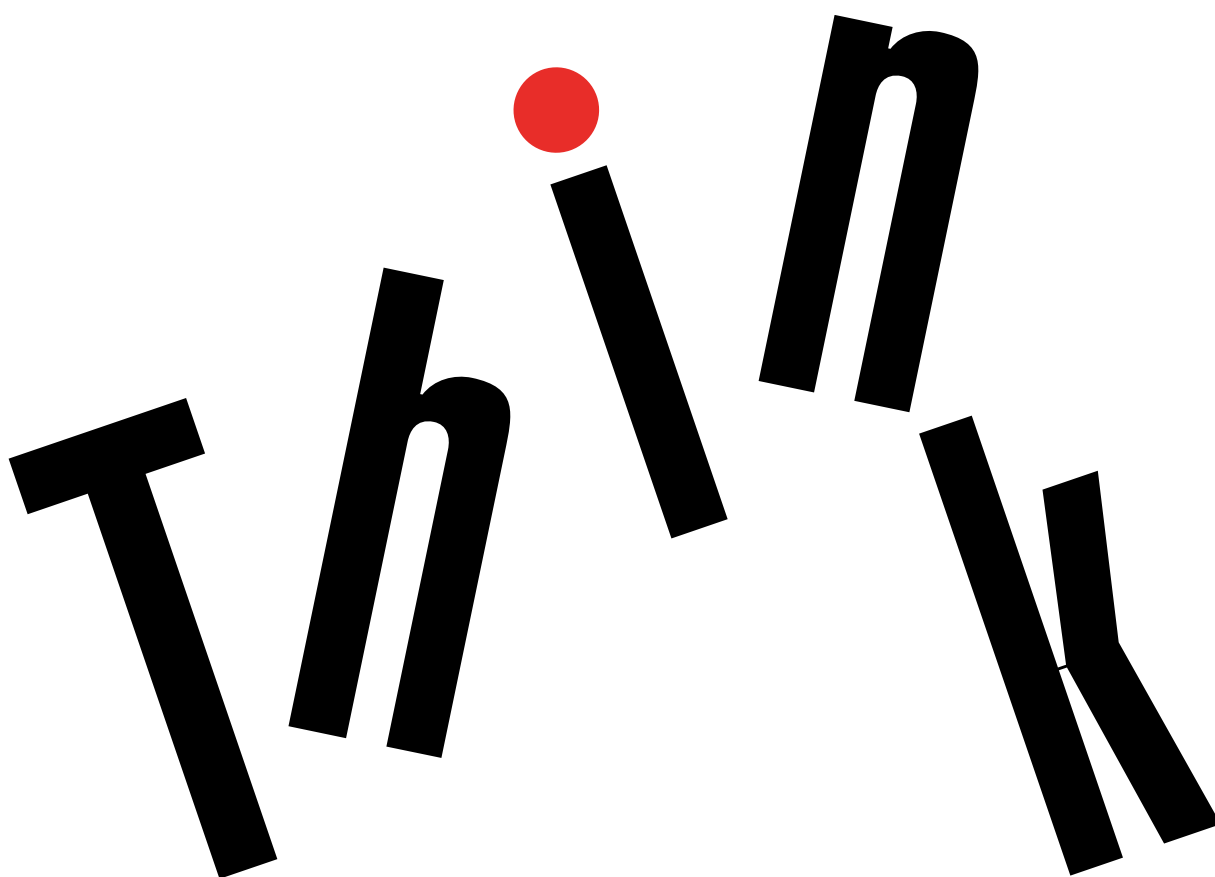


**Lenovo**

**ThinkServer®**

ThinkServer TS150  
User Guide and Hardware Maintenance  
Manual



**Machine Types:** 70LU, 70LV, 70LW, 70LX, 70UA, 70UB, 70UC, and  
70UD



## Welcome

Before using your server and this document, be sure to read the *Read Me First* that comes with your server.

Lenovo makes constant improvement on the documentation of your server. To get all the latest documents, go to:

<http://www.lenovo.com/UserManuals>

**Note:** Your server might look slightly different from illustrations in this document. To show the main parts clearly, some of the illustrations do not show all components.

**Seventh Edition (October 2018)**

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## Read this first: safety information

**Note:** Before using the product, be sure to read and understand the multilingual *Safety Information* on the Lenovo Web site at:

<https://support.lenovo.com/documents/LNVO-DOCS>

قبل استخدام المنتج، تأكد من قراءة *Safety Information* (معلومات السلامة) المتعددة اللغات وفهمها في موقع Lenovo على الويب.

Antes de usar o produto, certifique-se de ler e entender as *Safety Information* (Informações sobre segurança) multilíngues no site da Lenovo.

Преди да използвате продукта, прочетете и разберете многоезичната *Safety Information* (Информация за безопасност) на уебсайта на Lenovo.

Prije korištenja našeg proizvoda svakako s razumijevanjem pročitajte višjejezični dokument *Safety Information* (Informacije o sigurnosti) na web-mjestu tvrtke Lenovo.

Před použitím tohoto produktu si nezapomeňte přečíst vícejazyčný dokument *Safety Information* (Bezpečnostní informace) na webu společnosti Lenovo.

Før du bruger produktet, skal du sørge for at læse og forstå *Safety Information* (sikkerhedsforskrifter), der findes på flere sprog, på Lenovos websted.

Lue monikielinen *Safety Information* (Turvaohjeet) -julkaisu Lenovon verkkosivustosta ennen tuotteen käyttöä.

Avant d'utiliser ce produit, prenez connaissance des *Safety Information* (Informations relatives à la sécurité) multilingues sur le site Web Lenovo.

Πριν χρησιμοποιήσετε το προϊόν, φροντίστε να διαβάσετε και να κατανοήσετε τις *Safety Information* (Πληροφορίες ασφαλείας) στο δικτυακό τόπο της Lenovo.

Vor Verwendung des Produkts sollten Sie die mehrsprachigen *Safety Information* (Sicherheitsinformationen) auf der Lenovo Website lesen und verstehen.

לפני השימוש במוצר, הקפידו לקרוא ולהבין את המסמך *Safety Information* (מידע בנושא בטיחות) המופיע בשפות רבות באתר האינטרנט של Lenovo.

A termék használatára előtt olvassa át, és ismerje meg a Lenovo webhelyén több nyelven is elérhető *Safety Information* (Biztonsági tájékoztató) című dokumentumot.

Prima di utilizzare il prodotto, accertarsi di leggere e comprendere la documentazione multilingua *Safety Information* (Informazioni sulla sicurezza) sul sito Web Lenovo.

製品をご使用になる前に、Lenovo Web サイトに掲載されているマルチリンガルの *Safety Information* (安全上の注意) を読んで理解してください。

제품을 사용하기 전에 Lenovo 웹 사이트의 다국어 *Safety Information* (안전 정보)를 주의 깊게 읽어보십시오.

Zorg dat u alle *Safety Information* (veiligheidsvoorschriften) op de website van Lenovo hebt gelezen en begrepen voordat u het product gebruikt.



Przed skorzystaniem z produktu należy zapoznać się z wielojęzycznym dokumentem *Safety Information* (Informacje dotyczące bezpieczeństwa), dostępnym w serwisie internetowym Lenovo.

Antes de utilizar o produto, certifique-se de que lê e compreende a documentação multilingue *Safety Information* (Informações sobre Segurança) no sítio da Web da Lenovo.

Înainte de a utiliza produsul, citiți și înțelegeți *Safety Information* (informațiile de siguranță) în mai multe limbi de pe site-ul web Lenovo.

Før du bruker produktet, må du lese og forstå den flerspråklige *Safety Information* (sikkerhetsinformasjonen) på nettstedet til Lenovo.

Перед использованием продукта обязательно ознакомьтесь с разделом *Safety Information* (Информация по технике безопасности), представленным на нескольких языках на веб-сайте Lenovo.

在使用产品之前，请务必先阅读和了解 **Lenovo Web** 站点上的多语言 *Safety Information* 《安全信息》。

Pre korišćenja proizvoda, obavezno pažljivo i sa razumevanjem pročitajte višezjezične *Safety Information* (Bezbednosne informacije) na veb lokaciji kompanije Lenovo.

Skôr než produkt začnete používať, prečítajte si viacjazyčné *Safety Information* (Bezpečnostné informácie) na webovej lokalite spoločnosti Lenovo.

Pred uporabo izdelka poskrbite, da boste prebrali in razumeli razdelek *Safety Information* (Varnostne informacije), ki je na spletnem mestu Lenovo na voljo v več jezikih.

Antes de usar el producto, asegúrese de leer y entender la sección *Safety Information* (Información de seguridad) multilingüe del sitio web de Lenovo.

Innan du använder den här produkten är det viktigt att du har läst och förstått den flerspråkiga *Safety Information* (säkerhetsinformationen) på Lenovos webbplats.

使用本產品之前，請務必先閱讀及瞭解 **Lenovo** 網站上多國語言版本的 *Safety Information*（安全資訊）。

Ürünü kullanmadan önce, Lenovo web sitesindeki *Safety Information* (Güvenlik Bilgileri) belgesini (birden çok dilde yayınlanmaktadır) mutlaka okuyun.

Перш ніж використовувати продукт, обов'язково прочитайте *Safety Information* (інструкції з техніки безпеки), доступні різними мовами на веб-сайті Lenovo.

ก่อนใช้ผลิตภัณฑ์นี้ โปรดอ่านและทำความเข้าใจกับ *Safety Information* (ข้อมูลความปลอดภัย) หลายภาษา บนเว็บไซต์ **Lenovo**

**Important:** Ensure that you read and understand all caution and danger statements in this document before you perform the procedures. Read and understand any additional safety information that is included with the server or optional device before you install, remove, or replace the device.

#### Statement 1



#### DANGER



Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- Connect all power cords to a properly wired and grounded electrical outlet.
- Ensure that all power cord connectors are securely and completely plugged into receptacles.
- Connect to properly wired outlets any equipment that will be attached to this product.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.

**To connect:**

1. Turn everything OFF.
2. First, attach all cables to devices.
3. Attach signal cables to connectors.
4. Attach power cords to outlets.
5. Turn devices ON.

**To disconnect:**

1. Turn everything OFF.
2. First, remove power cords from outlets.
3. Remove signal cables from connectors.
4. Remove all cables from devices.

## Statement 2



### DANGER

**Danger of explosion if battery is incorrectly replaced.**

When replacing the lithium coin cell battery, use only the same or an equivalent type that is recommended by the manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

**Do not:**

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

## Statement 3



### CAUTION:

When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.



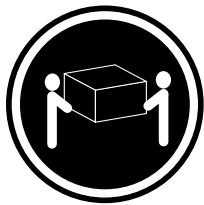
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.



**DANGER**

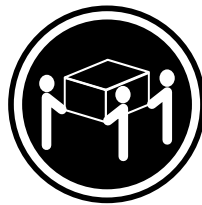
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following: Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

#### Statement 4



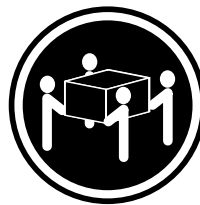
$\geq 18$  kg (39.7 lb)

$< 32$  kg (70.5 lb)



$\geq 32$  kg (70.5 lb)

$< 55$  kg (121.2 lb)



$\geq 55$  kg (121.2 lb)

$< 100$  kg (220.5 lb)

#### CAUTION:

Use safe practices when lifting.

#### Statement 5



#### CAUTION:

The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



#### Statement 6



#### CAUTION:

If you install a strain-relief bracket option over the end of the power cord that is connected to the device, you must connect the other end of the power cord to a power source that is easily accessible in case it needs to be disconnected.



**Statement 7**



**CAUTION:**

If the device has doors, ensure that you remove or secure the doors before moving or lifting the device to protect against personal injury. The doors will not support the weight of the device.

**Statement 8**



**CAUTION:**

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

**Statement 9**



**CAUTION:**

Disconnect the hot-swap fan cables before removing the fan from the device to protect against personal injury.

**Statement 10**



**CAUTION:**

The following label indicates a sharp-edge hazard.



**Statement 11**



**CAUTION:**

The following label indicates a potential heat hazard.





#### Statement 12



#### DANGER

Overloading a branch circuit is a potential fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch current ratings at the installation site.

#### Statement 13



#### CAUTION:

Ensure that the rack is secured properly to avoid tipping when the server unit is extended on the rails.

#### Statement 14



#### CAUTION:

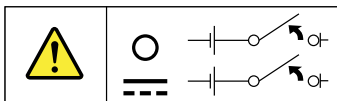
Some accessory or option board outputs exceed Class 2 or limited power source limits. You must install the appropriate interconnecting cabling in accordance with your local electrical code requirements.

#### Statement 15



#### CAUTION:

The power-control button on the device may put the device in standby mode instead of turning off the device. In addition, the device might have multiple connections to dc power. To remove all electrical current from the device, ensure that all connections to dc power are disconnected at the dc power input terminals.



#### Statement 16



#### CAUTION:

To reduce the risk of electric shock or energy hazards:

- This equipment must be installed by trained service personnel in a restricted-access location, as defined by your local electrical code and the latest edition of IEC 60950.
- The branch circuit overcurrent protection must be rated in accordance with local electrical code requirements.
- Use 1.3 mm<sup>2</sup> or 16 American Wire Gauge (AWG) copper conductor only, not exceeding 3 meters in length.



- Torque the wiring-terminal screws to 1.4 newton-meters or 12 inch-pounds.
- Provide a readily available, approved and rated disconnect device in the field wiring.

Statement 17



**CAUTION:**

This product contains a Class 1M laser. Do not view directly with optical instruments.

Statement 18



**CAUTION:**

Do not place any object on top of rack-mounted products.

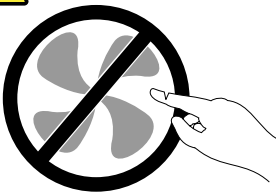


Statement 19



**CAUTION:**

Hazardous moving parts. Keep fingers and other body parts away.



Statement 20



**CAUTION:**

A lithium ion battery is provided. To avoid possible explosion, do not burn the battery. Replace the battery only with the Lenovo-approved part. Recycle or discard the battery as instructed by local regulations.

---

## Products that are not assessed

Typical products that are **not assessed** include but not limited to the following:

- Server and IT-rack components (for example, uninterruptible power supplies and current distribution systems)
- Devices in IT rooms (for example, bulk storage units and network products)



- Industrial low-voltage switchgear

---

## Safety inspection guide

The purpose of this inspection guide is to assist you in identifying potentially unsafe conditions. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury. This guide addresses only those items. You should use good judgment to identify potential safety hazards due to attachment of non-ThinkServer features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock)
- Explosive hazards, such as a damaged Cathode Ray Tube (CRT) monitor or a bulging capacitor
- Mechanical hazards, such as loose or missing hardware

To determine whether there are any potentially unsafe conditions, use the following checklist at the beginning of every service task. Begin the checks with the power off, and the power cords disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power off the server. Disconnect the power cords.
3. Check the power cord for:
  - a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
  - b. The power cord should be the authorized type specified for your server. Go to: <http://www.lenovo.com/serviceparts-lookup>
  - c. Insulation must not be frayed or worn.
4. Check for cracked or bulging batteries.
5. Remove the cover.
6. Check for any obvious non-ThinkServer alterations. Use good judgment as to the safety of any non-ThinkServer alterations.
7. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
8. Check for worn, frayed, or pinched cables.
9. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

---

## Grounding requirements

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



---

## Chapter 1. General information

This chapter contains the following items:

- “Introduction” on page 1
- “Server documentation” on page 2

---

### Introduction

The following table lists important information about your server and where to obtain the information.

Information	Where to obtain
<b>Lenovo Limited Warranty (LLW)</b>	<p>The LLW contains the warranty terms that apply to the product you purchased from Lenovo®. The LLW is available at: <a href="http://www.lenovo.com/warranty/llw_02">http://www.lenovo.com/warranty/llw_02</a></p> <p>If you cannot obtain the LLW from the Lenovo Web site, contact your local Lenovo office or reseller to obtain a printed version of the LLW, free of charge.</p>
<b>Worldwide Lenovo Support telephone list</b>	<p>Telephone numbers are subject to change without notice. The most up-to-date telephone list for Lenovo Support is always available at: <a href="http://www.lenovo.com/support/phone">http://www.lenovo.com/support/phone</a></p> <p>If the telephone number for your country or region is not listed, contact your Lenovo reseller or Lenovo marketing representative.</p>
<b>Most up-to-date information about the server</b>	<a href="http://www.lenovo.com/thinkserver">http://www.lenovo.com/thinkserver</a>
<b>Latest technical information, documentation, device drivers, and other updates</b>	<a href="http://www.lenovo.com/support">http://www.lenovo.com/support</a>
<b>Instructions on how to register your server with Lenovo</b>	<p>Follow the instructions at: <a href="http://www.lenovo.com/register">http://www.lenovo.com/register</a></p> <p>When you register your server, information is entered into a database, which enables Lenovo to contact you in case of a recall or other severe problem. After you register your server with Lenovo, you will receive quicker service when you call Lenovo for help. In addition, some locations offer extended privileges and services to registered users.</p>
<b>Product information label</b>	<p>Record information about your server in the following table. You will need the information if you ever need to have your server serviced. The product information label is attached on the chassis. See “Machine type, model, and serial number label” on page 11.</p>

<b>Product name</b>	_____
<b>Machine type and model (MT-M)</b>	_____
<b>Serial number (S/N)</b>	_____



Date of purchase \_\_\_\_\_

---

## Server documentation

This topic provides a general description of each document for your server and instructions on how to obtain all the documents.

