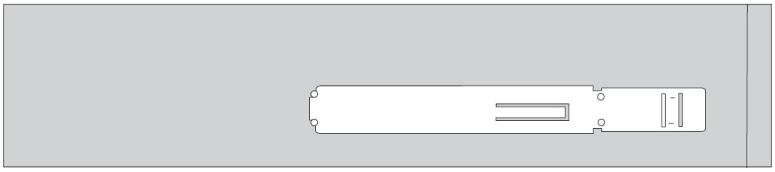


Figure 30. Installing the optical-drive retainer

6. Slide the new optical drive into the drive bay until the optical drive snaps into position.

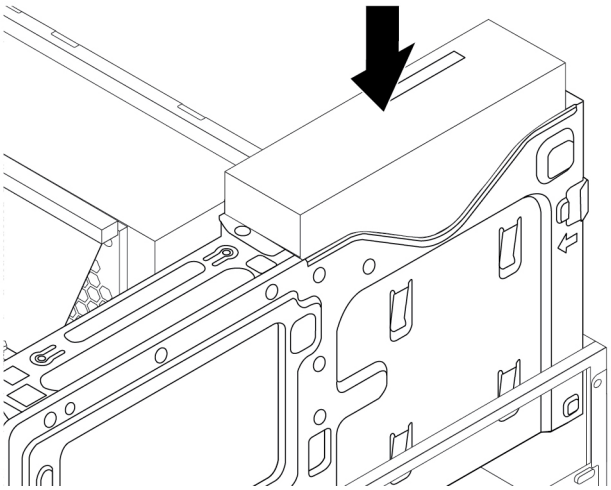


Figure 31. Installing the optical drive

7. Connect any required cables. For the optical drive, connect the power cable and the signal cable to the rear of the optical drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Hard disk drive in the front-access storage enclosure

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

You can install or replace a hard disk drive in the front-access storage enclosure. The hard disk drive also can be hot-swappable, which means that you can install or replace the drive without even turning off your computer.

The hard disk drive in the front-access storage enclosure is hot-swappable only when the following requirements are met:

- The SATA cable of the front-access storage enclosure is connected to the eSATA connector on the system board. To verify the cable connection, see “Preparing your computer and removing the computer cover” on page 69 and “Parts on the system board” on page 11 for more information.
- The operating system of your computer does not reside on the hard disk drive installed in the front-access storage enclosure.

Attention: If any of the above requirements are not met, do not install or replace the hard disk drive when the computer is turned on. Otherwise, data on the hard disk drive might get damaged.

3.5-inch storage drive

To remove or install a 3.5-inch storage drive, do the following:

1. Before removing an old 3.5-inch storage drive, safely eject the old storage drive from the operating system first. For more information, see the Windows help system.

2. Unlock the enclosure cover with the provided key as shown. Press the notch a to open the enclosure cover.

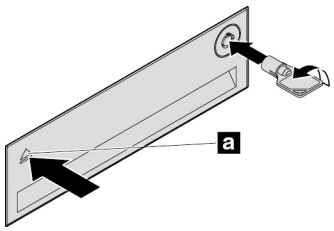


Figure 32. Opening the front-access storage enclosure cover

3. Press the pit on the bracket cover, and then grasp the tilted cover to pull the bracket out of the front-access storage enclosure.

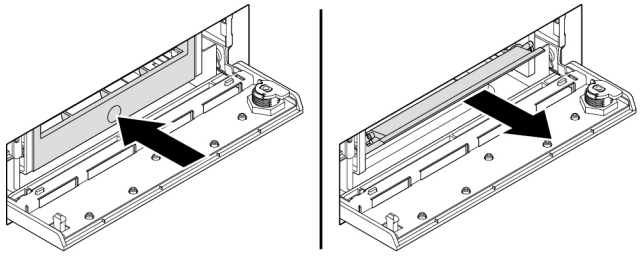


Figure 33. Removing the bracket from the front-access storage enclosure

4. To remove the 3.5-inch storage drive, flex both sides of the bracket to remove the 3.5-inch storage drive from the bracket.

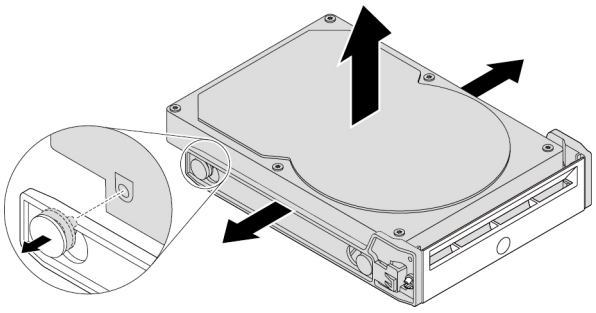


Figure 34. Removing the 3.5-inch storage drive from the bracket

5. To install a new 3.5-inch storage drive, flex both sides of the bracket and align pins 1 on the bracket with the corresponding holes in the new drive.

Notes:

- Ensure that the circuit board faces downward and the connectors face toward the rear of the bracket.
- Do not touch the circuit board on the storage drive during operation.

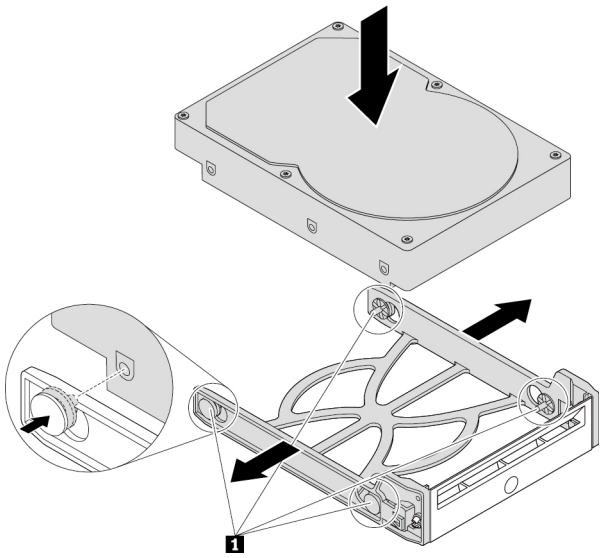


Figure 35. Installing the 3.5-inch storage drive into the bracket

6. Slide the bracket with the new 3.5-inch storage drive into the front-access storage enclosure until it snaps into position. Press the notch to secure the enclosure cover and lock the enclosure cover with the key.

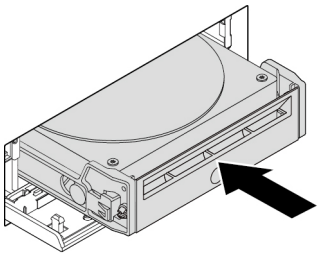


Figure 36. Installing the 3.5-inch storage drive into the front-access storage enclosure

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

2.5-inch storage drive

To remove or install a 2.5-inch storage drive, do the following:

1. Before removing an old 2.5-inch storage drive, safely eject the old storage drive from the operating system first. For more information, see the Windows help system.
2. Unlock the enclosure cover with the provided key as shown. Press the notch a to open the enclosure cover.

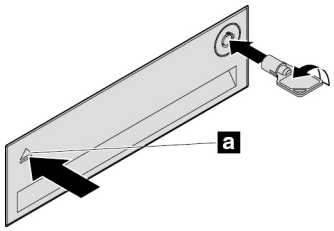


Figure 37. Opening the front-access storage enclosure cover

3. Press the pit on the bracket cover, and then grasp the tilted cover to pull the bracket out of the front-access storage enclosure.

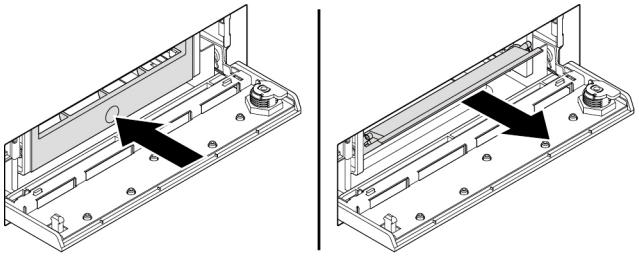


Figure 38. Removing the bracket from the front-access storage enclosure

4. To remove the 2.5-inch storage drive, do the following:
   a. Flex both sides of the bracket to remove the 2.5-inch storage drive from the bracket.

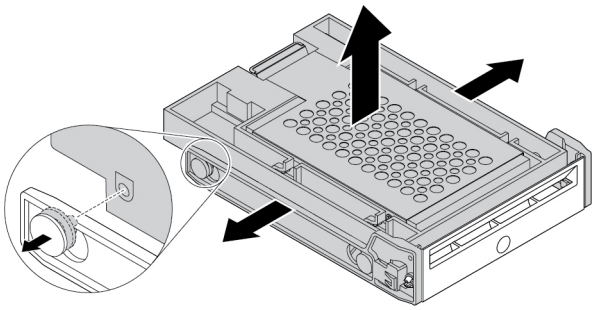


Figure 39. Removing the 2.5-inch storage drive from the bracket

   b. Lift the tab 1 of the metal bracket and push the metal bracket with force as shown. Then slide the bracket and remove it from the plastic frame.

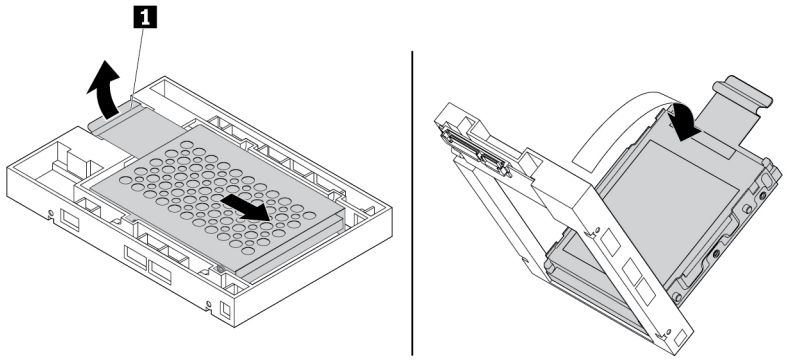


Figure 40. Removing the metal bracket from the plastic frame of the converter

c. Carefully flex both sides of the metal bracket to remove the storage drive from the bracket.

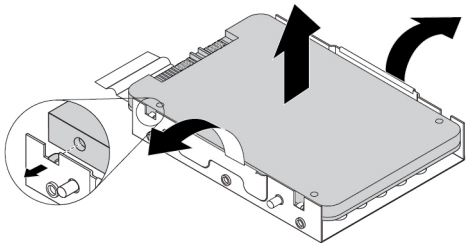


Figure 41. Removing the storage drive from the metal bracket

5. To install a new 2.5-inch storage drive into the front-access storage enclosure, do the following:
   a. Carefully flex both sides of the metal bracket and align the four tabs **1** on the metal bracket with the corresponding holes in the new storage drive.

      Note: Ensure that the connectors of the storage drive face toward the tab of the metal bracket.

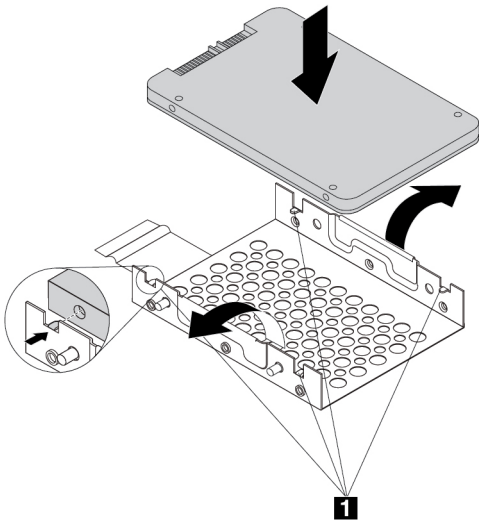


Figure 42. Installing the 2.5-inch storage drive into the metal bracket

   b. Insert the four posts **1** on the metal bracket into the corresponding slots in the plastic frame as shown.

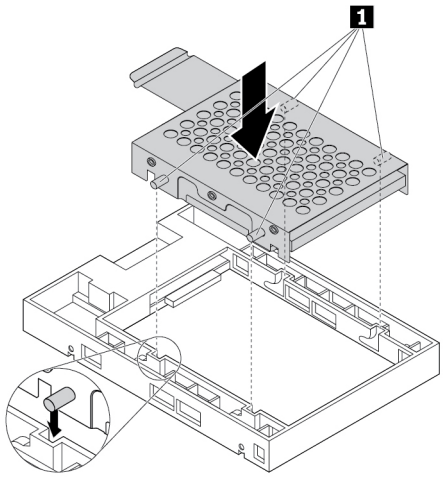


Figure 43. Inserting the metal bracket into the plastic frame of the converter

c. Push the metal bracket down until the tab 1 is slightly curved. Then, push the bracket with the storage drive forward as shown until the tab 1 snaps into position.

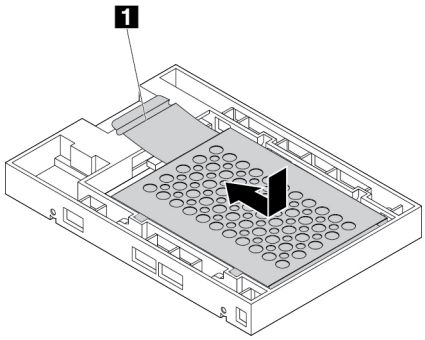


Figure 44. Installing the metal bracket into the plastic frame of the converter

d. Flex both sides of the plastic bracket and align pins 1 on the plastic bracket with the corresponding holes in the plastic frame of the converter.

Notes:

- Ensure that the circuit board faces downward and the connectors face toward the rear of the bracket.
- Do not touch the circuit board on the storage drive during operation.

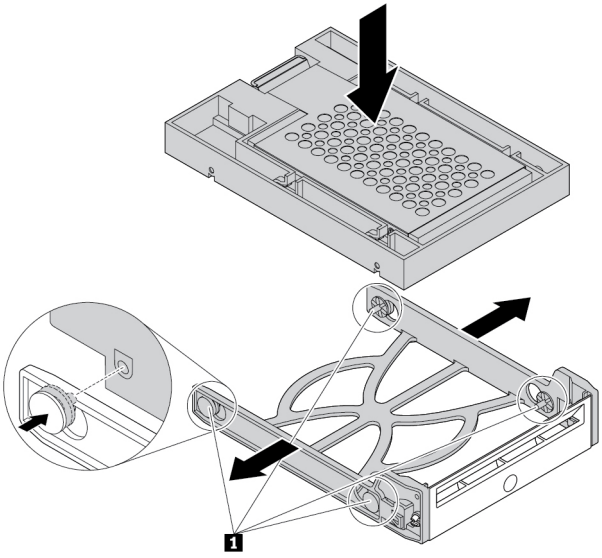


Figure 45. Installing the converter with the 2.5-inch storage drive into the plastic bracket

6. Slide the plastic bracket with the new 2.5-inch storage drive into the front-access storage enclosure until it snaps into position. Press the notch to secure the enclosure cover and lock the enclosure cover with the key.

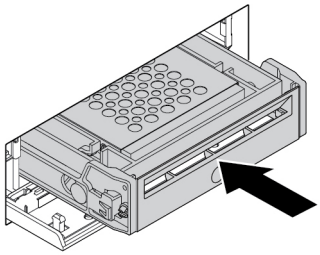


Figure 46. Installing the bracket with the 2.5-inch storage drive into the front-access storage enclosure

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Device in the Multi-drive Conversion Kit

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

The Multi-drive Conversion Kit (hereafter referred to as kit) might be equipped with either one or both of the following components:

- Slim optical drive
- Internal storage drive (such as hard disk drive, solid-state drive, or hybrid drive)

Slim optical drive

To install or replace a slim optical drive in the kit, do the following:

Note: The instructions on how to install or replace a slim optical drive in the kit also applies to the Slim Optical Drive Adapter.

1. Slide the kit out of the chassis. See “Optical drive” on page 80.
2. If you are replacing an old slim optical drive, do the following:
   a. Press the clip through the hole in the top of the kit as shown and push forward the slim optical drive. Then, slide the slim optical drive out of the kit.

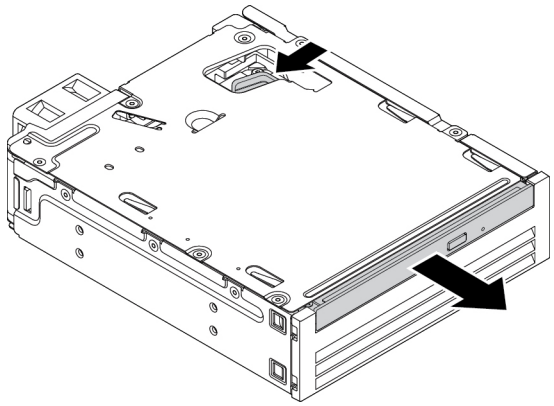


Figure 47. Removing the slim optical drive from the kit

   b. Pull the bracket as shown to remove it from the slim optical drive.

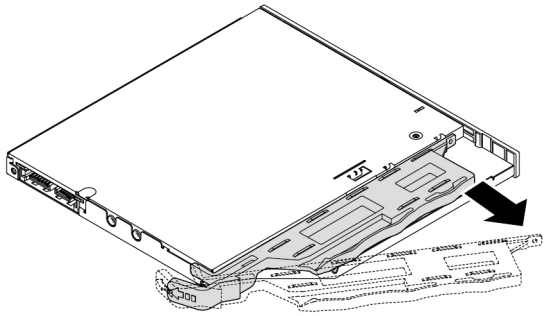


Figure 48. Removing the bracket from the slim optical drive

3. Align the three tabs on the bracket with the corresponding holes in the new slim optical and install the bracket to the new slim optical drive.

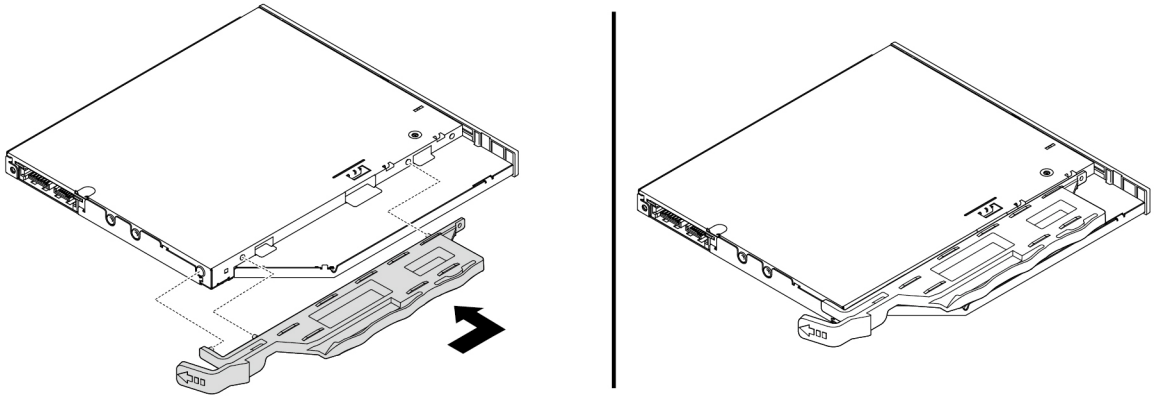


Figure 49. Installing the bracket to the new slim optical drive

4. Insert the new slim optical drive into the kit until you hear a click. The slim optical drive is secured in place.

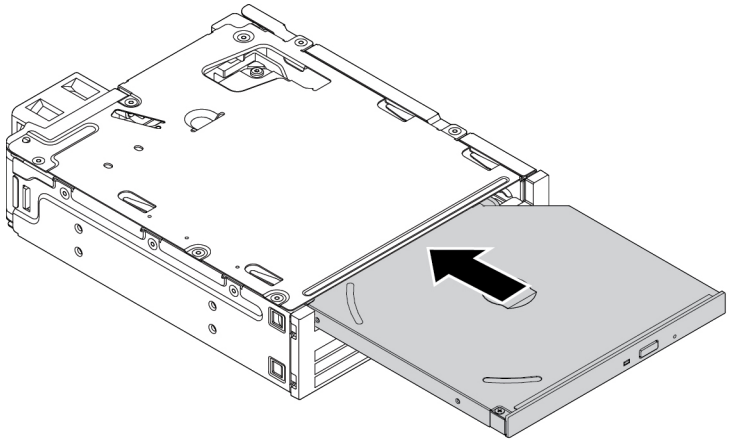


Figure 50. Installing the slim optical drive into the kit

3.5-inch internal storage drive

To install or replace a 3.5-inch internal storage drive in the kit, do the following:

1. Slide the kit out of the chassis. See “Optical drive” on page 80.
2. Press the clip as shown to open the rear cover of the kit.

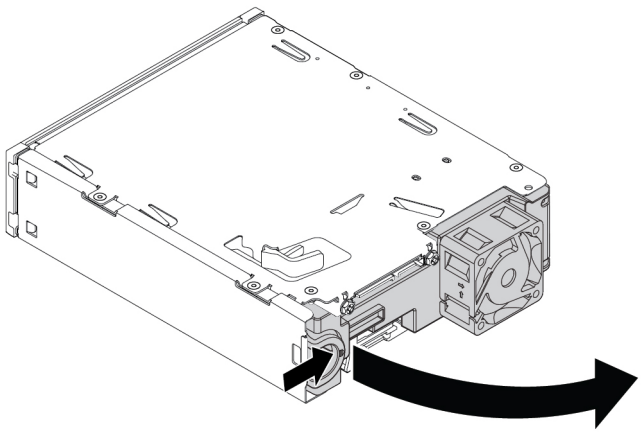


Figure 51. Opening the kit from the rear

3. If you are replacing an old 3.5-inch internal storage drive, do the following:
   a. Press both clips simultaneously toward each other and slide the 3.5-inch internal storage drive out of the rear of the kit.

