

lenovo

ThinkStation

Hardware Installation and Replacement Guide



ThinkThink**ThinkStation**Think

Machine Types: 4155, 4158, and 4218

Note: Before using this information and the product it supports, be sure to read and understand the *ThinkStation Safety and Warranty Guide* for this product and Appendix B “Notices” on page 53.

Second Edition (September 2011)

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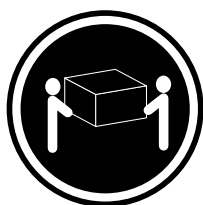
Chapter 1. Important safety information

CAUTION:

Before using this manual, it is important that you read and understand all the related safety information for this product. Refer to the *ThinkStation Safety and Warranty Guide* that you received with this product for the latest safety information. Reading and understanding the safety information reduces the risk of personal injury and or damage to your product.

If you no longer have a copy of the *ThinkStation Safety and Warranty Guide*, you can obtain a Portable Document Format (PDF) version from the Lenovo® Support Web site at:
<http://support.lenovo.com>

CAUTION:



ThinkStation™ machine types 4155, 4158, and 4218 require two people to lift and or carry.

Chapter 2. Overview

This guide provides information about installing and or replacing Customer Replaceable Units (CRUs). However, this guide does not include procedures for all parts. It is expected that cables, switches, and certain mechanical parts be replaced by trained service personnel without the need for step-by-step procedures.

Note: Use only parts provided by Lenovo.

This guide contains instructions for installing or replacing the following parts:

- Battery
- Power supply
- Memory module
- Adapter card
- Heat sink and fan assembly
- Hard disk drive
- Optical drive
- Diskette drive or card reader
- Front panel connector assembly
- Hard disk drive fan assembly
- Rear fan assembly
- Internal speaker
- Keyboard
- Mouse

Additional information resources

If you have Internet access, the most up-to-date information for your computer is available at:
<http://support.lenovo.com>

You can find:

- CRU removal and installation information
- CRU removal and installation videos
- Downloads and drivers
- Links to other useful sources of information
- Parts information
- Publications
- Support phone list
- Troubleshooting information

Handling static-sensitive devices

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

When you handle parts 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 parts and other computer components carefully. Handle adapter cards, memory modules, system boards, and microprocessors by the edges. Never touch any exposed circuitry.
- Prevent others from touching the parts and other computer components.
- Before you replace a new part, 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 in the package and your body.
- When possible, remove the new part from the static-protective packaging, and install it directly in the computer without setting the part down. When this is not possible, place the static-protective package that the part came in on a smooth, level surface and place the part on it.
- Do not place the part on the computer cover or other metal surface.

Locations

This section contains illustrations to help locate the various connectors, controls, and components of the computer.

Locating controls and connectors on the front of your computer

Figure 1 “Front connectors” on page 4 shows the location of the connectors on the front of your computer.

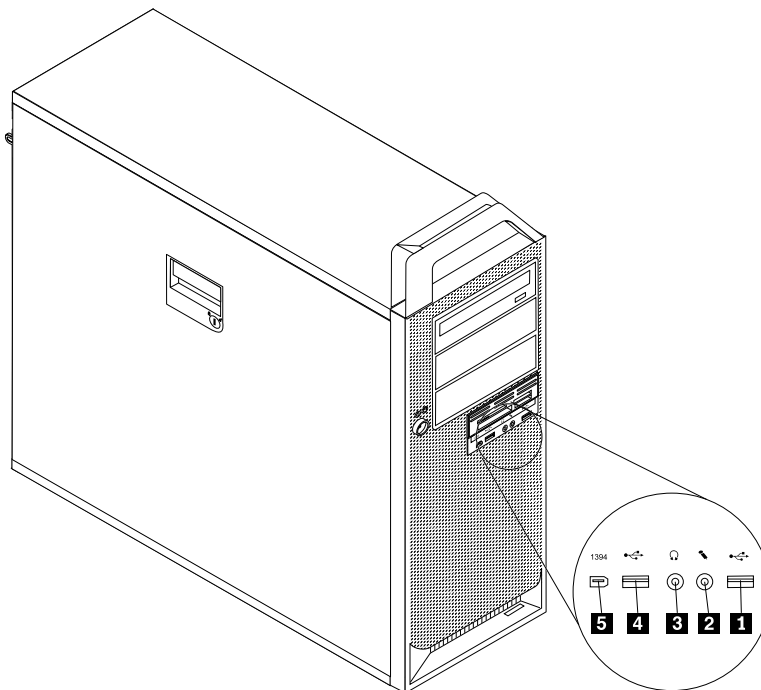


Figure 1. Front connectors

1 USB connector

2 Microphone connector

3 Headphone connector

4 USB connector

5 IEEE 1394 connector

Locating connectors on the rear of your computer

Figure 2 “Rear connector locations” on page 5 shows the location of the connectors on the rear of your computer. Some connectors on the rear of your computer are color-coded to help you determine where to connect the cables on your computer.

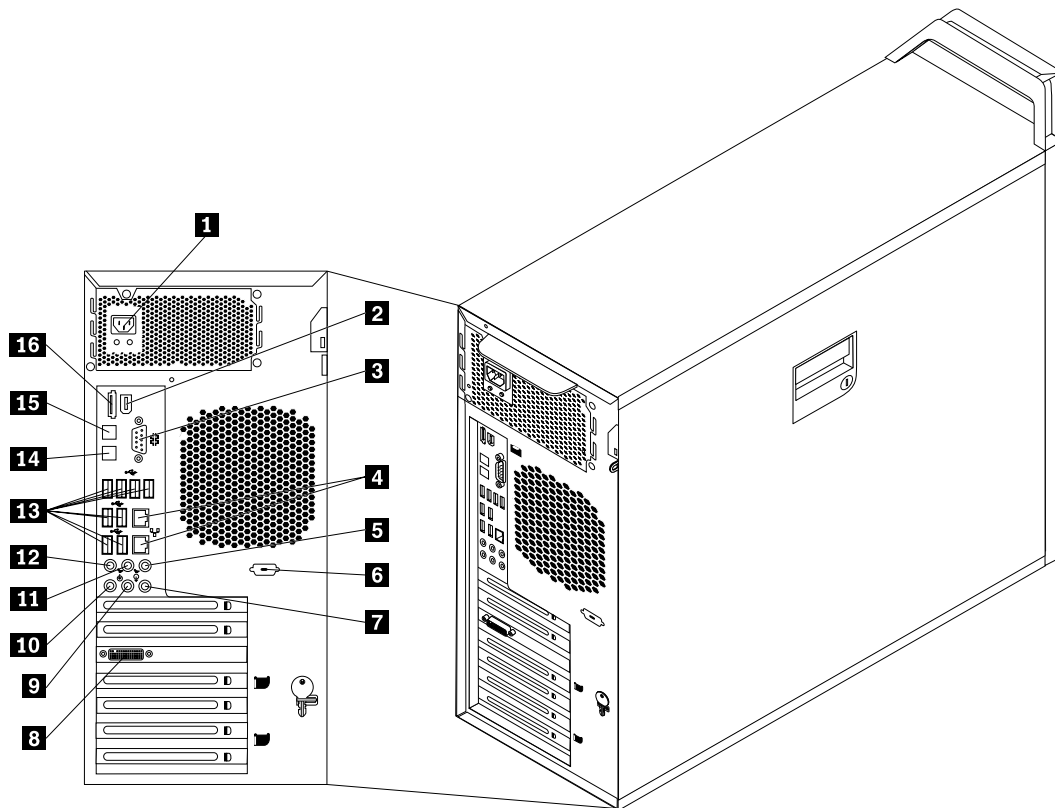


Figure 2. Rear connector locations

- | | |
|--|--|
| 1 Power cord connector | 9 Audio line-out front speaker connector |
| 2 IEEE 1394 connector | 10 Microphone connector |
| 3 Serial port | 11 Audio line-out rear speaker connector |
| 4 Ethernet connectors (2) | 12 Audio line-out side speaker connector |
| 5 Audio line-out subwoofer/center speaker connector | 13 USB connectors (8) |
| 6 Serial port (some models) | 14 Optical SPDIF (Sony Philips Digital Interconnect Format) out connector |
| 7 Audio line-in connector | 15 Optical SPDIF in connector |
| 8 Video connector (some models) | 16 eSATA connector |

Connector	Description
USB connector	Used to attach a device that requires a Universal Serial Bus (USB) connector, such as a USB keyboard, a USB mouse, a USB scanner, or a USB printer. If you have more than 10 USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.
Ethernet connector	Used to attach an Ethernet cable for a local area network (LAN). Notes: <ol style="list-style-type: none"> 1. To operate the computer within FCC Class B limits, use a Category 5 Ethernet cable. 2. Your computer has two Ethernet connectors. For optimal performance, connect your Ethernet cable for the primary LAN to the connector marked as number "1."
Serial port	Used to attach an external modem, a serial printer, or other devices that use a 9-pin serial port.
Microphone connector	Used to attach a microphone to your computer when you want to record sound or if you use speech-recognition software.
Audio line-in connector	Used to receive audio signals from an external audio device, such as a stereo system. When you attach an external audio device to your computer, connect the cable to the audio line-out connector of the device and the audio line-in connector of the computer.
Audio line-out connector (front speaker connector)	Used to send audio signals from the computer to external devices, such as powered stereo speakers (speakers with built-in amplifiers), multimedia keyboards, or the audio line-in connector on a stereo system or other external recording devices.
Audio line-out connector (subwoofer/center speaker connector)	When used with 5.1 or 7.1 surround speakers, this connector should be attached to the front left and right speakers. When used with 5.1 or 7.1 surround speakers, this connector should be attached to the center speakers and subwoofer.
Audio line-out connector (rear speaker connector)	When used with 5.1 or 7.1 surround speakers, this connector should be attached to the rear left and right speakers.
Audio line-out connector (side speaker connector)	When used with 7.1 surround speakers, this connector should be attached to the side left and right speakers.
Optical SPDIF out connector	Used to send 5.1 digital audio signals from a computer to an external device (such as an amplifier or a receiver) through a TOSLINK (ToshibaLink) optical cable.
Optical SPDIF in connector	Used to receive 5.1 digital audio signals from external equipment (such as a receiver or other multimedia device) through a TOSLINK optical cable.
eSATA connector	Use this external Serial Advanced Technology Attachment (eSATA) connector to attach an external hard disk drive.
IEEE 1394 connector	Used to send and receive IEEE 1394 signals between the computer and other compliant devices, such as a video camera or external storage drive. This connector is sometimes called Firewire because it transmits data rapidly.

Locating components

To remove the computer cover, see “Removing the computer cover” on page 11.

Figure 3 “Component locations” on page 7 shows the location of the components in your computer.

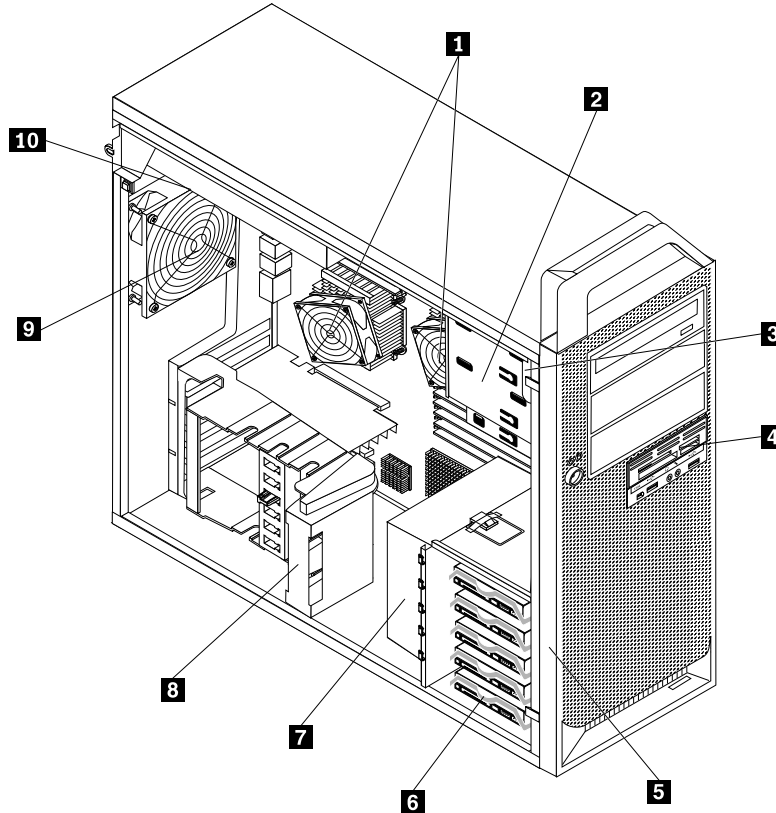


Figure 3. Component locations

- | | |
|---|---------------------------------------|
| 1 Microprocessors and heat sinks (2) | 6 Hard disk drive bays (5) |
| 2 Optical drive bays (3) | 7 Hard disk drive fan assembly |
| 3 Internal speaker | 8 Adapter card retainer |
| 4 3.5-inch diskette drive or card reader | 9 Rear fan assembly |
| 5 Front bezel | 10 Power supply assembly |

Identifying parts on the system board

Figure 4 “System board parts locations” on page 8 shows the location of the parts on the system board.