### Printed documents

Your server package contains the following printed documents:

- *Read Me First*

This is a multilingual document. It illustrates safety symbols and instructs you to read the complete safety, warranty, and support information provided on the Lenovo Web site before using the server. This document also tells you how to find the most up-to-date information on the Lenovo Support Web site. In addition, recycling, environmental, and legal notices are all included.

- A letter to customers

This is a multilingual letter to customers, which tells customers that Lenovo is undertaking a paperless electronic documentation initiative to protect environment. This letter also provides information about how to contact Lenovo if you require a printed version of any electronic documents.

### Electronic documents

- You can find the following electronic documents at <https://support.lenovo.com/documents/LNVO-DOCS>:

- *Safety Information*

This is a multilingual document that includes all the safety statements for your product. Ensure that you read and understand these safety statements before using the product.

- *Lenovo Limited Warranty*

This document includes the Lenovo terms and warranty statements.

- *Lenovo License Agreement*

This document includes the terms and conditions of the Lenovo License Agreement.

- You can find the following electronic documents from the Lenovo Support Web site. Go to <http://www.lenovo.com/support>, click **Documentation**, and follow the instructions on the screen to find the document you need.

- *Safety, Warranty, and Support Information*

This is a multilingual document that includes all the safety statements for your product in more than 30 languages. Ensure that you read and understand all the safety statements before using the product. This document also includes the Lenovo warranty statement, Customer Replaceable Units (CRUs) information, and information about how to contact the Lenovo Customer Support Center.

- *User Guide and Hardware Maintenance Manual*

This document provides detailed information to help you get familiar with your server and help you use, configure, and maintain your server.

- *MegaRAID SAS Software User Guide (English only)*

This document provides information about Redundant Array of Independent Disks (RAID) and how to use the utility programs to configure, monitor, and maintain your server RAID and related devices.



**Note:** Refer to this document for hardware RAID information if the server has a required RAID card installed. See RAID card. For information about onboard software RAID, see Configuring onboard SATA software RAID.

- Other documents

You might find other documents for the Host Bus Adapter (HBA), Ethernet card, or other optional parts.







---

## Chapter 2. Server setup road map

This chapter provides a general road map to guide you through setting up your server.

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

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### Server setup procedure

The following list is a general procedure for setting up your server:

1. Unpack the server package. See “In the box” on page 7.
2. Install any required hardware or server options. See the related topics in Chapter 5 “Replacing hardware” on page 39.
3. Connect the Ethernet cables and power cords to the server. See “Rear view of the server” on page 12 to locate the connectors.
4. Turn on the server to verify operation. See “Turning on the server” on page 5.
5. Review the Basic Input Output System (BIOS) settings and customize as needed. See “Using the Setup Utility program” on page 25.
6. Configure RAID and install the operating system and device drivers. See “Using the ThinkServer EasyStartup program” on page 31 and “Configuring RAID” on page 33.
7. Install any additional drivers required for added features. Refer to the instructions that come with the hardware option.
8. Configure Ethernet settings in the operating system by referring to the operating system help. Skip this step if the operating system was installed using the Lenovo ThinkServer Deployment Manager program.
9. Check for firmware updates. To check and update the firmware, do the following:
  - a. Go to <http://www.lenovo.com/drivers> and follow the instructions on the Web page to check for the latest level of firmware, such as the BIOS updates and device drivers.
  - b. If needed, use the Firmware Updater program to update your system firmware. See “ThinkServer EasyUpdate Firmware Updater” on page 10.
10. Install management applications and any other applications. Refer to the documentation that comes with the applications that you want to install.

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### Turning on the server

After you finish unpacking and setting up the server, connect it to an ac power source. Press the power button on the front panel to turn on the server. See “Front view of the server” on page 11.

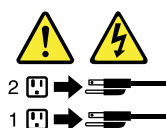
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### Turning off the server

#### CAUTION:

**The power control button on the device and the power button on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.**





The server can be turned off in one of the following ways:

- Turn off the server from the operating system if your operating system supports this feature. After an orderly shutdown of the operating system, the server turns off automatically. For instructions on how to shut down your specific operating system, refer to the related documentation or help system for the operating system.
- Press the power button on the front panel to start an orderly shutdown of the operating system and turn off the server, if your operating system supports this feature.
- If your server stops responding and you cannot turn it off, press and hold the power button on the front panel for four seconds or more. If you still cannot turn off the server, disconnect all power cords from the server.
- The server might turn off as an automatic response to a critical system failure.



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## Chapter 3. Product overview

This chapter contains the following items:

- “In the box” on page 7
- “Features and specifications of your server” on page 7
- “Operating environment” on page 9
- “Software programs” on page 9
- “Component locations” on page 11

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### In the box

Your shipping box contains the following items:

- Server
- Material box, including items such as power cords (available on some models), keyboard, mouse and printed documentation

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### Features and specifications of your server

This topic lists the features and specifications of your server, such as dimension and weight; hardware configurations; and reliability, availability, and serviceability (RAS) features. The RAS features include security features and basic system management features. The RAS features help you to ensure the integrity of the data stored on the server, the availability of the server when you need it, and the ease with which you can diagnose and correct problems.

<b>Dimension and weight</b>	<p>Dimension:</p> <p>Width: 175 mm (14.76 inches)</p> <p>Height: 375 mm (6.89 inches)</p> <p>Depth: 431 mm (16.97 inches)</p> <p>Weight:</p> <p>Maximum product weight without package: 12.5 kg (27.6 lb)</p> <p>Maximum product weight with package: 14.5 kg (32.0 lb)</p>
<b>Electrical input</b>	<ul style="list-style-type: none"><li>• Input voltage:<p>Low range: 100–127 V ac</p><p>High range: 200–240 V ac</p></li><li>• Input frequency: 50 Hz or 60 Hz</li></ul>
<b>Central Processing Unit (CPU)</b>	<p>Your server comes with one of the following CPUs (internal cache size varies by model type):</p> <ul style="list-style-type: none"><li>• Intel® Xeon®</li><li>• Intel Core™</li><li>• Intel Pentium®</li><li>• Intel Celeron®</li></ul>



<b>Memory</b>	Your server provides four memory slots. Each slot supports 4 GB, 8 GB, and 16 GB double data rate 4 (DDR4) memory modules. For more information, see “Memory module installation rules” on page 69.
<b>Power supply</b>	<p>The server might come with one of the following power supply configurations:</p> <ul style="list-style-type: none"> <li>• 250-watt power supply (80 PLUS Bronze)</li> <li>• 400-watt power supply (80 PLUS Platinum)</li> </ul> <p><b>Note:</b> To support a discrete graphic adapter, a 400-watt power supply must be installed.</p>
<b>System Fan</b>	<p>Your server comes with the following fans to provide proper system cooling and airflow:</p> <ul style="list-style-type: none"> <li>• One front system fan</li> <li>• One heat sink and fan assembly</li> <li>• One rear system fan</li> <li>• Up to two hard-disk-drive (HDD) fans (available on some models)</li> </ul>
<b>Internal drives</b>	<p>The internal drives supported by your server vary by model.</p> <ul style="list-style-type: none"> <li>• Internal storage drive <ul style="list-style-type: none"> <li>– Up to five 2.5-inch SATA hard disk drives (HDDs) or solid-state drives (SSDs)</li> <li>– Up to four 3.5-inch SATA HDDs</li> <li>– Up to four 2.5-inch HDD/SSD and 3.5-inch HDD mixed configuration</li> </ul> </li> <li>• Optical drive <ul style="list-style-type: none"> <li>– Up to two SATA optical drives</li> <li>– One slim SATA optical drive (available on some models)</li> </ul> </li> <li>• RDX tape drive <p>Your server supports one RDX tape drive. If your server is installed with a Windows Server operating system, you can use the Windows Backup program to back up the data stored on RDX media. For detailed information, refer to the user guide of the tape drive. The user guide is available for download at: <a href="http://www.lenovo.com/UserManuals">http://www.lenovo.com/UserManuals</a></p> </li> </ul> <p>For more information about the internal drives or drive bays, see “Internal drives” on page 44.</p>
<b>Expansion slots</b>	The server has four Peripheral Component Interconnect Express (PCIe) expansion slots on the system board. For detailed information, see “System board components” on page 19.
<b>Input/Output (I/O) features</b>	<ul style="list-style-type: none"> <li>• One serial connector</li> <li>• One Video Graphics Array (VGA) monitor connector</li> <li>• One DisplayPort® connector</li> <li>• One RJ-45 Ethernet connector</li> <li>• Eight USB 3.0 connectors (two on the front panel and six on the rear panel)</li> <li>• Three audio connectors (audio line-in connector, audio line-out connector, and microphone connector)</li> </ul> <p>To locate the connectors, refer to the related topics in “Component locations” on page 11.</p>
<b>Video subsystem</b>	The server provides VGA and DisplayPort connectors for connecting video devices. The two connectors are functional only when the CPU in your server comes with an integrated graphics controller.



<b>Ethernet connectivity</b>	There is one RJ-45 Ethernet connector on the rear panel with 10 megabits per second (Mbps), 100 Mbps, or 1000 Mbps network connectivity. For more information, see “Rear view of the server” on page 12.
<b>Security features</b>	<ul style="list-style-type: none"> <li>• Administrator password and user password to help protect unauthorized access to the server (see “Using passwords” on page 28)</li> <li>• ThinkServer Trusted Platform Module (TPM), which is an integrated security chip, to help enhance server security</li> <li>• Remote monitoring or control by an administrator to provide protection or help</li> <li>• Intrusion switch that informs you through an event in the system event log (SEL) when the server cover is not properly installed or closed</li> </ul>
<b>Basic system management features</b>	<ul style="list-style-type: none"> <li>• Ability to store the power-on self-test (POST) hardware test results</li> <li>• BIOS Setup Utility program The BIOS Setup Utility program helps you view the server information and configure the server in the pre-operating system environment. See “Using the Setup Utility program” on page 25.</li> <li>• Preboot Execution Environment (PXE) The Intel PXE technology enables you to boot your computers, load an operating system, or deploy executable images from a remote server by using a network interface. The operation can be done independently of local data storage devices (such as hard disk drives) or operating systems.</li> <li>• Redundant Array of Independent Disks (RAID) Your server supports onboard SATA software RAID. If a required RAID card is installed, your server also supports advanced SATA/SAS hardware RAID configurations. For detailed information, see “Configuring RAID” on page 33.</li> <li>• Software programs For more information about the software programs, see “Software programs” on page 9.</li> </ul>

## Operating environment

The following table provides information about the operating environment for your server.

Table 1. Operating environment specifications

<b>Air temperature (operating)</b>	from 10°C to 35°C (50°F to 95°F)
<b>Air temperature (storage)</b>	from -40°C to 60°C (-40°F to 140°F) in original shipping package
<b>Humidity (operating)</b>	from 8% to 80% (non-condensing)
<b>Humidity (storage)</b>	from 10% to 90% (non-condensing)
<b>Altitude</b>	<p>from 0 to 3048 m (0 to 10 000 ft) in an unpressurized environment</p> <p><b>Note:</b> When the altitude exceeds 3000 m (10 000 ft), the defined maximum dry-bulb temperature for operation becomes a dependent variable. The temperature value decreases by 1°C (1.8°F) per 300 m (984 ft) as the altitude increases.</p>

## Software programs

This topic provides information about the software programs that you can use to set up, use, and maintain the server.



To download the software programs, go to the Lenovo Support Web site at <http://www.lenovo.com/support> and follow the instructions on the Web page.

For detailed information about a program, refer to the help system or user guide of the program.

## ThinkServer EasyStartup

The ThinkServer EasyStartup program simplifies the process of configuring RAID and installing supported operating systems and device drivers on your server. You can download the ISO image for the ThinkServer EasyStartup program from the Lenovo Support Web site and burn it into a disc or a USB flash drive. For detailed information, see “Using the ThinkServer EasyStartup program” on page 31.

## ThinkServer EasyUpdate Firmware Updater

The ThinkServer EasyUpdate Firmware Updater program (hereinafter referred to as Firmware Updater) enables you to maintain your server firmware up-to-date and helps you avoid unnecessary server outages. Firmware Updater is provided on the Lenovo Support Web site.

To update your system firmware using Firmware Updater, do the following:

**Note:** Before distributing firmware updates to a server, ensure that your server can restart successfully without encountering hardware problems.

1. Go to <http://www.lenovo.com/drivers> and follow the instructions on the Web page to locate the program.
2. Download the ISO image for Firmware Updater and the TXT file that contains installation instructions.
3. Use any CD or DVD burning software to create a bootable disc with the ISO image.
4. Print the TXT file and follow the instructions to use Firmware Updater to update your system firmware.

## Lenovo ThinkServer Diagnostics

The Lenovo ThinkServer Diagnostics program enables you to diagnose server problems offline, perform some diagnostic tests, and collect system information. Examples of the system information include basic operating-system information, hardware information, SEL, RAID log, and so on. Depending on the model, your server might come with one of the following diagnostic program editions:

- Lenovo ThinkServer Diagnostics Embedded Edition
- Lenovo ThinkServer Diagnostics Standalone Edition

For more information about Lenovo ThinkServer Diagnostics, go to <http://support.lenovo.com/us/en/lenovodiagnosicsolutions/downloads>. Locate the **Lenovo ThinkServer Diagnostics** section at the bottom of the Web page. Then, click the desired link for more information.

## Lenovo ThinkServer Power Planner

The Lenovo ThinkServer Power Planner program provides information about the power consumption and electric current calculation based on the different configurations of servers and other devices. The program also helps to plan servers and devices deployment in an efficient way.

## Lenovo XClarity Essentials OneCLI

Lenovo XClarity Essentials OneCLI consists of individual application modules that utilize a command-line interface (CLI) to help you manage servers. These application modules can help you to configure the server, collect service data for the server, update firmware and device drivers, and perform power-management functions on the server. Lenovo XClarity Essentials OneCLI also enables you to get inventory information for some ThinkServer servers.



For more information about Lenovo XClarity Essentials OneCLI, go to:  
<https://support.lenovo.com/solutions/HT116433?LinkTrack=Solr>

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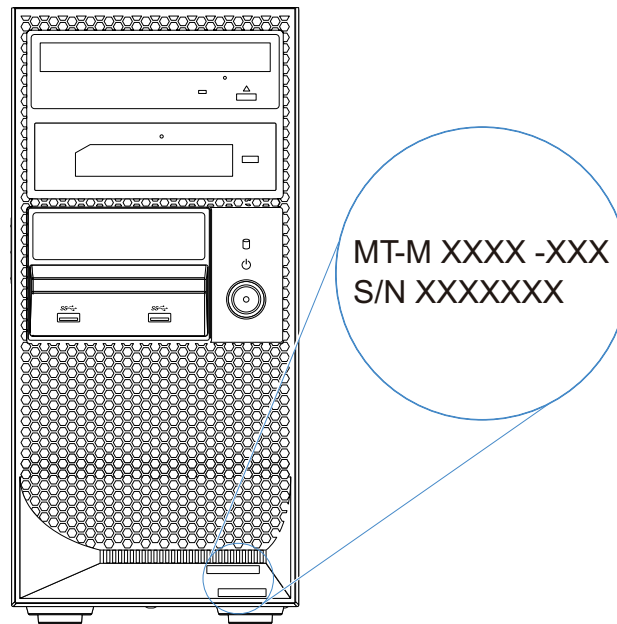
## Component locations

This topic provides information to help you locate your server components.

### Machine type, model, and serial number label

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

The following illustration is a sample of the machine type, model, and serial number label on the server.



*Figure 1. Machine type, model, and serial number label*

### Front view of the server

The front view of the server varies by model. Depending on the model, your server might look slightly different from the illustration in this topic.



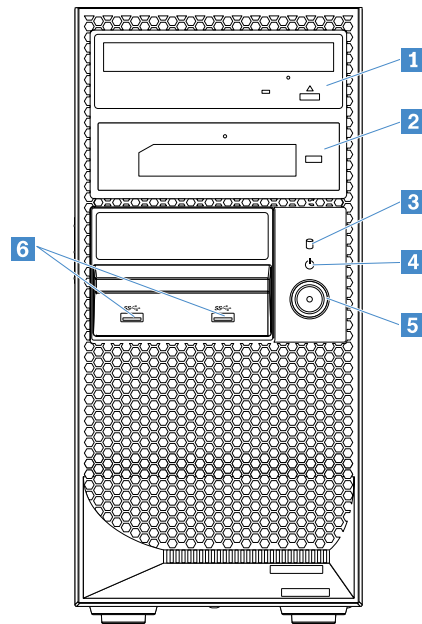






Figure 2. Front view of the server

<b>1</b> Optical drive (available on some models)	<b>2</b> RDX tape drive (available on some models)
<b>3</b> HDD status LED	<b>4</b> Power status LED
<b>5</b> Power button	<b>6</b> USB 3.0 connectors (2)

Table 2. LED status

LED	Status	Description
<b>3</b> HDD status LED	 Blinking green	Storage drives are active and data is being transferred.
	 Off	Storage drives are not in use.
<b>4</b> Power status LED	 Green	The system is powered on.
	 Off	The system is powered off.