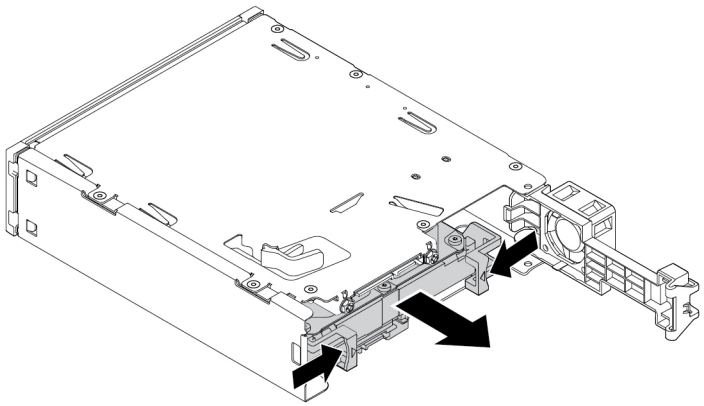


Figure 52. Removing the 3.5-inch internal storage drive from the rear

   b. Flex both sides of the bracket to remove the 3.5-inch internal storage drive from the bracket. Do not touch the circuit board 1 on the internal storage drive.

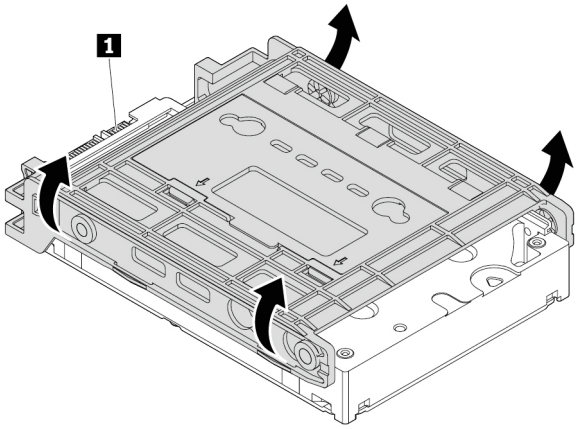


Figure 53. Flexing both sides of the bracket to remove the 3.5-inch internal storage drive

4. Flex the bracket and align pins **1**, **2**, **3**, and **4** on the bracket with the corresponding holes in the new 3.5-inch internal storage drive. Then install a new 3.5-inch internal storage drive into the bracket. Do not touch the circuit board **5** on the internal storage drive.

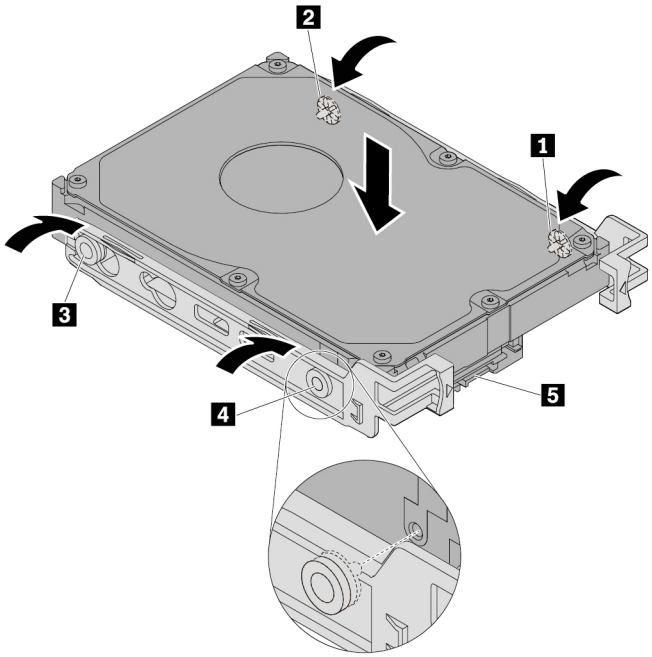


Figure 54. Installing the new 3.5-inch internal storage drive into the bracket

5. Slide the new 3.5-inch internal storage drive into the kit from the rear until the internal storage drive snaps into position.

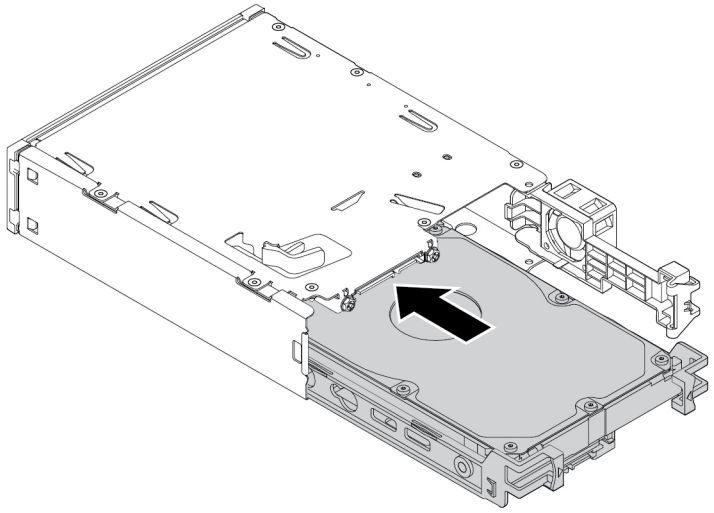


Figure 55. Sliding the new 3.5-inch internal storage drive into the kit

6. Pivot the rear cover of the kit inward until you hear a click. The rear cover is secured in place.

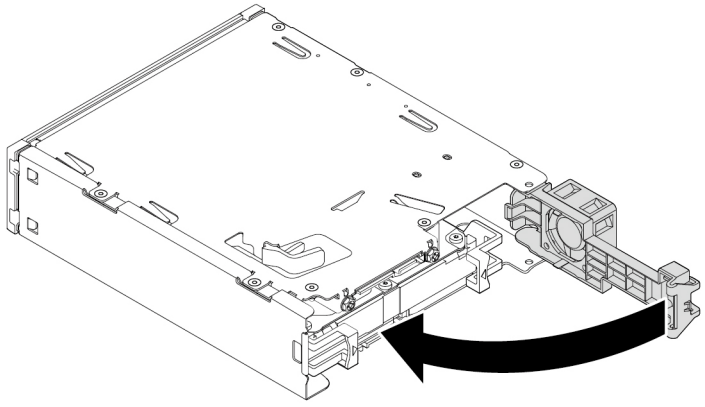


Figure 56. Pivoting the rear cover inward

2.5-inch internal storage drive

To install or replace a 2.5-inch internal storage drive in the kit, do the following:

1. Slide the kit out of the chassis. See “Optical drive” on page 80.
2. Press the clip as shown to open the rear cover of the kit.

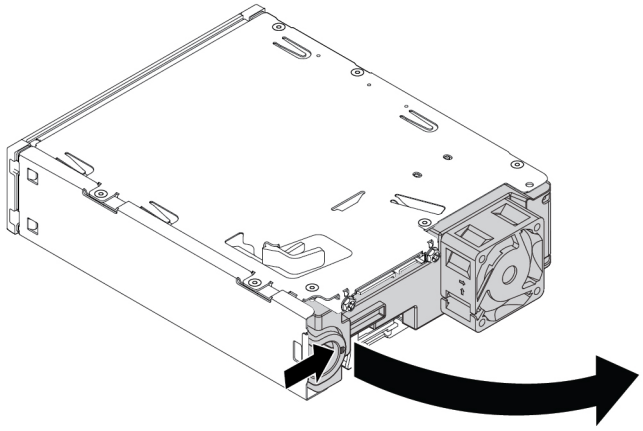


Figure 57. Opening the kit from the rear

3. If you are replacing an old 2.5-inch internal storage drive, do the following:
   a. Press both clips simultaneously toward each other and slide the 2.5-inch internal storage drive out of the rear of the kit.

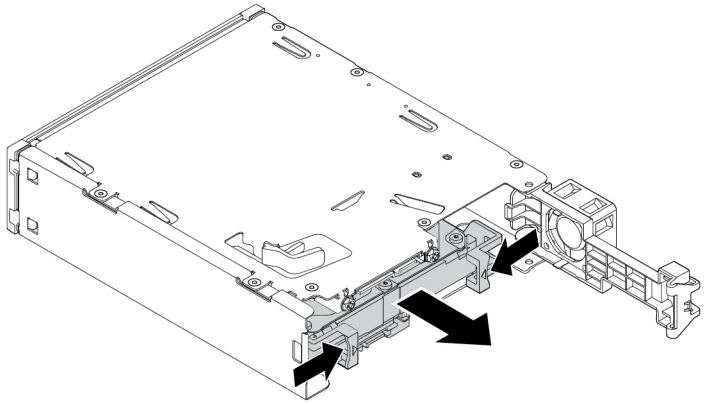


Figure 58. Removing the 2.5-inch internal storage drive from the rear

   b. Flex both sides of the bracket to remove the 2.5-inch internal storage drive from the bracket.

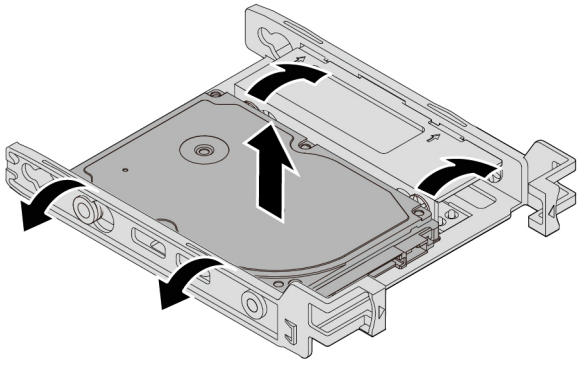


Figure 59. Flexing both sides of the bracket to remove the 2.5-inch internal storage drive

4. Flex the bracket and align pins 1, 2, 3, and 4 on the bracket with the corresponding holes in the new 2.5-inch internal storage drive. Then install a new 2.5-inch internal storage drive into the bracket. Do not touch the circuit board 5 on the internal storage drive.

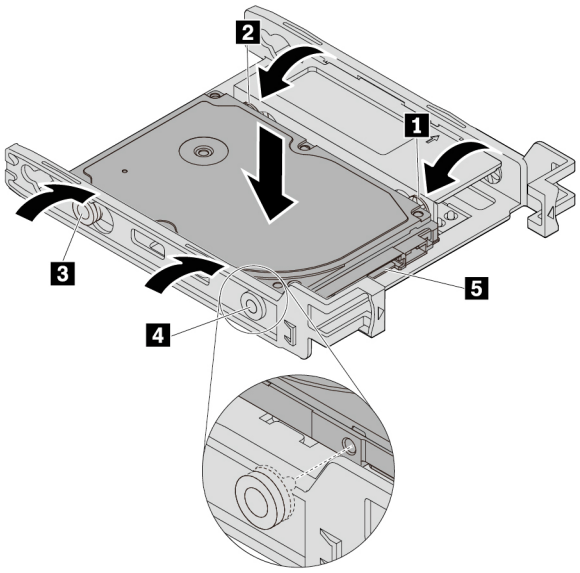


Figure 60. Installing the new 2.5-inch internal storage drive into the bracket

5. Slide the new 2.5-inch internal storage drive into the kit from the rear until the internal storage drive snaps into position.

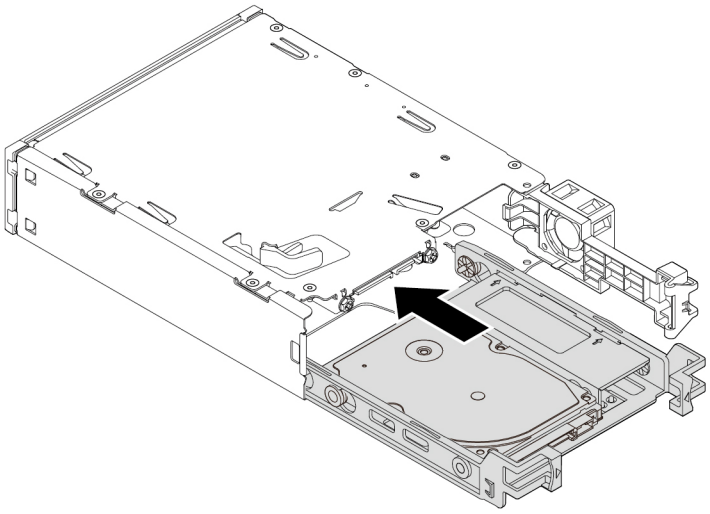


Figure 61. Sliding the new 2.5-inch internal storage drive into the kit

6. Pivot the rear cover of the kit inward until you hear a click. The rear cover is secured in place.

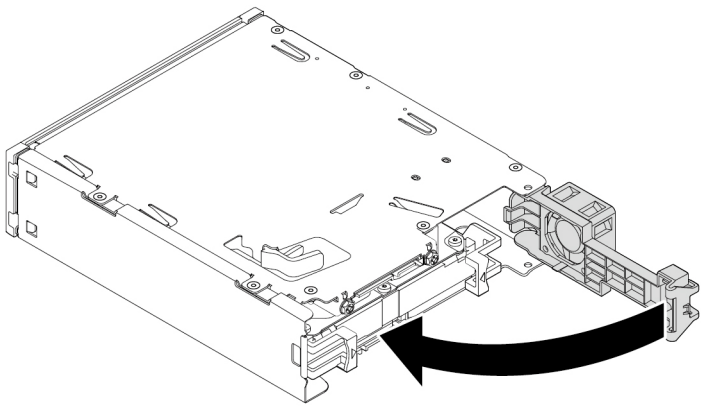


Figure 62. Pivoting the rear cover inward

Replacing a 3.5-inch internal storage drive with a 2.5-inch internal storage drive

To replace a 3.5-inch internal storage drive with a 2.5-inch internal storage drive, do the following:

1. Ensure that the 3.5-inch internal storage drive is removed from the bracket first. See “3.5-inch internal storage drive” on page 91.
2. Remove three pins 1 and install them into slots 2.

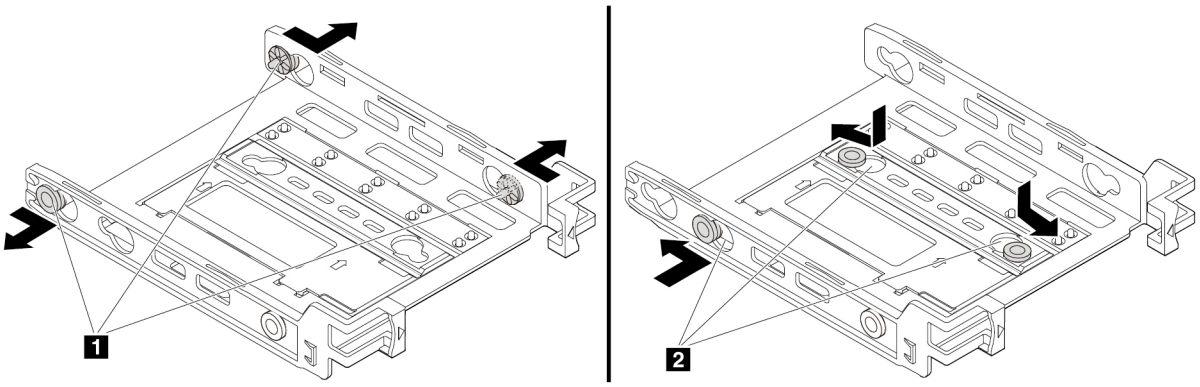


Figure 63. Removing three pins and installing them into new slots

3. Pivot the bracket as shown to release both tabs 1 and 3 from the slots.

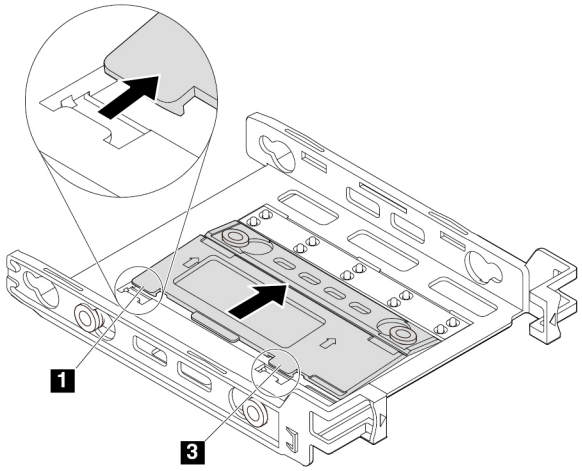


Figure 64. Pivoting the bracket

4. Fold the bracket as shown.

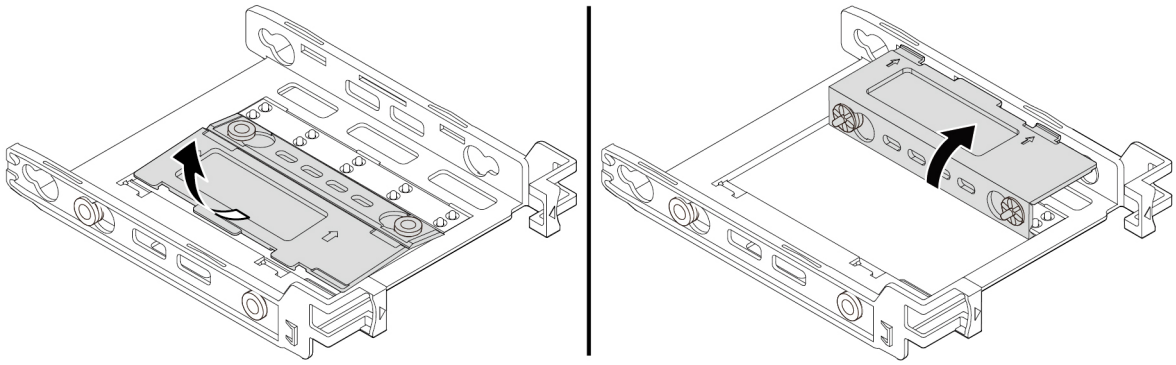


Figure 65. Folding the bracket

5. Insert tabs 1 and 3 into the corresponding slots until you hear a click. Ensure that the tab 2 is secured in place.

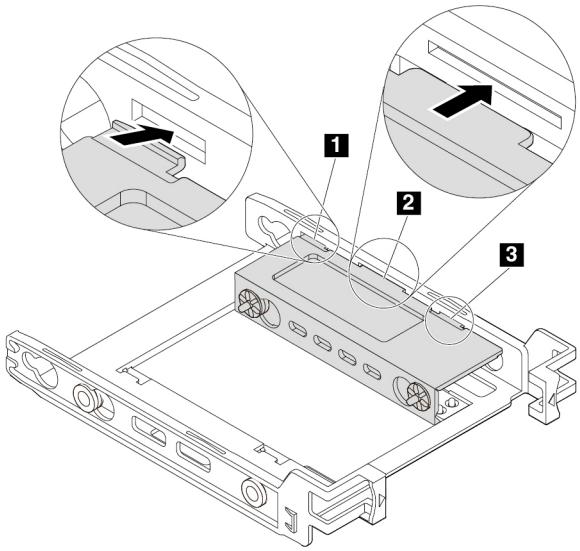


Figure 66. Inserting tabs 1 and 3 into the corresponding slots

6. Install a 2.5-inch internal storage drive into the bracket. See “2.5-inch internal storage drive” on page 94.

Replacing a 2.5-inch internal storage drive with a 3.5-inch internal storage drive

To replace a 2.5-inch internal storage drive with a 3.5-inch internal storage drive, do the following:

1. Ensure that the 2.5-inch internal storage drive is removed from the bracket. See “2.5-inch internal storage drive” on page 94.
2. Remove three pins 1 and install them into slots 2.