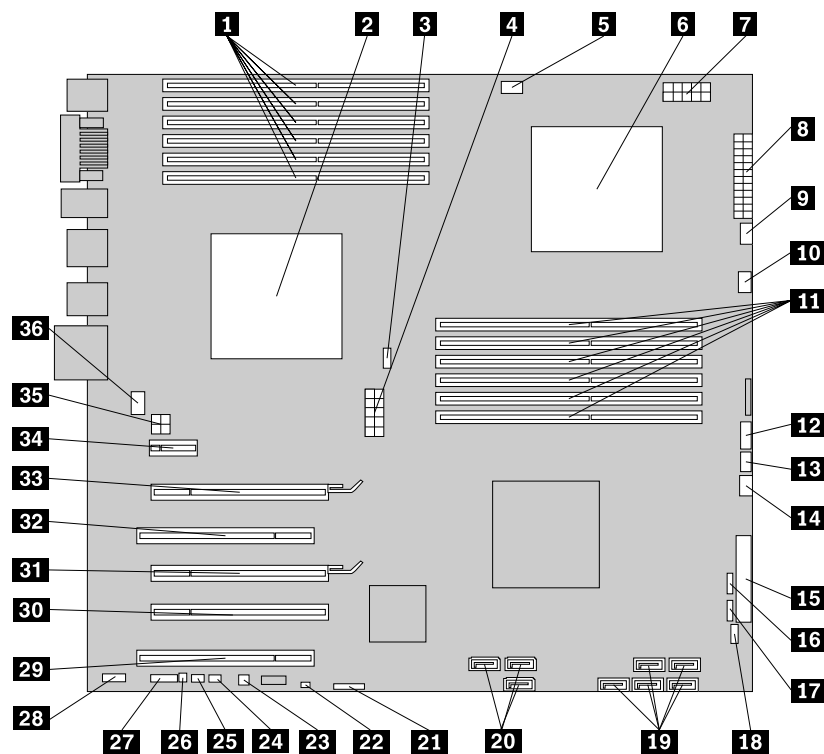


Figure 4. System board parts locations

- | | |
|---|--|
| 1 CPU 1 memory slots (6) | 19 Hard disk drive connectors (5) |
| 2 Microprocessor and heat sink 1 | 20 Optical drive connectors (3) |
| 3 CPU 1 fan connector | 21 Battery |
| 4 CPU 1 12 V power connector | 22 Clear CMOS/Recovery jumper |
| 5 CPU 1 memory fan connector | 23 Thermal sensor connector |
| 6 Microprocessor and heat sink 2 | 24 Cover presence switch connector |
| 7 CPU 2 12 V power connector | 25 PS/2 keyboard and mouse connector |
| 8 24-pin power connector | 26 Internal speaker connector |
| 9 CPU 2 fan connector | 27 COM 2 connector |
| 10 CPU 2 memory fan connector | 28 Front audio connector |
| 11 CPU 2 memory slots (6) | 29 PCI adapter card slot |
| 12 Power switch/LEDs connector | 30 PCI Express x4 graphics adapter card slot (x16 mechanical) |
| 13 Auxiliary LED connector | 31 PCI Express x16 graphics adapter card slot |
| 14 Hard disk drive fan connector | 32 PCI adapter card slot |
| 15 Diskette drive connector | 33 PCI Express x16 graphics adapter card slot |
| 16 Card reader connector | 34 PCI Express x1 adapter card slot |

17 Front USB connector

18 Front IEEE 1394 connector

35 Graphic card power connector

36 Rear fan connector

Chapter 3. Installing options and replacing hardware

This chapter is an introduction to the features and options that are available for your computer. You can expand the capabilities of your computer by adding memory modules, adapter cards, or drives. When installing an option, use these instructions along with the instructions that come with the option.

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

Note: Use only parts provided by Lenovo.

Installing external options

External speakers, a printer, or a scanner can be connected to your computer. For some external options, you must install additional software in addition to making the physical connection. When adding an external option, see “Locating connectors on the rear of your computer” on page 5 and “Locating controls and connectors on the front of your computer” on page 4 to identify the required connector, and then use the instructions that are included with the option to help you make the connection and install any software or device drivers that are required for the option.

Installing internal options

Important: Read “Handling static-sensitive devices” on page 3 before removing the computer cover.

Removing the computer cover

CAUTION:



Turn off the computer and wait three to five minutes to let the computer cool before removing the computer cover.

To remove the computer cover:

1. Remove any media from the drives and shut down your operating system. Turn off all attached devices. Turn off the computer.
2. Unplug all power cords from electrical outlets.
3. Disconnect the cables attached to the computer. This includes power cords, input/output (I/O) cables, and any other cables that are connected to the computer. See “Locating controls and connectors on the front of your computer” on page 4 and “Locating connectors on the rear of your computer” on page 5.
4. Remove any locking devices, such as a cable lock or padlock that secures the computer cover. See Chapter 5 “Security features” on page 47.

5. Disengage the cover latch **1** and remove the cover. Place the cover on a flat surface.

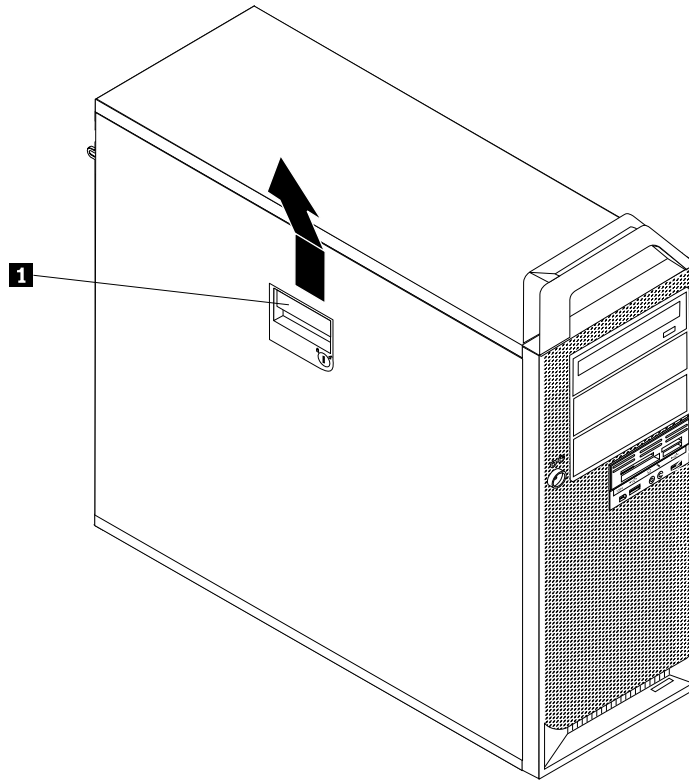


Figure 5. Removing the computer cover

Removing the front bezel

To remove the front bezel:

1. Remove the computer cover. See “Removing the computer cover” on page 11.

2. Remove the front bezel by releasing the two plastic tabs on the left side and pivoting the bezel outward.

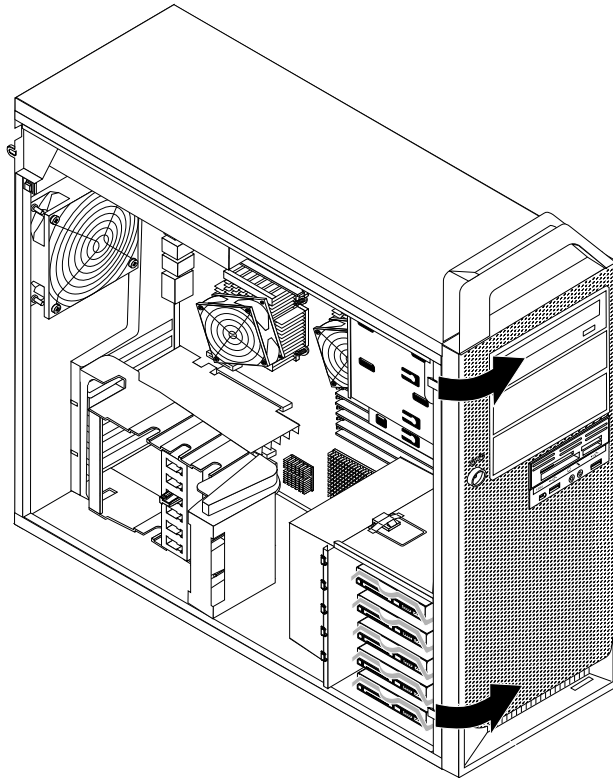


Figure 6. Removing the front bezel

3. Lay the front bezel on a flat surface.
4. To reinstall the bezel, align the plastic tabs on the right side of the bezel with the corresponding holes in the chassis, then pivot the bezel inward until it snaps into position on the left side.

Accessing system board components

To access the system board components:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Unlatch and open the adapter card retainer.

3. Remove the hard disk drive fan duct by pressing downwards on the top of the duct and then rotating the duct.

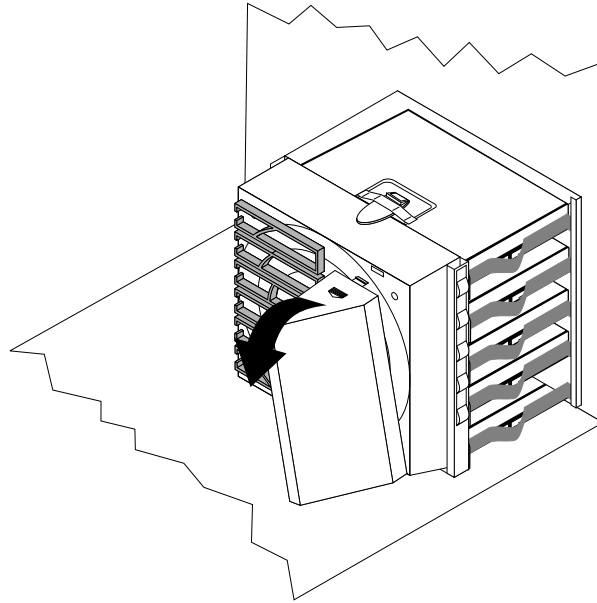


Figure 7. Removing the hard disk drive fan duct

4. Remove the adapter cards if necessary. See “Replacing adapter cards” on page 30.

5. You might need to remove the hard disk drive fan bracket to gain easy access to some internal components. To remove the bracket, press downward on the hard disk drive fan bracket latch and then pivot the bracket to remove the hard disk drive fan and bracket from the chassis.

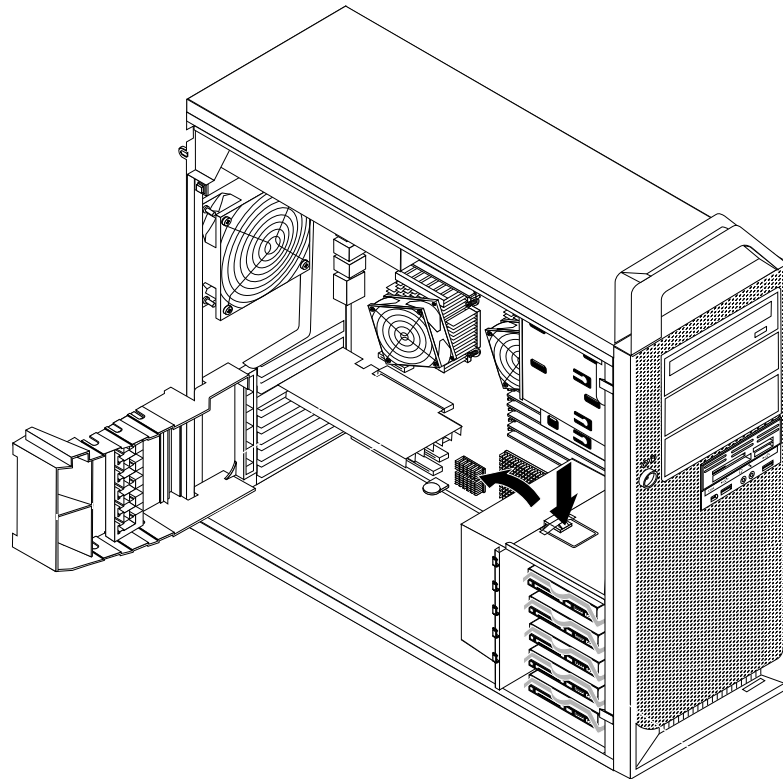


Figure 8. Removing the hard disk drive fan and bracket

Installing internal drives

This section provides information and instructions for installing the internal 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 to enable your computer to read other types of media. Some of the types of drives that are available for your computer are:

- Serial Attached SCSI (SAS) hard disk drives
- Serial ATA (SATA) hard disk drives
- SATA optical drives, such as CD drives or DVD drives
- Removable media drives

Internal drives are installed in bays. In this book, the bays are referred to as bay 1, bay 2, and so on.