**Note:** The HDD status LED is functional only when the storage drives are connected to the SATA connectors on the system board.

## Rear view of the server

This topic provides information to help you locate the connectors and components on the rear of your server. Some connectors on the rear of your server are color-coded to help you determine where to connect cables to your server.



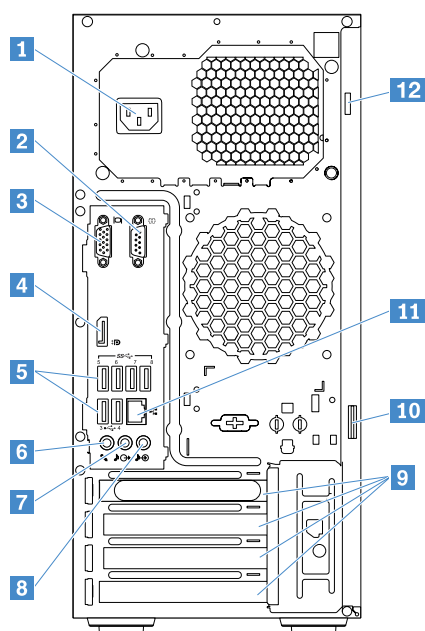


Figure 3. Rear view of the server

<b>1</b> Power cord connector	<b>2</b> Serial connector
<b>3</b> VGA connector (DB-15)	<b>4</b> DisplayPort connector
<b>5</b> USB 3.0 connectors (6)	<b>6</b> Microphone connector
<b>7</b> Audio line-out connector	<b>8</b> Audio line-in connector
<b>9</b> PCIe slots	<b>10</b> Padlock loop
<b>11</b> Ethernet connector	<b>12</b> Security-lock slot

#### **1 Power cord connector**

Used to connect the power cord.

#### **2 Serial connector**

Used to connect a device that uses a 9-pin serial connector.

#### **3 VGA connector (DB-15)**

Used to connect a VGA-compatible video device, such as a VGA monitor.

#### **4 DisplayPort connector**

Used to connect a high-performance monitor, a direct-drive monitor, or other devices that use a DisplayPort connector.

#### **5 USB 3.0 connectors (6)**

Used to connect a USB device, such as a USB keyboard, mouse, scanner, or printer. If you have more than eight USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.

#### **6 Microphone connector**



Used to connect a microphone to your server when you want to record sound or if you use speech-recognition software.

#### **7 Audio line-out connector**

Used to send audio signals from the server to external devices, such as stereo speakers, headphones, multimedia keyboards, and so on.

#### **8 Audio line-in connector**

Used to receive audio signals from an external audio device, such as a stereo system.

#### **9 PCIe slots**

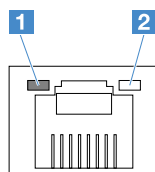
Used to install expansion cards, such as a graphics card, a RAID adapter, or an Ethernet card. For more information, see “System board components” on page 19.

#### **10 Padlock loop**

Used to attach a padlock.

#### **11 Ethernet connector**

Used to connect an Ethernet cable for a local area network (LAN). The Ethernet connector has two status LEDs to help you identify the Ethernet connectivity, activity, and connection speed.



Ethernet status LED	Status	Description
<b>1</b> Connection speed	○ Off	The connection speed is 10 Mbps.
	● Green	The connection speed is 100 Mbps.
	● Orange	The connection speed is 1000 Mbps.
<b>2</b> Link and activity	○ Off	The server is disconnected from a LAN.
	● Yellow	The server is connected to a LAN.
	☀ Blinking yellow	The LAN is connected and active.

#### **12 Security-lock slot**

Used to attach a cable lock.

## **Server locks**

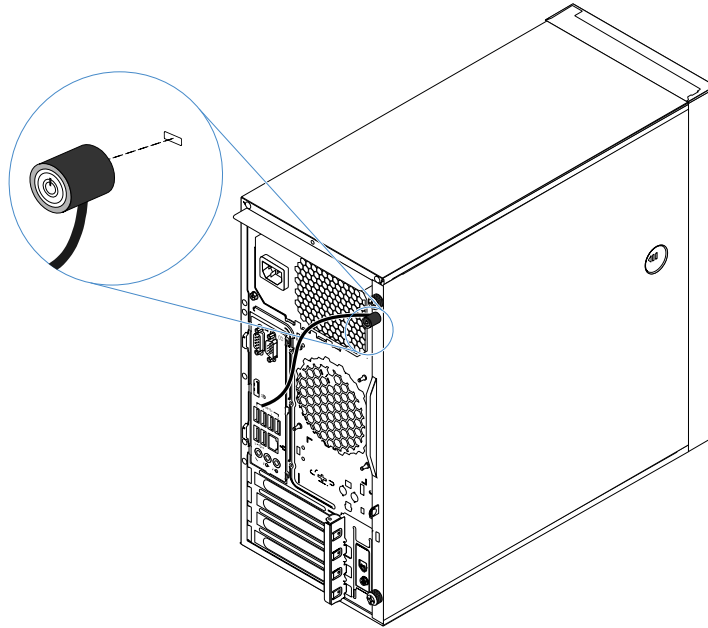
Locking the server cover prevents unauthorized access to the inside of your server.

**Note:** Depending on the model, your server might look slightly different from the illustrations in this topic.



### **Kensington-style cable lock**

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

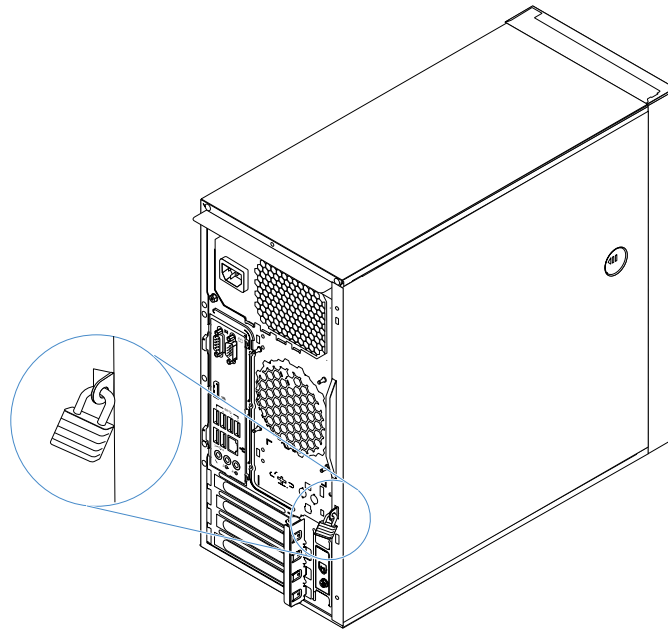


*Figure 4. Kensington-style cable lock*

### **Padlock**

Your server comes with a padlock loop. When a padlock is installed, the server cover cannot be removed.





*Figure 5. Padlock*

## Server components

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



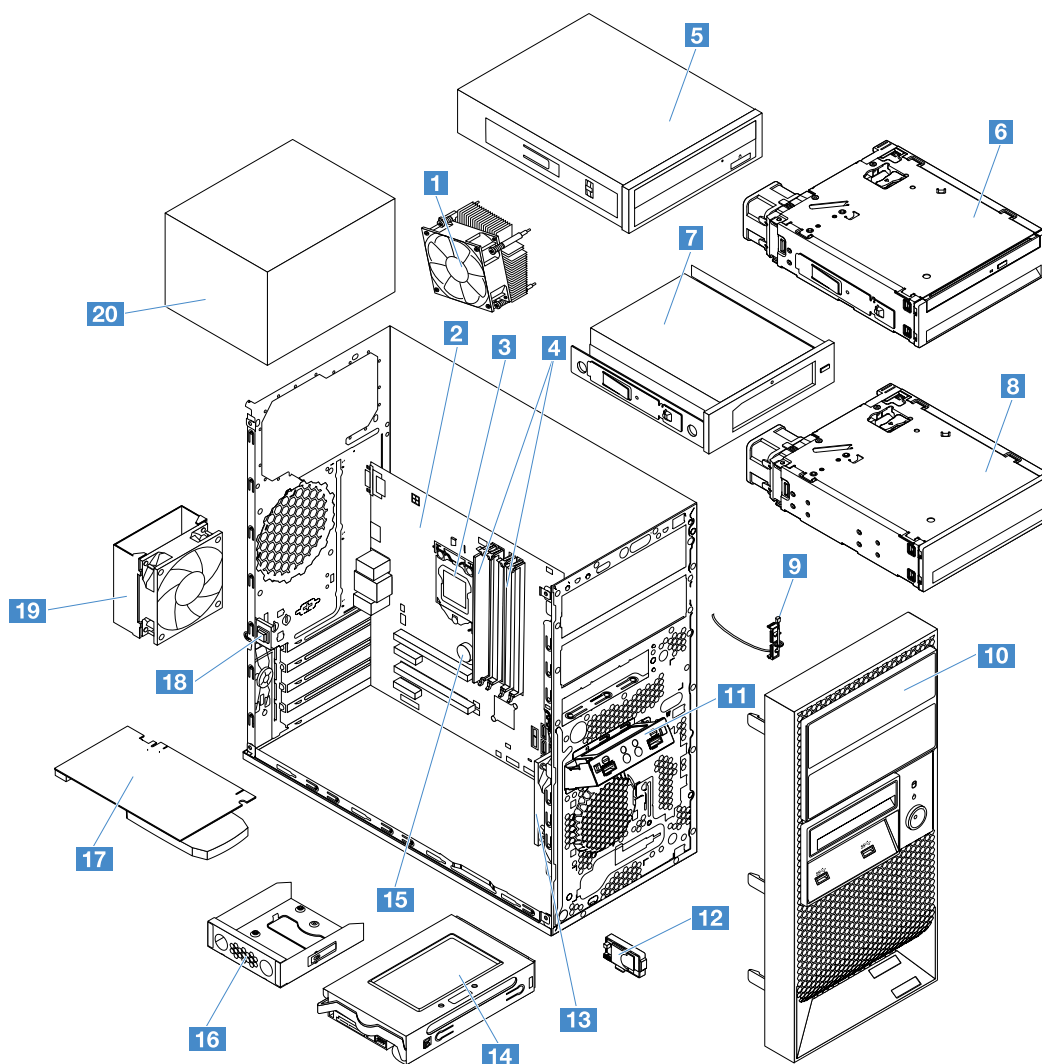


Figure 6. Server components

<b>1</b> Heat sink and fan assembly <sup>3</sup>	<b>2</b> System board <sup>3</sup>
<b>3</b> CPU <sup>3</sup>	<b>4</b> Memory modules <sup>1</sup>
<b>5</b> Optical drive* <sup>1</sup>	<b>6</b> ThinkServer TS150 3.5" HDD to 5.25" Tray Converter with Slim ODD Kit* <sup>2</sup>
<b>7</b> RDX tape drive* <sup>1</sup>	<b>8</b> ThinkServer TS150 3.5" HDD to 5.25" Tray Converter Kit* <sup>2</sup>
<b>9</b> Thermal sensor <sup>2</sup>	<b>10</b> Front bezel <sup>2</sup>
<b>11</b> Front USB assembly <sup>2</sup>	<b>12</b> Secure digital (SD) module* <sup>2</sup>
<b>13</b> Front fan assembly <sup>2</sup>	<b>14</b> Hard disk drive or solid-state drive <sup>1</sup>
<b>15</b> Coin-cell battery <sup>1</sup>	<b>16</b> ThinkServer TS150 FDD to 2.5" HDD Converter Kit* <sup>2</sup>
<b>17</b> PCIe card* <sup>1</sup>	<b>18</b> Intrusion switch* <sup>1</sup>
<b>19</b> Rear fan assembly <sup>2</sup>	<b>20</b> Power supply assembly <sup>2</sup>



## Notes:

- \* Available on some models
- <sup>1</sup> Self-service CRUs: Parts to be installed or replaced by customer themselves.
- <sup>2</sup> Optional 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.
- <sup>3</sup> Non-CRUs: Parts must be installed or replaced only by trained service technicians.

Before servicing a Lenovo product, ensure that you read and understand Read this first: safety information. Use only parts provided by Lenovo for replacement. For a complete listing of FRU information, such as FRU part numbers and supported server models, go to:

<http://www.lenovo.com/serviceparts-lookup>

## RAID card

You can install an add-on RAID card into your server to provide advanced SATA/SAS hardware RAID functions. Your server supports the Lenovo ThinkServer RAID 520i PCIe Adapter.

The following illustration shows the connectors on the Lenovo ThinkServer RAID 520i PCIe Adapter.

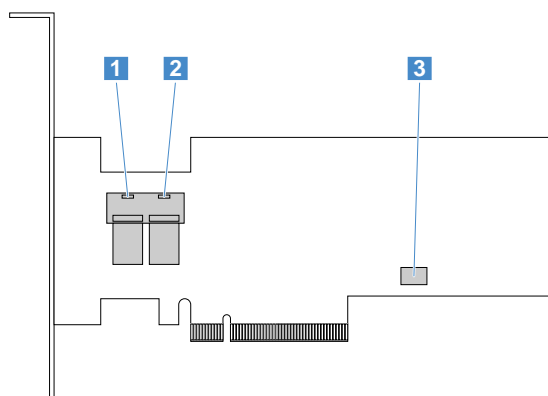


Figure 7. Lenovo ThinkServer RAID 520i PCIe Adapter

Connector	Description
<b>1</b> Connector 0	Used to connect the 1-to-4 mini-SAS signal cable.
<b>2</b> Connector 1	Used to connect the 1-to-1 mini-SAS signal cable.
<b>3</b> J3 connector	Used to install a ThinkServer RAID 520i upgrade key. See “Lenovo ThinkServer RAID 520i upgrade key” on page 74.

### Connecting cables to the RAID 520i PCIe adapter

- If your server has no more than four storage drives installed, do the following:
  1. Connect one end of the 1-to-4 mini-SAS signal cable to connector 0 on the adapter.
  2. Connect the four connectors on the other end of the cable to the storage drives by referring to the following illustration and table.



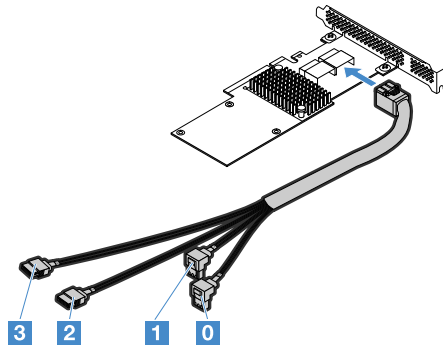


Figure 8. Connecting the 1-to-4 mini-SAS cable

From connectors of the cable	To connectors of the storage drives
Connector <b>0</b>	Signal connector on the first storage drive
Connector <b>1</b>	Signal connector on the second storage drive
Connector <b>2</b>	Signal connector on the third storage drive
Connector <b>3</b>	Signal connector on the fourth storage drive

- If your server has five storage drives installed, connect the first four drives using the 1-to-4 mini-SAS signal cable. Then, connect the fifth storage drive using the 1-to-1 mini-SAS signal cable:
  1. Connect one end of the 1-to-1 mini-SAS signal cable to connector 1 on the adapter.
  2. Connect the other end of the cable to the signal connector of the storage drive.

## System board components

The following illustration shows the component locations on the system board.