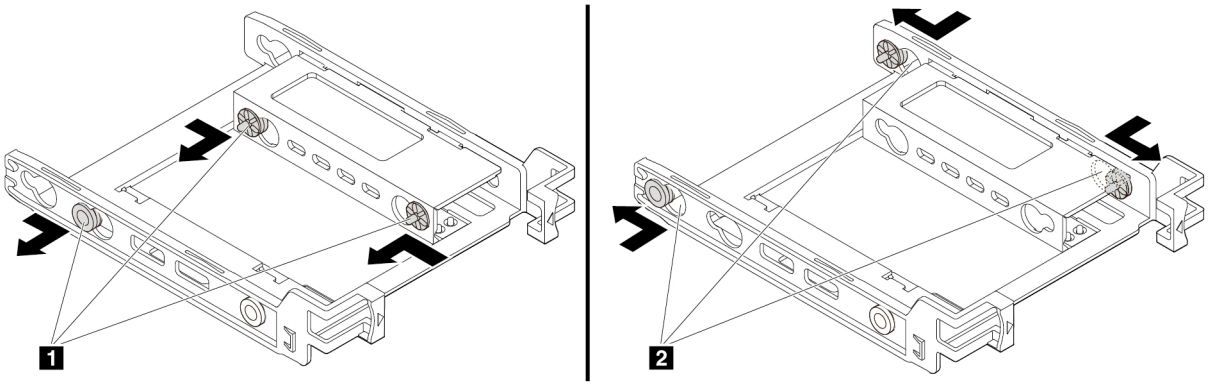


Figure 67. Removing three pins 1 and installing them into slots 2

3. Release tabs 1, 2, and 3 from the corresponding slots.

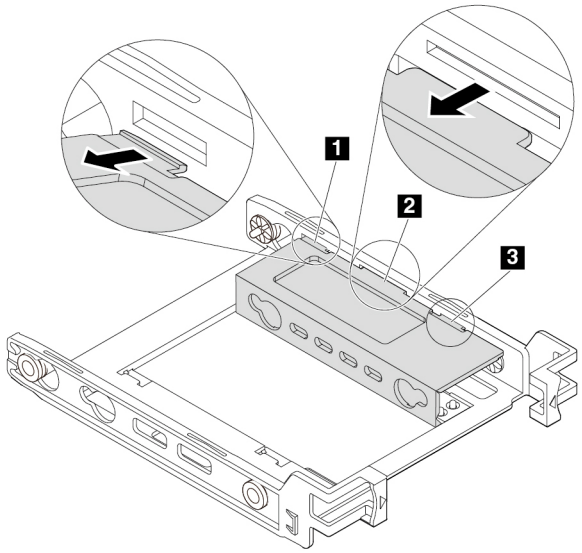


Figure 68. Releasing tabs 1, 2, and 3 from the corresponding slots

4. Unfold the bracket as shown.

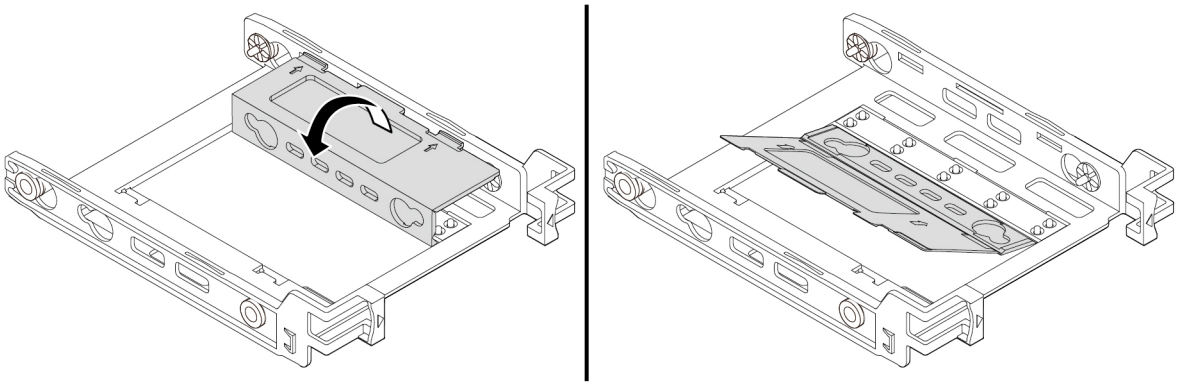


Figure 69. Unfolding the bracket

5. Insert tabs 1 and 3 into the corresponding slots. Ensure that the tab 2 is secured in place.

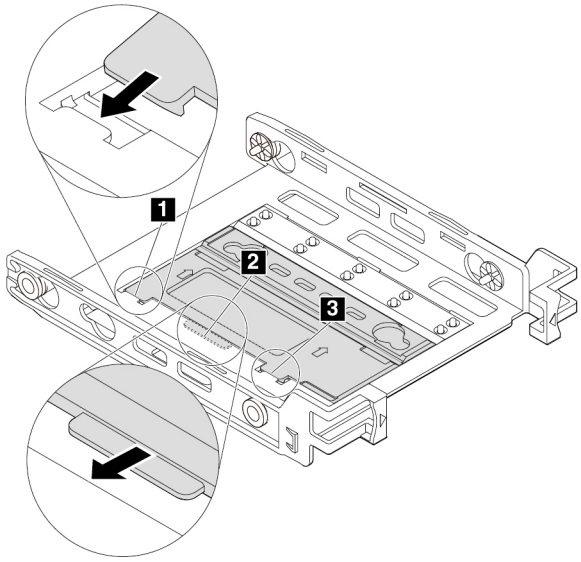


Figure 70. Inserting tabs 1 and 3 into the corresponding slots

6. Install a 3.5-inch internal storage drive into the bracket. See “3.5-inch internal storage drive” on page 91.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Solid-state drive

The solid-state drive is only available on some models.

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

Installing the solid-state drive

To install the solid-state drive, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Install the solid-state drive into the storage converter shipped with the solid-state drive. Then install the four screws to secure the solid-state drive to the storage converter.

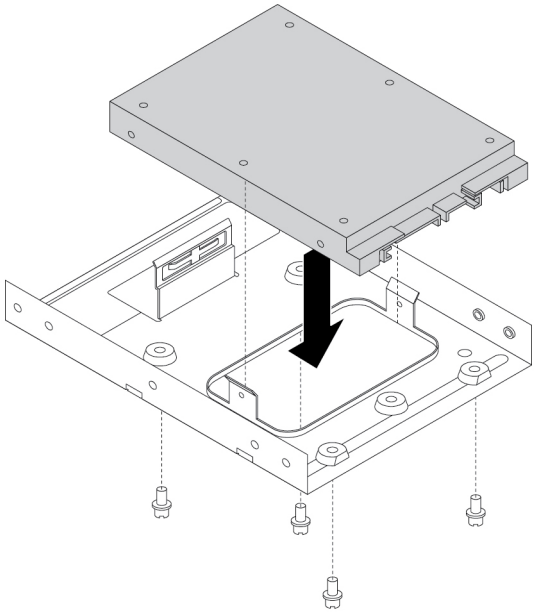


Figure 71. Installing the solid-state drive into the storage converter

3. Remove the 3.5-inch storage drive bracket out of the chassis.
4. To install the storage converter into the 3.5-inch storage drive bracket, flex the bracket and align pin 1, pin 2, pin 3, and pin 4 on the bracket with the corresponding holes in the storage converter.

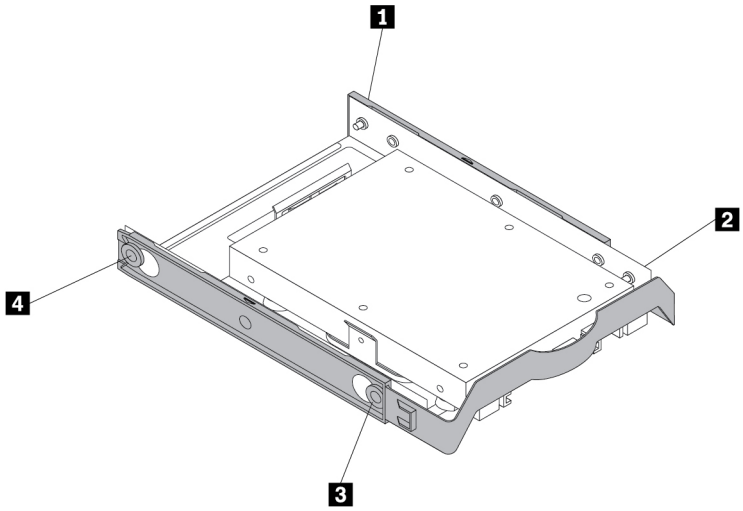


Figure 72. Installing the storage converter together with the solid-state drive into the storage drive bracket

5. Install the storage converter with the bracket into the desired storage drive bay. See “Primary hard disk drive” on page 111 or “Secondary hard disk drive” on page 113.
6. Connect the signal cable and the power cable to the solid-state drive.

Replacing the solid-state drive

To replace the solid-state drive, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Locate the desired storage drive bay. See “Internal storage drives” on page 12.
3. Disconnect the signal cable and power cable from the solid-state drive.
4. Remove the storage converter with the solid-state drive from the storage drive bay. See “Primary hard disk drive” on page 111 or “Secondary hard disk drive” on page 113.
5. Flex the sides of the plastic 3.5-inch storage drive bracket to remove the storage converter from the bracket.

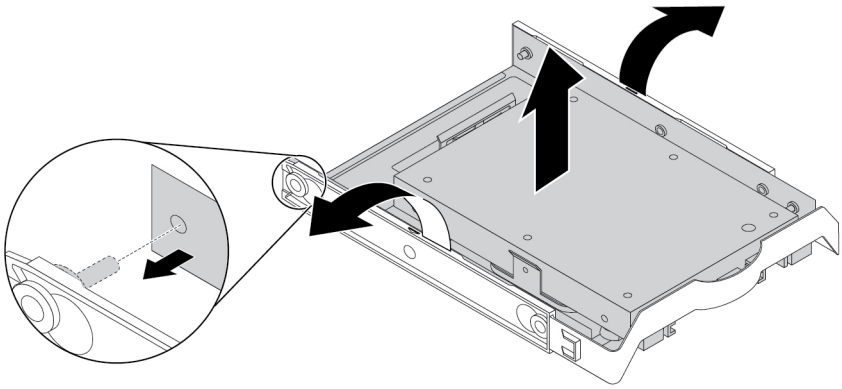


Figure 73. Removing the storage converter from the 3.5-inch storage drive bracket

6. Remove the four screws that secure the solid-state drive. Then lift the solid-state drive out of the storage converter.

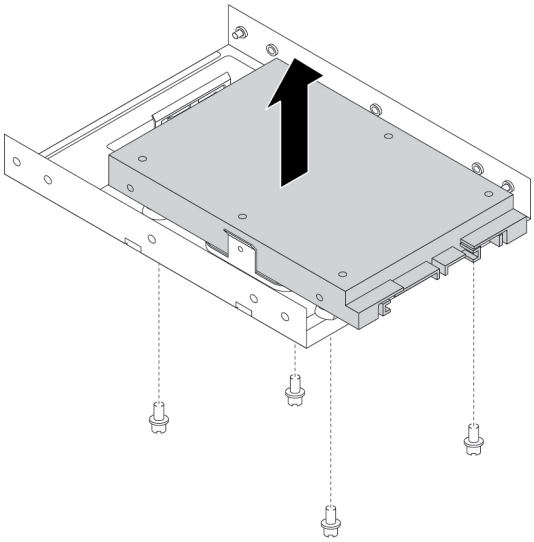


Figure 74. Removing the solid-state drive from the storage converter

7. Install a new solid-state drive into the storage converter. Then install the four screws to secure the new solid-state drive to the storage converter.

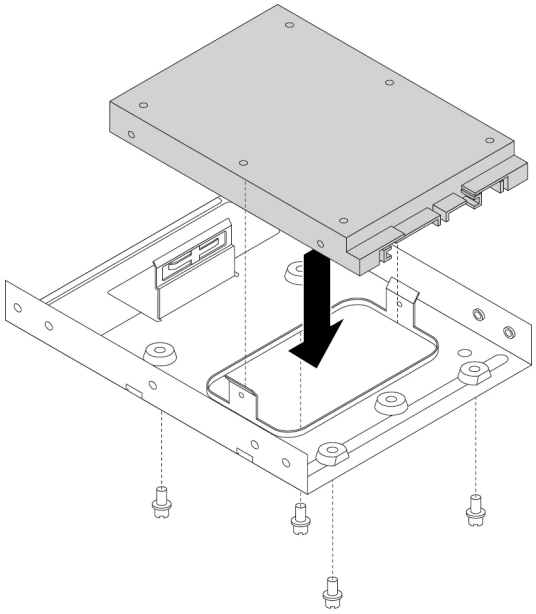


Figure 75. Installing the new solid-state drive into the storage converter

8. To install the storage converter into the 3.5-inch storage drive bracket, flex the bracket and align pin 1, pin 2, pin 3, and pin 4 on the bracket with the corresponding holes in the storage converter.

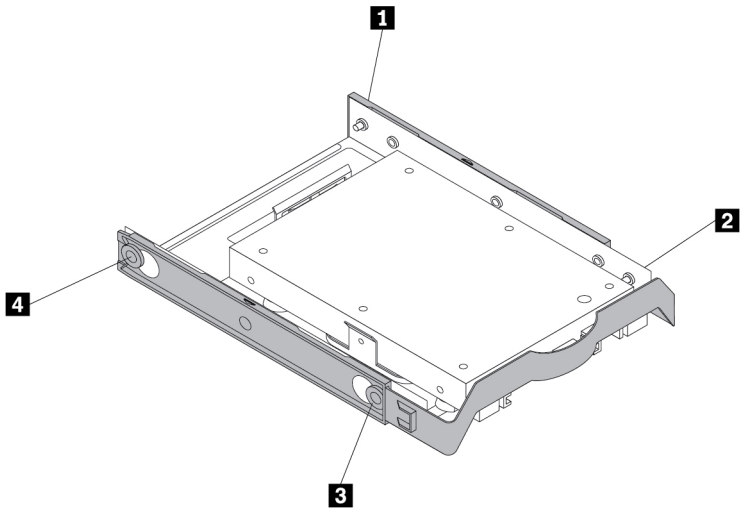


Figure 76. Installing the storage converter with the new solid-state drive into the storage drive bracket

9. Install the storage converter with the bracket into the storage drive bay. See “Primary hard disk drive” on page 111 or “Secondary hard disk drive” on page 113.
10. Connect the signal cable and the power cable to the solid-state drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.

- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Heat sink and fan assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

CAUTION:

Avoid contact with hot components inside the computer. During operation, some components become hot enough to burn the skin. Before you open the computer cover, turn off the computer, disconnect power, and wait approximately 10 minutes for the components to cool.

To replace the heat sink and fan assembly, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Lay the computer on its side for easier access to the system board.
3. Locate the heat sink and fan assembly. See “Parts on the system board” on page 11.
4. Disconnect the heat sink and fan assembly cable from the microprocessor fan connector on the system board. See “Parts on the system board” on page 11.
5. Pivot the two plastic retaining clips that secure the heat sink fan duct outward. Then remove the heat sink fan duct from the failing heat sink and fan assembly.

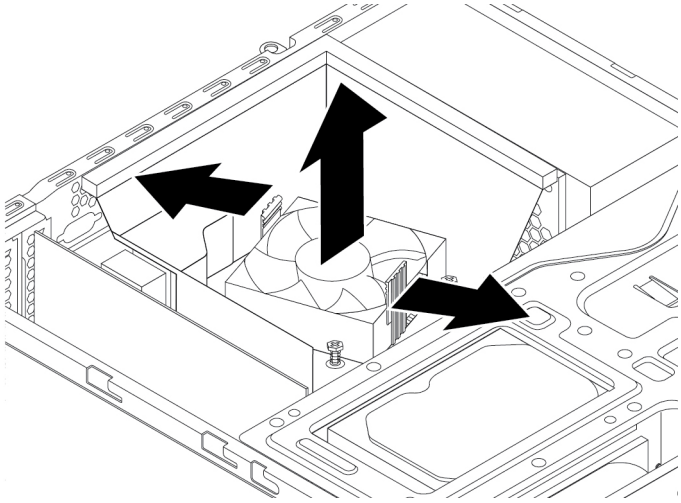


Figure 77. Removing the heat sink fan duct

6. Follow this sequence to remove the four screws that secure the heat sink and fan assembly to the system board:
   a. Partially remove screw 1, then fully remove screw 2, and then fully remove screw 1.
   b. Partially remove screw 3, then fully remove screw 4, and then fully remove screw 3.

   Note: Carefully remove the four screws to avoid any possible damage to the system board. The four screws cannot be removed from the heat sink and fan assembly.

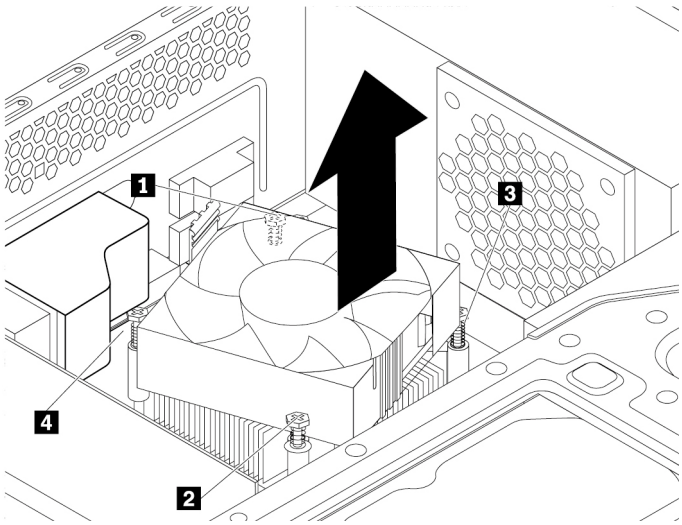


Figure 78. Screws that secure the heat sink and fan assembly

7. Lift the failing heat sink and fan assembly off the system board.

   Notes:

   - You might have to twist the heat sink and fan assembly gently to free it from the microprocessor.
   - Do not touch the thermal grease while handling the heat sink and fan assembly.

8. Position the new heat sink and fan assembly on the system board so that the four screws are aligned with the holes in the system board.

   Note: Ensure that the heat sink and fan assembly cable is toward the microprocessor fan connector on the system board.

9. Follow the following sequence to install the four screws to secure the new heat sink and fan assembly. Do not over-tighten the screws.
   a. Partially tighten screw 1, then fully tighten screw 2, and then fully tighten screw 1.
   b. Partially tighten screw 3, then fully tighten screw 4, and then fully tighten screw 3.
10. Connect the heat sink and fan assembly cable to the microprocessor fan connector on the system board. See “Parts on the system board” on page 11.
11. Lower and position the heat sink fan duct on the top of the heat sink and fan assembly until it snaps into position.

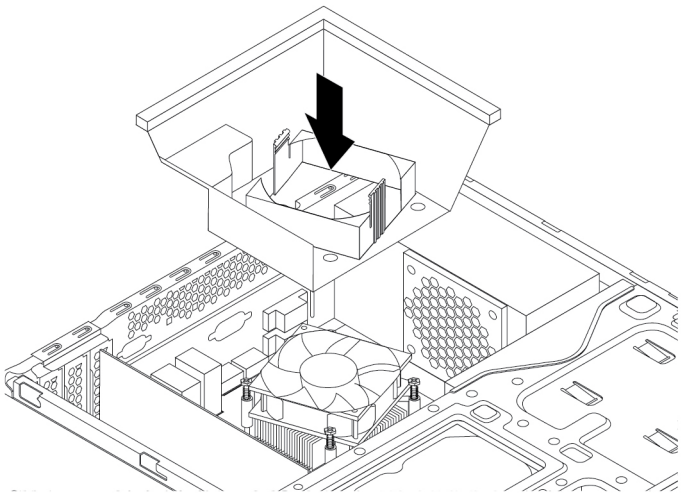


Figure 79. Installing the heat sink fan duct

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Power supply assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

CAUTION:

Keep fingers and other parts of your body away from hazardous, moving parts. If you suffer an injury, seek medical care immediately.

 **DANGER**

Disconnect all power cords from electrical outlets before removing the computer cover or any part that has the above label attached.

DO NOT disassemble components that have the above label attached. There are no serviceable parts inside these components.

Your product is designed for safe use. However, hazardous voltage, current, and energy levels are present inside any component that has this label attached. Disassembling of these components might cause fire or might even result in death. If you suspect a problem with one of these parts, contact a service technician.

To replace the power supply assembly, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.

3. Gently pivot the two plastic retaining clips that secure the heat sink fan duct outward, and then lift the heat sink fan duct out of the chassis.

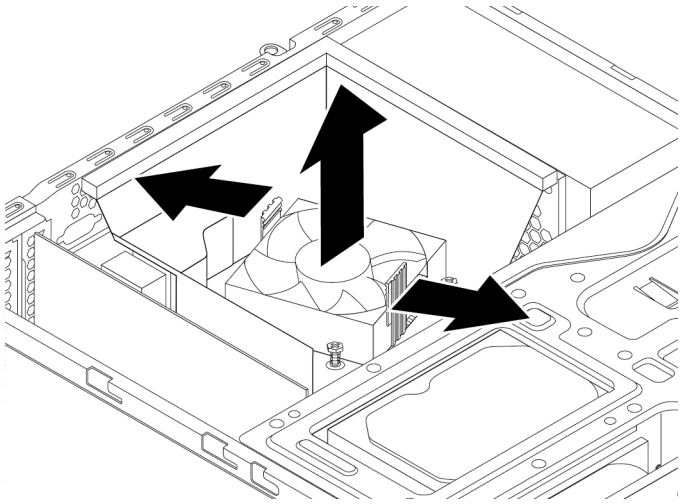


Figure 80. Removing the heat sink fan duct

4. Press the release tab 1 as shown and pivot the drive bay assembly upward.

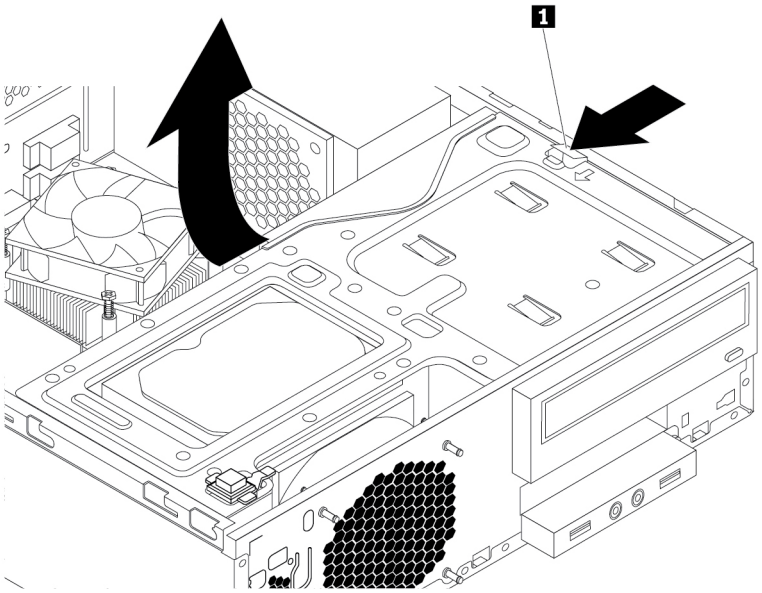


Figure 81. Pivoting the drive bay assembly upward

5. Record the cable routing and cable connections. Then, disconnect the power supply assembly cables from all drives and from the system board. See “Parts on the system board” on page 11.
6. Release the power supply assembly cables from any cable clips or ties.
7. At the rear of the computer, remove the three screws that secure the power supply assembly. Press the power supply clip 1 downward to release the power supply assembly and then slide the power supply assembly to the front of the computer. Lift the power supply assembly out of the computer.