When you install an internal drive, it is important to note the type and size of the drive that you can install in each bay. Also, it is important to correctly connect the internal drive cables to the installed drive.

Drive specifications

Your computer comes with the following factory-installed drives:

- An optical drive in bay 1
- A blank bay for expansion or an optional optical drive in bay 2 or bay 3 (some models)
- A 3.5-inch diskette drive or a card reader in bay 4 (some models)
- Up to five hard disk drives in bay 5 (varies by model)

Any bay that does not have a drive installed has a static shield and bay panel installed.

Figure 9 “Drive bay locations” on page 16 shows the location of the drive bays.

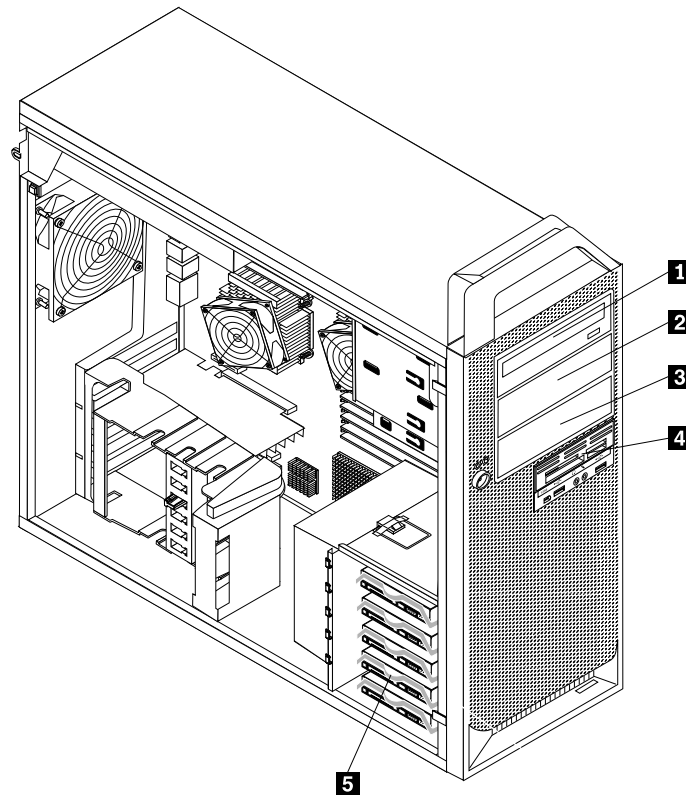


Figure 9. Drive bay locations

The following list describes the types and size of drives that you can install in each bay:

- | | |
|---|---|
| 1 Bay 1 - Maximum height: 43 mm (1.7 inches) | Optical drives, such as CD drive or DVD drive (preinstalled in some models) |
| 2 Bay 2 - Maximum height: 43 mm (1.7 inches) | Optional drives such as CD drive or DVD drive (preinstalled in some models) |
| 3 Bay 3 - Maximum height: 43 mm (1.7 inches) | Optional drives such as CD drive or DVD drive (preinstalled in some models) |
| 4 Bay 4 - Maximum height: 26.1 mm (1 inch) | 3.5-inch diskette drive or card reader (preinstalled in some models) |
| 5 Bay 5 | Up to five hard disk drives (varies by model) |

Installing a drive in bay 2 or bay 3

To install an optical drive in bay 2 or bay 3:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Remove the front bezel. See “Removing the front bezel” on page 12.

Note: There is a drive retainer bracket on the inside of the front bezel where the drive is to be located. If there is no drive installed, there are drive retainer brackets for each drive. Remove the drive retainer bracket and use it to install the drive.

3. Remove the plastic drive cover from the bezel.
4. Remove the metal static shield from the drive bay using your fingers to pull it outward.
5. Install the retainer bracket on the left side of the drive to be installed.

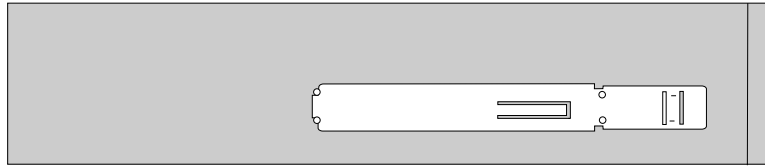


Figure 10. Installing the retainer bracket

6. Slide the drive into the bay until it locks into position.

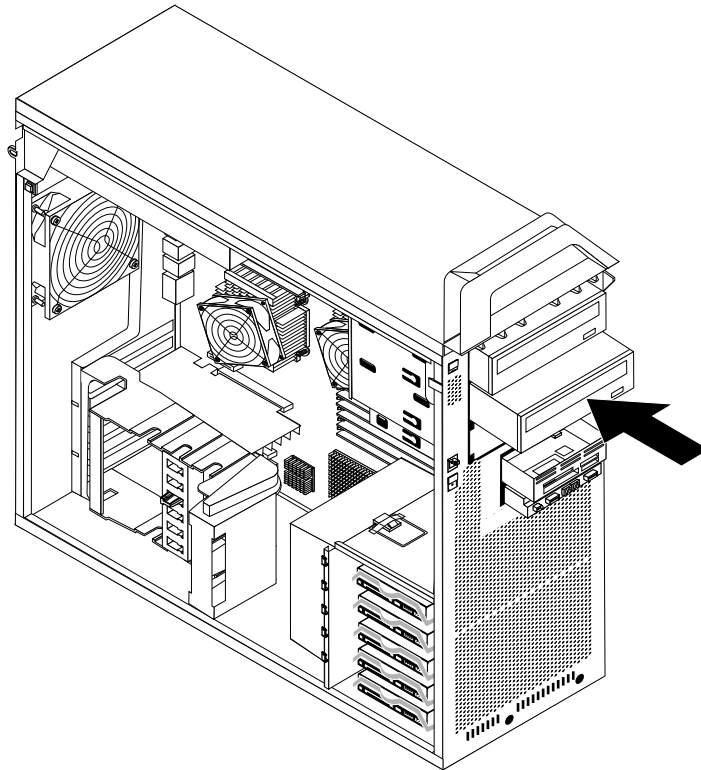


Figure 11. Installing an optical drive

7. To reinstall the front bezel, align the plastic tabs on the right side of the bezel with the corresponding holes in the chassis, then pivot the front bezel inward until it snaps into position on the left side.

8. Locate an available optical drive connector on the system board. See “Identifying parts on the system board” on page 8.
9. Using the signal cable that came with the new drive, connect one end of the signal cable to the drive and the other end to the available optical drive connector on the system board.
10. Locate one of the extra five-wire power cables and connect it to the drive.

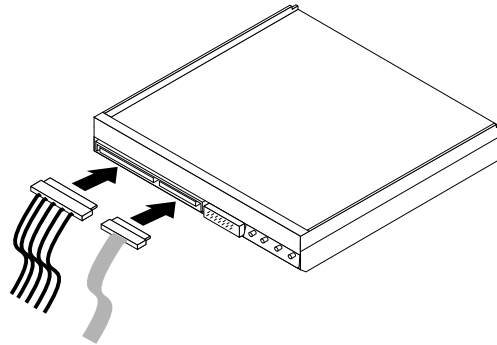


Figure 12. Connecting the drive

What to do next:

- To work with another option, go to the appropriate section.
- To complete the installation, go to Chapter 4 “Completing the parts replacement” on page 45.

Installing a diskette drive or card reader in bay 4

To install a diskette drive or card reader in bay 4:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Remove the front bezel. See “Removing the front bezel” on page 12.
3. Remove the plastic panel in the bezel by squeezing the plastic tabs that secure the panel on the inside of the bezel.

Note: There is a drive retainer bracket for each drive on the inside of the front bezel where the drive is to be located. Remove the drive retainer bracket and use it to install the drive.

4. Install the retainer bracket on the diskette drive or card reader.

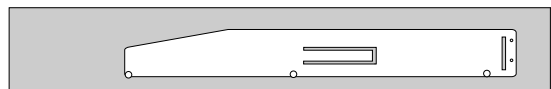


Figure 13. Installing the retainer bracket

5. Remove the static shield from the computer chassis.

- Slide the diskette drive or card reader into the drive bay until it snaps into position. See “Locating components” on page 7.

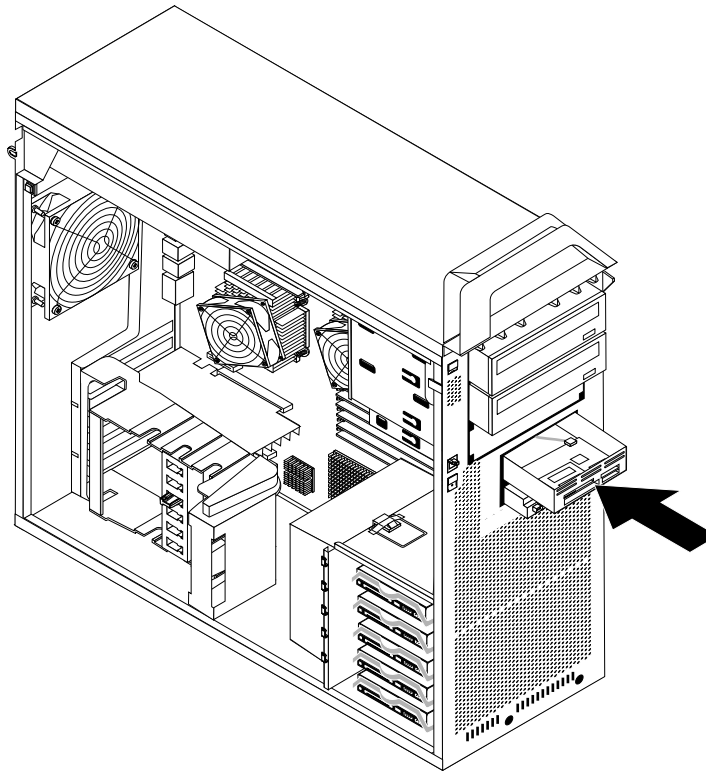


Figure 14. Installing a new diskette drive or card reader

- Connect the diskette drive to the diskette drive connector on the system board. If you are installing a card reader, connect it to the card reader connector on the system board. See “Identifying parts on the system board” on page 8.
- Reinstall the front bezel.

What to do next:

- To work with another option, go to the appropriate section.
- To complete the installation, go to Chapter 4 “Completing the parts replacement” on page 45.

Installing a hard disk drive in bay 5

This section provides instructions on how to install a hard disk drive.

Note: You can install a combination of SATA and SAS hard disk drives within the same computer. However, SATA and SAS hard disk drives cannot be installed within the same RAID array.

To install a new hard disk drive:

- Remove the computer cover. See “Removing the computer cover” on page 11.
- Locate one of the empty hard disk drive slots in bay 5. See “Locating components” on page 7. Each empty hard disk drive slot has a spare bracket.
- Pull the handle to remove a spare bracket.

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

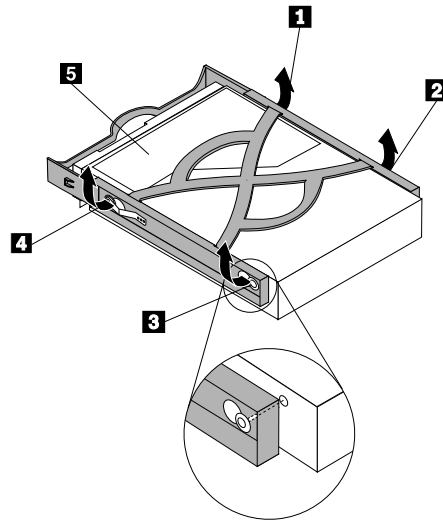


Figure 15. Installing a 3.5-inch hard disk drive into the bracket

Note: If you are installing a 2.5-inch hard disk drive into the bracket, flex the bracket, and then align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the holes in the hard disk drive adapter **5**.