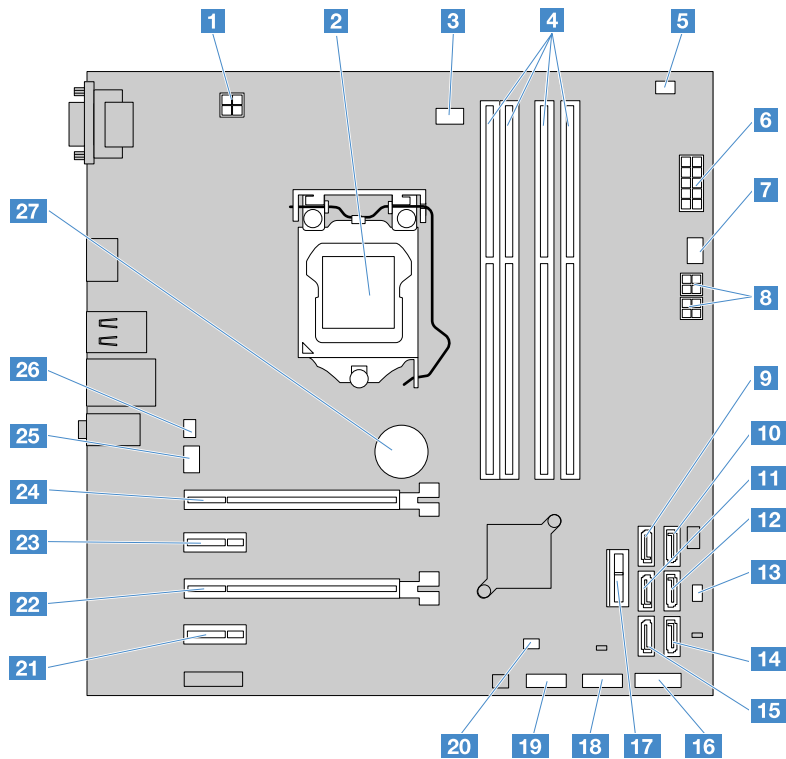


Figure 9. System board components

<b>1</b> 4-pin power connector	<b>2</b> CPU socket
<b>3</b> CPU fan connector	<b>4</b> Memory slots
<b>5</b> Thermal sensor connector	<b>6</b> 10-pin power connector
<b>7</b> HDD fan connector	<b>8</b> 4-pin power connectors (2)
<b>9</b> SATA connector 4	<b>10</b> SATA connector 5
<b>11</b> SATA connector 2	<b>12</b> SATA connector 3
<b>13</b> Front system fan connector	<b>14</b> SATA connector 1
<b>15</b> SATA connector 0	<b>16</b> Front panel connector
<b>17</b> Front USB 3.0	<b>18</b> USB 2.0 connector 2
<b>19</b> USB 2.0 connector 1	<b>20</b> Clear CMOS jumper
<b>21</b> PCIe slot 4	<b>22</b> PCIe slot 3
<b>23</b> PCIe slot 2	<b>24</b> PCIe slot 1
<b>25</b> Rear system fan connector	<b>26</b> Intrusion switch connector
<b>27</b> Coin-cell battery	

#### **1 4-pin power connector**

Used to connect the 4-pin power cable of the power supply.

#### **2 CPU socket**

Used to accommodate the CPU.



### **3 CPU fan connector**

Used to connect the CPU fan on the CPU heat sink.

### **4 Memory slots**

Used to accommodate memory modules. For detailed information, see “Memory module installation rules” on page 69.

### **5 Thermal sensor connector**

Used to connect the thermal sensor.

### **6 10-pin power connector**

Used to connect the 10-pin power cable of the power supply.

### **7 HDD fan connector**

Used to connect the HDD fan cable for the storage drive in drive bay 4 or drive bay 5. For drive bay information, see “Internal drives” on page 44.

### **8 4-pin power connectors**

Used to connect the power cables for the storage drives, optical drives, or RDX tape drive.

### **9 10 11 12 14 15 SATA connectors**

Used to connect the SATA signal cables for the storage drives or optical drives.

**Note:** If your server has one SATA optical drive installed, connect the optical drive to SATA connector 5. If your server has two SATA optical drives installed, connect the secondary optical drive to SATA connector 4.

### **13 Front system fan connector**

Used to connect the front system fan.

### **16 Front panel connector**

Used to connect the LEDs and power button on the front of the server.

### **17 Front USB 3.0 connector**

Used to connect the front USB assembly.

### **18 19 USB 2.0 connectors**

Used to connect the signal cables for the RDX tape drive and SD module.

### **20 Clear CMOS jumper**

Used to restore BIOS settings to factory default settings, recover BIOS settings from a BIOS update failure, or clear a forgotten password. For more information, see “System board jumper” on page 22.

### **21 22 23 24 PCIe slots**



Slot	Physical slot size	Negotiable link bandwidth	Supported card length and height
<b>21</b> PCIe slot 4	x1	x1	Half-length, full height
<b>22</b> PCIe slot 3	x16	x4, x1	Half-length, full height
<b>23</b> PCIe slot 2	x1	x1	Half-length, full height
<b>24</b> PCIe slot 1	x16	x16, x8, x4, x1	Half-length, full height

## **25 Rear system fan connector**

Used to connect the rear system fan.

## **26 Intrusion switch connector**

Used to connect the intrusion switch.

## **27 Coin-cell battery**

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

## **System board jumper**

The Clear CMOS jumper is used to restore BIOS settings to factory default settings, recover BIOS settings from a BIOS update failure, or clear a forgotten password.

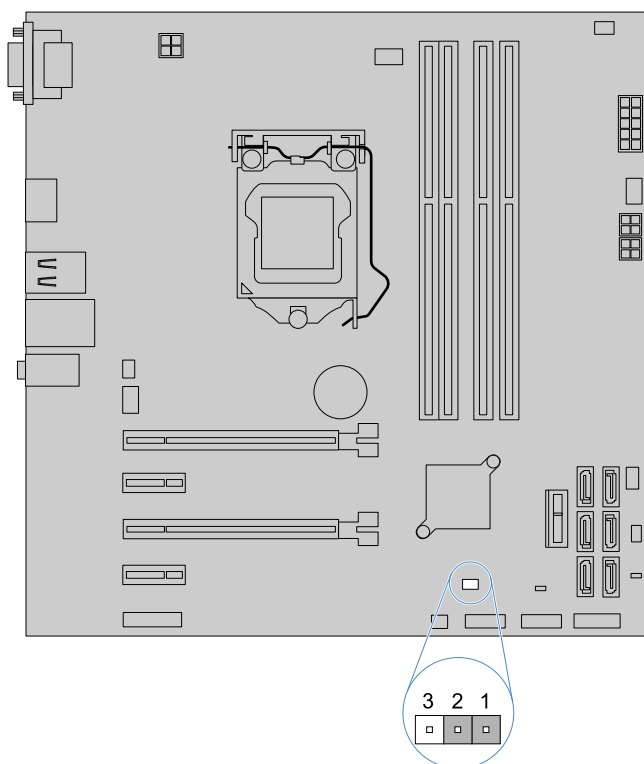


Figure 10. Clear CMOS jumper



Jumper cap position	Description
Pins 1–2	Default position (Normal state)
Pins 2–3	Short-circuited position (Clear-CMOS state)

**Attention:** To set the jumper, remove the server cover and gain access to the system board first. Do not open your server or attempt any repair before reading and understanding Read this first: safety information and “Getting familiar with important guidelines” on page 39.

### Restore BIOS settings to factory default settings or clear a forgotten password

To restore BIOS settings to factory default settings or clear a forgotten password, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the Clear CMOS jumper on the system board. Then, remove any parts and disconnect any cables that might impede your access to the jumper.

**Note:** Do not remove the memory modules or CPU.

3. Move the Clear CMOS jumper cap from the default position (pins 1–2) to the short-circuited position (pins 2–3).
4. Reinstall any parts and reconnect any cables. Then, reinstall the server cover. See “Completing the parts replacement” on page 96.
5. Reconnect the server to an ac power source and turn on the server. Then, wait for about 10 seconds.
6. Repeat steps 1 and 2.
7. Move the Clear CMOS jumper back to the default position.
8. Reinstall any parts and reconnect any cables. Then, reinstall the server cover. See “Completing the parts replacement” on page 96.
9. Connect the server to an ac power source and turn on the server to restart the operating system.

### Recover BIOS settings from a BIOS update failure

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

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the Clear CMOS jumper on the system board. Then, remove any parts and disconnect any cables that might impede your access to the jumper.

**Note:** Do not remove the memory modules or CPU.

3. Move the Clear CMOS jumper cap from the default position (pins 1–2) to the short-circuited position (pins 2–3).
4. Reinstall any parts and reconnect any cables. Then, reinstall the server cover. See “Completing the parts replacement” on page 96.
5. Reconnect the server to an ac power and turn on the server. Then, insert the BIOS update (flash update) disc into the optical drive. The recovery session begins. The recovery session will take two to three minutes. During this time, you will hear a series of beeps.
6. After the recovery session is completed, the series of beeps will end, and the system will automatically turn off. Remove the disc from the optical drive before the system completely turns off.
7. Repeat steps 1 and 2.
8. Move the Clear CMOS jumper cap back to the default position.



9. Reinstall any parts and reconnect any cables. Then, reinstall the server cover. See “Completing the parts replacement” on page 96.
10. Connect the server to an ac power source and turn on the server to restart the operating system.



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## Chapter 4. Configuring the server

This chapter provides the following information to help you configure the server:

- “Using the Setup Utility program” on page 25
- “Using the ThinkServer EasyStartup program” on page 31
- “Configuring RAID” on page 33

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### Using the Setup Utility program

The Setup Utility program is part of the server firmware. You can use the Setup Utility program to view and change the configuration settings of your server, regardless of which operating system you are using. However, 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. Connect the server to an ac power source and press the power button on the front panel to turn on the server. See “Turning on the server” on page 5.
2. Press the F1 key as soon as you see the logo screen. Then, wait for several seconds, and the Setup Utility program opens. If you have set a password, type the correct password to enter the Setup Utility program. For password information, see “Using passwords” on page 28.

### Setup Utility program interface

Depending on the BIOS version of your server, some menu or item information might differ slightly from the information in this topic.

#### Notes:

- The default settings already are optimized for you. Use the default value for any item you are not familiar with. To avoid unexpected problems, do not change the values of unfamiliar items. If you consider changing the server configuration, proceed with extreme caution. Incorrect settings might cause unexpected results. If you cannot turn on the server because of incorrect BIOS settings, use the Clear CMOS jumper to restore the BIOS settings to the factory default settings. See “System board jumper” on page 22.

- If you have changed any hardware in the server, you might need to upgrade the BIOS.

Lenovo provides the BIOS update utility on the Lenovo Support Web site. You can download the BIOS update utility to update the BIOS. See “Updating or recovering the BIOS” on page 30.

If the power to your server is interrupted while the BIOS is being updated and your server cannot start properly, use the Clear CMOS jumper to recover from a BIOS update failure. See “System board jumper” on page 22.

The Setup Utility program main interface consists of the following menus:

- “Main menu” on page 26
- “Devices menu” on page 26
- “Advanced menu” on page 26
- “Power menu” on page 26
- “Security menu” on page 27



- “Startup menu” on page 27
- “Exit menu” on page 28

## Main menu

After entering the Setup Utility program, you can see the **Main** menu. The menu lists basic information about your server, such as the BIOS, CPU type, memory, and system date and time.

## Devices menu

You can view or change various device settings on the **Devices** menu in the Setup Utility program. Some items are displayed on the menu only if the server supports the corresponding features.

The **Devices** menu contains the following items.

Menu item	Description
<b>Serial Port Setup</b>	View and set serial port configuration parameters.
<b>USB Setup</b>	View and set USB configuration parameters.
<b>ATA Drive Setup</b>	View and set SATA storage drive configuration parameters.
<b>Video Setup</b>	View and set the primary video adapter type.
<b>Audio Setup</b>	Enable or disable the onboard audio controller.
<b>Network Setup</b>	Enable or disable the onboard Ethernet controller and other network features.

## Advanced menu

You can view or change various server component settings on the **Advanced** menu in the Setup Utility program. The **Advanced** menu contains various configuration items. Some items are displayed on the menu only if the server supports the corresponding features.

The **Advanced** menu contains the following items.

Menu item	Description
<b>CPU Setup</b>	View information about the installed CPU and set CPU configuration parameters.
<b>Intel®Manageability</b>	View and set Intel Manageability configuration parameters.
<b>Intel SIPP Support</b>	Enable or disable the Intel SIPP Support feature.
<b>CPU CRID Support</b>	Enable or disable the CPU CRID Support feature.
<b>Chipset CRID support</b>	Enable or disable the Chipset CRID Support feature.

## Power menu

You can view or change server power options on the **Power** menu in the Setup Utility program.

The **Power** menu contains the following items.

Menu item	Description
<b>After Power Loss</b>	View and configure the system performance after the ac power is interrupted.
<b>Enhanced Power Saving Mode</b>	Enable or disable Enhanced Power Saving Mode.

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Menu item	Description
<b>Intelligent Cooling Engine (ICE)</b>	Enable the system to enter the lower acoustic level or better thermal level.
<b>Automatic Power On</b>	Enable or disable the Automatic Power On features.

## Security menu

You can set passwords and configure other security features on the **Security** menu in the Setup Utility program. Some items are displayed on the menu only if the server supports the corresponding features.

The **Security** menu contains the following main items:

Menu item	Description
<b>Administrator Password</b>	View the status of an administrator password.
<b>Power-On Password</b>	View the status of a user password.
<b>Set Administrator Password</b>	Set an administrator password to protect against unauthorized access to your server. See “Using passwords” on page 28.
<b>Set Power-On Password</b>	Set a user password to protect against unauthorized access to your server. See “Using passwords” on page 28.
<b>Chassis Intrusion Detection</b>	Enable or disable the Chassis Intrusion Detection feature.
<b>TCG Feature Setup</b>	Configure the TPM function. See “Configuring the TPM function” on page 30.
<b>System Event Log</b>	View and clear the system event log.
<b>Secure Boot</b>	View and set secure boot parameters.

## Startup menu

The **Startup** menu provides an interface for you to view or change the server startup options, including the startup sequence and boot priority for various devices. Changes to the startup options take effect when the server restarts. The startup sequence specifies the order in which the server checks devices to find a boot record. The server starts from the first boot record that it finds. For example, you can define a startup sequence that checks a disc in the optical drive, then checks the hard disk drive, and then checks a network device. For information about setting the startup sequence or selecting a startup device, see “Selecting a startup device” on page 29.

The **Startup** menu contains various configuration items. Some items are displayed on the menu only if the server supports the corresponding features.

Menu item	Description
<b>Primary Boot Sequence</b>	This sequence is used when the system is powered up normally.
<b>Automatic Boot Sequence</b>	This sequence is used when a communication device wakes up the system.
<b>Error Boot Sequence</b>	This sequence is used when an error occurs.

The **Startup** menu contains the following items.



Menu item	Description
<b>CSM</b>	Specify whether you can install a UEFI operating system or a non-UEFI operating system. <ul style="list-style-type: none"> <li>• <b>Enabled:</b> non-UEFI operating system</li> <li>• <b>Disable:</b> UEFI operating system</li> </ul>
<b>Boot Mode</b>	Choose the boot policy.
<b>Boot Priority</b>	Set the boot priority of operating systems.
<b>Option Keys Display</b>	Specify whether the option keys will be displayed on the logo screen. <ul style="list-style-type: none"> <li>• <b>Enabled:</b> The option keys will be displayed.</li> <li>• <b>Disable:</b> The option keys will not be displayed.</li> </ul>
<b>Option Keys Display Style</b>	Specify the option keys display style when you select <b>Enabled</b> for the <b>Option Keys Display</b> item. <ul style="list-style-type: none"> <li>• <b>Legacy:</b> The message “Press F1 to enter Setup, F12 to display Boot Menu” will be displayed on the logo screen.</li> <li>• <b>Normal:</b> The message “To interrupt normal startup, press Enter” will be displayed on the logo screen.</li> </ul>

## Exit menu

After you finish viewing or changing settings in the Setup Utility program, you can choose a desired action from the **Exit** menu to save changes, discard changes, or load default values, and exit the program. Press Enter to select the item on the **Exit** menu, and then select **Yes** when prompted to confirm the action. For information about exiting the Setup Utility program, see “Exiting the Setup Utility program” on page 30.

The **Exit** menu contains the following items:

Menu item	Description
<b>Save Changes and Exit</b>	Save changes and exit the Setup Utility program.
<b>Discard Changes and Exit</b>	Discard changes, load previous values, and then exit the Setup Utility program.
<b>Load Optimal Defaults</b>	Restore the user default values for all the items.
<b>OS Optimized Defaults</b>	Select <b>Enabled</b> to meet the Microsoft Windows 8 certification requirement. The settings for the CSM support, boot mode, boot priority, secure boot, and security RollBack prevention will be affected.

## Using passwords

By using the Setup Utility program, you can set a password to prevent unauthorized access to your server.

You do not have to set a password to use your server. However, using a password improves computing security. If you decide to set a password, read the following topics.

### Setup Utility program password types

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

- **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 type 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 typed in.

- **Power-On password**

When a Power-On password is set, you are prompted to type a valid password each time the server turns on. You cannot log in to any operating system until a valid password is typed in.

**Note:** If both the administrator password and Power-On password are set, you can type either password to use the server. However, you must use your administrator password to change any configuration settings.

## Password considerations

For security reasons, it is recommended to use a strong password that cannot be easily compromised.

### Notes:

- The Setup Utility program passwords are not case sensitive.
- The server supports Setup Utility program passwords that consist of up to 64 alphabetic and numeric characters.

To set a strong password, use 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 using the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 25.
2. On the **Main** menu, select **Security**.
3. Depending on the password type, select **Set Power-On Password** or **Set Administrator Password**.
4. Follow the instructions on the screen to set, change, or delete a password.

**Note:** A password can be any combination of up to 64 alphabetic and numeric characters. For more information, see “Password considerations” on page 29.

5. Press F10 to save settings and exit the Setup Utility program.

If you have forgotten the password, you can use the Clear CMOS jumper on the system board to erase the password. See “System board jumper” on page 22. Then, set a new password for the server.

## Selecting a startup device

If your server does not start up from a desired device such as the disc or hard disk drive as expected, do one of the following to select the startup device you want.