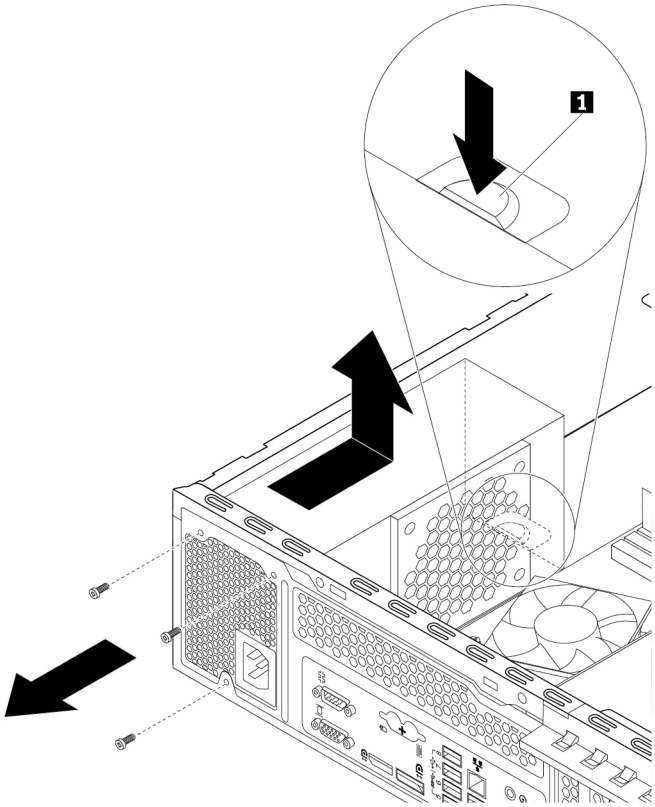


Figure 82. Removing the power supply assembly

8. Ensure that the new power supply assembly is the correct replacement.
9. Install the new power supply assembly into the chassis so that the screw holes in the new power supply assembly are aligned with the corresponding holes in the rear of the chassis. Then, install the three screws to secure the new power supply assembly in place.

   Note: Use only screws provided by Lenovo.

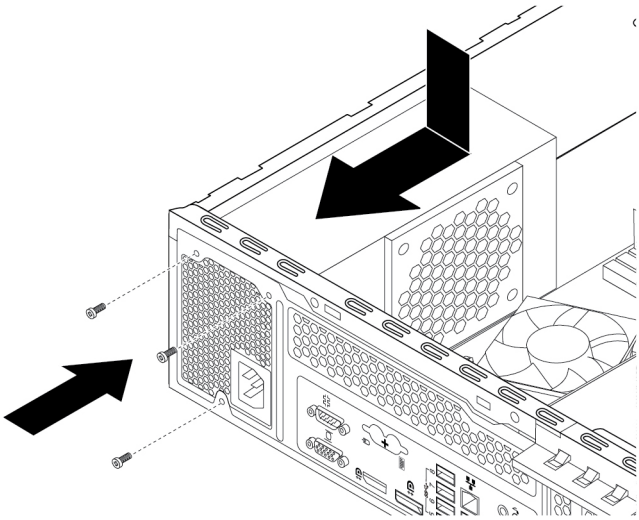


Figure 83. Installing the power supply assembly

10. Connect the new power supply assembly cables to all drives and the system board. See “Parts on the system board” on page 11.
11. Press the release tab **1** as shown and pivot the drive bay assembly downward until it snaps into position.

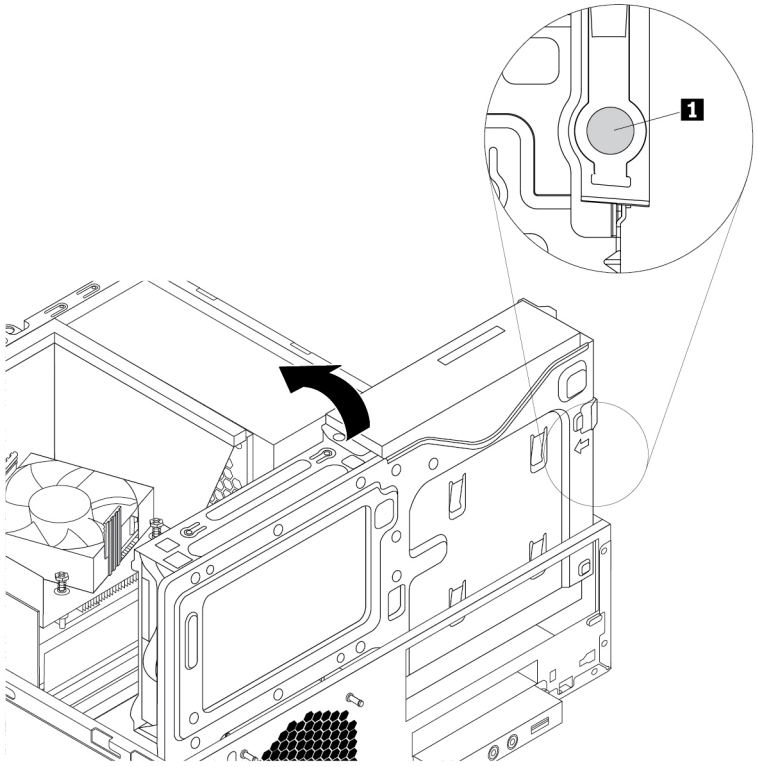


Figure 84. Pivoting the drive bay assembly downward

12. Position the heat sink fan duct on the top of the heat sink as shown. Then, press the heat sink fan duct straight down until it snaps into position.

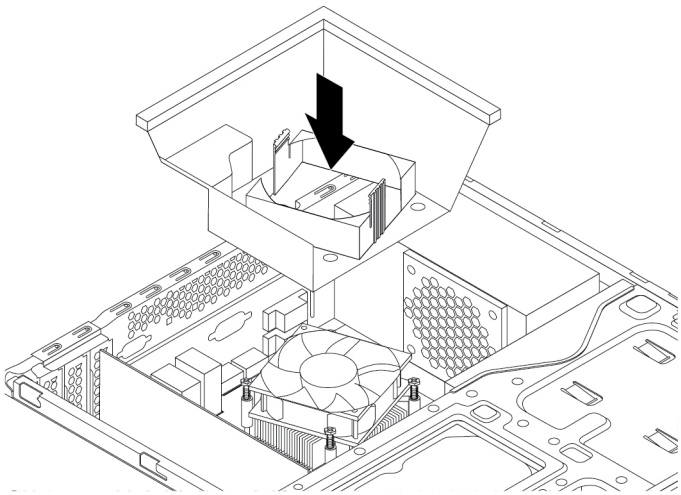


Figure 85. Installing the heat sink fan duct

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Primary hard disk drive

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

To replace the primary hard disk drive, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Press the release tab 1 as shown and pivot the drive bay assembly upward.

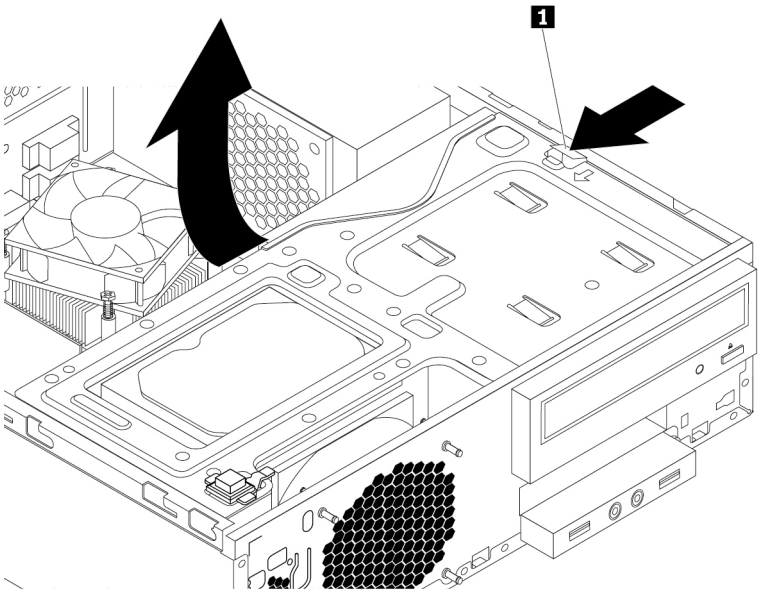


Figure 86. Pivoting the drive bay assembly upward

4. Locate the primary hard disk drive. See “Internal storage drives” on page 12.
5. Disconnect the signal cable and the power cable from the hard disk drive.
6. Pull the blue handle to slide the hard disk drive out of the drive cage.

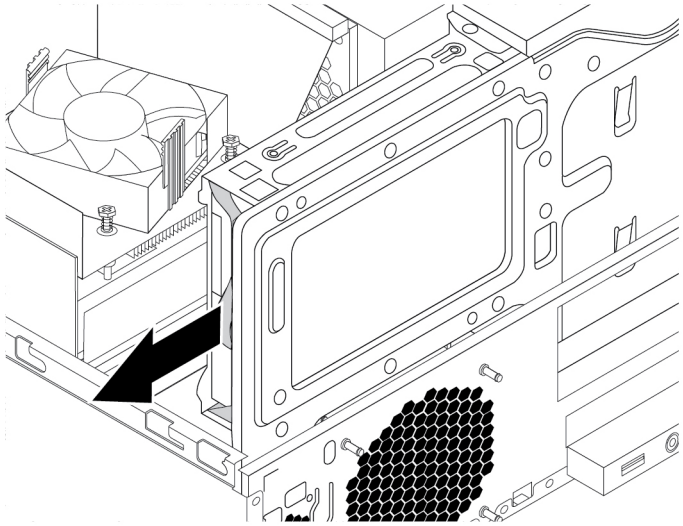


Figure 87. Removing the primary hard disk drive

7. Flex the sides of the blue bracket to remove the hard disk drive from the bracket.
8. To install a new hard disk drive into the blue bracket, flex the bracket and align pin 1, pin 2, pin 3, and pin 4 on the bracket with the corresponding holes in the hard disk drive. Do not touch the circuit board 5 on the bottom of the hard disk drive.

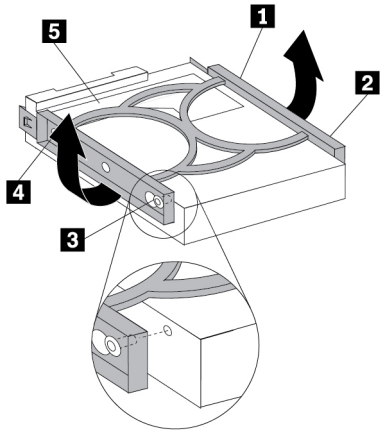


Figure 88. Installing the hard disk drive into the bracket

9. Slide the new hard disk drive into the drive cage until it snaps into position.

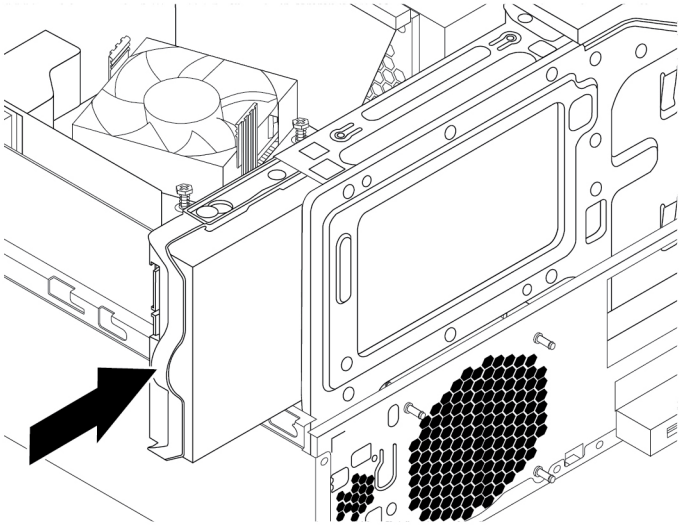


Figure 89. Installing the primary hard disk drive

10. Connect the signal cable and the power cable to the new hard disk drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Secondary hard disk drive

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

Note: The secondary hard disk drive is available only on some models.

To replace the secondary hard disk drive, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Press the release tab 1 as shown and pivot the drive bay assembly upward.

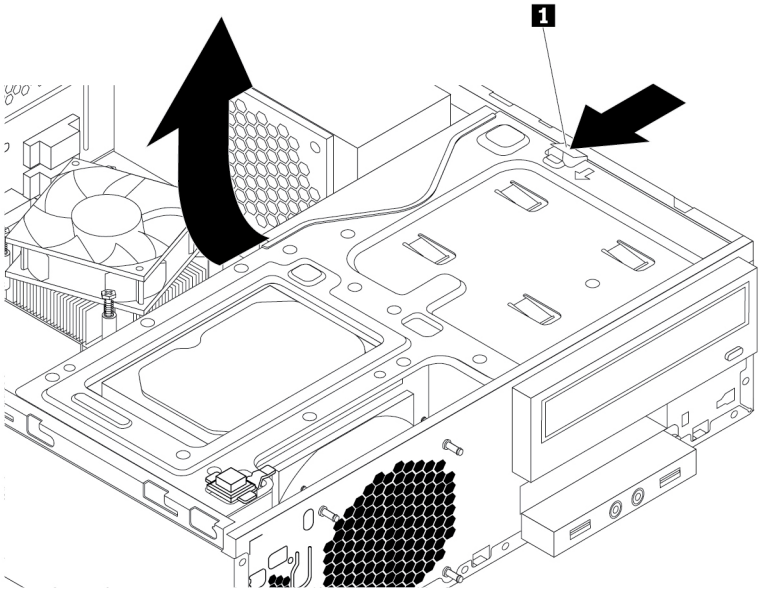


Figure 90. Pivoting the drive bay assembly upward

4. Locate the secondary hard disk drive. See “Computer components” on page 7.
5. Disconnect the signal cable and the power cable from the hard disk drive.
6. Remove the cable clip on the bottom of the primary hard-disk-drive bay as shown.

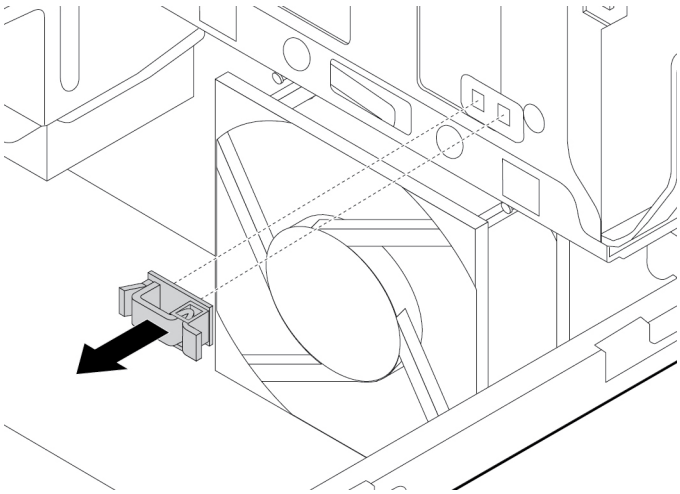


Figure 91. Removing the cable clip

7. Align the four holes in the secondary hard-disk-drive cage with the corresponding four tabs on the bottom of the bay as shown. Then, position the cage onto the bottom of the primary hard-disk-drive bay so that the tabs on the bay pass through the holes in the cage.

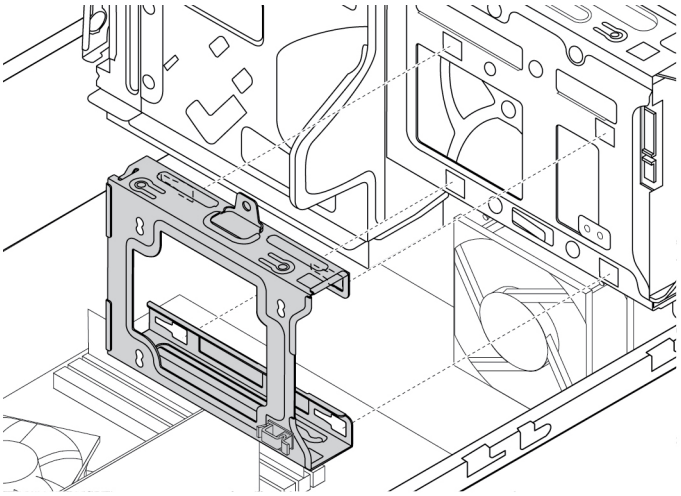


Figure 92. Positioning the cage onto the bottom of the primary hard-disk-drive bay

8. Slide the secondary hard-disk-drive cage to the left of the chassis until it snaps into position and the screw hole **1** in the cage is aligned with the screw hole **2** in the bay.

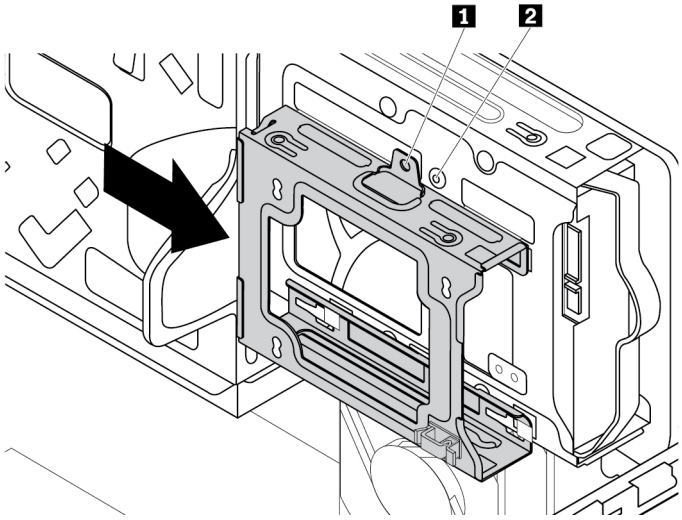


Figure 93. Installing the secondary hard-disk-drive cage

9. Install the screw to secure the secondary hard-disk-drive cage to the chassis.

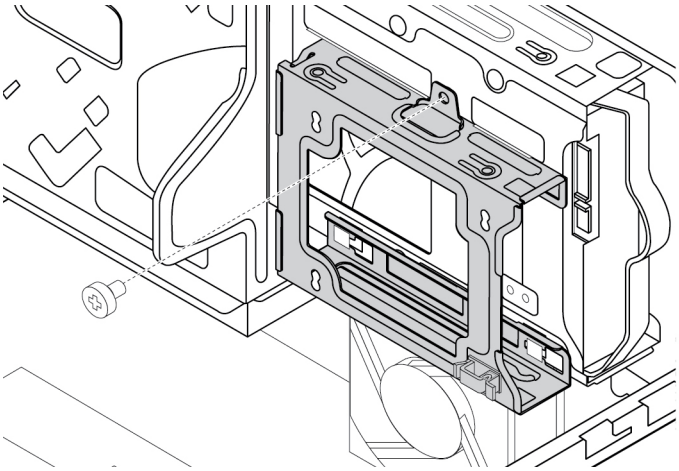


Figure 94. Installing the screw to secure the secondary hard disk drive cage

10. To install a new hard disk drive into the blue bracket, flex the bracket and align pin 1, pin 2, pin 3, and pin 4 on the bracket with the corresponding holes in the hard disk drive. Do not touch the circuit board 5 on the bottom of the hard disk drive.