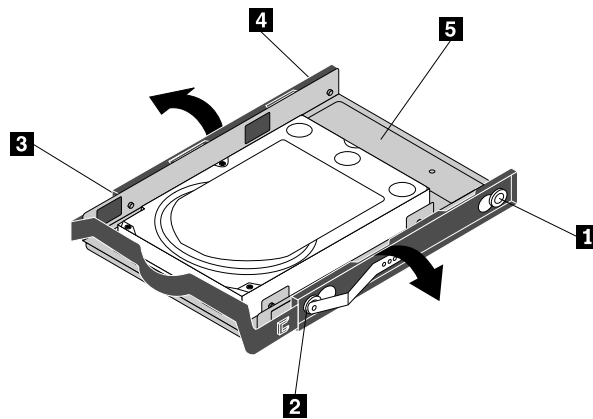


Figure 16. Installing a 2.5-inch hard disk drive into the bracket

- Install the hard disk drive and bracket into the drive bay.
- Using the signal cable that came with the new drive, connect one end of the signal cable to the drive. Locate one of the extra five-wire power cables and connect it to the drive.

Note: The signal cable will be different depending on whether you are installing a SATA hard disk drive or a SAS hard disk drive.

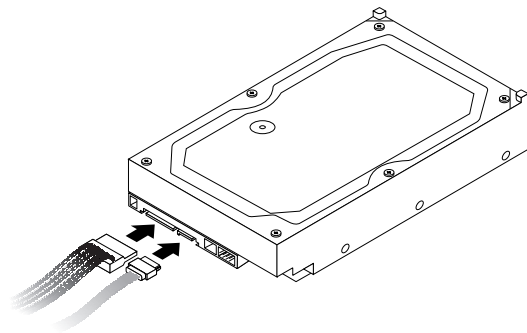


Figure 17. Connecting a 3.5-inch SATA hard disk drive

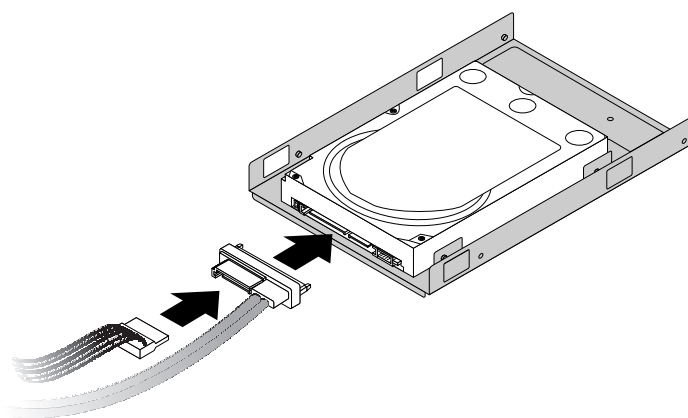


Figure 18. Connecting a 2.5-inch SATA hard disk drive

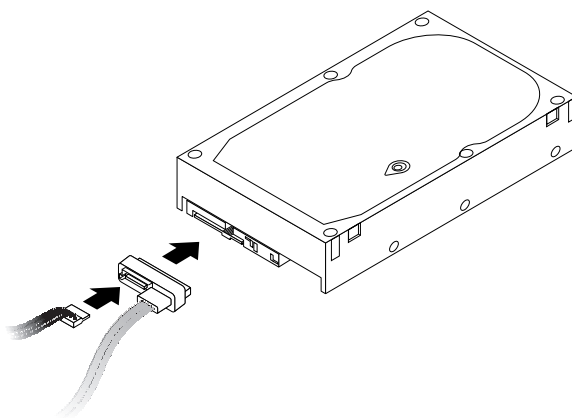


Figure 19. Connecting a 3.5-inch SAS hard disk drive

7. Connect the other end of the signal cable to one of the available hard disk drive connectors on the system board. See "Identifying parts on the system board" on page 8.

What to do next:

- To work with another option, go to the appropriate section.

- To complete the installation, go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the battery

Your computer has a special type of memory that maintains the date, time, and settings for built-in features, such as serial-port assignments (configuration). A battery keeps this information active when you turn off the computer.

The battery normally requires no charging or maintenance throughout its life; however, no battery lasts forever. If the 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 battery notice" in the *ThinkStation Safety and Warranty Guide* for information about replacing and disposing of the battery.

To replace the battery:

1. Turn off the computer and disconnect the power cord from the electrical outlet and from the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 11.
3. Access the system board. See “Accessing system board components” on page 13.
4. Locate the battery. See “Identifying parts on the system board” on page 8.
5. Remove the old battery.

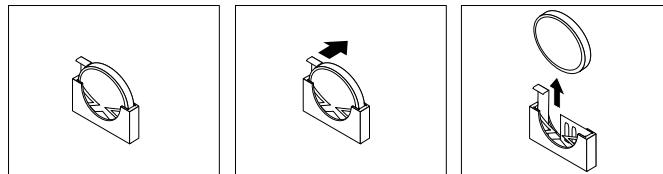


Figure 20. Removing the old battery

6. Install the new battery.

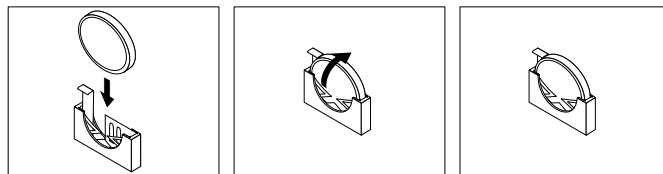


Figure 21. Installing the new battery

7. Reinstall any adapter card that was removed. Replace the computer cover and connect the cables. See Chapter 4 “Completing the parts replacement” on page 45.

Note: When the computer is turned on for the first time after replacing the battery, an error message might be displayed. This is normal after replacing the battery.

8. Turn on the computer and all attached devices.
9. Use the Setup Utility program to set the date and time and any passwords. See "Using the Setup Utility" in the *ThinkStation User Guide*.

Replacing the power supply assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace the power supply assembly.

To replace the power supply assembly:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Lay the computer on its side.
3. Locate the power supply assembly. See “Locating components” on page 7.
4. Disconnect the power supply cables **1**, **2**, **3**, and **4** from the system board connectors, adapter cards, and all drives.

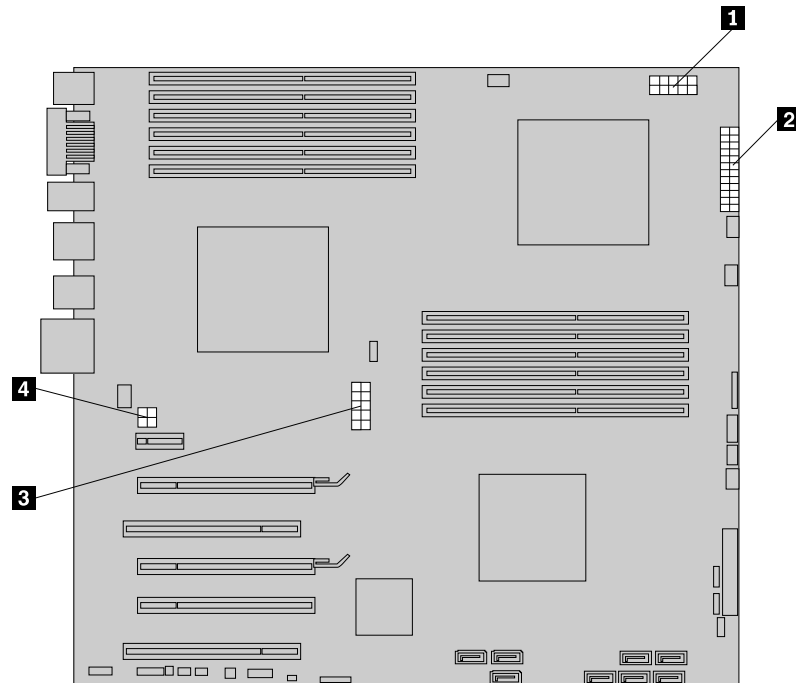


Figure 22. Power supply cable connectors

5. Remove the power supply cables from any cable clips and ties.

6. Remove the six power supply retaining screws at the rear of the chassis and inside the chassis.

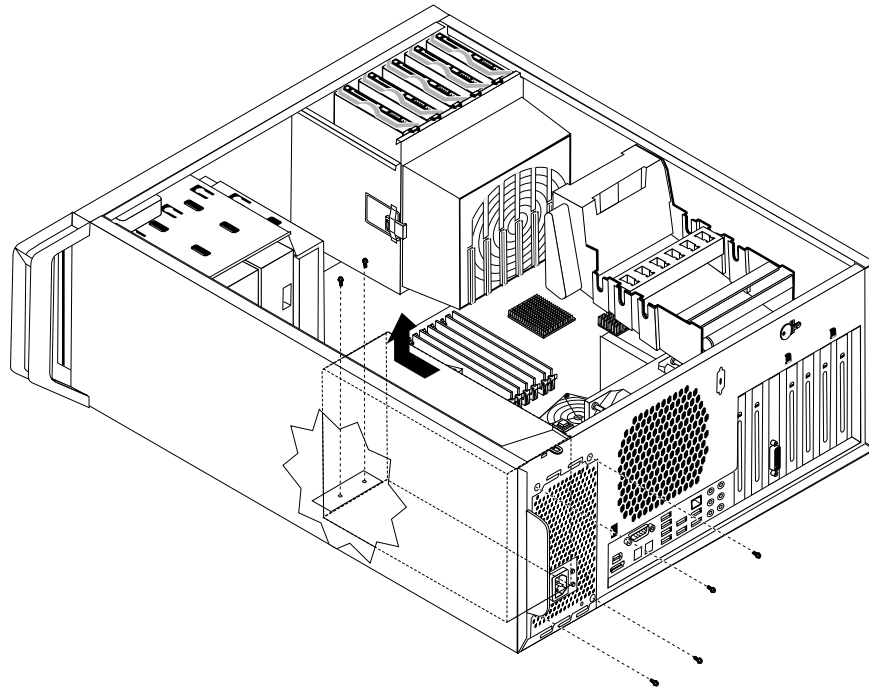


Figure 23. Removing the power supply retaining screws

7. Slide the power supply assembly toward the front of the computer and lift it out from the chassis.
8. Ensure that the new power supply is the correct replacement. Some power supplies automatically sense the voltage, some power supplies are voltage specific, and some power supplies have a voltage-selection switch. If there is a voltage-selection switch, use a ballpoint pen to slide the switch, if necessary.

Note: For models that have a voltage-selection switch:

- If the voltage supply range is 100–127 V AC, set the switch to 115 V.
- If the voltage supply range is 200–240 V AC, set the switch to 230 V.

9. Install the new power supply into the chassis so that the screw holes in the power supply align with those in the chassis.

Note: Use only the screws provided by Lenovo.

10. Install and tighten the four screws at the rear of the chassis to secure the power supply.
11. Install and tighten the two screws that secure the power supply to the inside of the chassis.
12. Reconnect all power supply cables to the drives, adapter cards, and the system board. Make sure to reconnect the power cable to the graphics cards that require an additional cable.
13. Go to Chapter 4 “Completing the parts replacement” on page 45.

Installing or replacing a memory module

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

CAUTION:



The memory modules might be very hot. Turn off the computer and wait three to five minutes to let the computer cool before removing the computer cover.

Your computer has 12 slots for installing or replacing DDR3 ECC UDIMMs (double data rate 3 error correction code unbuffered dual in-line memory modules) or DDR3 ECC RDIMMs (double data rate 3 error correction code registered dual in-line memory modules).

When installing or replacing memory modules, use the following guidelines:

- Use either DDR3 ECC UDIMMs or DDR3 ECC RDIMMs for your computer. Do not install both the UDIMMs and RDIMMs into the same computer.
- Use 1 GB, 2 GB, or 4 GB UDIMMs in any combination up to a maximum of 48 GB.
- Use 1 GB, 2 GB, 4 GB, or 8 GB RDIMMs in any combination up to a maximum of 96 GB.
- Always install DIMMs in the numerical order printed on the system board (DIMM1, DIMM2, DIMM3, and so on). Install memory modules into the blue color memory slots first.
- If your computer has only one CPU installed, be sure to install memory modules only in the memory slots adjacent to that CPU.
- If your computer has two CPUs installed, install equal numbers of memory modules in both sets of CPU DIMM slots for maximum performance.

To install or replace a memory module:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Lay the computer on its side.
3. Locate the memory slots. See “Identifying parts on the system board” on page 8.
4. For some computer models, you might need to remove the memory fan duct to access the memory slots. To remove the memory fan duct, disconnect the memory fan cable from the system board, remove the blue shipping clip, press inward on the two tabs, pivot the fan duct, and then disengage the other end of the duct.