**Note:** Not all discs, hard disk drives, or other removable devices are bootable.

- To select a temporary startup device, do the following:

**Note:** Selecting a startup device using the following method does not permanently change the startup sequence.

1. Turn on or restart your server.



2. When you see the logo screen, press F12 to display the boot menu. The boot device selection window opens.
  3. In the boot device selection window, use the up and down arrow keys on the keyboard to switch between the selections. Press Enter to select the device of your choice. Then, the server will start up from the selected device.
- To view or permanently change the configured startup device sequence, do the following:
    1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 25.
    2. On the **Startup** menu, follow the instructions on the screen to select devices for the Primary Startup Sequence, the Automatic Startup Sequence, and the Error Startup Sequence.
    3. Press F10 to save settings and exit the Setup Utility program. The server will follow the startup device sequence you have set each time you turn on the server.

## Configuring the TPM function

The TPM chip is integrated on the system board and works as a hardware security solution to help you to encrypt data and protect the server.

To enable the TPM function in the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 25.
2. On the **Security** menu, select **TCG Feature Setup** and press Enter.
3. Select **TCG Security Features**. Then, set **TPM Support** to **Active**.
4. Press F10 to save settings and exit the Setup Utility program. The server will restart to enable the TPM function.

## Exiting the Setup Utility program

After you finish viewing or changing settings, press Esc to return to the Setup Utility program main interface. If you are on a nested submenu, press Esc repeatedly until you reach the main interface. Then, do one of the following to exit the Setup Utility program:

- Press F10 to save the new settings and exit the Setup Utility program.
- Press F9 to return to the default settings.

For more information about the **Exit** menu in the Setup Utility program, see “Exit menu” on page 28.

## Updating or recovering the BIOS

This topic provides instructions on how to update the BIOS and how to recover from a POST and BIOS update failure.

Lenovo might make changes and enhancements to the BIOS. When updates are released, they are available for download on the Lenovo Web site at <http://www.lenovo.com/drivers>.

You also can use the Firmware Updater program to help you keep the server firmware up-to-date. See “ThinkServer EasyUpdate Firmware Updater” on page 10.

## Updating (flashing) the BIOS

This topic provides instructions on how to update (flash) the BIOS.

### Notes:



- Update the BIOS on your server only if the newer BIOS version specifically solves a problem you have. We do not recommend BIOS updates for servers that do not need them. You can view the updated information for the new BIOS version in the installation instructions for the BIOS update utility program.
- Downgrading the BIOS to an earlier version is not recommended and might not be supported. An earlier BIOS version might not support the latest system configurations.
- If the power to your server is interrupted while the POST and BIOS are being updated, your server might not restart properly. Ensure that you perform the BIOS update procedure in an environment with a steady power supply. Besides, ensure that your server can restart successfully without encountering hardware problems.
- If you have updated the BIOS firmware, all the BIOS settings become the default settings of the updated BIOS version. You need to check and reconfigure the BIOS settings for your specific needs. You also can record your specific BIOS settings before updating the BIOS for an easier reconfiguration in the new BIOS version.

To update (flash) the BIOS, do the following:

1. Go to <http://www.lenovo.com/drivers> and follow the instructions on the Web page to locate the BIOS update package.
2. Download the BIOS update package and the installation instructions in a TXT file.
3. Print the TXT file that contains the installation instructions and follow the instructions to update (flash) the BIOS.
4. After the BIOS update process is completed, check and reconfigure the BIOS settings for your specific needs based on your note or refer to “Using the Setup Utility program” on page 25.

## Recovering from a BIOS update failure

If the power to your server is interrupted while the POST and BIOS is being updated, your server might not restart properly. If this happens, use the Clear CMOS jumper to recover BIOS settings. For detailed procedure, see “System board jumper” on page 22.

**Note:** If you cannot recover the BIOS, the BIOS read-only memory (ROM) might get damaged. You might need to replace the system board. Contact the Lenovo Customer Support Center.

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## Using the ThinkServer EasyStartup program

The ThinkServer EasyStartup program simplifies the process of configuring RAID and installing supported operating systems and device drivers on your server.

The ISO image for the ThinkServer EasyStartup program is available at the Lenovo Support Web site. To download the ISO image and burn it into a disc or a USB flash drive, do the following:

1. Go to <http://www.lenovo.com/support> and follow the instructions on the Web page to locate the ThinkServer EasyStartup program.
2. Download the ISO package for the ThinkServer EasyStartup program. The ISO package contains the ISO image and a utility for burning the ISO image into a USB flash drive.
3. Download the readme file and read it carefully. The readme file contains important information about the program.
4. Do one of the following:
  - Use an optical drive and any CD/DVD burning software to create a bootable disc with the ISO image.
  - Use an empty USB flash drive and the utility in the ISO package to create a bootable USB flash drive with the ISO image.



For instructions on how to use the ThinkServer EasyStartup program, view the user guide from the main interface of the program.

## Features of the ThinkServer EasyStartup program

The ThinkServer EasyStartup program has the following features:

- Easy-to-use, language-selectable interface
- Integrated help system and user guide
- Automatic hardware detection
- Support for multiple operating systems
- Ability to install the operating system and device drivers in an unattended mode to save time
- Provides device drivers based on the server model and detected devices
- Selectable partition size and file system type
- Ability to create a reuseable response file that can be used with similarly configured Lenovo servers to make future installations faster

## Starting the ThinkServer EasyStartup program

This topic provides instructions on how to start the ThinkServer EasyStartup program. After you start the program and enter the main interface, click **User Guide** for detailed information about how to use this program to help you configure the server and install an operating system.

To start the ThinkServer EasyStartup program, do the following:

1. Insert the disc or USB flash drive with the ThinkServer EasyStartup ISO image into your server, and set the optical drive with the disc or USB flash drive as the first startup device. Then, start your server from the disc or USB flash drive. See “Selecting a startup device” on page 29.
2. Wait for the program to load. Then, select the language for the program and keyboard layout when prompted.

**Note:** The supported languages and keyboard layouts for the ThinkServer EasyStartup program are Dutch, English, French, German, Italian, Japanese, Russian, Spanish, and Turkish.

3. After selecting the language and keyboard layout, click **OK**. Then, you will see one or more messages about configuring storage devices. Click **Next** until you are presented with the Lenovo License Agreement.
4. Read the Lenovo License Agreement carefully. Accept the terms by clicking **Agree**. Then, the Date and time window opens.
5. Set the current date and time and click **OK**. The Start option window opens.
6. The Start option window provides the following selections:
  - Continue to the main interface.
  - Install the operating system using a preexisting response file.

Read the explanations on the screen and select a desired option. Then, follow the instructions on the screen. If this is the first time you are using the ThinkServer EasyStartup program, select the option to continue to the main interface and view the compatibility notes and user guide.

### Notes:

- Functionality and supported operating systems vary depending on the version of the ThinkServer EasyStartup program. From the main interface of the program, click **Compatibility notes** to view the operating systems and server configurations supported by the specific version of the program. Click **User Guide** to view the various functions and learn how to use the program.



- Before using the ThinkServer EasyStartup program to install an operating system, ensure that any external storage devices and fiber channels are configured correctly.

The ThinkServer EasyStartup program main interface provides the following menus on the left pane of the screen.

Menu item	Description
<b>Home</b>	Provide general information about the program.
<b>Compatibility notes</b>	Provide information about the operating systems and server configurations supported by the version of the program you are using.
<b>User Guide</b>	Provide information about the features of the program and instructions on how to use the program
<b>Hardware list</b>	Display a list of hardware devices detected by the program.
<b>Configure RAID</b>	Instruct you to configure RAID or view the current RAID configuration and make changes if needed
<b>Install operating system</b>	Display a series of choices and prompts to collect information required for operating system installation, prepare the hard disk drive for installation, and then initiate the installation process using your operating system installation disc.
<b>About</b>	Provide the version information and legal notices.

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## Configuring RAID

This topic provides information about RAID and how to configure RAID for your server.

- “About RAID” on page 33
- “RAID for your server” on page 34
- “Configuring onboard SATA software RAID” on page 35
- “Configuring advanced SATA or SAS hardware RAID” on page 37

## About RAID

RAID, an acronym for Redundant Array of Independent Disks, is a technology that provides increased storage functions and reliability through redundancy. This is achieved by combining multiple hard disk drives into a logical unit, where data is distributed across the drives in one of several ways called RAID levels.

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

RAID drive groups also improve data storage reliability and fault tolerance compared with single-drive storage systems. Data loss resulting from a drive failure can be prevented by reconstructing missing data from the remaining drives.

The following list describes some of the most commonly used RAID levels:

- **RAID 0:** block-level striping without parity or mirroring  
Simple stripe sets are normally referred to as RAID 0. RAID 0 uses striping to provide high data throughput, especially for large files in an environment that does not require fault tolerance. RAID 0 has no redundancy and it provides improved performance and additional storage without fault tolerance. Any



drive failure destroys the array and the likelihood of failure increases with more drives in the array. RAID 0 does not implement error checking, so any error is uncorrectable. More drives in the array means higher bandwidth, but greater risk of data loss.

RAID 0 requires a minimum number of one hard disk drive.

- **RAID 1:** mirroring without parity or striping

RAID 1 uses mirroring so that data written to one drive is simultaneously written to another drive. This is good for small databases or other applications that require small capacity but complete data redundancy. RAID 1 provides fault tolerance from disk errors or failures and continues to operate as long as at least one drive in the mirrored set is functioning. With appropriate operating system support, there can be increased read performance and only a minimal write performance reduction.

RAID 1 requires a minimum number of two hard disk drives.

- **RAID 5:** block-level striping with distributed parity

RAID 5 uses disk striping and parity data across all drives (distributed parity) to provide high data throughput, especially for small random access. RAID 5 distributes parity along with the data and requires all drives but one to be present to operate; drive failure requires replacement, but the array is not destroyed by a single drive failure. Upon drive failure, any subsequent read operations can be calculated from the distributed parity so that the drive failure is masked from the end user. The array will have data loss in the event of a second drive failure and is vulnerable until the data that was on the failing drive is rebuilt onto a replacement drive. A single drive failure in the set will result in reduced performance of the entire set until the failing drive has been replaced and rebuilt.

RAID 5 requires a minimum number of three hard disk drives.

- **RAID 10:** a combination of RAID 0 and RAID 1

RAID 10 consists of striped data across mirrored spans. A RAID 10 drive group is a spanned drive group that creates a striped set from a series of mirrored drives. RAID 10 allows a maximum of eight spans. You must use an even number of drives in each RAID virtual drive in the span. The RAID 1 virtual drives must have the same stripe size. RAID 10 provides high data throughput and complete data redundancy but uses a larger number of spans.

RAID 10 requires a minimum number of four hard disk drives and also requires an even number of drives, for example, six hard disk drives or eight hard disk drives.

- **RAID 50:** a combination of RAID 0 and RAID 5

RAID 50 uses distributed parity and disk striping. A RAID 50 drive group is a spanned drive group in which data is striped across multiple RAID 5 drive groups. RAID 50 works best with data that requires high reliability, high request rates, high data transfers, and medium-to-large capacity.

**Note:** Having virtual drives of different RAID levels, such as RAID 0 and RAID 5, in the same drive group is not allowed. For example, if an existing RAID 5 virtual drive is created out of partial space in an array, the next virtual drive in the array has to be RAID 5 only.

RAID 50 requires a minimum number of six hard disk drives.

## RAID for your server

**Notes:** Before configuring RAID for your server, ensure that you use drives that are of the same type and have the same capacity within a single RAID array. Any one of the following is not supported in a single array:

- A mix of 3.5-inch hard disk drives (HDDs) and 2.5-inch HDDs
- A mix of SATA HDDs and SAS HDDs
- A mix of HDDs and solid-state drives (SSDs)

Your server supports the following two types of RAID configurations:

- **Onboard SATA software RAID**



The onboard SATA software RAID controller is integrated on the PCH chip on the system board. If your server has SATA drives that are connected to the system board, you can use the Intel Rapid Storage Technology enterprise (RSTe) program to configure RAID. The RSTe program also supports configuration of hot-spare drives. By default, your server supports onboard SATA software RAID levels 0, 1, 5, and 10.

For detailed configuration information, see “Enabling the onboard SATA RAID functionality” on page 35.

- **Advanced SATA/SAS hardware RAID**

Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. You can also purchase the RAID card from Lenovo and install it into your server to get advanced SATA/SAS hardware RAID functions. See “RAID card” on page 18. By default, your server supports RAID levels 0, 1, and 10. For the ThinkServer RAID 520i PCIe Adapter, to activate RAID 5, install a RAID 520i upgrade key on the RAID card.

For detailed configuration information, see “Configuring advanced SATA or SAS hardware RAID” on page 37.

**Note:** When the CPU utilization is high, it is recommended that you install an add-on RAID card instead of using the integrated software RAID controller for RAID 5 configuration.

## Configuring onboard SATA software RAID

- “Enabling the onboard SATA RAID functionality” on page 35
- “Creating RAID volumes” on page 35
- “Deleting RAID volumes” on page 36
- “Resetting disks to non-RAID” on page 36
- “Marking disks as spare” on page 36

### Enabling the onboard SATA RAID functionality

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

To enable onboard SATA RAID functionality, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 25.
2. Select **Devices → ATA Drive Setup**.
3. Select **Configure SATA as** and press Enter.
4. Select **RAID** and press Enter.
5. Press F10 to save changes and exit the Setup Utility program.

### Creating RAID volumes

To create RAID volumes, do the following:

1. During system startup, press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility.
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. If needed, return to step 2 to create additional RAID volumes.



10. When finished, select **Exit** and press Enter.

## Deleting RAID volumes

To delete RAID volumes, do the following:

1. During the system startup, press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility.
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.
  - Create a new RAID volume. See “Creating RAID volumes” on page 35 .
  - 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. During system startup, press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility.
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 the hard disk drives to non-RAID, you can:
  - Delete a RAID volume. See “Deleting RAID volumes” on page 36.
  - Create a RAID volume. See “Creating RAID volumes” on page 35.
  - Use the up and down arrow keys to select **Exit** and press Enter.

## Marking disks as spare

To mark hard disk drives as spare drives, do the following:

1. During the system startup, press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility.
2. Use the up and down arrow keys to select **Mark Disks as Spare** and press Enter.
3. Use the arrow keys to locate a hard disk drive and press the space key to select or deselect the hard disk drive. You can select multiple hard disk drives if required. Then, press Enter to complete the selection.
4. When prompted, press Y to confirm the operation.

**Note:** Marking a hard disk drive as a spare drive will remove all data on the drive.

5. When finished, select **Exit** and press Enter.

**Notes:** If your server has one of the following Linux operating systems installed, continue with the corresponding actions:

- For the Redhat Enterprise Linux 6.7 operating system, add the following line to the end of the `/etc/mdadm.conf` file and restart the operating system.  
`POLICY domain=DOMAIN path=* metadata=imsm action=spare-same-slot`
- For the SUSE Linux Enterprise Server 11.4 operating system, do the following:



1. Add the following line to the end of the `/etc/mdadm.conf` file.  
`POLICY domain=DOMAIN path=* metadata=imsm action=spare-same-slot`
2. Run the following commands as a root user.  
`# chkconfig -s mdadm on`  
`# /etc/init.d/mdadm start`

## Configuring advanced SATA or SAS hardware RAID

Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. You can also purchase the RAID card from Lenovo and install it into server models that support the RAID card to get advanced SATA/SAS hardware RAID functions. See “RAID card” on page 18 and “PCIe card” on page 71 for more information.

### Programs for configuring SATA/SAS hardware RAID

Lenovo provides the following programs to help you configure advanced SATA/SAS hardware RAID:

- ThinkServer EasyStartup program to configure RAID  
See “Using the ThinkServer EasyStartup program” on page 31 and view the user guide from the main interface of the program.
- WebBIOS Configuration Utility program (configuring RAID independently of the operating system)  
To use the program, follow the instructions on the booting screen.
- MegaRAID Storage Manager program and the StorCLI Configuration Utility program (configuring RAID in an operating system environment)  
To install and use the MegaRAID Storage Manager program, refer to the following chapters in the *MegaRAID SAS Software User Guide*:

**Note:** Some information in these chapters might be intended for the advanced SATA/SAS hardware RAID configurations and might not apply to the onboard SATA software configurations.

- “MegaRAID Storage Manager Overview and Installation”
- “MegaRAID Storage Manager Window and Menus”
- “Monitoring System Events and Storage Devices”
- “Maintaining and Managing Storage Configurations”

To download the *MegaRAID SAS Software User Guide* and the installation packages of the programs, go to <http://www.lenovo.com/support>, and then follow the instructions on the Web page.

### Instructions for configuring SATA/SAS hardware RAID

For instructions on how to configure and manage the advanced SATA or SAS hardware RAID, refer to the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at: <http://www.lenovo.com/support>







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## Chapter 5. Replacing hardware

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

This chapter contains the following items:

- “Purchasing ThinkServer options” on page 39
- “Getting familiar with important guidelines” on page 39
- “Preparing your server and removing the server cover” on page 41
- “Removing and installing hardware” on page 42
- “Completing the parts replacement” on page 96

**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.

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### Purchasing ThinkServer options

Depending on your server model, some of the hardware options in this chapter might not be available in your server. You can purchase the supported options from Lenovo and install them in your server to enable desired functions. For a list of ThinkServer options, go to:

<http://lenovoquickpick.com/usa/home/thinkserver/rack-and-tower-server>

**Note:** The option kit is designed for different types of servers and might contain additional cables that are not required for your server.