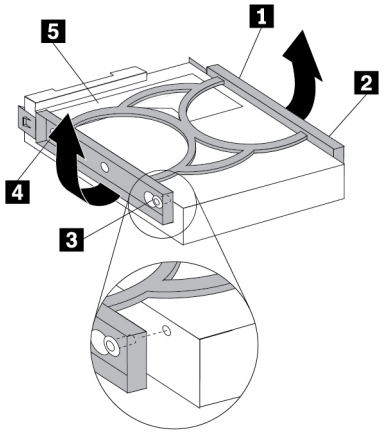


Figure 95. Installing the hard disk drive into the bracket

11. Slide the new secondary hard disk drive into the hard-disk-drive cage until it snaps into position.

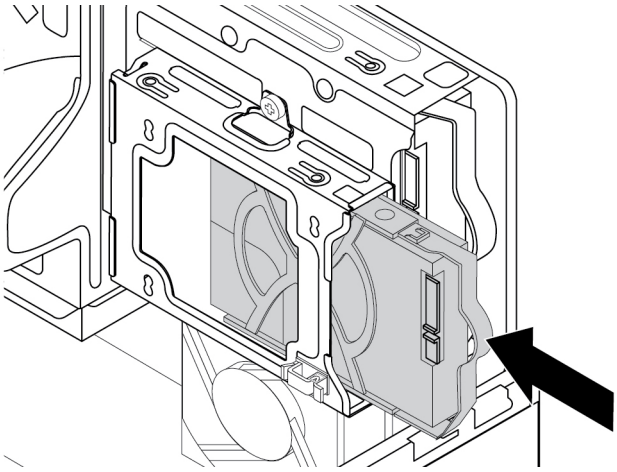


Figure 96. Installing the secondary hard disk drive

12. Connect the signal cable and the power cable to the new secondary hard disk drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Microprocessor

Attention: Before you replace any FRU, be sure to read and understand Chapter 1 “Read this first: Important safety information” on page 1.

CAUTION:

The heat sink and microprocessor might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the microprocessor, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Lay the computer on its side for easier access to the system board.
3. Locate the microprocessor and disconnect the cable connected to the heat sink and fan assembly. See “Parts on the system board” on page 11.
4. Remove the heat sink and fan assembly. See “Heat sink and fan assembly” on page 105.

   Note: Place the heat-sink-and-fan-assembly on its side so that the thermal grease on the bottom does not contact with anything.
5. Lift the small handle 1 and open the retainer 2 to access the microprocessor 3.

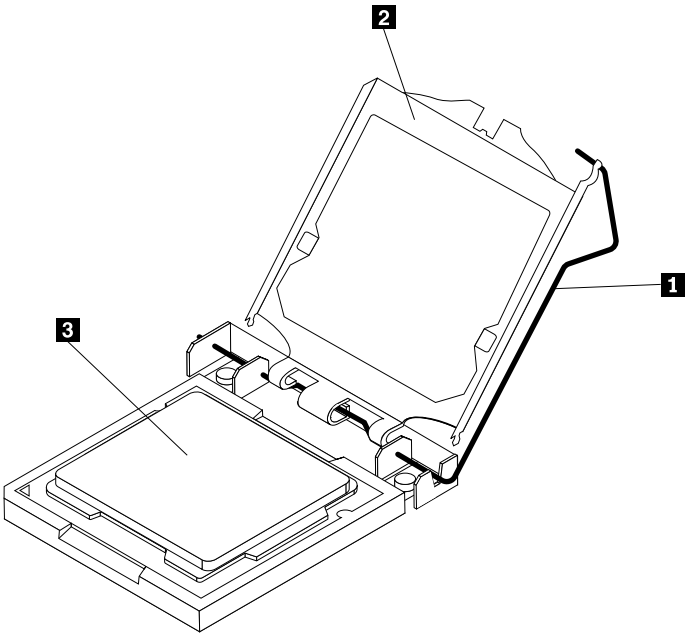


Figure 97. Accessing the microprocessor

6. Lift the microprocessor straight up and out of the microprocessor socket.

   Notes:

   - Your microprocessor and socket might look different from the one illustrated.
   - Touch only the edges of the microprocessor. Do not touch the gold contacts on the bottom.
   - Do not drop anything onto the microprocessor socket while it is exposed. The socket pins must be kept as clean as possible.

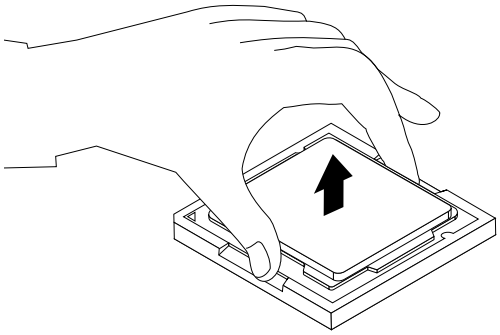


Figure 98. Removing the microprocessor

7. Ensure that the small handle is in the raised position and the microprocessor retainer is fully open.
8. Remove the protective cover that protects the gold contacts of the new microprocessor.
9. Note the orientation of the new microprocessor. Hold the new microprocessor by its edges and align the notches 1 on it with the tabs 2 in the microprocessor socket. Then, carefully lower the new microprocessor straight down into the microprocessor socket.

   Note: The small triangle 3 on one corner of the new microprocessor is the microprocessor orientation indicator. The new microprocessor is in the correct orientation when this indicator points to the beveled corner 4 of the microprocessor socket.

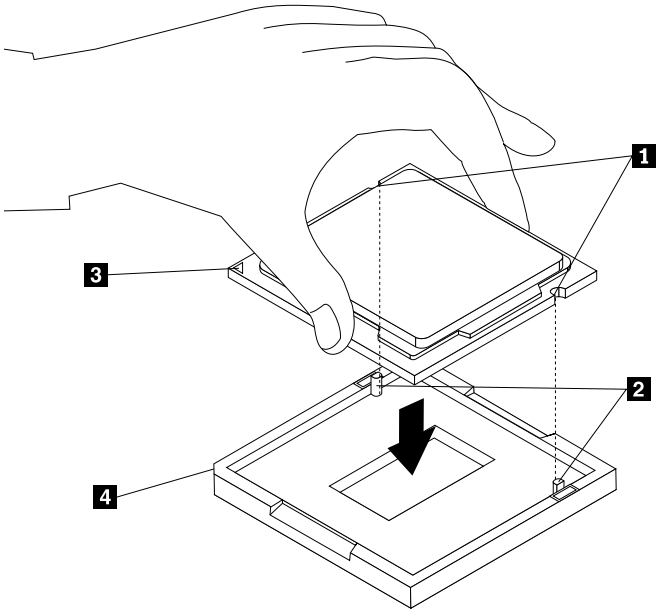


Figure 99. Installing the microprocessor

10. Close the microprocessor retainer and lock it into position with the small handle. Ensure that the new microprocessor is securely seated in the socket.
11. Reinstall the heat sink and fan assembly. See “Heat sink and fan assembly” on page 105.
12. Reconnect any cables that were disconnected from the system board.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 139.

System board

Attention: Before you replace any FRU, be sure to read and understand Chapter 1 “Read this first: Important safety information” on page 1.

CAUTION:

The heat sink and microprocessor might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the system board, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Lay the computer on its side for easier access to the system board.
3. Remove the front bezel. See “Front bezel” on page 70.
4. Press the release tab 1 as shown and pivot the drive bay assembly upward.

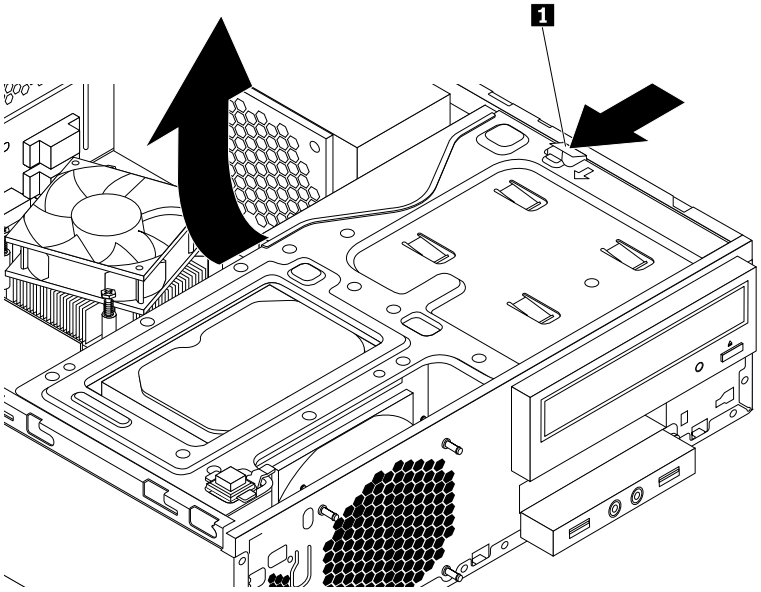


Figure 100. Pivoting the drive bay assembly upward

5. Remove all installed memory modules and PCIe cards. See “Memory module” on page 77 and “PCIe card” on page 71.
6. Remove the heat sink and fan assembly. See “Heat sink and fan assembly” on page 105.
7. Record the cable routing and cable connections and then disconnect all cables from the system board. See “Parts on the system board” on page 11.
8. Remove the eight screws that secure the system board in the sequence as shown.

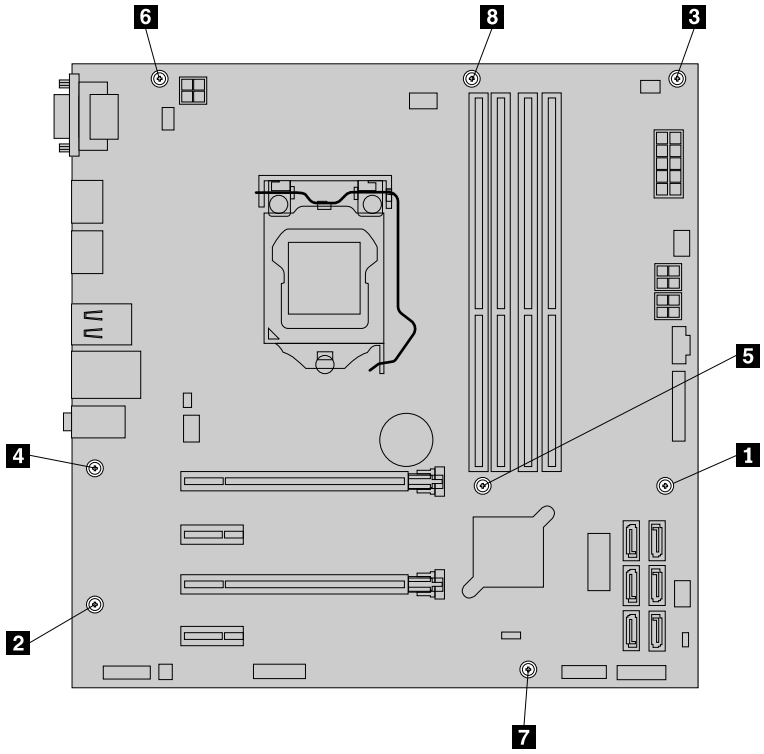


Figure 101. Removing the eight screws that secure the system board

9. Slide the system board to the front of the computer and then carefully lift the system board out of the chassis.
10. Remove the microprocessor from the failing system board and install it on the new system board. See “Microprocessor” on page 117.
11. Install the new system board into the chassis. Align the eight screw holes in the new system board with the corresponding mounting studs on the chassis. Then, install the eight screws in the sequence as shown to secure the new system board.

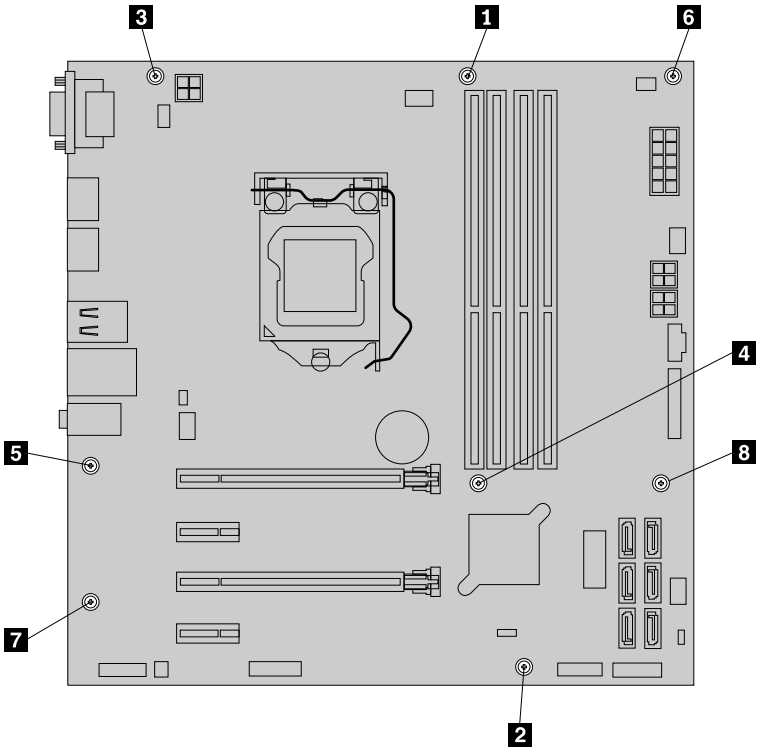


Figure 102. Installing the eight screws to secure the system board

12. Install the heat sink and fan assembly and connect its cable to the new system board. See “Heat sink and fan assembly” on page 105.
13. Install all memory modules and PCIe cards removed from the failing system board onto the new system board. See “Memory module” on page 77 and “PCIe card” on page 71.
14. Refer to your record to connect cables to the new system board. You also can refer to “Parts on the system board” on page 11 to help you locate the connectors on the system board and connect cables.
15. To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

The failing system board must be returned with a microprocessor socket cover to protect the pins during shipping and handling.

To install the microprocessor socket cover, do the following:

1. After you have removed the microprocessor from the failing system board, close the microprocessor retainer. Then put the small handle to the locked position to secure the retainer in place.
2. Note the orientation of the socket cover, and install one side of the socket cover into the microprocessor socket. Carefully press the other side of the socket cover downward until the socket cover snaps into position.

Note: Your microprocessor socket and cover might look slightly different from the illustration.

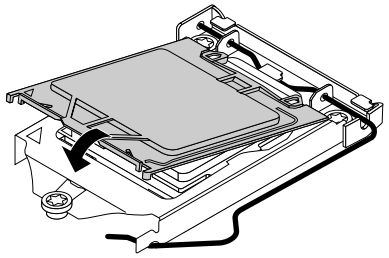


Figure 103. Installing the microprocessor socket cover

3. Carefully check the four corners of the socket cover to ensure that the cover is seated securely.
4. Follow any additional instructions that are included with the replacement part you received.

Front audio and USB assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

To replace the front audio and USB assembly, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Locate the front audio and USB assembly. See “Computer components” on page 7.
4. Press the release tab 1 as shown and pivot the drive bay assembly upward.

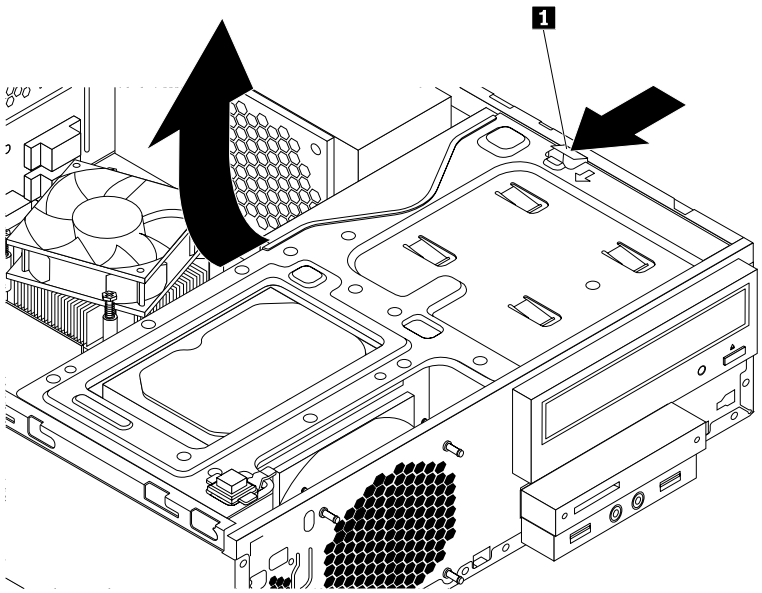


Figure 104. Pivoting the drive bay assembly upward

5. Disconnect the front audio and USB assembly cables from the system board. See “Parts on the system board” on page 11.

   Note: Ensure that you note the locations of the cables when you disconnect the cables from the system board.

6. Remove the screw that secures the front audio and USB assembly bracket to the chassis. Remove the bracket from the chassis.

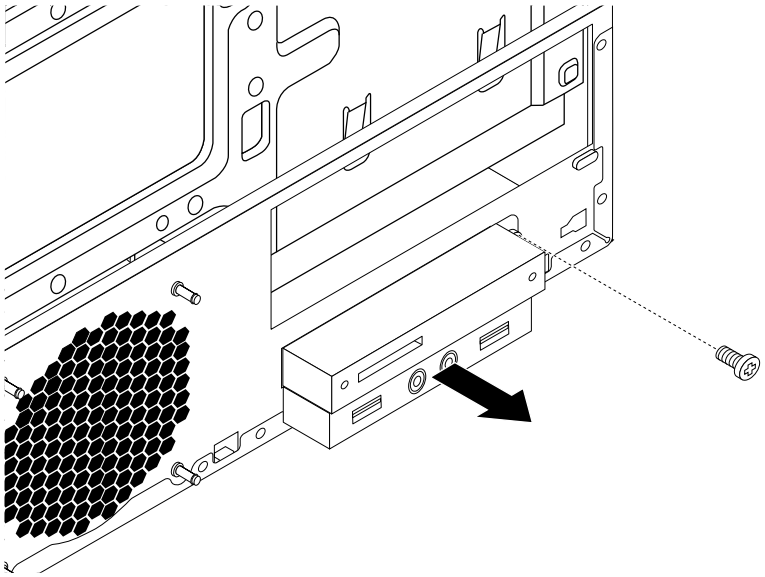


Figure 105. Removing the front audio and USB assembly

7. Remove the two screws that secure the front audio and USB assembly and remove the failing front audio and USB assembly from the bracket.
8. Install a new front audio and USB assembly into the bracket and install two screws to secure the front audio and USB assembly to the bracket.
9. Install the front audio and USB assembly bracket into the chassis and align the screw hole in the bracket with the corresponding hole in the chassis.
10. Install the screw to secure the bracket to the chassis.
11. Reconnect the front audio and USB assembly cables to the front audio connector and the front USB connector on the system board. See “Parts on the system board” on page 11.
12. Reinstall the front bezel. See “Front bezel” on page 70.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

System fan

Attention: Do not open your computer or attempt any repair before reading and understanding the Chapter 1 “Read this first: Important safety information” on page 1.

To replace the system fan, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Press the release tab 1 as shown and pivot the drive bay assembly upward.

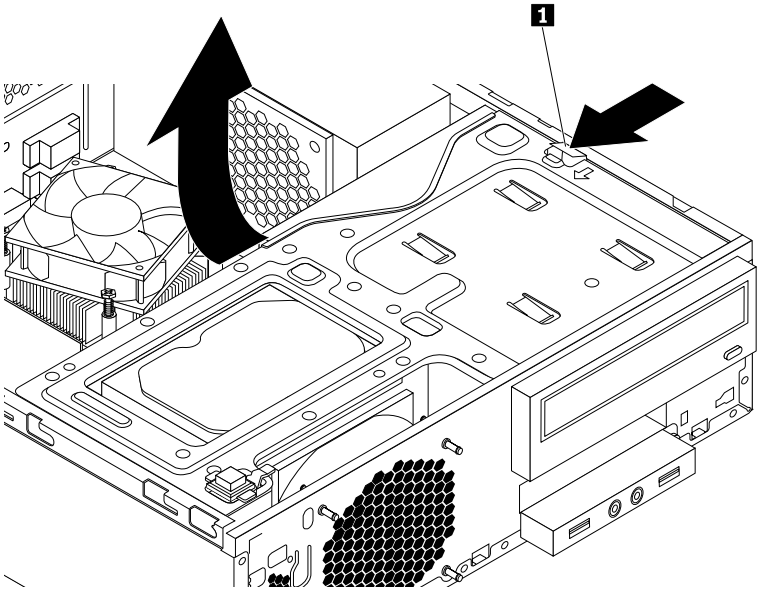


Figure 106. Pivoting the drive bay assembly upward

4. Disconnect the system fan cable from the power fan connector on the system board. See “Parts on the system board” on page 11.
5. The system fan is attached to the chassis by four rubber mounts. Remove the system fan by cutting the rubber mounts and lifting the system fan out of the chassis.

   Note: The new system fan comes with four new rubber mounts attached.

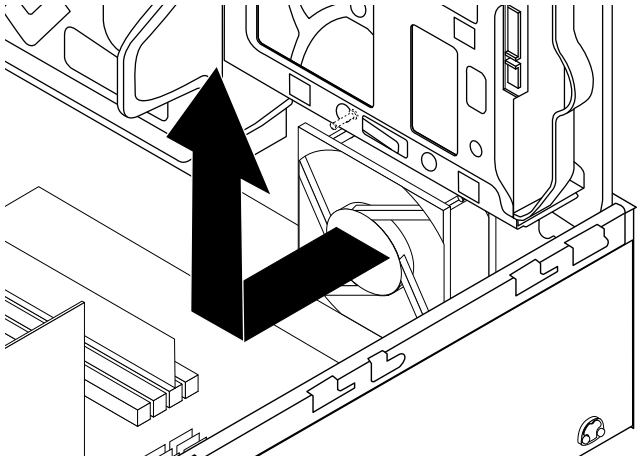


Figure 107. Removing the system fan

6. Install the new system fan by aligning the new rubber mounts (shipped with the new fan) with the corresponding holes in the chassis. Push the rubber mounts through the holes. Then, carefully pull on the tips of the rubber mounts from the bottom until the new system fan is secured in place.