Note: Not all computer models have the memory fan duct and blue shipping clip.

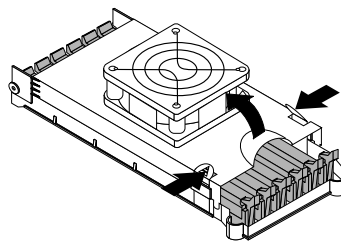


Figure 24. Removing the memory fan duct

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.

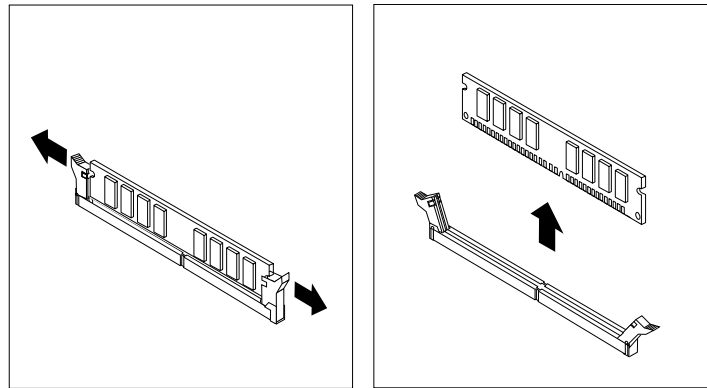


Figure 25. Removing a memory module

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

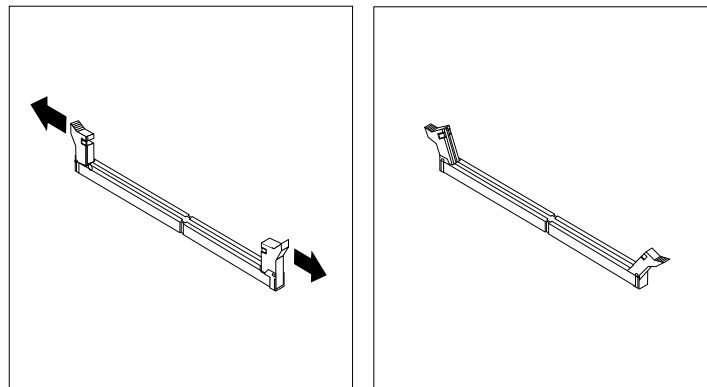


Figure 26. Opening the retaining clips

6. Position the new memory module over the memory slot. Make sure the notch **1** on the memory module aligns correctly with the slot key **2** on the system board. Push the memory module straight down into the slot until the retaining clips close.

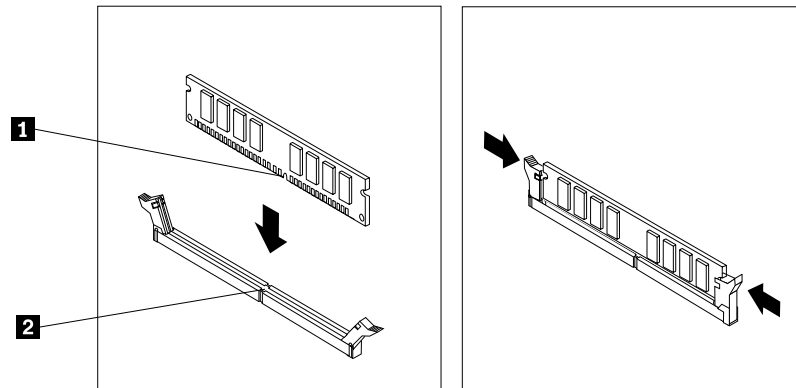


Figure 27. Installing the memory module

7. To install the memory fan, engage the rear of the duct with the retainer on the system board and then pivot the duct downwards until the duct snaps into position. Reconnect the memory fan cable to the system board.

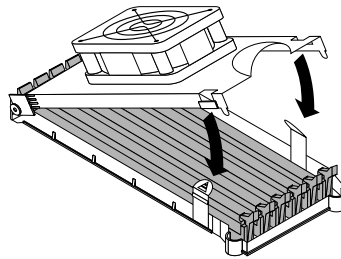


Figure 28. Installing the memory fan duct

8. Reinstall the blue shipping clip if your computer needs to be repackaged and shipped in the future.
9. Go to Chapter 4 “Completing the parts replacement” on page 45.

Note: Your system memory speed is determined by a number of factors, including the microprocessor model and the type, speed, size (capacity), and number of DIMMs installed. See Appendix A “System memory speed” on page 49 for more information.

Installing or replacing adapter cards

This section provides instructions for installing adapter cards. Your computer has the following six expansion slots for installing or replacing adapter cards:

- Two PCI adapter card slots
- One PCI Express x1 adapter card slot
- One PCI Express x4 adapter card slot
- Two PCI Express x16 graphics adapter card slots

Installing adapter cards

To install an adapter card:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Unlatch and open the adapter card retainer.
3. Remove the metal cover for the appropriate adapter card slot if you are installing an adapter card.
4. If you are installing a full length adapter card, remove the duct on the hard disk drive fan bracket by pressing downwards on the top of the duct and then rotating the duct.

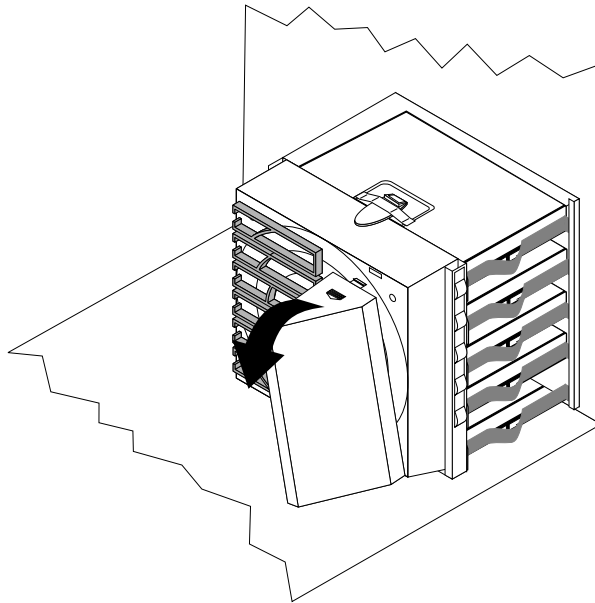


Figure 29. Removing the hard disk drive fan duct

5. Remove the adapter card from its static-protective package.

6. Install the adapter card into the appropriate adapter card slot on the system board. See “Identifying parts on the system board” on page 8.

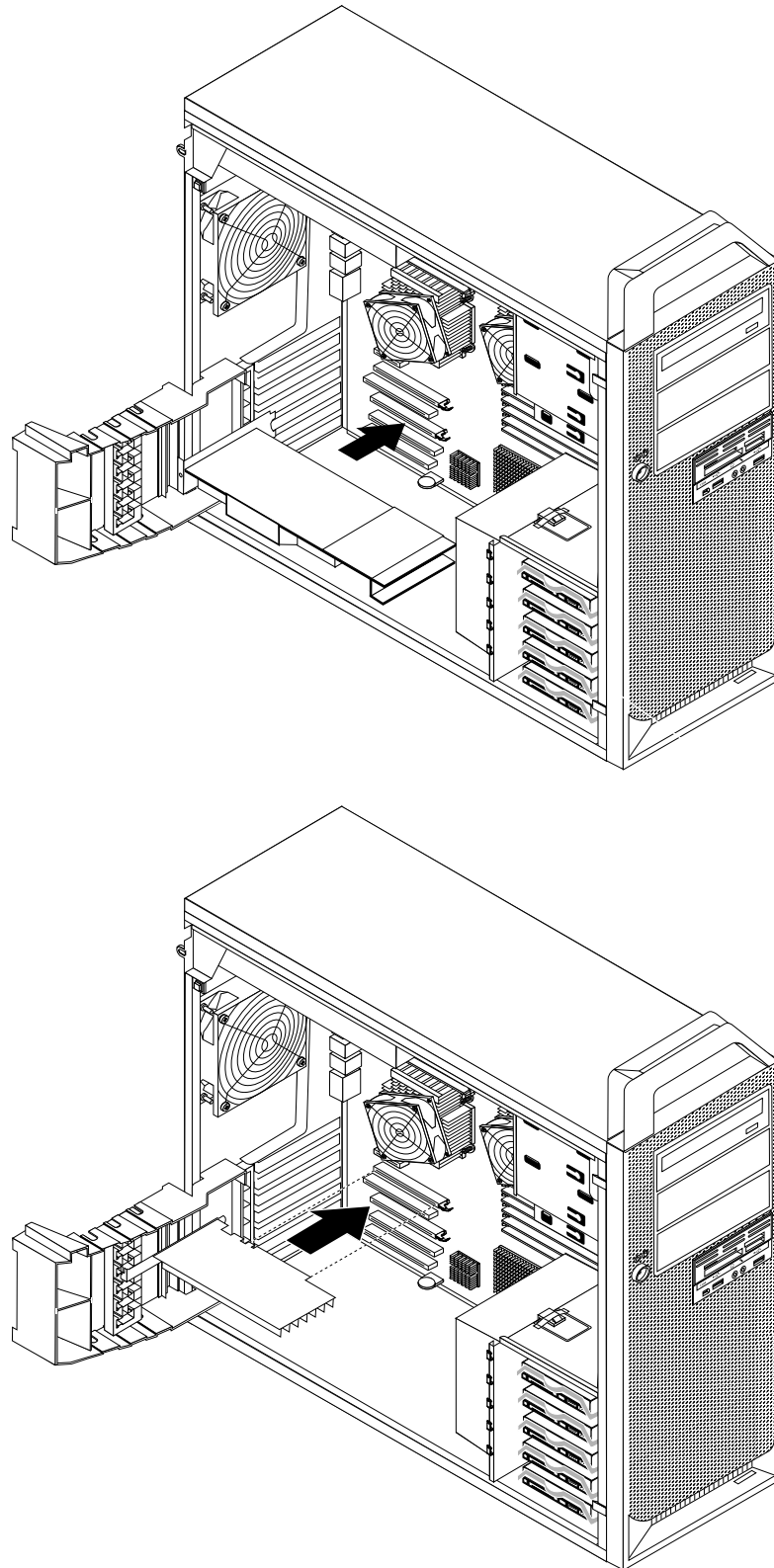


Figure 30. Installing an adapter card

7. Connect any adapter card cable to the system board.
8. Latch the adapter card retainer to secure the adapter card.

What to do next:

- To work with another option, go to the appropriate section.
- To complete the installation, go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing adapter cards

To replace an adapter card:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Unlatch and open the card retainer.
3. Take note of the location of all cable connections on the adapter card. It will be necessary to reconnect them properly when installing a new card.
4. Disconnect all cables connected to the adapter card. See “Identifying parts on the system board” on page 8.
5. To remove the adapter card, do one of the following:
 - If you are replacing a full length adapter card, remove the duct on the hard disk drive fan bracket by pressing downwards on the top of the duct and then rotating the duct. Grasp the adapter card and pull the adapter card out of the slot.

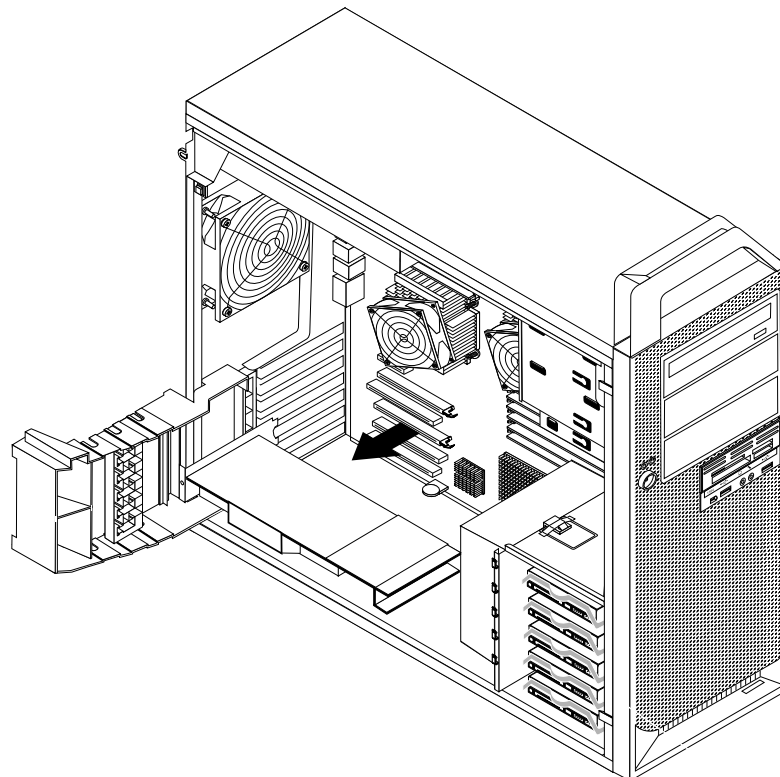


Figure 31. Removing a full length adapter card

- Some adapter cards are held in place by a retaining latch, such as video cards that are smaller than 512 MB. Press the adapter card retaining latch **1** as shown to disengage the latch. Grasp the adapter card and then pull the adapter card out of the slot.