---

### Getting familiar with important guidelines

This topic provides some guidelines that you should read and understand before using your server.

### Precautions

Before using the server, ensure that you read and understand the following precautions:

- Before using the product, ensure that you read and understand the multilingual safety instructions and the Lenovo Limited Warranty (LLW) on the Lenovo Web site at <https://support.lenovo.com/document/LNVO-SOCS>. Reading and understanding the safety instructions reduces the risk of personal injury and damage to your product.
- When you install your new server, download and apply the most recent firmware updates. This step helps to ensure that any known issues are addressed and that your server is ready to function at maximum levels of performance. To download firmware updates for your server, go to <http://www.lenovo.com/drivers> and follow the instructions on the Web page.
- Before you install optional hardware devices, ensure that the server is working correctly. If the server is not working correctly, see Chapter 6 “Troubleshooting and diagnostics” on page 99 to do basic troubleshooting. If the problem cannot be solved, see Chapter 7 “Getting information, help, and service” on page 105.
- Observe good housekeeping in the area where you are working. Put removed covers and other parts in a safe place.
- If you must turn on the server while the server cover is removed, ensure that no tools or other objects are left inside the server.



- Do not attempt to lift an object that you think is too heavy for you. If you have to lift a heavy object, observe the following precautions:
  - Ensure that you can stand safely without slipping.
  - Distribute the weight of the object equally between your feet.
  - Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
  - To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Ensure that you have enough properly-grounded electrical outlets for the server, monitor, and other devices.
- Back up all important data before you make changes to drives.
- Have a small flat-blade screwdriver available.
- You do not have to turn off the server to install or replace a hot-swap redundant power supply, hot-swap drives, or hot-plug USB devices. However, you must turn off the server before performing any steps that involve installing, removing, or replacing adapter cables or non-hot-swap devices or components.
- To view the LEDs on the system board and internal components, leave the server connected to power.
- When working inside the server, you might find some tasks easier if you lay the server on its side.
- When you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.

## Handling static-sensitive devices

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

When you handle server parts and components, take these precautions to avoid static-electricity damage:

- Limit your movement. Movement can cause static electricity to build up around you.
- The use of a grounding system is recommended. For example, it is recommended to wear an electrostatic discharge (ESD) wrist strap, if one is available. Ensure that you work in an ESD-safe area.
- Always carefully handle the parts and other components (such as PCI cards, memory modules, system boards, and CPUs) by edges or frame. Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- Before you replace a new part, touch the static-protective package containing the new part to an unpainted metal part of the server for at least two seconds. This reduces static electricity from the package and your body.
- Remove the new part from the static-protective package and directly install it in the server without placing it on any other surface. If it is hard for you to do this in your specific situation, place the static-protective package of the new part on a smooth, level surface, and then place the new part on the static-protective package. Do not place the part on the server cover or other metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

## System reliability guidelines

To help ensure proper cooling and system reliability, strictly follow these guidelines:

- All drive bays and PCI card slots are either occupied by drives and cards or covered by electromagnetic interference (EMI) protective panels or EMI shields. When you install an internal drive or a PCI card, save the EMI shield or dummy tray from the drive bay or save the PCI card slot bracket in case that you later remove the device.



**Attention:** An unoccupied drive bay or PCI card slot without a cover, shield, dummy tray, filler, or any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage.

- Leave adequate space around the server to ensure that the server cooling system works well. Leave approximately 50 mm (2 inches) of open space around the front and rear of the server. Do not place objects in front of the fans.
- For proper cooling and airflow, install the server cover before you turn on the server. Operating the server with the server cover removed might damage server components.
- Properly route the cables. For some options, such as PCI cards, follow the cabling instructions that come with the options in addition to the instructions in this manual.
- If your server has air ducts or air baffles, do not remove them while the server is running. Operating the server without the air ducts or air baffles might cause the CPU to overheat.
- Ensure that you replace a failing fan as soon as possible.

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## Preparing your server and removing the server cover

**CAUTION:**

**Do not open your server or attempt any repair before reading and understanding “Read this first: safety information” on page iii and “Getting familiar with important guidelines” on page 39.**

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

**Note:** Wait three to five minutes to let the server cool before removing the server cover.

1. Remove all external media from the drives. Then, turn off all attached devices and the server.
2. Disconnect all power cords from electrical outlets.
3. Disconnect all cables that are connected to the server.
4. Remove any locking device that secures the server cover, such as a padlock or an integrated cable lock. See “Server locks” on page 14.
5. Remove the two thumbscrews, press the cover-release button, and slide the cover backward to remove the server cover.



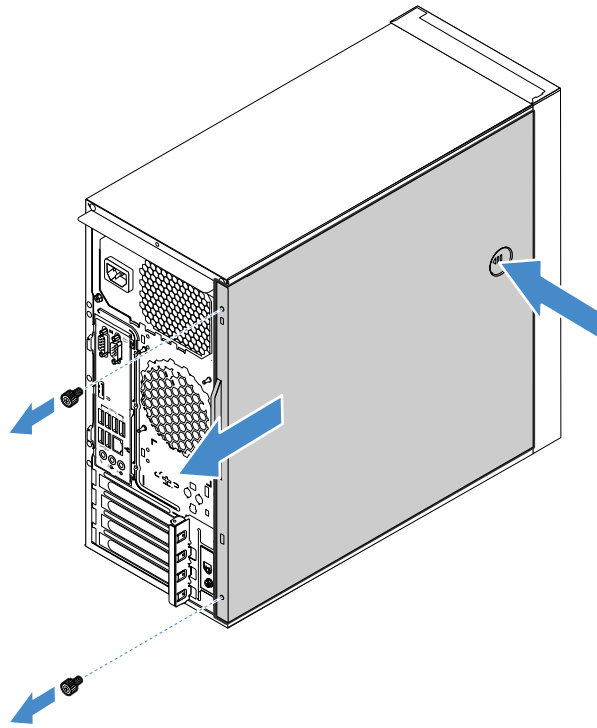


Figure 11. Removing the server cover

**Attention:** For proper cooling and airflow, install the server cover before turning on the server. Operating the server with the server cover removed might damage server components.

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## Removing and installing hardware

This topic provides instructions on how to remove and install hardware for your server. You can expand the capabilities of your server and maintain your server by installing or replacing hardware devices.

If you are handling a server option, refer to the appropriate instructions in this manual along with the instructions that come with the option.

### Notes:

- Use only parts provided by Lenovo.
- Depending on your server model, your server might look slightly different from the illustrations in this chapter.

## Front bezel

- “Removing the front bezel” on page 42
- “Installing the front bezel” on page 43

### Removing the front bezel

To remove the front bezel, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Release the three plastic tabs on the left side. Then, pivot the front bezel as shown to remove the front bezel from the chassis.



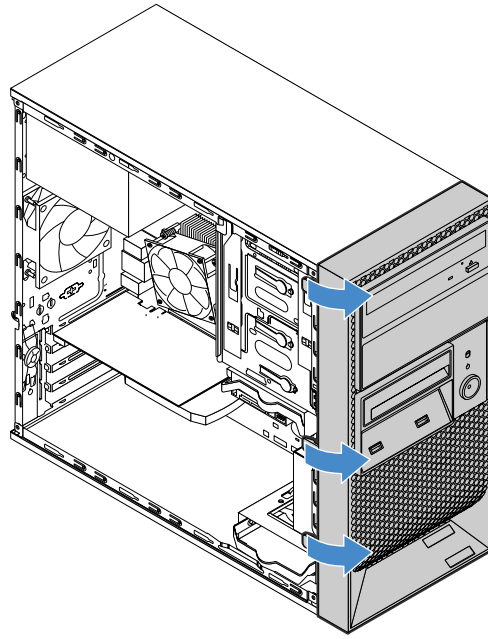


Figure 12. Removing the front bezel

### Installing the front bezel

To install the front bezel, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Align the three plastic tabs on the right side of the front bezel with the corresponding holes in the chassis. Then, pivot the front bezel as shown until it snaps into position on the left side.

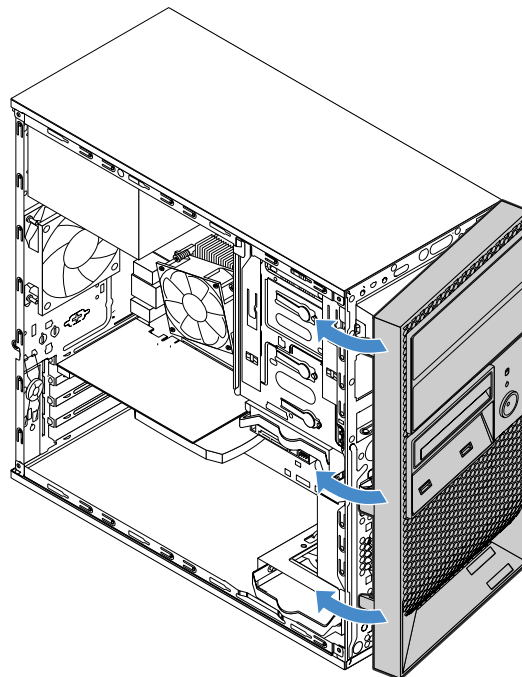


Figure 13. Installing the front bezel



## Internal drives

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

- “Optical drive” on page 46
- “Tape drive” on page 49
- “Storage drive in drive bay 1” on page 52
- “Storage drive in drive bay 2” on page 54
- “Storage drive in drive bay 3” on page 56
- “Storage drive in drive bay 4” on page 59
- “Slim optical drive and storage drive in drive bay 5” on page 63

### Drive bays and supported drives

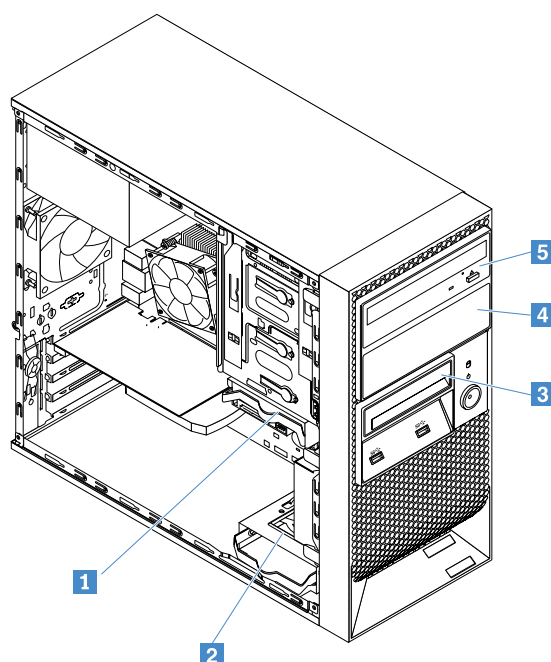


Figure 14. Drive bay locations

HDD: hard disk drive; SSD: solid-state drive

Drive bay	Supported drive
<b>1</b> Bay 1	2.5-inch HDD/SSD or 3.5-inch HDD
<b>2</b> Bay 2	2.5-inch HDD/SSD or 3.5-inch HDD
<b>3</b> Bay 3	2.5-inch HDD/SSD
<b>4</b> Bay 4	<ul style="list-style-type: none"><li>• Secondary optical drive</li><li>• RDX tape drive</li><li>• 2.5-inch HDD/SSD or 3.5-inch HDD</li></ul>
<b>5</b> Bay 5	<ul style="list-style-type: none"><li>• Primary optical drive</li><li>• Slim optical drive and storage drive (2.5-inch HDD/SSD or 3.5-inch HDD)</li></ul>



## Installation rules

**Note:** For different drive types, install 2.5-inch SSDs first, then 2.5-inch HDDs and 3.5-inch HDDs. To install a 2.5-inch drive into a 3.5-inch drive bay of your server, install the drive into a 2.5-inch to 3.5-inch drive adapter first. See “Installing a 2.5-inch drive into a 2.5-inch to 3.5-inch drive adapter” on page 45.

Drive quantity	Installation order
Up to five 2.5-inch SATA HDDs or SSDs	bay 1, bay 2, bay 3, bay 4, bay 5
Up to four 3.5-inch SATA HDDs	bay 1, bay 2, bay 4, bay 5
Up to four 2.5-inch HDD/SSD and 3.5-inch HDD mixed configuration	bay 1, bay 2, bay 4, bay 5

### Installing a 2.5-inch drive into a 2.5-inch to 3.5-inch drive adapter

If you want to install a 2.5-inch hard disk drive or solid-state drive into a 3.5-inch drive bay of your server, install the drive into a 2.5-inch to 3.5-inch drive adapter first.

To install a 2.5-inch drive into a 2.5-inch to 3.5-inch drive adapter, do the following:

1. Align the screw holes in the drive with the corresponding ones in the drive adapter. Then, install four screws to secure the drive to the drive adapter.

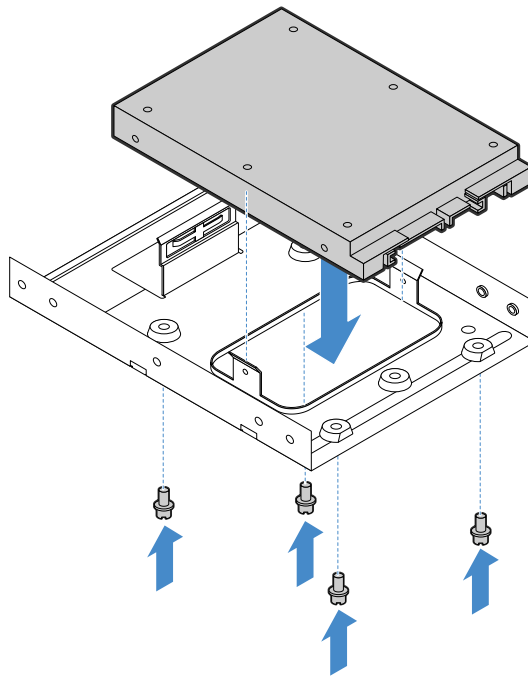


Figure 15. Installing a 2.5-inch drive into a 3.5-inch to 2.5-inch drive adapter

2. Flex the drive bracket and align pins **1**, **2**, **3**, and **4** on the bracket with the corresponding holes in the drive adapter. Do not touch the circuit board on the bottom of the drive.



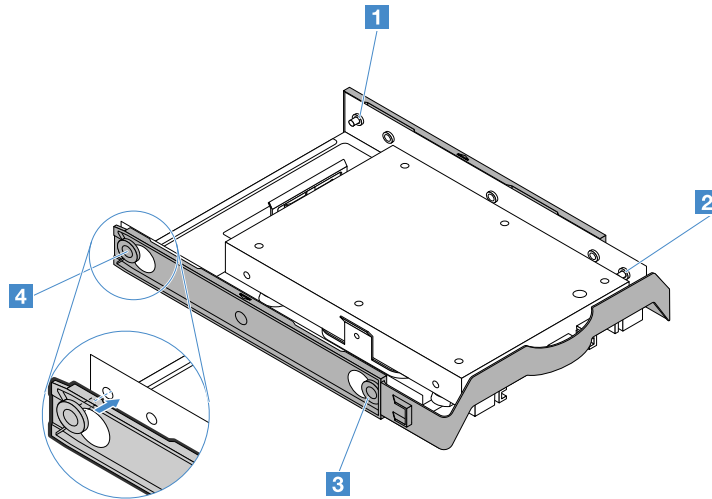


Figure 16. Installing the drive adapter into the drive bracket

## Optical drive

Your server supports up to two optical drives: primary optical drive in drive bay 5 and secondary optical drive in drive bay 4. For information about drive bays and installation rules, see “Internal drives” on page 44. This topic describes how to remove or install the primary optical drive. The removal or installation procedure for the secondary optical drive is similar.

- “Removing an optical drive” on page 46
- “Installing an optical drive” on page 47

### CAUTION:

**When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:**


- **Do not remove the covers.** Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**



**Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following: Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.**

## Removing an optical drive

To remove the primary optical drive, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. Disconnect the signal cable and power cable from the optical drive.
4. Press the release tab  and slide the optical drive out of the drive bay.



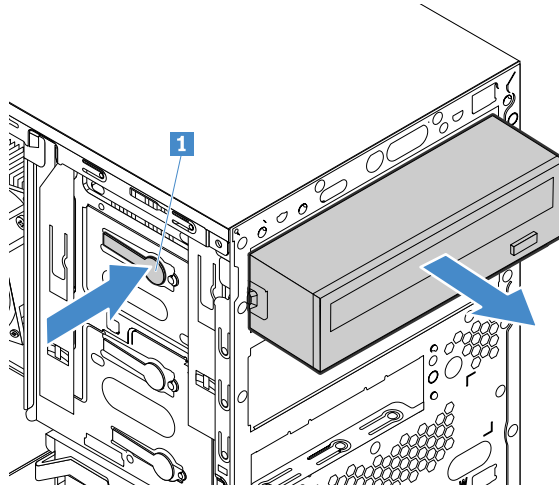


Figure 17. Removing the optical drive from the drive bay

5. Install a new optical drive or install a metal shield to cover the drive bay.
6. If you are instructed to return the old optical drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

### Installing an optical drive

To install an optical drive, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. If there is a metal shield covers the drive bay, remove the metal shield. Save the metal shield in case that you later remove the drive and need the metal shield to cover the drive bay.
4. If needed, remove the drive bay retainer from the server. Push the retainer downwards to unlock it and then lift it out of the chassis.