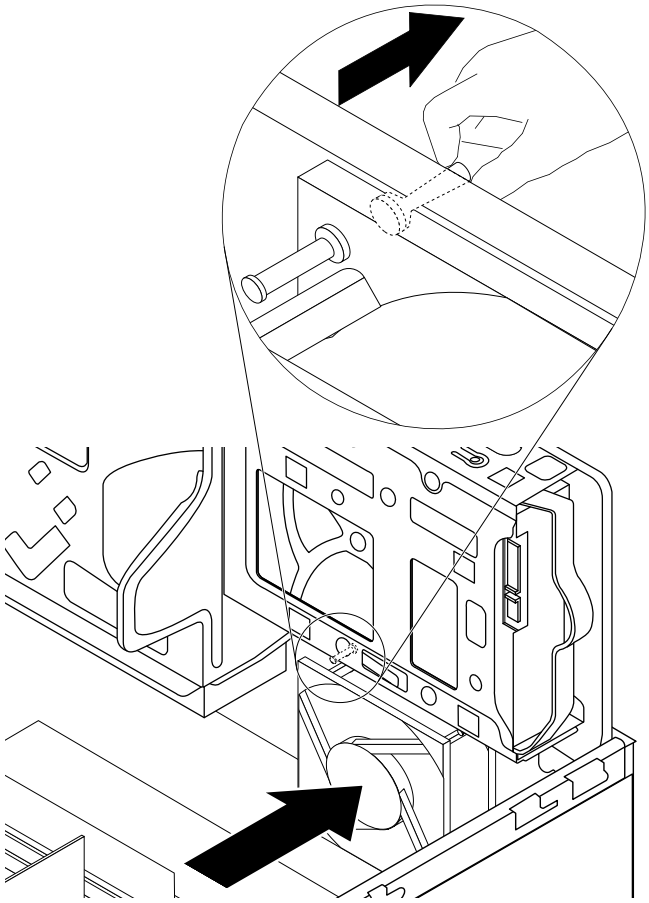


Figure 108. Installing the system fan

7. Connect the system fan cable to the power fan connector on the system board. See “Parts on the system board” on page 11.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Internal speaker

Attention: Before you replace any FRU, be sure to read and understand Chapter 1 “Read this first: Important safety information” on page 1.

To replace the internal speaker, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Press the release tab 1 as shown and pivot the drive bay assembly upward.

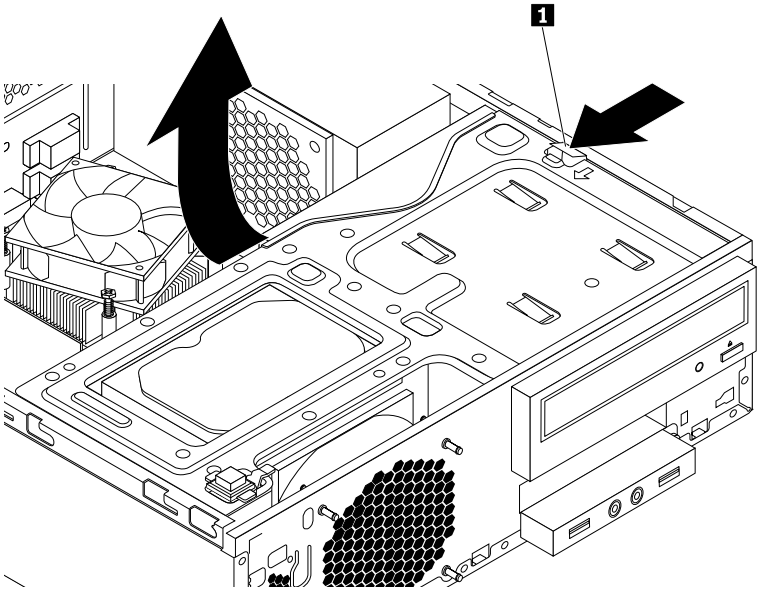


Figure 109. Pivoting the drive bay assembly upward

4. Locate and disconnect the internal speaker cable from the system board. See “Parts on the system board” on page 11.
5. Push the metal tab **1** outward and slide the internal speaker toward the system fan to remove it from the chassis.

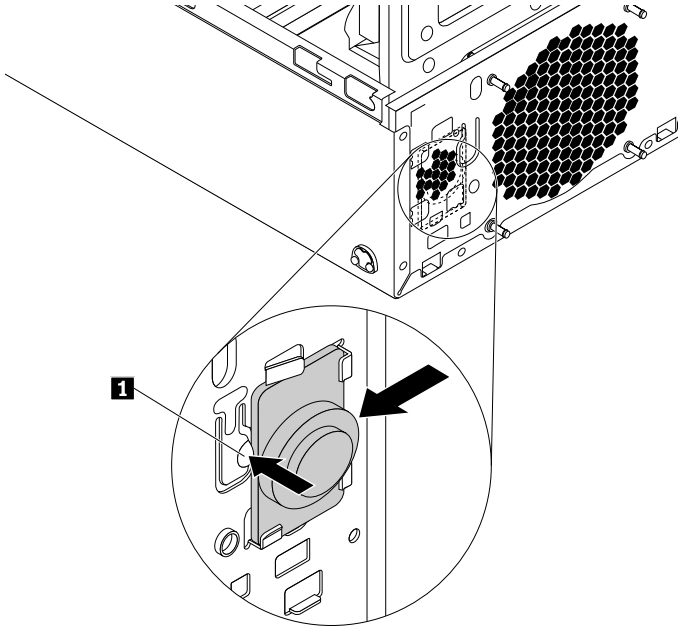


Figure 110. Removing the internal speaker

6. Position the new internal speaker into the four metal clips **1** and push the internal speaker towards the bottom of the chassis until it is secured in place.

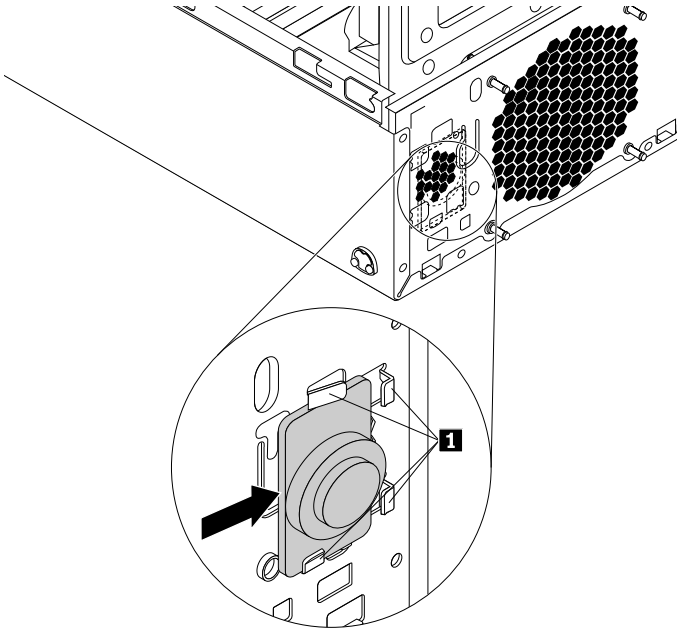


Figure 111. Installing the internal speaker

7. Connect the internal speaker cable to the internal speaker connector on the system board. See “Parts on the system board” on page 11.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Thermal sensor

Attention: Before you replace any FRU, be sure to read and understand Chapter 1 “Read this first: Important safety information” on page 1.

To replace the thermal sensor, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Disconnect the thermal sensor cable from the thermal sensor connector on the system board. See “Parts on the system board” on page 11.
4. From the inner side of the chassis, pivot the left retaining clip **1** that secures the plastic holder of the thermal sensor. Push the clip outward to release it and then disengage the plastic holder from the chassis. Pull the entire thermal sensor out of the chassis.

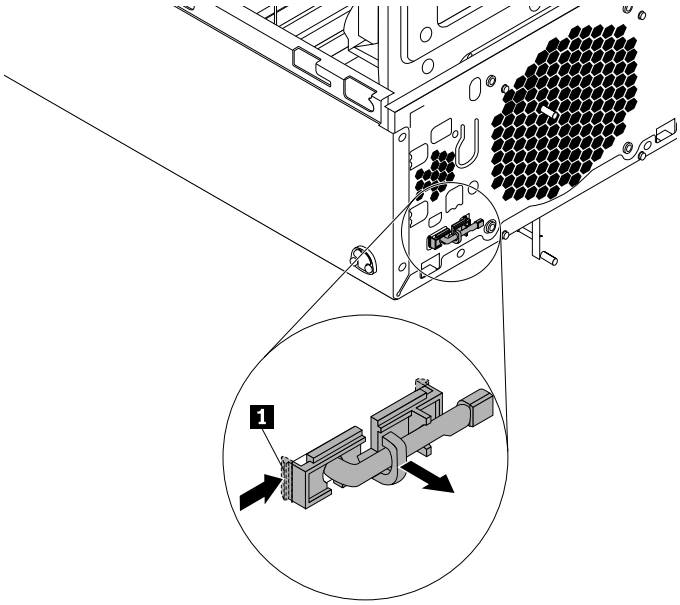


Figure 112. Removing the thermal sensor

5. Insert the cable of the new thermal sensor into the left hole **1** in the chassis. Then align the two tabs on the plastic holder with the two holes **1** and **2** in the chassis. Press the plastic holder until it snaps into position.

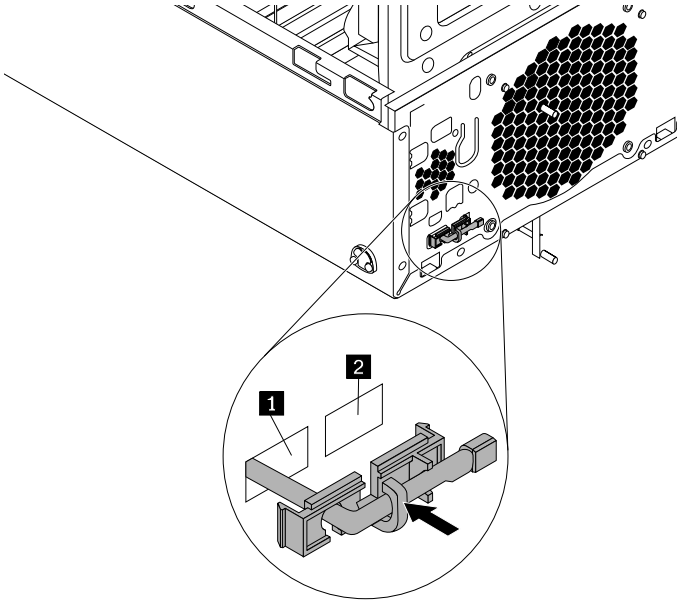


Figure 113. Installing the thermal sensor

6. Reconnect the thermal sensor cable to the thermal sensor connector on the system board. See “Parts on the system board” on page 11.
7. Reinstall the front bezel. See “Front bezel” on page 70.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Cover presence switch

Attention: Before you replace any FRU, be sure to read and understand Chapter 1 “Read this first: Important safety information” on page 1.

To replace the cover presence switch, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Disconnect the cover presence switch cable from the system board. See “Parts on the system board” on page 11.
4. Press the clip 1 as shown and lift the cover presence switch up to remove it from the chassis.

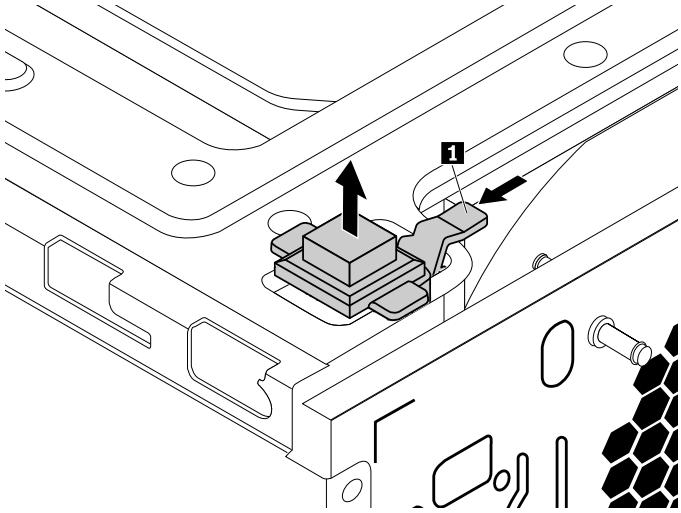


Figure 114. Removing the cover presence switch

5. Put the new cover presence switch into the hole and press it down until it snaps into position.

   Note: Pay attention to the orientation of the cover presence switch.

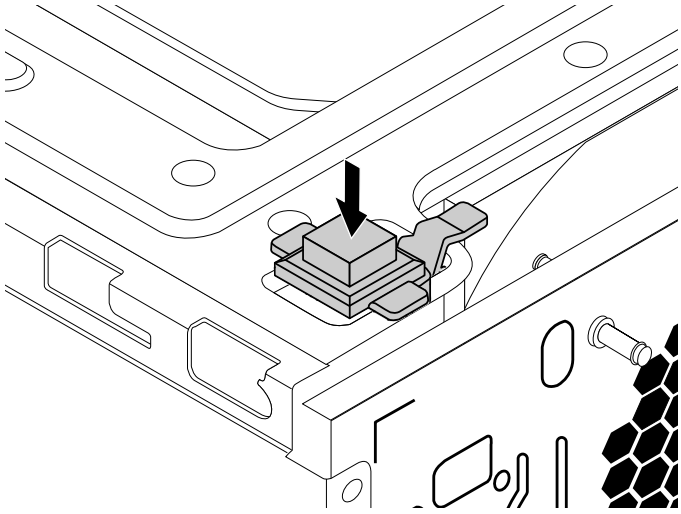


Figure 115. Installing the cover presence switch

6. Connect the cover presence switch cable to the cover presence switch connector on the system board. See “Parts on the system board” on page 11.
7. Reinstall the front bezel. See “Front bezel” on page 70.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Wi-Fi units

Attention: Before you replace any FRU, be sure to read and understand Chapter 1 “Read this first: Important safety information” on page 1.

This section provides instructions on how to replace the Wi-Fi units. The Wi-Fi units include a Wi-Fi adapter card, a Wi-Fi card module, a front Wi-Fi antenna, and a rear Wi-Fi antenna.

Replacing the Wi-Fi units involves the following operations:

- “Removing the Wi-Fi units” on page 130
- “Installing the Wi-Fi units” on page 134

Removing the Wi-Fi units

Front Wi-Fi antenna

To remove the front Wi-Fi antenna, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Locate the Wi-Fi adapter card installed in the PCIe card area. See “Parts on the system board” on page 11.
4. Disconnect the front antenna cable from the Wi-Fi card module.

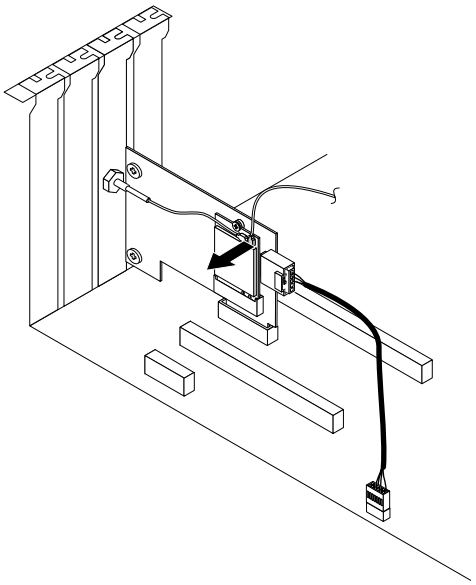


Figure 116. Disconnecting the front Wi-Fi antenna cable

5. Press the release tab 1 as shown and pivot the drive bay assembly upward.

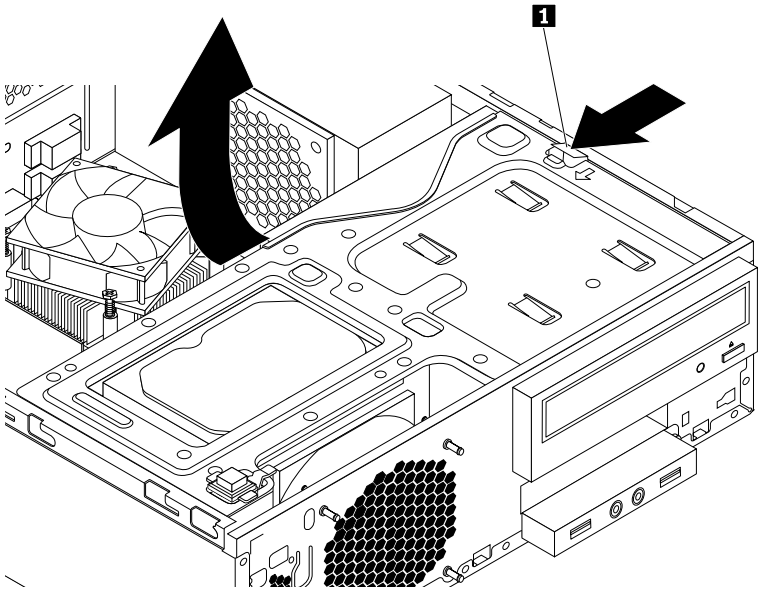


Figure 117. Pivoting the drive bay assembly upward

6. Disconnect the front antenna cable from the Wi-Fi card module.
7. Remove the front antenna and cable from the front of the computer.

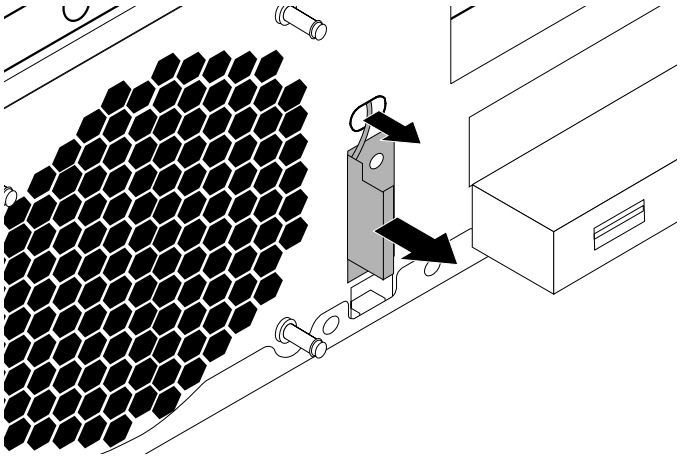


Figure 118. Removing the front Wi-Fi antenna

Rear Wi-Fi antenna

To remove the rear Wi-Fi antenna, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Straighten the rear Wi-Fi antenna so that it can be more easily twisted.
3. Locate the Wi-Fi adapter card installed in the PCIe card area. See “Parts on the system board” on page 11.
4. Hold the thicker end of the rear Wi-Fi antenna and unscrew the Wi-Fi antenna from the rear of the computer.

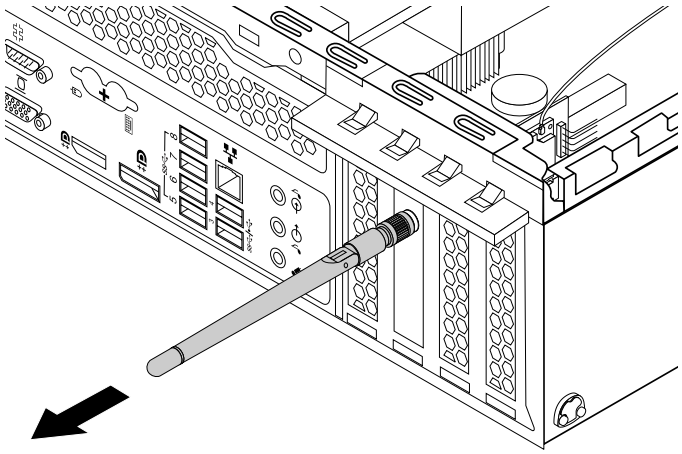


Figure 119. Removing the rear Wi-Fi antenna

Wi-Fi adapter card

To remove the Wi-Fi adapter card, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Preparing your computer and removing the computer cover” on page 69.
3. If your computer comes with a Wi-Fi card module that supports the Bluetooth function, disconnect the Bluetooth cable from the Wi-Fi adapter card.

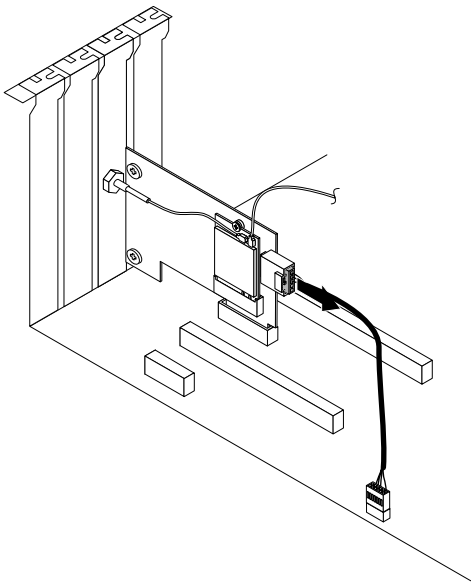


Figure 120. Disconnecting the Bluetooth cable

Note: The Bluetooth cable connects the Bluetooth connector on the Wi-Fi adapter card to the USB 2.0 connector on the system board.

4. Remove the rear Wi-Fi antenna. See “Rear Wi-Fi antenna” on page 131.
5. Grasp the Wi-Fi adapter card that is installed and gently pull it out of the slot.