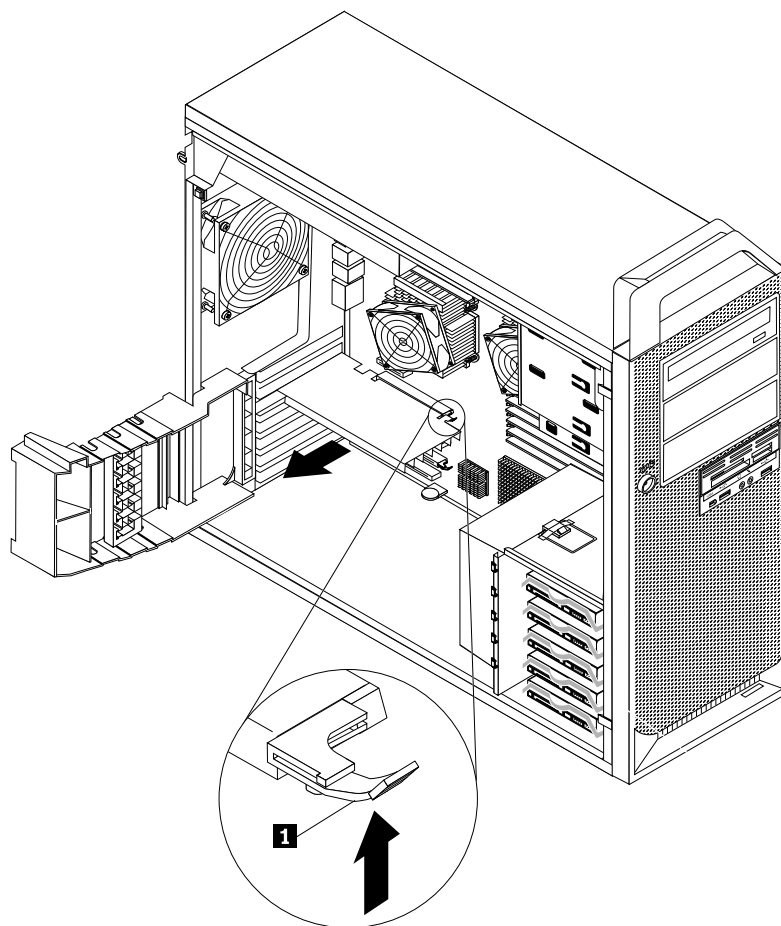


Figure 32. Pressing the latch and removing the adapter card

Note: The adapter card fits tightly into the card slot. If necessary, alternate moving each side of the adapter card a small amount until it is removed from the adapter card slot.

6. To install an adapter card, see “Installing adapter cards” on page 28.
7. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the heat sink and fan assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

CAUTION:



The heat sink and fan assembly might be very hot. Turn off the computer and wait three to five minutes to let the computer cool before removing the computer cover.

This section provides instructions on how to replace the heat sink and fan assembly.

To replace the heat sink and fan assembly:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Lay the computer on its side for easier access to the heat sink and fan assembly.
3. Your computer supports two heat sink and fan assemblies. Locate the heat sink and fan assembly you want to replace. See “Locating components” on page 7.
4. Remove the heat sink and fan assembly cable from the system board. Note the cable location.
5. 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: The four screws can be removed from the system board, but they cannot be removed from the heat sink and fan assembly.

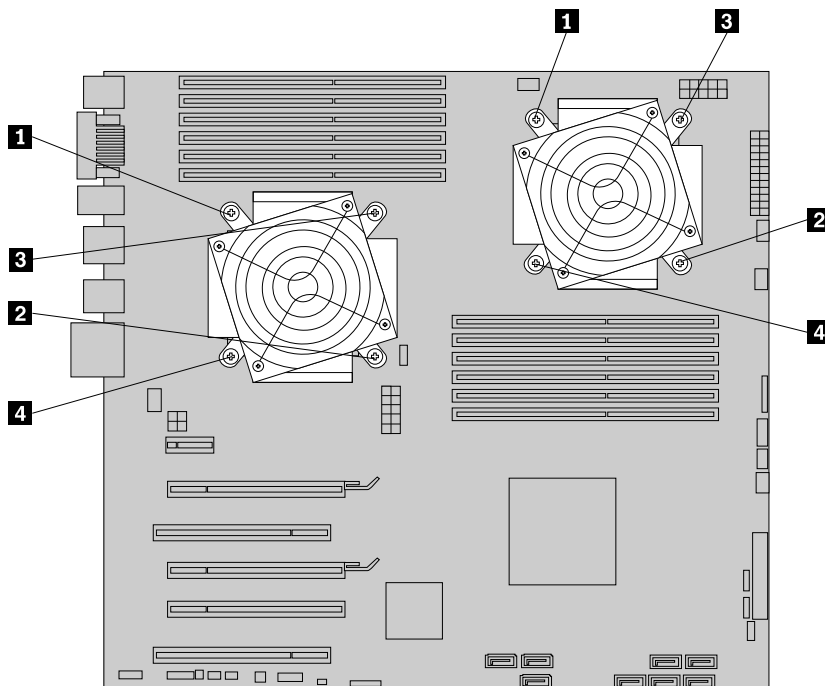


Figure 33. Removing the heat sink and fan assembly

6. Carefully lift the heat sink and fan assembly off the system board.

Notes:

- a. You might have to gently twist the heat sink and fan assembly to free it from the microprocessor.
 - b. Do not touch the thermal grease while handling the heat sink and fan assembly.
7. Remove the plastic cover from the bottom of the new heat sink and fan assembly to expose the thermal grease (this cover protects the thermal grease from contamination).

Notes:

- a. Do not remove the plastic cover until you are ready to install the heat sink and fan assembly on the microprocessor.
- b. Do not touch the thermal grease on the heat sink and fan assembly.
- c. Do not put the heat sink and fan assembly anywhere except on the microprocessor after the plastic cover has been removed and the thermal grease exposed.

8. Position the new heat sink and fan assembly on the microprocessor so that the four screws are aligned with the holes on the system board.
9. Follow this sequence to install the four screws to secure the heat sink and fan assembly:
 - 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. Reconnect the heat sink fan assembly cable to the system board.
11. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing a hard disk drive

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to:
<http://support.lenovo.com>

This section provides instructions on how to replace the hard disk drive.

Important: When you receive a new hard disk drive, you also receive a set of *Product Recovery discs*. The set of *Product Recovery discs* will enable you to restore the contents of the hard disk drive to the factory-installed state. For more information on recovering factory-installed software, refer to “Recovering software” in your *ThinkStation User Guide*.

Note: You can install a combination of SATA and SAS hard disk drives within the same computer. However, SATA and SAS hard disk drives cannot be installed within the same RAID array.

To replace a hard disk drive:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Locate the hard disk drive. See “Locating components” on page 7.
3. Disconnect the signal and power cables from the hard disk drive.

4. Pull the handle of the hard disk drive bracket to remove the hard disk drive.

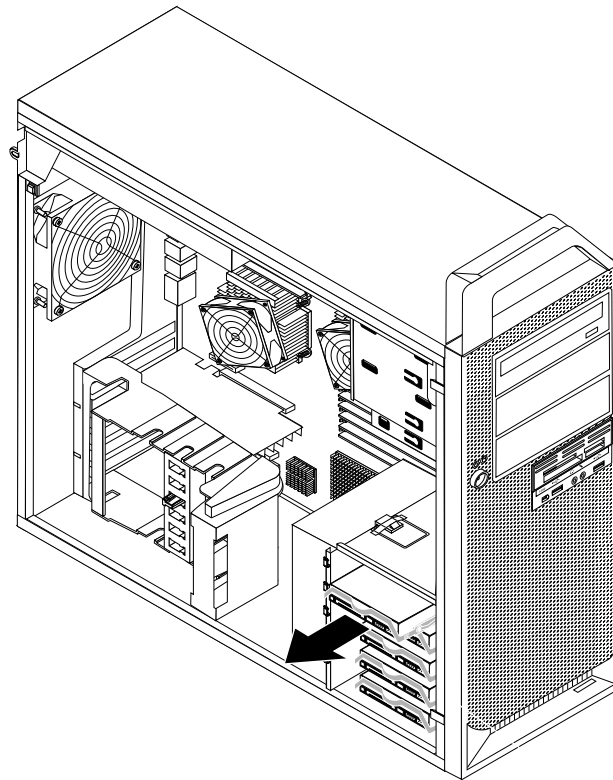


Figure 34. Removing a hard disk drive

5. Remove the failing hard disk drive from the bracket by flexing the bracket.
6. Install the new hard disk drive into the bracket. See “Installing a hard disk drive in bay 5” on page 19.
7. Install the hard disk drive and bracket into the drive bay.
8. Reconnect the signal and power cables to the new hard disk drive. See “Installing a hard disk drive in bay 5” on page 19.
9. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing an optical drive

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace the optical drive.

To replace the optical drive:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Remove the front bezel. See “Removing the front bezel” on page 12.
3. Locate the optical drive. See “Locating components” on page 7.
4. Note the location of the optical drive cables. Disconnect the signal and power cables from the rear of the optical drive.

5. Press the drive latch **1** and slide the optical drive out the front of the chassis.

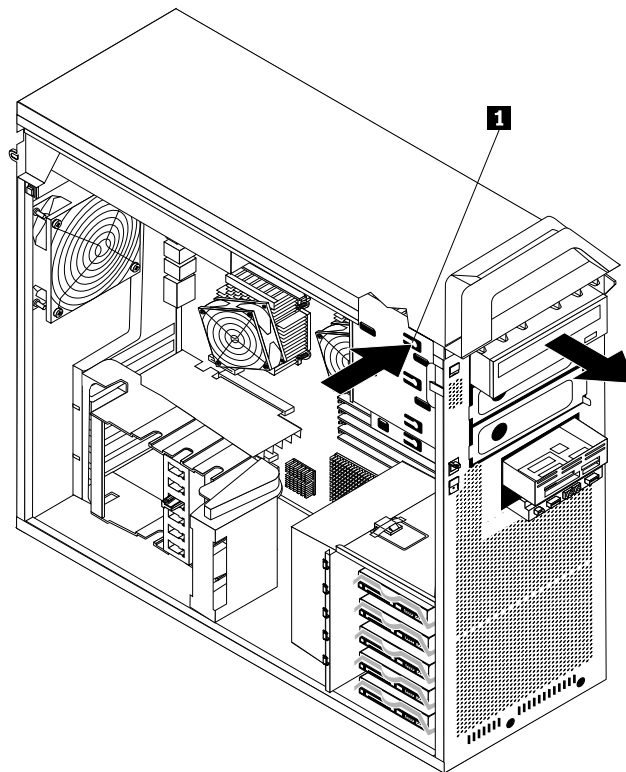


Figure 35. Removing the optical drive

6. Remove the retainer bracket from the drive being replaced and install it on the new drive.

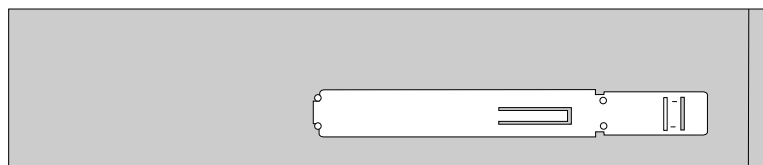


Figure 36. Retainer bracket for optical drive

7. Slide the new optical drive into the optical drive bay from the front until it snaps into position.
8. Connect the signal and power cables to the new drive.
9. Reinstall the front bezel.
10. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the diskette drive or card reader

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace the diskette drive or card reader.

To replace the diskette drive or card reader:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Remove the front bezel. See “Removing the front bezel” on page 12.
3. Locate the diskette drive or card reader. See “Locating components” on page 7.
4. Disconnect the signal and power cables from the rear of the diskette drive. If you are replacing a card reader, disconnect the card reader cable from the system board. See “Identifying parts on the system board” on page 8.
5. Press the drive latch **1** and slide the diskette drive or card reader out the front of the chassis.