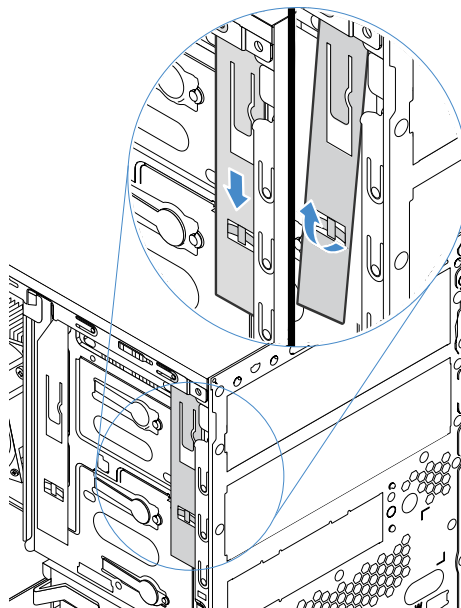


Figure 18. Removing the retainer



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

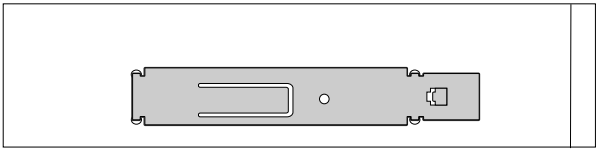


Figure 19. Installing the retainer

6. Hold the optical drive in correct orientation and then slide it into the optical drive bay until it snaps into position.

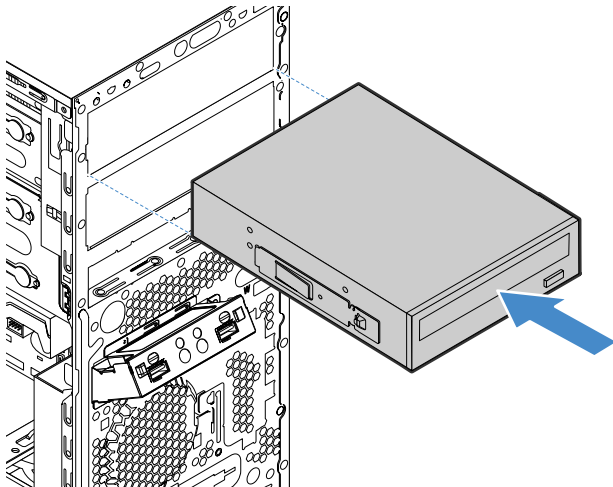


Figure 20. Installing the optical drive into the drive bay

7. Connect cables to the optical drive.

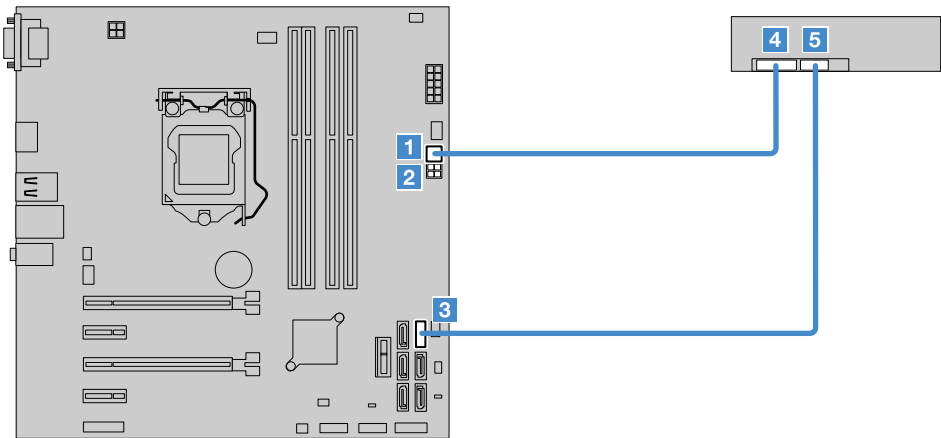


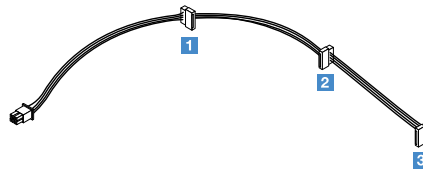
Figure 21. Connecting cables to the optical drive

Cable	From the system board	To the optical drive
1-to-3 power cable	<b>1</b> or <b>2</b> 4-pin power connector	<b>4</b> Power connector on the optical drive
Signal cable	<b>3</b> SATA connector 5	<b>5</b> Signal connector on the optical drive



**Notes:**

- The 1-to-3 power cable provides three SATA power connectors **1**, **2**, and **3**. You can connect any one of the SATA connectors to the drive.



- If your server has a secondary optical drive installed, connect the signal cable from the secondary optical drive to the SATA connector 4 on the system board. See “System board components” on page 19.

**Tape drive**

Your server supports an RDX tape drive in drive bay 4. For information about drive bays and installation rules, see “Internal drives” on page 44.

- “Removing a tape drive” on page 49
- “Installing a tape drive” on page 49

**Removing a tape drive**

To remove a tape drive, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. Disconnect the signal cable and power cable from the tape drive.
4. Press the release tab **1** and slide the tape drive out of the drive bay.

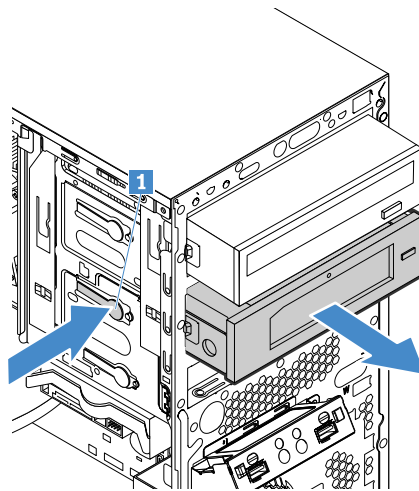


Figure 22. Removing the tape drive from the drive bay

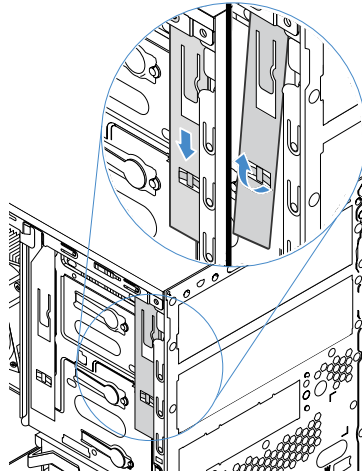
5. Install a new tape drive or install a metal shield to cover the drive bay.
6. If you are instructed to return the old tape drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

**Installing a tape drive**

To install a tape drive, do the following:

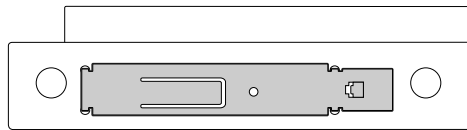


1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. If there is a metal shield covers the drive bay, remove the metal shield. Save the metal shield in case that you later remove the drive and need the metal shield to cover the drive bay.
4. If needed, remove the drive bay retainer from the server. Push the retainer downwards to unlock it and then lift it out of the chassis.



*Figure 23. Removing the retainer*

5. Install the retainer on the side of the tape drive.



*Figure 24. Installing the retainer*

6. Hold the tape drive in correct orientation and then slide it into the drive bay until it snaps into position.



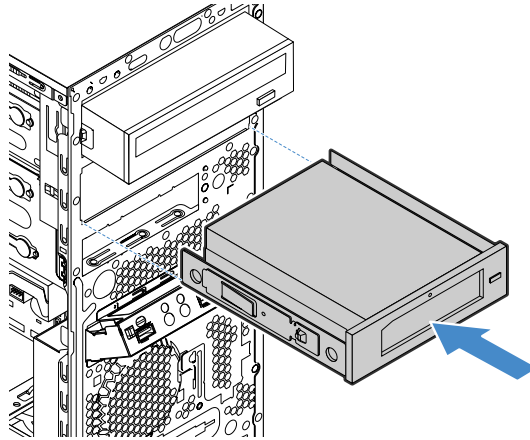


Figure 25. Installing the tape drive into the drive bay

7. Connect cables to the tape drive.

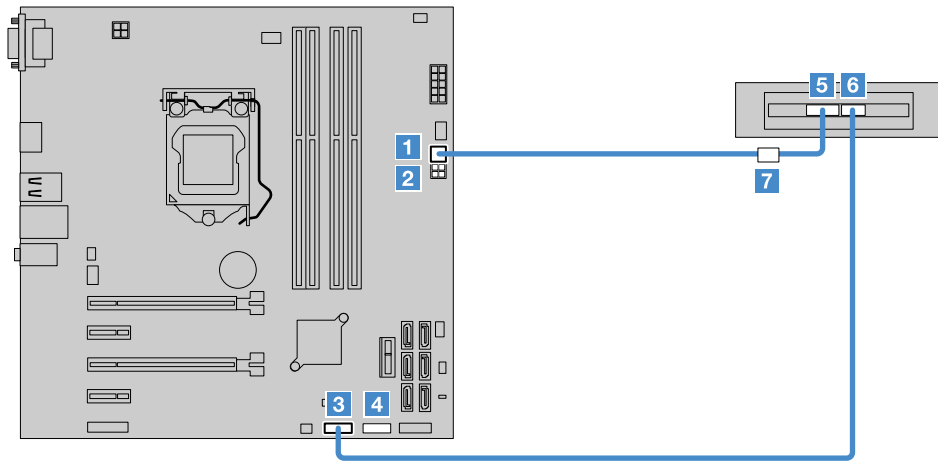
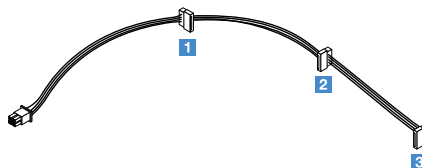


Figure 26. Connecting cables to the tape drive

Cable	From the system board	To the tape drive
1-to-3 power cable	<b>1</b> or <b>2</b> 4-pin power connector	<b>7</b> SATA power connector on the power cable of the tape drive <b>Note:</b> The tape drive comes with a power cable that is connected to the power connector <b>5</b> .
Signal cable	<b>3</b> or <b>4</b> USB 2.0 connector	<b>6</b> Signal connector on the tape drive

**Note:** The 1-to-3 power cable provides three SATA power connectors **1**, **2**, and **3**. You can connect any one of the SATA connectors to the power cable of the tape drive.





## Storage drive in drive bay 1

Drive bay 1 of your server supports a 2.5-inch/3.5-inch hard disk drive or 2.5-inch solid-state drive. For information about drive bays and installation rules, see “Internal drives” on page 44.

- “Removing a storage drive from drive bay 1” on page 52
- “Installing a storage drive into drive bay 1” on page 52

### Removing a storage drive from drive bay 1

To remove a storage drive from drive bay 1, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Disconnect the signal cable and power cable from the drive.
3. Pull the bracket handle to slide the drive out of the drive bay.

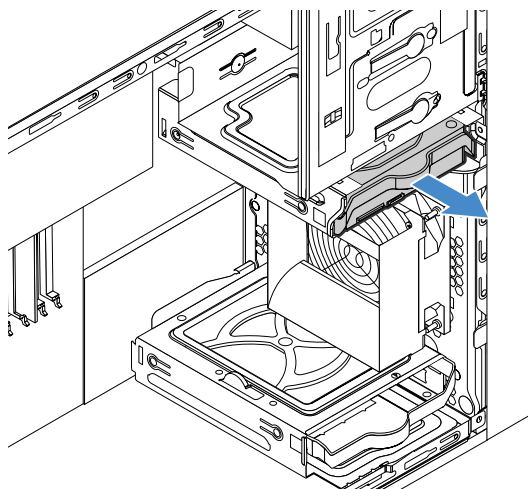


Figure 27. Removing the drive from the drive bay

4. Flex two sides of the drive bracket to remove the drive from the bracket.
5. If you are instructed to return the old drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

### Installing a storage drive into drive bay 1

**Note:** For a 2.5-inch hard disk drive or solid-state drive, install the drive into a 2.5-inch to 3.5-inch drive adapter first. See “Installing a 2.5-inch drive into a 2.5-inch to 3.5-inch drive adapter” on page 45.

To install a storage drive into drive bay 1, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Flex the drive bracket and align pins **1**, **2**, **3**, and **4** on the bracket with the corresponding holes in the drive. Do not touch the circuit board **5** on the bottom of the drive.



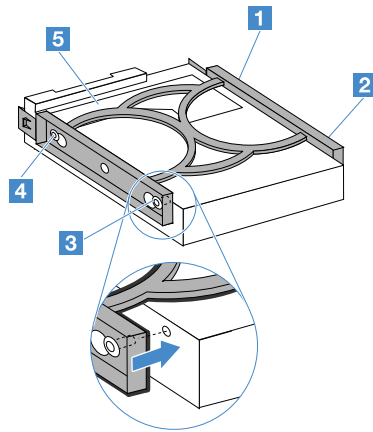


Figure 28. Installing the drive into the drive bracket

3. Slide the drive into the drive bay until it snaps into position.

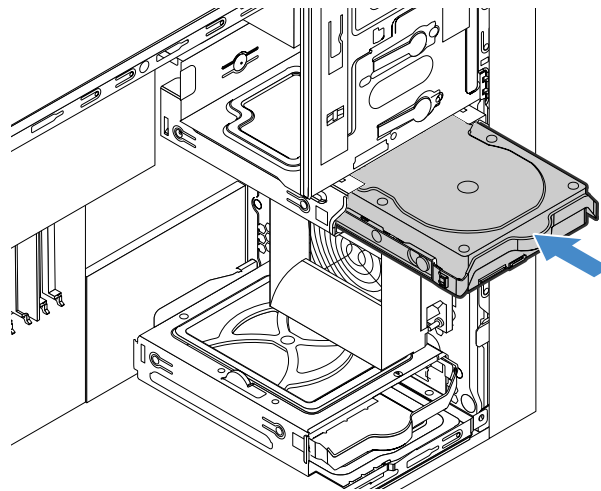


Figure 29. Installing the drive into the drive bay

4. Connect cables to the drive.

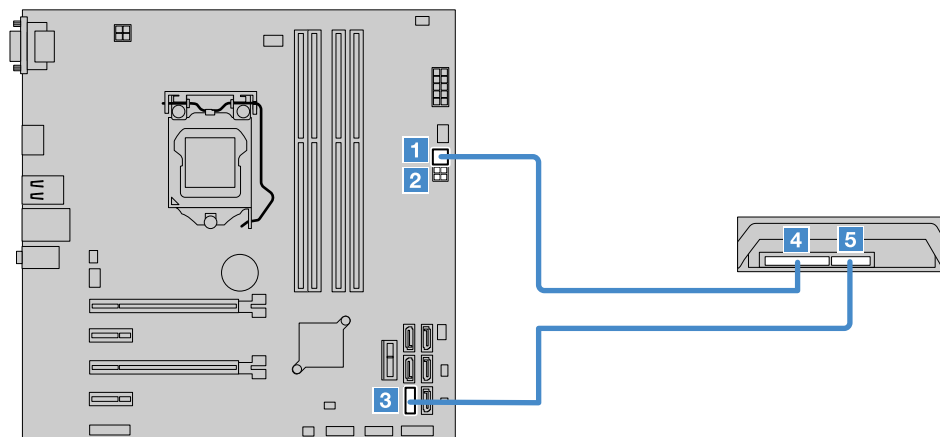
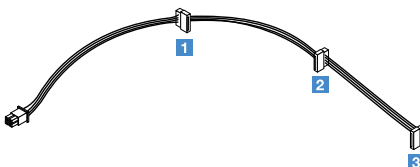


Figure 30. Connecting cables to the drive



Cable	From the system board	To the drive
1-to-3 power cable	<b>1</b> or <b>2</b> 4-pin power connector	<b>4</b> Power connector on the drive
Signal cable	<b>3</b> SATA connector 0	<b>5</b> Signal connector on the drive

**Note:** The 1-to-3 power cable provides three SATA power connectors **1**, **2**, and **3**. You can connect any one of the SATA connectors to the drive.



## Storage drive in drive bay 2

Drive bay 2 of your server supports a 2.5-inch/3.5-inch hard disk drive or 2.5-inch solid-state drive. For information about drive bays and installation rules, see “Internal drives” on page 44.

- “Removing a storage drive from drive bay 2” on page 54
- “Installing a storage drive into drive bay 2” on page 54

### Removing a storage drive from drive bay 2

To remove a storage drive from drive bay 2, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Disconnect the signal cable and power cable from the drive.
3. Pull the bracket handle to slide the drive out of the drive bay.