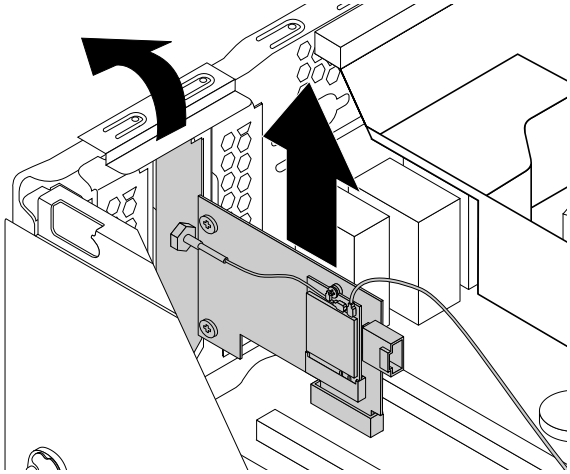


Figure 121. Removing the Wi-Fi adapter card

Note: The card fits tightly into the slot. If necessary, alternately move each side of the card a small amount until the card is removed from the slot.

Wi-Fi card module

To remove the Wi-Fi card module, do the following:

1. Remove the Wi-Fi adapter card from the computer. See “Wi-Fi adapter card” on page 132.
2. Disconnect the front and rear Wi-Fi antenna cables from the Wi-Fi card module.

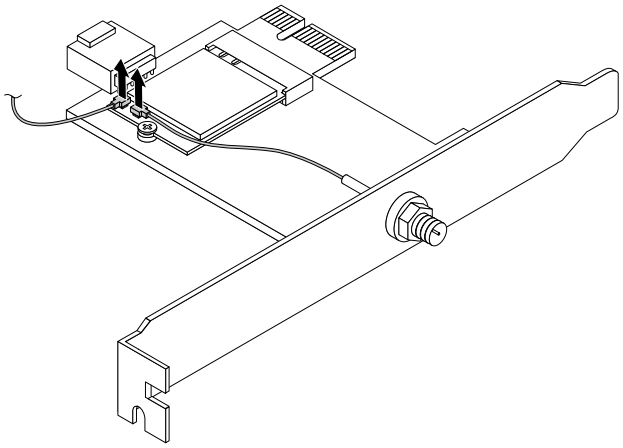


Figure 122. Disconnecting the Wi-Fi antenna cables

3. Remove the screw that secures the Wi-Fi card module to the Wi-Fi adapter card.

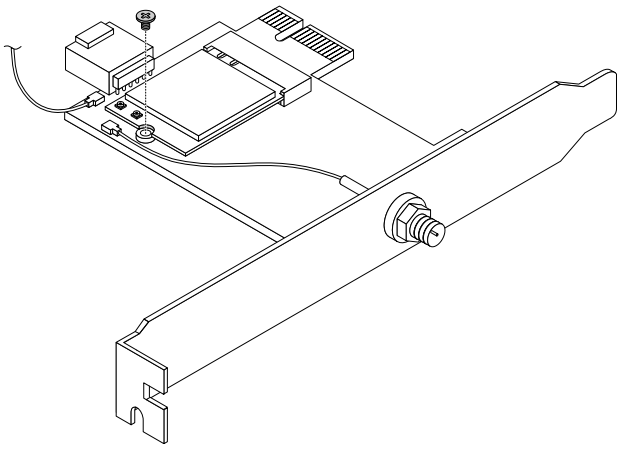


Figure 123. Removing the screw that secures the Wi-Fi card module

4. Pull the Wi-Fi card module out of the mini PCIe slot.

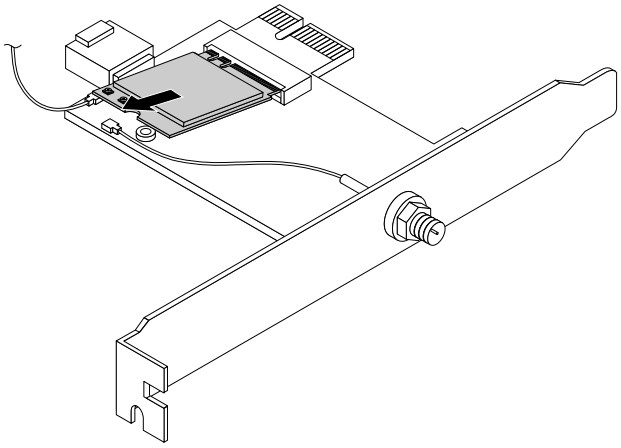


Figure 124. Removing the Wi-Fi card module

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Installing the Wi-Fi units

Front Wi-Fi antenna

To install the front Wi-Fi antenna, do the following:

1. Prepare your computer. See “Preparing your computer and removing the computer cover” on page 69.
2. Remove the front bezel. See “Front bezel” on page 70.
3. Press the release tab 1 as shown and pivot the drive bay assembly upward.

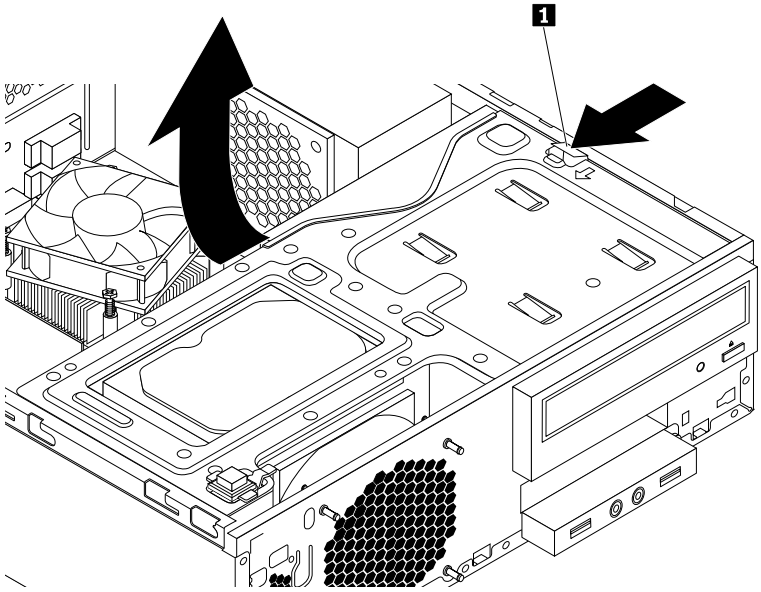


Figure 125. Pivoting the drive bay assembly upward

4. Peel off the paper that protects the sticker on the front antenna and remove the plastic cover from the front antenna cable connector.

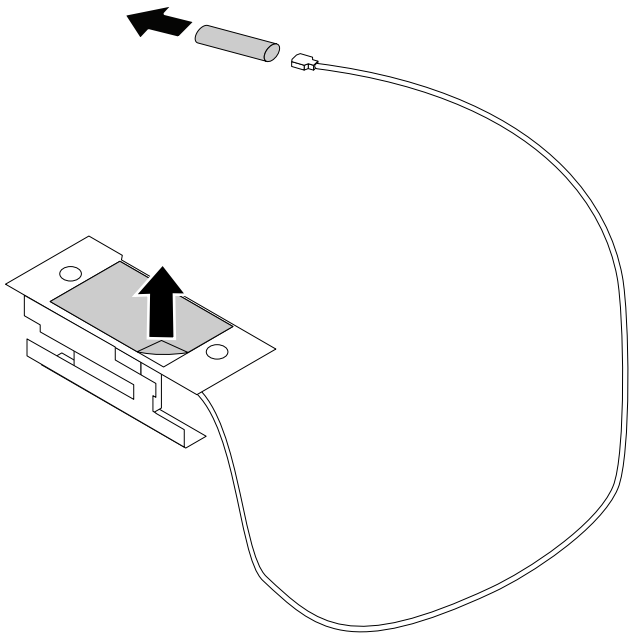


Figure 126. Peeling off the paper that protects the sticker and removing the plastic cover

5. Stick the front antenna to the front panel as shown. Then insert the front antenna cable into the hole in the front panel.

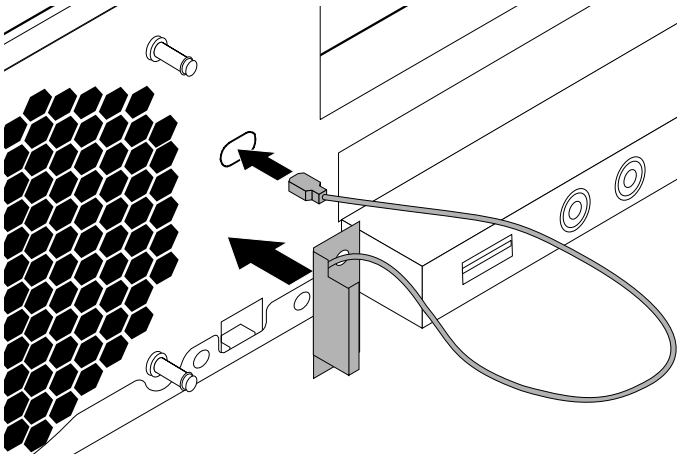


Figure 127. Installing the front Wi-Fi antenna

6. Connect the front antenna cable to the Wi-Fi card module.

Wi-Fi card module

To install the Wi-Fi card module, do the following:

1. Insert the Wi-Fi card module into the mini PCIe slot.

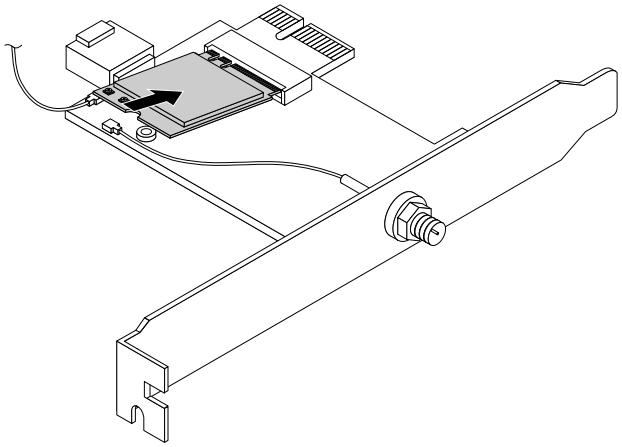


Figure 128. Installing the Wi-Fi card module

2. Install a screw to secure the Wi-Fi card module to the Wi-Fi adapter card.

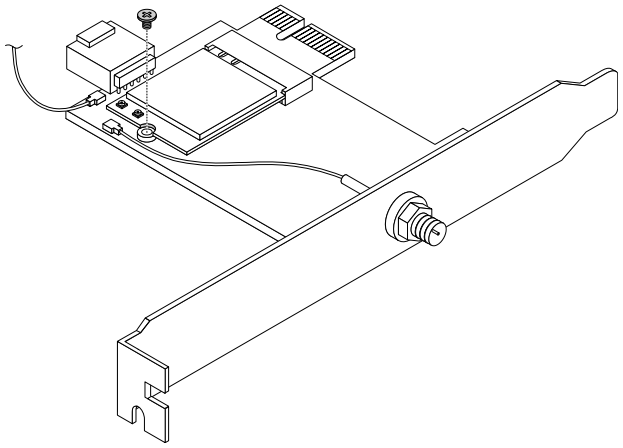


Figure 129. Installing a screw to secure the Wi-Fi card module

3. Connect the front and rear antenna cables to the Wi-Fi card module.

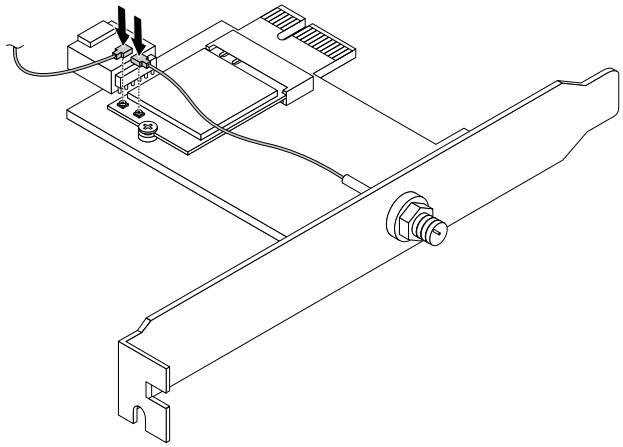


Figure 130. Installing the Wi-Fi antenna cables

Wi-Fi adapter card

To install the Wi-Fi adapter card, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Preparing your computer and removing the computer cover” on page 69.
3. Install the Wi-Fi adapter card into the PCIe x1 card slot on the system board. See “Parts on the system board” on page 11.
4. If the installed Wi-Fi card module supports the Bluetooth function, connect a Bluetooth cable from the Bluetooth connector on the Wi-Fi adapter card to the USB 2.0 connector on the system board.
5. Pivot the card latch to the closed position to secure the Wi-Fi adapter card.

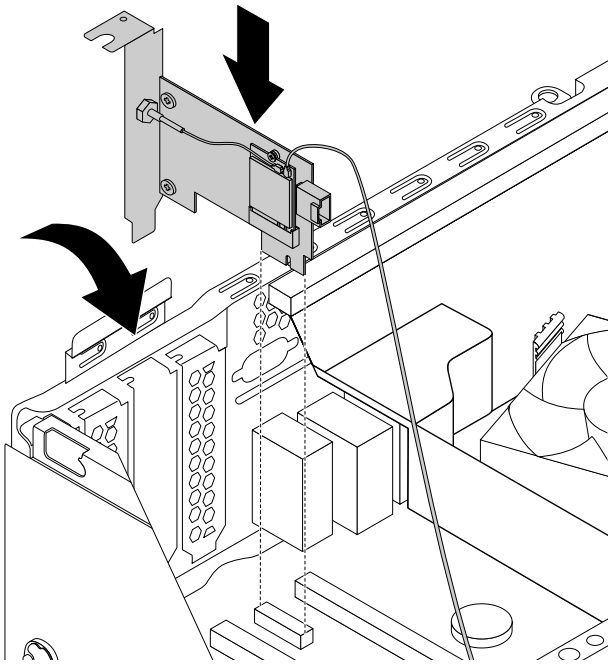


Figure 131. Installing the Wi-Fi adapter card

Rear Wi-Fi antenna

To install the rear Wi-Fi antenna, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Install the rear Wi-Fi antenna to the rear Wi-Fi antenna cable connector attached on the rear of the computer.
3. Adjust the angle of the rear antenna to avoid the risk of breaking the antenna by accident.

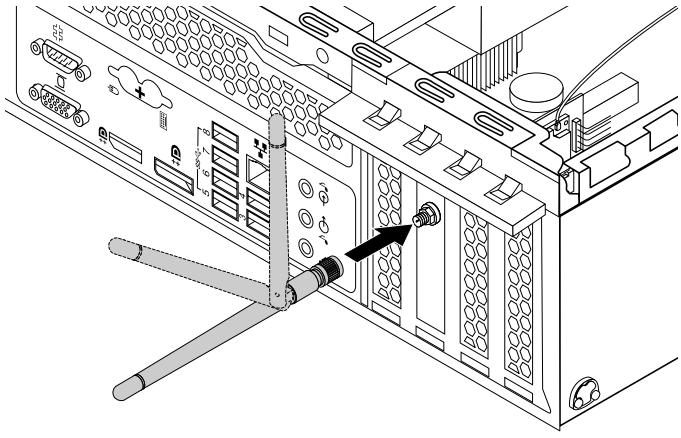


Figure 132. Installing the rear Wi-Fi antenna

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 139.

Completing the parts replacement

CAUTION:
After replacing a CRU, reinstall all protective covers, including the computer cover, before connecting power and operating the computer. This action is important to help prevent unexpected electrical shock and help ensure the containment of an unexpected fire that could happen under extremely rare conditions.

After completing the installation or replacement for all parts, reinstall the computer cover and reconnect cables. Depending on the parts you installed or replaced, you might need to confirm the updated information in the Setup Utility program. Refer to “Using the Setup Utility program” on page 39.

To reinstall the computer cover and reconnect cables to your computer, do the following:

1. Ensure that all components have been reassembled correctly and that no tools or loose screws are left inside your computer. See “Computer components” on page 7 for the locations of various components in your computer.
2. Ensure that the cables are routed correctly before reinstalling the computer cover. Keep cables clear of the hinges and sides of the computer chassis to avoid interference with reinstalling the computer cover.
3. Press the release tab 1 as shown and pivot the drive bay assembly downward until it snaps into position.

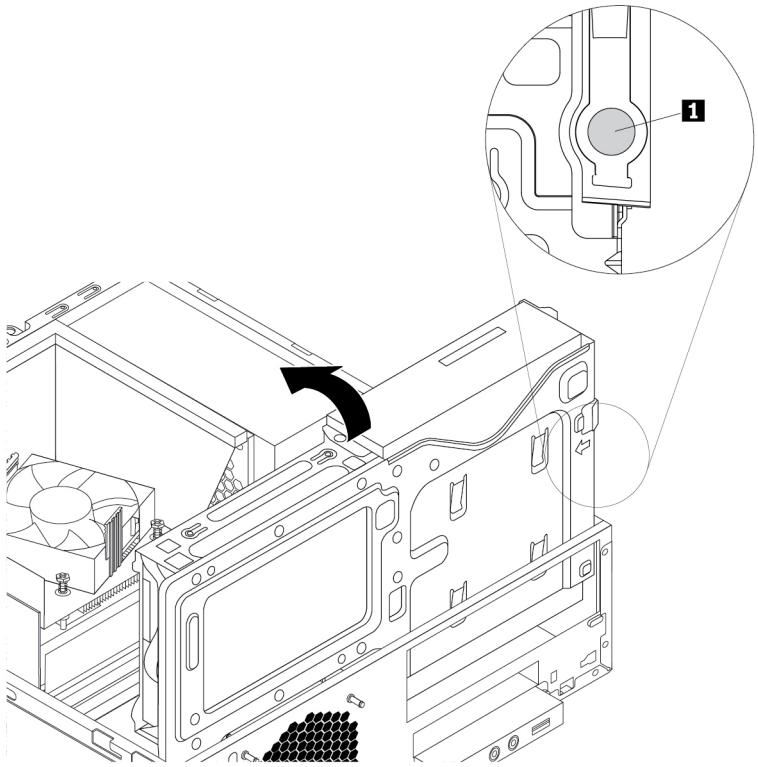


Figure 133. Pivoting the drive bay assembly downward

4. Position the computer cover on the chassis so that the rail guides on the bottom of the computer cover engage the rails on the chassis. Then, push the cover to the front of the computer until it snaps into position.

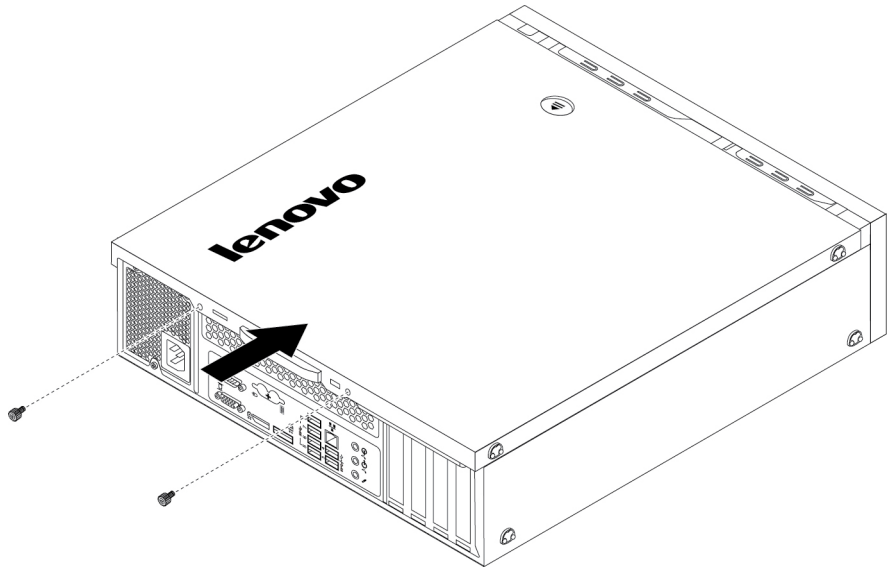


Figure 134. Reinstalling the computer cover

5. Install the screws to secure the computer cover.
6. Place the computer in an upright position.
7. If a locking device is available, lock the computer cover. See “Locking your computer” on page 33.
8. Reconnect the external cables and power cords to the corresponding connectors on the computer. See “Hardware locations” on page 3.
9. Update the configuration of your computer. See “Using the Setup Utility program” on page 39.
10. If a newly installed hardware component does not work correctly, update the device driver. See “Keeping your computer current” on page 30.

Chapter 9. Getting information, help, and service

This chapter provides information about getting help and support from Lenovo.

Information resources

You can use the information in this section to access useful resources relating to your computing needs.

Accessing the user guide in various languages

To access the user guide in various languages, go to:
http://www.lenovo.com/support

Windows help system

The Windows help system provides you with detailed information about using the Windows operating system.

To access the Windows help system, do the following:

1. Click the Start button to open the Start menu.
2. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Help and Support**. You can choose to use the online or offline help at the bottom of the screen.
   - For Windows 10: Click **Get Help**.

Note: Using online help for Windows 7 or the help for Windows 10 requires an active Internet connection.