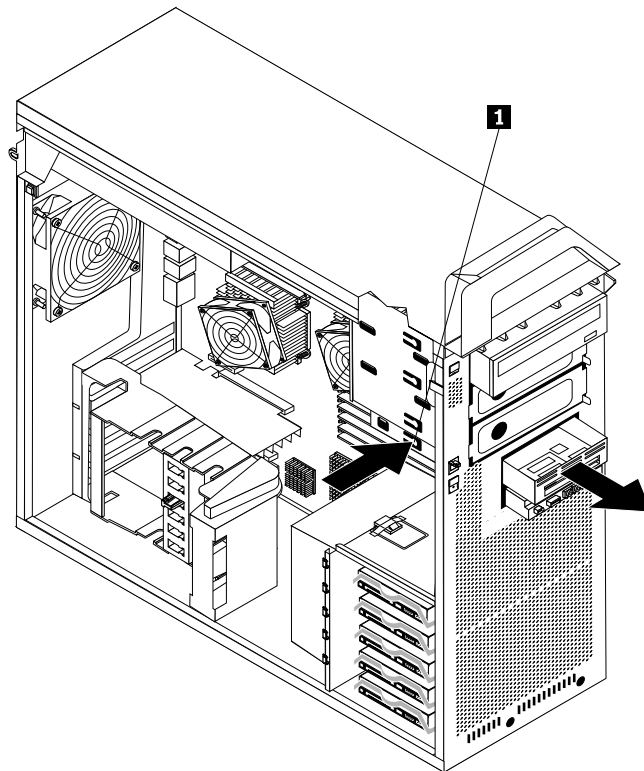


Figure 37. Removing the diskette drive or card reader

6. Remove the retainer bracket from the failing diskette drive or card reader and install it on the new diskette drive or card reader.



Figure 38. Installing the retainer bracket

7. Slide the new diskette drive or card reader into the drive bay until it snaps into position.
8. Connect the signal cable and power cable to the new diskette drive. If you are installing a card reader, connect the card reader cable to the card reader connector on the system board. See “Identifying parts on the system board” on page 8.

9. Reinstall the hard disk drive fan bracket if removed.
10. Reinstall the front bezel.
11. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the front panel connector assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace the front panel connector assembly.

To replace the front panel connector assembly:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Remove the front bezel. See “Removing the front bezel” on page 12.
3. Locate the front panel connector assembly.
4. Access system board components. See “Accessing system board components” on page 13.
5. Disconnect the front audio, front USB, auxiliary LED, and IEEE 1394 cables from the system board and note the routes of the cables.
6. Remove the two screws that secure the front panel connector assembly to the chassis and then completely release the front panel connector assembly from the chassis.

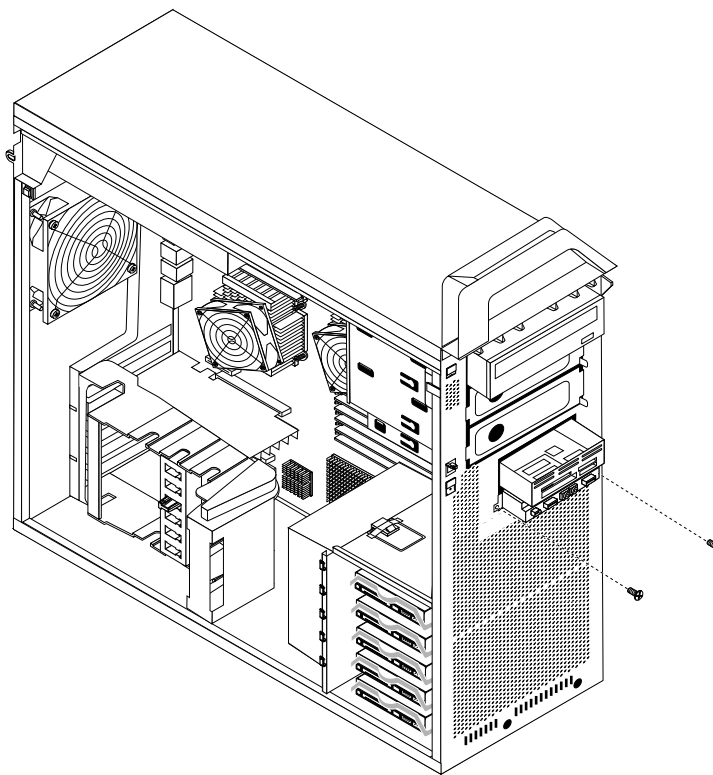


Figure 39. Removing the front panel connector assembly

7. Align the screw holes in the new front panel connector assembly with the holes in the chassis. Install the two screws to secure the assembly.
8. Reconnect all the cables to the system board. See “Identifying parts on the system board” on page 8.
9. Reinstall the hard disk drive fan bracket if removed.
10. Reinstall the front bezel.
11. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the hard disk drive fan assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace the hard disk drive fan assembly.

To replace the hard disk drive fan assembly:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Locate the hard disk drive fan assembly. See “Locating components” on page 7.
3. Unlatch and open the adapter card retainer.
4. Press downwards on the top of the hard disk drive fan duct, and then rotate the duct to remove it.

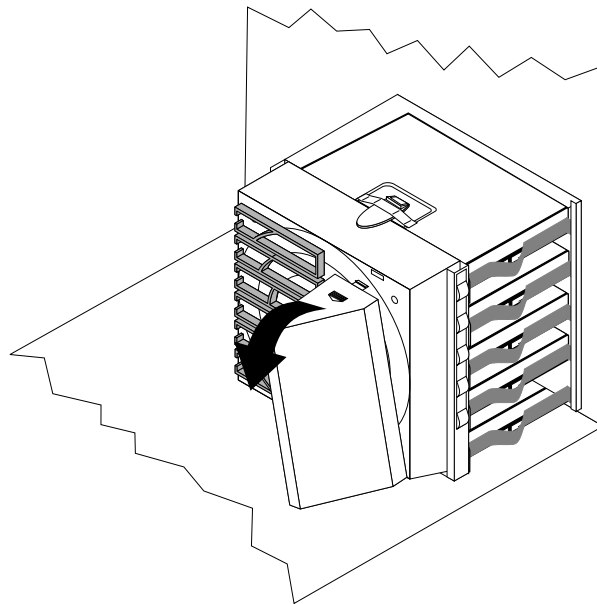


Figure 40. Removing the hard disk drive fan duct

5. Press the hard disk drive fan assembly bracket latch downwards and pivot the bracket to remove it from the chassis.

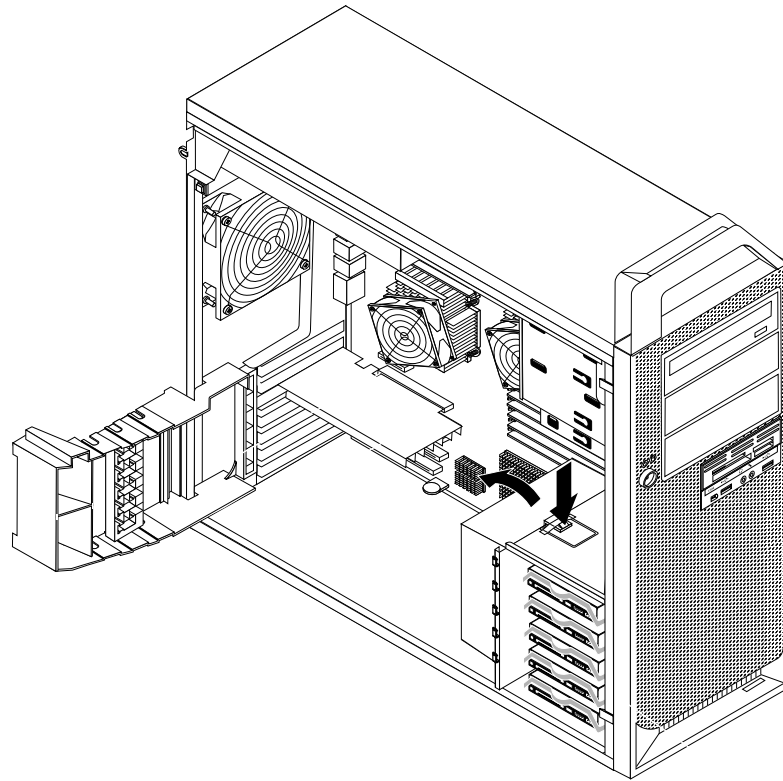


Figure 41. Removing the hard disk drive fan assembly bracket

6. Disconnect the hard disk drive fan assembly cable from the system board.
7. The hard disk drive fan assembly is attached to the bracket by four rubber mounts **1**. Remove the fan assembly by gently pulling it out of the bracket.

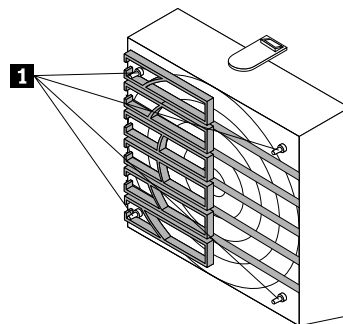


Figure 42. Removing the hard disk drive fan assembly

8. Install the new hard disk drive fan assembly by aligning the rubber mounts of the fan assembly with the holes in the hard disk drive fan assembly bracket and pushing the rubber mounts through the holes.
9. Connect the hard disk drive fan assembly cable to the system board and then install the bracket and hard disk drive fan assembly to the chassis.
10. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the rear fan assembly

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace the rear fan assembly.

To replace the rear fan assembly:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Locate the rear fan assembly. See “Locating components” on page 7.
3. Disconnect the rear fan assembly cable from the system board. See “Identifying parts on the system board” on page 8.
4. The rear fan assembly is attached to the chassis by four rubber mounts. Remove the rear fan assembly by gently pulling it out of the chassis.

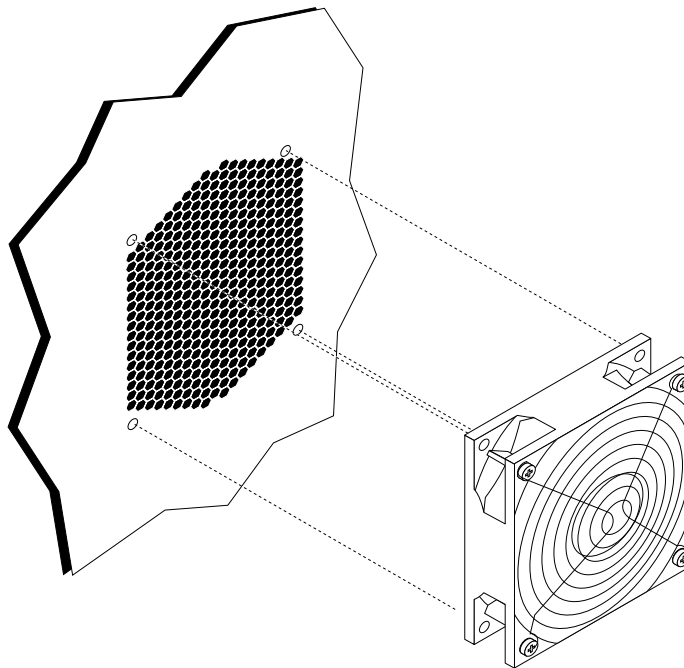


Figure 43. Removing the rear fan assembly

5. Install the new rear fan assembly by aligning the rubber mounts of the rear fan assembly with the holes on the chassis and push the rubber mounts through the holes.
6. Pull on the tips of the rubber mounts until the rear fan assembly is in place.
7. Connect the rear fan assembly cable to the rear fan connector on the system board.
8. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the internal speaker

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace the internal speaker.

To replace the internal speaker:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Remove the front bezel. See “Removing the front bezel” on page 12.
3. Locate the internal speaker. See “Locating components” on page 7.
4. Access system board components. See “Accessing system board components” on page 13. Note the route of the internal speaker cable and power LED cable, and then disconnect these cables from the system board. See “Identifying parts on the system board” on page 8.
5. Disengage the internal speaker locking tab **3** and slide the internal speaker **1** downwards to completely remove it from the chassis.