Safety and warranty

The *Safety, Warranty, and Setup Guide* provided with your computer contains important safety information, product warranty terms, initial setup procedure, and legal notices. Ensure that you read and understand all safety information in the *Safety, Warranty, and Setup Guide* before using your computer.

In addition, read and understand Chapter 1 “Read this first: Important safety information” on page 1 before using your computer. This preface provides additional safety information that applies to topics and tasks described in this *User Guide*.

Lenovo Web site

The Lenovo Web site (http://www.lenovo.com) provides up-to-date information and services to help you buy, upgrade, and maintain your computer. You also can do the following:

- Shop for desktop and notebook computers, monitors, projectors, upgrades, and accessories for your computer, and special offers.
- Purchase additional services, such as support for hardware, operating systems, programs, network setup and configuration, and custom installations.
- Purchase upgrades and extended hardware repair services.
- Access troubleshooting and support information for your computer model and other supported products.
- Find a Service Provider located near you.

Lenovo Support Web site

Technical support information is available on the Lenovo Support Web site at:
http://www.lenovo.com/support

This Web site is updated with the latest support information such as the following:

- Drivers and software
- Diagnostic solutions
- Product and service warranty
- Product and parts details
- User guides and manuals
- Knowledge base and frequently asked questions
- Lenovo Support phone numbers

Frequently asked questions

For the answers to frequently asked questions about your computer, go to:
http://www.lenovo.com/support/faq

Help and service

This section provides information about obtaining help and service.

Calling for service

During the warranty period, you can get help and information by telephone through the Customer Support Center. For the warranty period of your computer, go to http://www.lenovo.com/warranty-status. For a list of Lenovo Support phone numbers, go to http://www.lenovo.com/support/phone.

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.

The following services are available during the warranty period:

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

These items are not covered by the warranty:
- Replacement or use of parts not manufactured for or by Lenovo or non-warranted Lenovo parts
- Identification of software problem sources
- Configuration of 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

If possible, be at your computer when you call. Have the following information available:
- Machine type and model
- Serial numbers of your hardware products

- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

Using other services

You might travel with your computer or relocate it to a country or region where the machine type for your desktop or notebook computer is sold. In such a situation, your computer might be eligible for International Warranty Service, which automatically entitles you to obtain warranty service throughout the warranty period. Service will be performed by service providers authorized to perform warranty service.

Service methods and procedures vary by country, and some services might not be available in all countries. International Warranty Service is delivered through the method of service (such as depot, carry-in, or on-site service) that is provided in the servicing country. Service centers in certain countries might not be able to service all models of a particular machine type. In some countries, fees and restrictions might apply at the time of service.

To determine whether your computer is eligible for International Warranty Service and to view a list of the countries or regions where service is available, go to http://www.lenovo.com/support.

For technical assistance with the installation of or questions related to Service Packs for your preinstalled Microsoft Windows product, go to http://support.microsoft.com. You also can contact the Lenovo Customer Support Center for help. Some fees might apply.

Purchasing additional services

During and after the warranty period, you can purchase additional services. Examples of these additional services include:

- Support for hardware, operating systems, and programs
- Network setup and configuration services
- Upgraded or extended hardware repair services
- Custom installation services

Service availability and service name might vary by country or region. For more information about these services, go to the Lenovo Web site at:
http://www.lenovo.com

Appendix A. System memory speed

The Intel Xeon®, Intel Core™, and Intel Pentium® microprocessor families compatible with this ThinkStation computer feature an integrated memory controller. The memory controller provides the microprocessor with direct access to the system memory. Therefore, the system memory speed will be determined by the memory module type, frequency, size (capacity), the number of memory modules installed, and the microprocessor model.

Refer to the following information about the system memory modules:

- **Memory module type**: DDR4 UDIMM
- **Memory module operating voltage**: 1.2 V
- **Memory module frequency**: 2400 MT/s
- **Microprocessor model**:
  - **Intel Xeon**:
    - For models with the Windows 10 operating system: E3-1280 v6, E3-1275 v6, E3-1270 v6, E3-1245 v6, E3-1240 v6, E3-1230 v6, E3-1225 v6, E3-1220 v6
    - For models with the Window 7 operating system: E3-1245 v5, E3-1240 v5, E3-1230 v5, E3-1225 v5, E3-1220 v5
  - **Intel Pentium** (for models with the Windows 10 operating system): G4560
  - **Intel Core**:
    - For models with the Windows 10 operating system: i7-7700K, i7-7700, i5-7600, i5-7500, i5-7400, i3-7300, i3-7100
    - For models with the Windows 7 operating system: i7-6700, i5-6500, i5-6400, i3-6100

Appendix B. 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.

Accessing 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:
http://www.lenovo.com/warranty/llw_02

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

```
/usr/share/doc/lenovo-doc
```

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.

Accessing the Ubuntu help system

The Ubuntu help system provides information about how to use the Ubuntu operating system. To access the help system from the Unity, 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, and type Help to search it.

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

Getting 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, Warranty, and Setup Guide*.

To access the latest *User Guide* and *Safety, Warranty, and Setup Guide*, go to:
http://www.lenovo.com/support

Note: For information about configuring RAID in the Linux® environment, contact your Linux software provider.

Appendix C. Regulatory information

The latest compliance information is available at:
http://www.lenovo.com/compliance

Export classification notice

This product is subject to the United States Export Administration Regulations (EAR) and has an Export Classification Control Number (ECCN) of 5A992.c. It can be re-exported except to any of the embargoed countries in the EAR E1 country list.

Electronic emissions notices

Federal Communications Commission Declaration of Conformity

The following information refers to Lenovo personal computer machine types 30BJ, 30BK, and 30BS.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an authorized dealer or service representative for help.

Lenovo is not responsible for any radio or television interference caused by using other than specified or recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party:
Lenovo (United States) Incorporated
1009 Think Place - Building One
Morrisville, NC 27560
Phone Number: 919-294-5900

Industry Canada Class B emission compliance statement

CAN ICES-3(B)/NMB-3(B)

European Union conformity

EU contact: Lenovo, Einsteinova 21, 851 01 Bratislava, Slovakia

Models without a radio device: This product is in conformity with the protection requirements of EU Council EMC Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility.

Models with a radio device: This product is in conformity with all the requirements and essential norms that apply to EU Council Radio Equipment Directive 1999/5/EC (until June 12, 2017) and Council Radio Equipment Directive 2014/30/EU (from June 13, 2017) on the approximation of the laws of the Member States relating to radio equipment. The full text of the system EU declaration of conformity and the EU wireless module declarations are available at the following Internet address: http://www3.lenovo.com/us/en/social_responsibility/EU_DoC_workstations/

Lenovo cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the installation of option cards from other manufacturers. This product has been tested and found to comply with the limits for Class B equipment according to European Standards harmonized in the Directives in compliance. The limits for Class B equipment were derived for typical residential environments to provide reasonable protection against interference with licensed communication devices.

German Class B compliance statement

Deutschsprachiger EU Hinweis:

Hinweis für Geräte der Klasse B EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der Klasse B der Norm gemäß Richtlinie.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der Lenovo empfohlene Kabel angeschlossen werden. Lenovo übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung der Lenovo verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung der Lenovo gesteckt/eingebaut werden.

Deutschland:

Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Betriebsmitteln

Dieses Produkt entspricht dem „Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln“ EMVG (früher „Gesetz über die elektromagnetische Verträglichkeit von Geräten“). Dies ist die Umsetzung der EMV EU Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln, EMVG vom 20. Juli 2007 (früher Gesetz über die elektromagnetische Verträglichkeit von Geräten), bzw. der EMV EU Richtlinie 2014/30/EU (früher 2004/108/EC), für Geräte der Klasse B.

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen. Verantwortlich für die Konformitätserklärung nach Paragraf 5 des EMVG ist die Lenovo (Deutschland) GmbH, Meitnerstr. 9, D-70563 Stuttgart.

Informationen in Hinsicht EMVG Paragraf 4 Abs. (1) 4:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55032 Klasse B.

Korean wireless-radio compliance information

무선설비 전파 혼신 (사용주파수 **2400**～**2483.5**, **5725**～**5825** 무선제품해당)
해당 무선설비가 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없음

Japan VCCI Class B compliance statement

この装置は、クラスB情報技術装置です。この装置は家庭環境で使用する事を目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。取扱書に従って正しい取り扱いをして下さい。

VCCI-B

Japan compliance statement for products which connect to the power mains with rated current less than or equal to 20 A per phase

日本の定格電流が 20A/相 以下の機器に対する高調波電流規制
高調波電流規格 JIS C 61000-3-2 適合品

Japan notice for ac power cord

The ac power cord shipped with your product can be used only for this specific product. Do not use the ac power cord for other devices.

本製品およびオプションに電源コード・セットが付属する場合は、
それぞれ専用のものになっていますので他の電気機器には使用し
ないでください。

Lenovo product service information for Taiwan

委製商/進口商名稱: 荷蘭商聯想股份有限公司台灣分公司
進口商地址: 台北市內湖區堤頂大道2段89號5樓
進口商電話: 0800-000-702 (代表號)

Keyboard and mouse compliance statement for Taiwan

本產品隨貨附已取得經濟部標準檢驗局認可之PS/2或USB的鍵盤與滑鼠一組

Eurasian compliance mark

EAC

Brazil audio notice

Ouvir sons com mais de 85 decibéis por longos períodos pode provocar danos ao sistema auditivo.

Mexico wireless-radio compliance information

Advertencia: En Mexico la operación de este equipo estásujeta a las siguientes dos condiciones: (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

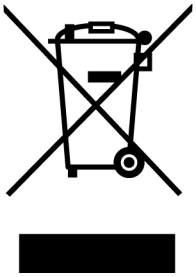
Additional regulatory information

For additional regulatory information, refer to the *Regulatory Notice* shipped with your computer. Depending on the configuration of your computer and the country or region where the computer was purchased, you might have received additional printed regulatory notices. All regulatory notices are available on the Lenovo Support Web site in electronic format. To access electronic copies of the documentation, go to http://www.lenovo.com/support.

Appendix D. WEEE and recycling information

Lenovo encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. Lenovo offers various programs and services to assist equipment owners in recycling their IT products. The latest environmental information is available at:
http://www.lenovo.com/ecodeclaration

Important WEEE information



The WEEE marking on Lenovo products applies to countries with WEEE and e-waste regulations (for example, the European WEEE Directive, India E-Waste Management Rules). Appliances are labeled in accordance with local regulations concerning waste electrical and electronic equipment (WEEE). These regulations determine the framework for the return and recycling of used appliances as applicable within each geography. This label is applied to various products to indicate that the product is not to be thrown away, but rather put in the established collection systems for reclaiming these end of life products.

Users of electrical and electronic equipment (EEE) with the WEEE marking must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to them for the return, recycle, and recovery of WEEE and to minimize any potential effects of EEE on the environment and human health due to the presence of hazardous substances. Lenovo electrical and electronic equipment (EEE) may contain parts and components, which at end-of-life might qualify as hazardous waste.

EEE and waste electrical and electronic equipment (WEEE) can be delivered free of charge to the place of sale or any distributor that sells electrical and electronic equipment of the same nature and function as the used EEE or WEEE.

For additional WEEE information, go to:
http://www.lenovo.com/recycling

WEEE information for Hungary

Lenovo, as a producer, bears the cost incurred in connection with the fulfillment of Lenovo's obligations under Hungary Law No. 197/2014 (VIII.1.) subsections (1)-(5) of section 12.

Recycling information for Japan

Collecting and recycling a disused Lenovo computer or monitor

If you are a company employee and need to dispose of a Lenovo computer or monitor that is the property of the company, you must do so in accordance with the Law for Promotion of Effective Utilization of Resources. Computers and monitors are categorized as industrial waste and should be properly disposed of by an industrial waste disposal contractor certified by a local government. In accordance with the Law for

Promotion of Effective Utilization of Resources, Lenovo Japan provides, through its PC Collecting and Recycling Services, for the collecting, reuse, and recycling of disused computers and monitors. For details, visit the Lenovo Web site at http://www.lenovo.com/recycling/japan. Pursuant to the Law for Promotion of Effective Utilization of Resources, the collecting and recycling of home-used computers and monitors by the manufacturer was begun on October 1, 2003. This service is provided free of charge for home-used computers sold after October 1, 2003. For details, visit the Lenovo Web site at http://www.lenovo.com/recycling/japan.

Disposing of Lenovo computer components

Some Lenovo computer products sold in Japan may have components that contain heavy metals or other environmental sensitive substances. To properly dispose of disused components, such as a printed circuit board or drive, use the methods described above for collecting and recycling a disused computer or monitor.

Disposing of disused lithium batteries from Lenovo computers

A button-shaped lithium battery is installed inside your Lenovo computer to provide power to the computer clock while the computer is off or disconnected from the main power source. If you need to replace it with a new one, contact your place of purchase or contact Lenovo for service. If you need to dispose of a disused lithium battery, insulate it with vinyl tape, contact your place of purchase or an industrial-waste-disposal operator, and follow their instructions. Disposal of a lithium battery must comply with local ordinances and regulations.

Recycling information for Brazil

Declarações de Reciclagem no Brasil

Descarte de um Produto Lenovo Fora de Uso

Equipamentos elétricos e eletrônicos não devem ser descartados em lixo comum, mas enviados à pontos de coleta, autorizados pelo fabricante do produto para que sejam encaminhados e processados por empresas especializadas no manuseio de resíduos industriais, devidamente certificadas pelos orgãos ambientais, de acordo com a legislação local.

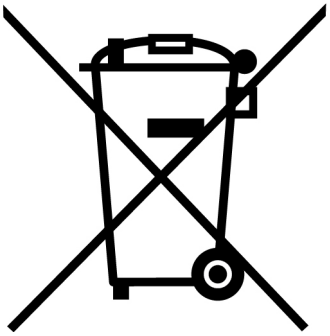
A Lenovo possui um canal específico para auxiliá-lo no descarte desses produtos. Caso você possua um produto Lenovo em situação de descarte, ligue para o nosso SAC ou encaminhe um e-mail para: reciclar@lenovo.com, informando o modelo, número de série e cidade, a fim de enviarmos as instruções para o correto descarte do seu produto Lenovo.

Battery recycling information for Taiwan

廢電池請回收

Battery recycling information for the European Union

EU



Notice: This mark applies only to countries within the European Union (EU).

Batteries or packaging for batteries are labeled in accordance with European Directive 2006/66/EC concerning batteries and accumulators and waste batteries and accumulators. The Directive determines the framework for the return and recycling of used batteries and accumulators as applicable throughout the European Union. This label is applied to various batteries to indicate that the battery is not to be thrown away, but rather reclaimed upon end of life per this Directive.

In accordance with the European Directive 2006/66/EC, batteries and accumulators are labeled to indicate that they are to be collected separately and recycled at end of life. The label on the battery may also include a chemical symbol for the metal concerned in the battery (Pb for lead, Hg for mercury, and Cd for cadmium). Users of batteries and accumulators must not dispose of batteries and accumulators as unsorted municipal waste, but use the collection framework available to customers for the return, recycling, and treatment of batteries and accumulators. Customer participation is important to minimize any potential effects of batteries and accumulators on the environment and human health due to the potential presence of hazardous substances.

Before placing electrical and electronic equipment (EEE) in the waste collection stream or in waste collection facilities, the end user of equipment containing batteries and/or accumulators must remove those batteries and accumulators for separate collection.

Disposing of lithium batteries and battery packs from Lenovo products

A coin-cell type lithium battery might be installed inside your Lenovo product. You can find details about the battery in the product documentation. If the battery needs to be replaced, contact your place of purchase or contact Lenovo for service. If you need to dispose of a lithium battery, insulate it with vinyl tape, contact your place of purchase or a waste-disposal operator, and follow their instructions.

Disposing of battery packs from Lenovo products

Your Lenovo device might contain a lithium-ion battery pack or a nickel metal hydride battery pack. You can find details on the battery pack in the product documentation. If you need to dispose of a battery pack, insulate it with vinyl tape, contact Lenovo sales, service, or your place of purchase, or a waste-disposal operator, and follow their instructions. You also can refer to the instructions provided in the user guide for your product.

For proper collection and treatment, go to:
http://www.lenovo.com/environment

Appendix E. Restriction of Hazardous Substances (RoHS) Directive

The latest environmental information is available at:
http://www.lenovo.com/ecodeclaration

European Union RoHS

This Lenovo product, with included parts (cables, cords, and so on) meets the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (“RoHS recast” or “RoHS 2”).

For more information about Lenovo worldwide compliance on RoHS, go to:
www.lenovo.com/rohs-communication

China RoHS

产品中有害物质的名称及含量

部件名称	有害物质					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬 (Cr(VI))	多溴连苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板组件*	X	O	O	O	O	O
硬盘	X	O	O	O	O	O
光驱	X	O	O	O	O	O
内存	X	O	O	O	O	O
电脑I/O 附件	X	O	O	O	O	O
电源	X	O	O	O	O	O
键盘	X	O	O	O	O	O
鼠标	X	O	O	O	O	O
机箱/ 附件	X	O	O	O	O	O
电池	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制。
O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。
注：表中标记“×”的部件，皆因全球技术发展水平限制而无法实现有害物质的替代。
印刷电路板组件*：包括印刷电路板及其零部件、电容和连接器
根据型号的不同，可能不会含有以上的所有部件，请以实际购买机型为准

在中华人民共和国境内销售的电子信息产品必须标识此标志，标志内的数字代表在正常使用状态下的产品的环保使用期限

Turkish RoHS

The Lenovo product meets the requirements of the Republic of Turkey Directive on the Restriction of the Use of Certain Hazardous Substances in Waste Electrical and Electronic Equipment (WEEE).

Türkiye EEE Yönetmeliğine Uygunluk Beyanı

Bu Lenovo ürünü, T.C. Çevre ve Orman Bakanlığı'nın “Elektrik ve Elektronik Eşyalarda Bazı Zararlı Maddelerin Kullanımının Sınırlandırılmasına Dair Yönetmelik (EEE)” direktiflerine uygundur.

EEE Yönetmeliğine Uygundur.

Ukraine RoHS

Цим підтверджуємо, що продукція Леново відповідає вимогам нормативних актів України, які обмежують вміст небезпечних речовин

India RoHS

RoHS compliant as per E-Waste (Management) Rules.

Taiwan RoHS

單元	限用物質及其化學符號					
	鉛 (Pb)	汞 (Hg)	鎘 (Cd)	六價鉻 (Cr^{+6})	多溴聯苯 (PBB)	多溴二苯醚 (PBDE)
印刷電路板組件	－	○	○	○	○	○
硬碟	－	○	○	○	○	○
光碟機	－	○	○	○	○	○
記憶體	－	○	○	○	○	○
電腦I/O配件	－	○	○	○	○	○
電源供應器	－	○	○	○	○	○
鍵盤	－	○	○	○	○	○
滑鼠	－	○	○	○	○	○
機殼/配件	－	○	○	○	○	○

備考1. 〝超出0.1 wt %〞及〝超出0.01 wt %〞係指限用物質之百分比含量超出百分比含量基準值。
備考2. 〝○〞係指該項限用物質之百分比含量未超出百分比含量基準值。
備考3. 〝－〞係指該項限用物質為排除項目。

Appendix F. ENERGY STAR model information

ENERGY STAR® is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy aimed at saving money and protecting the environment through energy efficient products and practices.

Lenovo is proud to offer our customers products with an ENERGY STAR compliant designation. Some models of the following machine types have been designed and tested to conform to the ENERGY STAR program requirement for computers at the time of manufacture: 30BJ, 30BK, and 30BS. For more information about ENERGY STAR ratings for Lenovo computers, go to:
http://www.lenovo.com

By using ENERGY STAR compliant products and taking advantage of the power-management features of your computer, you reduce the consumption of electricity. Reduced electrical consumption contributes to potential financial savings, a cleaner environment, and the reduction of greenhouse gas emissions.

For more information about ENERGY STAR, go to:
http://www.energystar.gov

Lenovo encourages you to make efficient use of energy an integral part of your day-to-day operations. To help in this endeavor, set the following power-management features to take effect when your computer has been inactive for a specified duration:

Table 2. ENERGY STAR power-management features

Windows 7 or Windows 10 operating system
Power plan: Default • Turn off the display: After 10 minutes • Put the computer to sleep: After 25 minutes • Advanced power settings: – Turn off hard disk drives: After 20 minutes – Hibernate: Never

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

To change power settings, do the following:

1. Click the Start button to open the Start menu.
2. Depending on your Windows version, do one of the following:
   - For Windows 7: Click **Control Panel**.
   - For Windows 10: Click **Windows System → Control Panel**.
3. View Control Panel by Large icons or Small icons, and then click **Power Options**.

4. Follow the instructions on the screen.

Appendix G. Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area. Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service.

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Lenovo (United States), Inc.
1009 Think Place - Building One
Morrisville, NC 27560
U.S.A.
Attention: Lenovo Director of Licensing

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

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The Lenovo logo
ThinkStation
The ThinkStation logo
ThinkVantage

Microsoft, Windows, and Windows Media are trademarks of the Microsoft group of companies.

Intel, Intel Xeon, Intel Core, Intel Pentiumare, Optane, and Thunderbolt are trademarks of Intel Corporation in the U.S. and/or other countries.

Linux is a registered trademark of Linus Torvalds.

DisplayPort are trademarks of the Video Electronics Standards Association.

Ubuntu is a registered trademark of Canonical Ltd.

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