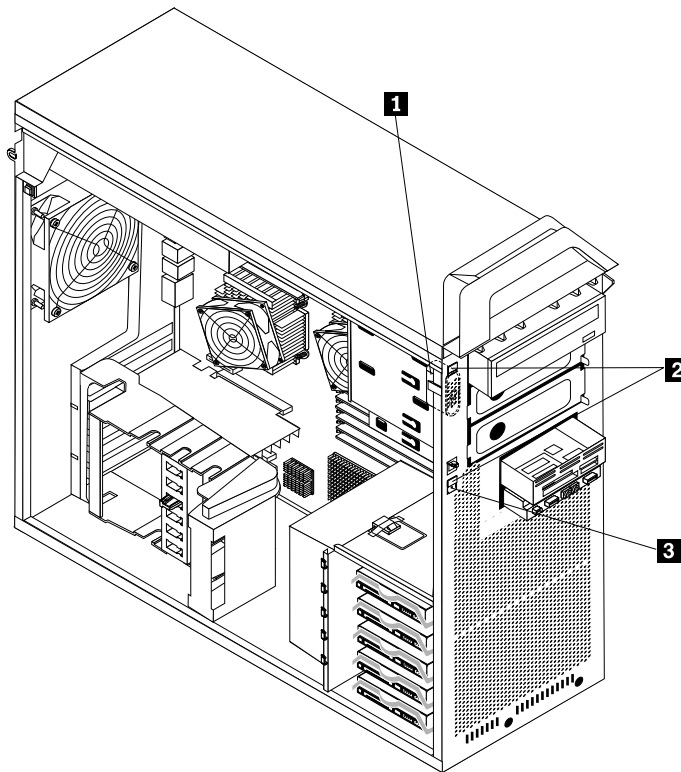


Figure 44. Removing the internal speaker

6. Route the new internal speaker cable and power LED cable, and then position the two internal speaker latches **2** into the metal slots in the chassis, then push the internal speaker upwards until it snaps into position.
7. Connect the internal speaker cable and the power LED cable to the system board. See “Identifying parts on the system board” on page 8.

8. Reinstall the hard disk drive fan bracket if removed.
9. Reinstall the front bezel.
10. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the keyboard

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace a keyboard.

To replace a keyboard:

1. Locate the keyboard connector. See “Locating controls and connectors on the front of your computer” on page 4 or “Locating connectors on the rear of your computer” on page 5.

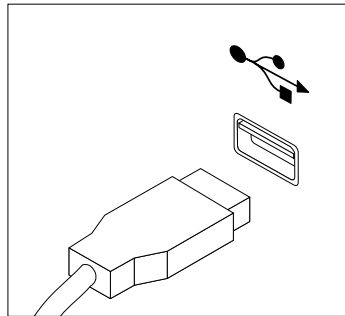


Figure 45. Keyboard connector

2. Disconnect the failing keyboard cable from the computer.
3. Connect the new keyboard cable to one of the USB connectors.
4. Go to Chapter 4 “Completing the parts replacement” on page 45.

Replacing the mouse

Attention: Do not open your computer or attempt any repair before reading and understanding the “Important safety information” in the *ThinkStation Safety and Warranty Guide* that came with your computer. To obtain a copy of the *ThinkStation Safety and Warranty Guide*, go to: <http://support.lenovo.com>

This section provides instructions on how to replace a mouse.

To replace a mouse:

1. Locate the connector for the mouse. See “Locating controls and connectors on the front of your computer” on page 4 or “Locating connectors on the rear of your computer” on page 5.

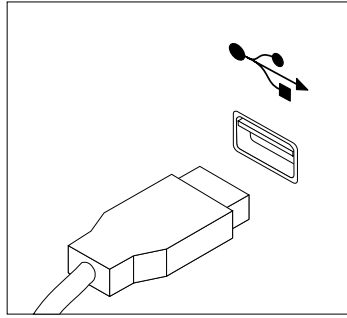


Figure 46. Mouse connector

2. Disconnect the failing mouse cable from the computer.
3. Connect the new mouse cable to one of the USB connectors.
4. Go to Chapter 4 “Completing the parts replacement” on page 45.

Chapter 4. Completing the parts replacement

After completing all parts replacements, replace the computer cover and reconnect cables, including telephone lines and power cords. Depending on the parts replaced, you might need to confirm the updated information in the Setup Utility program. Refer to "Using the Setup Utility" in the *ThinkStation User Guide* for this product.

To complete the parts replacement:

1. Ensure that all components have been reassembled correctly and that no tools or loose screws are left inside your computer. See "Locating components" on page 7 for the location of various components.
2. Make sure that the cables are routed correctly.

Important: Correctly route all power supply cables. Keep cables clear of the hinges and sides of the computer chassis.

3. Replace the computer cover.
 - a. Align the cover with the chassis.
 - b. Close the cover.
 - c. Engage the cover latch.
 - d. Check to be sure the cover is latched.
4. If a cover lock is installed, lock the cover.
5. Reconnect the external cables and power cords to the computer. See "Locating connectors on the rear of your computer" on page 5.
6. To update your configuration, see "Using the Setup Utility" in the *ThinkStation User Guide*.

Note: 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.

Obtaining device drivers

You can obtain device drivers for operating systems that are not preinstalled at:
<http://support.lenovo.com>

Installation instructions are provided in readme files with the device-driver files.

Chapter 5. Security features

To help prevent hardware theft and unauthorized access to your computer, several security lock options are available. In addition to a physical lock, unauthorized use of your computer can be prevented by a software lock that locks the keyboard until a correct password is typed in.

Make sure that any security cables that you install do not interfere with other computer cables.

Locking devices

This section describes the different kinds of locking devices for this product.

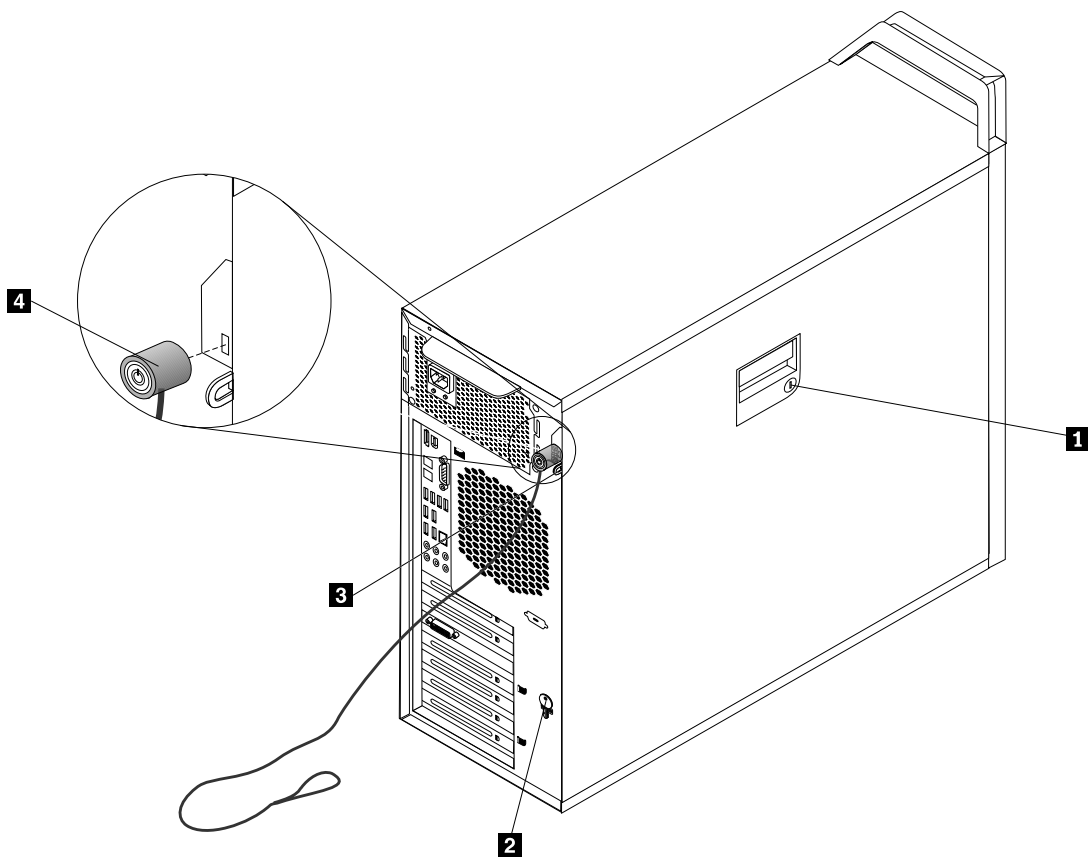


Figure 47. Locking devices

A keylock **1** comes with this product built into the side cover. The keys **2** for the side cover are attached to the rear of the machine. For security, store the keys in a secure place when you are not using them.

An optional padlock with a 5 mm (0.20 inch) shackle can be used to secure the product cover used the padlock hasp **3**.

An optional integrated cable lock **4** (sometimes referred to as the Kensington lock) can be used to secure your computer to a desk, table, or other non-permanent fixture. The cable lock attaches to a security slot at the rear of your computer and is operated with a key. 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 a security cable directly from Lenovo by searching on *Kensington* at: <http://support.lenovo.com>

Password protection

To deter unauthorized use of your computer, you can use the Setup Utility program to set a password. When you turn on your computer, you are prompted to type the password to unlock the keyboard for normal use.

What to do next:

- To work with another option, go to the appropriate section.
 - To complete the installation, go to Chapter 4 “Completing the parts replacement” on page 45.
-

Erasing a lost or forgotten password (clearing CMOS)

This section contains instructions on erasing some lost or forgotten passwords, such as a user password.

To erase a forgotten password:

1. Remove the computer cover. See “Removing the computer cover” on page 11.
2. Access the system board. See “Accessing system board components” on page 13.
3. Locate the Clear CMOS/Recovery jumper on the system board. See “Identifying parts on the system board” on page 8.
4. Move the jumper from the standard position (pin 1 and pin 2) to the maintenance or configure position (pin 2 and pin 3).
5. Reinstall the adapter card if removed.
6. Replace the computer cover and connect the power cord. See Chapter 4 “Completing the parts replacement” on page 45.
7. Restart the computer, leave it on for approximately 10 seconds. Turn off the computer by holding the power switch for approximately five seconds. The computer will turn off.
8. Repeat steps 1 through 3.
9. Move the Clear CMOS/Recovery jumper back to the standard position (pin 1 and pin 2).
10. Reinstall the adapter card if removed.
11. Replace the computer cover and connect the power cord. See Chapter 4 “Completing the parts replacement” on page 45.

Appendix A. System memory speed

The Intel Xeon microprocessor families compatible with this ThinkStation computer feature an integrated memory controller, which provides the microprocessor with direct access to the system memory. Because of this design, the system memory speed will be determined by a number of factors, including the microprocessor model and the type, speed, size (capacity), and number of DIMMs installed. Refer to the following table for the information on the supported system memory speed for your own computer model.

Table 1. DIMM type and speed: PC3-10600U

DIMM size (capacity)	Number of DIMMs installed per microprocessor bank	Microprocessor model	Memory frequency
1 GB, 2 GB, 4 GB	1 to 3	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, X5647	1066 MHz
		Intel Xeon E5645, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W5580, W5590	1333 MHz
	4 to 6	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, X5550, X5560, X5570, X5647, W5580, W5590	1066 MHz
		Intel Xeon E5645, E5649, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690	1333 MHz

Table 2. DIMM type and speed: PC3-8500U

DIMM size (capacity)	Number of DIMMs installed per microprocessor bank	Microprocessor model	Memory frequency
1 GB, 2 GB, 4 GB	1 to 6	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, E5645, X5647, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680,	1066 MHz

Table 2. DIMM type and speed: PC3-8500U (continued)

DIMM size (capacity)	Number of DIMMs installed per microprocessor bank	Microprocessor model	Memory frequency
		X5687, X5690, W5580, W5590	

Table 3. DIMM type and speed: PC3-10600R

DIMM size (capacity)	Number of DIMMs installed per microprocessor bank	Microprocessor model	Memory frequency
1 GB, 2 GB, 4 GB, 8 GB	1 to 3	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, X5647	1066 MHz
		Intel Xeon E5645, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W5580, W5590	1333 MHz
	4 to 6	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, X5550, X5560, X5570, X5647, W5580, W5590	1066 MHz
		Intel Xeon E5645, E5649, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690	1333 MHz

Table 4. DIMM type and speed: PC3-8500R

DIMM size (capacity)	Number of DIMMs installed per microprocessor bank	Microprocessor model	Memory frequency
1 GB, 2 GB, 4 GB	1 to 6	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, X5647, E5645, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W5580, W5590	1066 MHz

Table 4. DIMM type and speed: PC3-8500R (continued)

DIMM size (capacity)	Number of DIMMs installed per microprocessor bank	Microprocessor model	Memory frequency
8 GB, 16 GB	1 to 3	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, X5647, E5645, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W5580, W5590	1066 MHz
	4 to 6	Intel Xeon E5502, E5503, E5504, E5506, E5507, E5603, E5606, E5607, E5520, E5530, E5540, E5620, E5630, E5640, X5647, E5645, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W5580, W5590	800 MHz

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