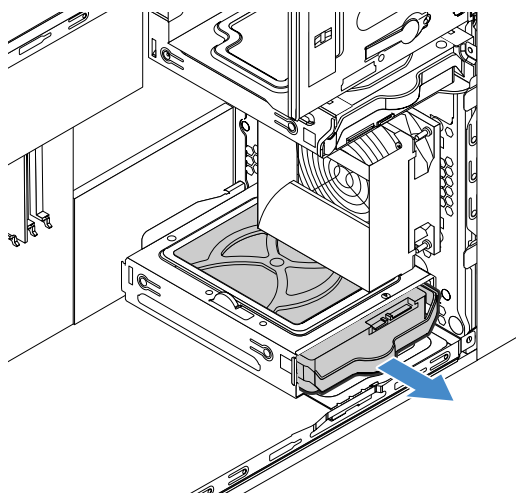


Figure 31. Removing the drive from the drive bay

4. Flex the sides of the drive bracket to remove the drive from the bracket.
5. If you are instructed to return the old drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

### Installing a storage drive into drive bay 2

**Note:** For a 2.5-inch hard disk drive or solid-state drive, install the drive into a 2.5-inch to 3.5-inch drive adapter first. See “Installing a 2.5-inch drive into a 2.5-inch to 3.5-inch drive adapter” on page 45.



To install a storage drive into drive bay 2, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Flex the drive bracket and align pins **1**, **2**, **3**, and **4** on the bracket with the corresponding holes in the drive. Do not touch the circuit board **5** on the bottom of the drive.

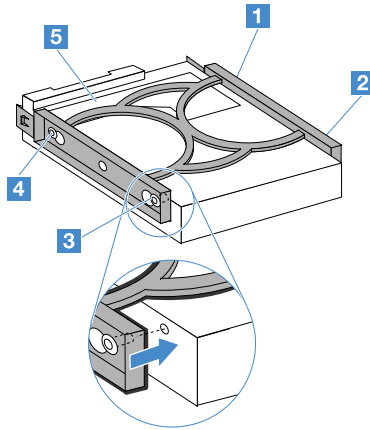


Figure 32. Installing the drive into the drive bracket

3. Slide the drive into the drive bay until it snaps into position.

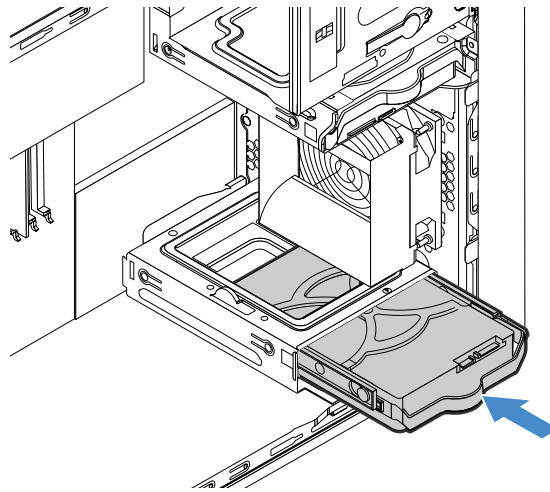


Figure 33. Installing the drive into the drive bay

4. Connect cables to the drive.



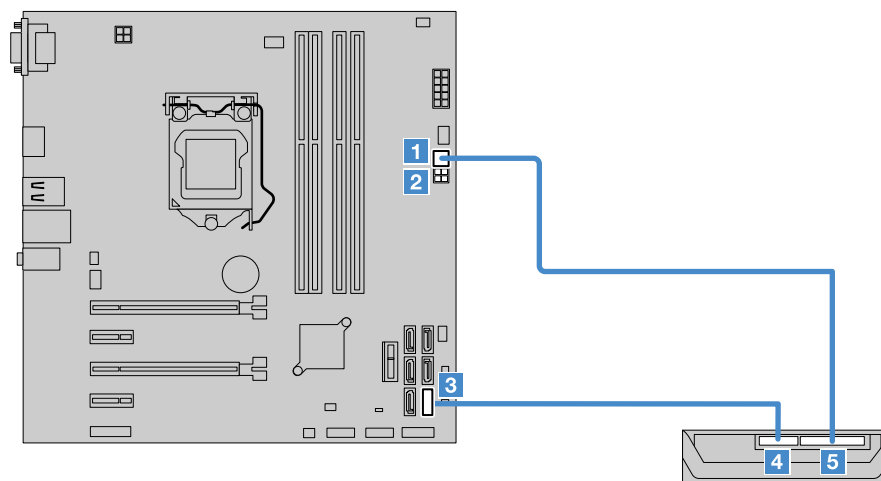
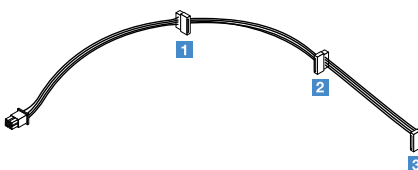


Figure 34. Connecting cables to the drive

Cable	From the system board	To the drive
1-to-3 power cable	<b>1</b> or <b>2</b> 4-pin power connector	<b>5</b> Power connector on the drive
Signal cable	<b>3</b> SATA connector 1	<b>4</b> Signal connector on the drive

**Note:** The 1-to-3 power cable provides three SATA power connectors **1**, **2**, and **3**. You can connect any one of the SATA connectors to the drive.



### Storage drive in drive bay 3

Drive bay 3 of your server supports only a 2.5-inch hard disk drive or solid-state drive. For information about drive bays and installation rules, see “Internal drives” on page 44.

- “Removing a storage drive from drive bay 3” on page 56
- “Installing a storage drive into drive bay 3” on page 57

### Removing a storage drive from drive bay 3

To remove a storage drive from drive bay 3, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Front bezel” on page 42.
3. Disconnect the signal cable and power cable from the drive.
4. Press the release tab **1** and slide the drive out of the drive bay.



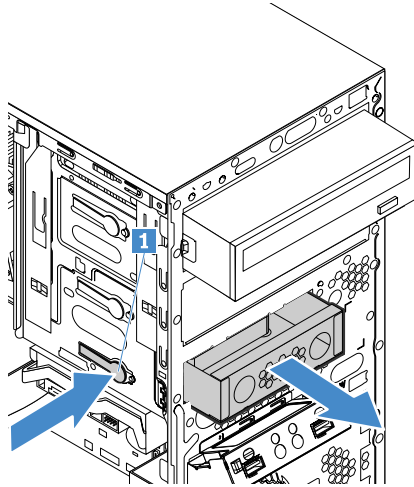


Figure 35. Removing the drive from the drive bay

5. Remove the four screws and then take the drive out of the Lenovo ThinkServer TS150 FDD to 2.5" HDD convertor kit (hereinafter called the 2.5-inch convertor kit).

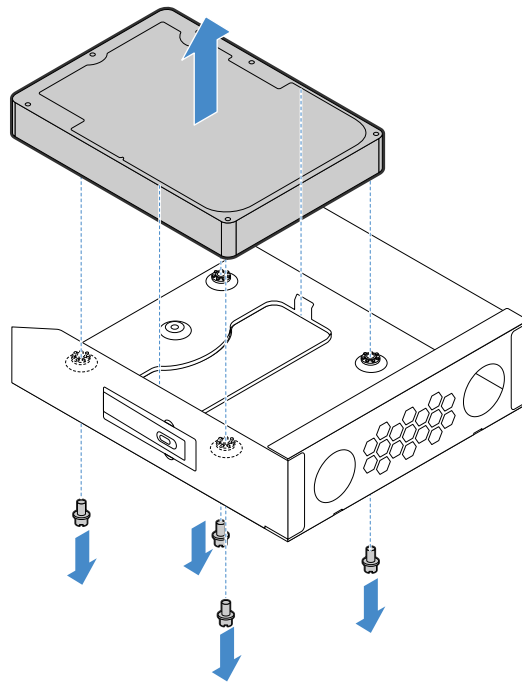


Figure 36. Removing the drive from the 2.5-inch convertor kit

6. Install a new drive or install a metal shield to cover the drive bay.
7. If you are instructed to return the old drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

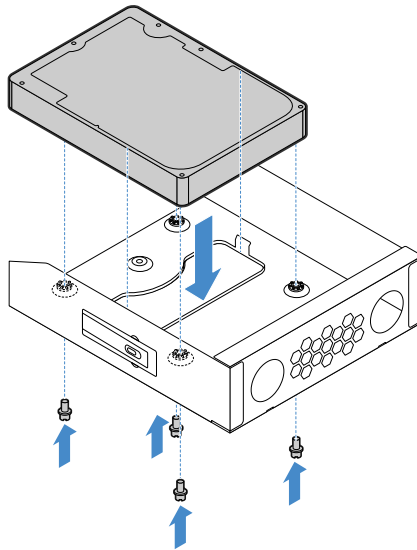
### Installing a storage drive into drive bay 3

**Note:** Drive bay 3 supports only a 2.5-inch hard disk drive or solid-state drive.

To install the storage drive, do the following:

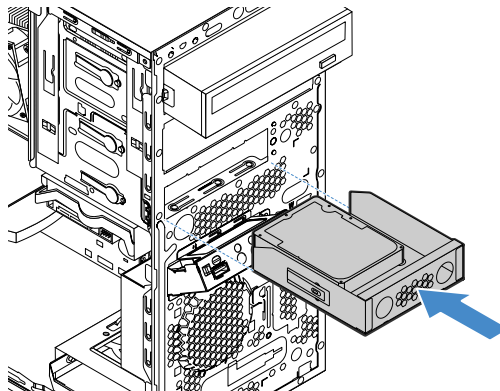


1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Front bezel” on page 42.
3. If there is a metal shield covers the drive bay, remove the metal shield. Save the metal shield in case that you later remove the drive and need the metal shield to cover the drive bay.
4. Install the drive into a 2.5-inch convertor kit. Align the four screw holes in the drive with the corresponding screw holes in the convertor kit. Then, install screws to secure the drive to the convertor kit.



*Figure 37. Installing the drive into a 2.5-inch convertor kit*

5. Slide the 2.5-inch convertor kit into the drive bay until it snaps into position.



*Figure 38. Installing the convertor kit into the drive bay*

6. Connect cables to the drive.



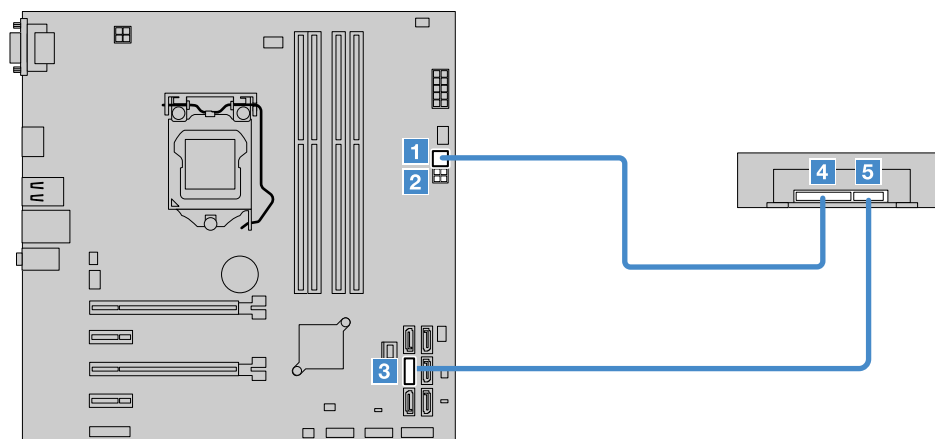
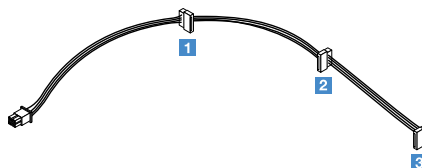


Figure 39. Connecting cables to the drive

Cable	From the system board	To the drive
1-to-3 power cable	<b>1</b> or <b>2</b> 4-pin power connector	<b>4</b> Power connector on the drive
Signal cable	<b>3</b> SATA connector 2	<b>5</b> Signal connector on the drive

**Note:** The 1-to-3 power cable provides three SATA power connectors **1**, **2**, and **3**. You can connect any one of the SATA connectors to the drive.



## Storage drive in drive bay 4

Drive bay 4 of your server supports one of the following:

- RDX tape drive  
For instructions on how to remove or install the tape drive, see “Tape drive” on page 49.
- Secondary optical drive  
For instructions on how to remove or install the optical drive, see “Optical drive” on page 46.
- Storage drive: a 2.5-inch/3.5-inch hard disk drive or 2.5-inch solid-state drive  
The storage drive is installed in a Lenovo ThinkServer TS150 3.5" HDD to 5.25" Tray Convertor Kit (hereinafter called the 5.25-inch convertor kit).
  - “Removing a storage drive from drive bay 4” on page 59
  - “Installing a storage drive into drive bay 4” on page 60

For information about drive bays and installation rules, see “Internal drives” on page 44.

## Removing a storage drive from drive bay 4

To remove a storage drive from drive bay 4, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Front bezel” on page 42.
3. Disconnect the signal cable and power cable from the drive.



4. Disconnect the HDD fan cable from the system board.
5. Press the release tab **1** and slide the 5.25-inch convertor kit out of the drive bay.

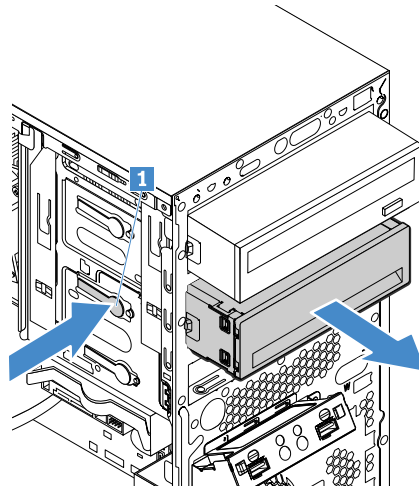


Figure 40. Removing the convertor kit from the drive bay

6. Remove the drive from the 5.25-inch convertor kit.
  - 1** Squeeze the release buttons as shown to open the rear cover of the convertor kit.
  - 2** Slide the drive out of the convertor kit.

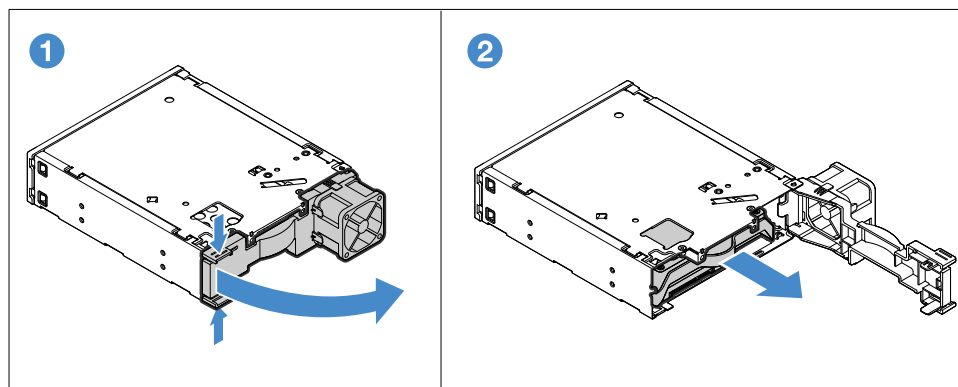


Figure 41. Removing the drive from the convertor kit

7. Flex two sides of the drive bracket to remove the drive from the bracket.
8. If needed, install a new drive into the 5.25-inch convertor kit. See “Installing a storage drive into drive bay 4” on page 60.
9. If you are instructed to return the old drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

### Installing a storage drive into drive bay 4

**Note:** For a 2.5-inch hard disk drive or solid-state drive, install the drive into a 2.5-inch to 3.5-inch drive adapter first. See “Installing a 2.5-inch drive into a 2.5-inch to 3.5-inch drive adapter” on page 45.

To install a storage drive into drive bay 4, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.



2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. If there is a metal shield covers the drive bay, remove the metal shield. Save the metal shield in case that you later remove the drive and need the metal shield to cover the drive bay.
4. Flex the sides of the drive bracket and align pins **1**, **2**, **3**, and **4** on the bracket with the corresponding holes in the drive. Do not touch the circuit board **5** on the bottom of the drive.

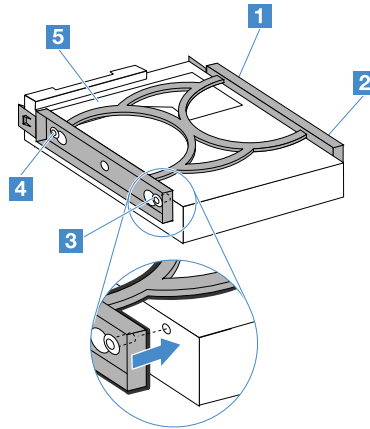


Figure 42. Installing the drive into the drive bracket

5. Install the drive into the 5.25-inch convertor kit.
  - 1 Squeeze the release buttons as shown to open the rear cover of the convertor kit.
  - 2 Slide the drive into the convertor kit until it snaps into position. Then, close the rear cover.

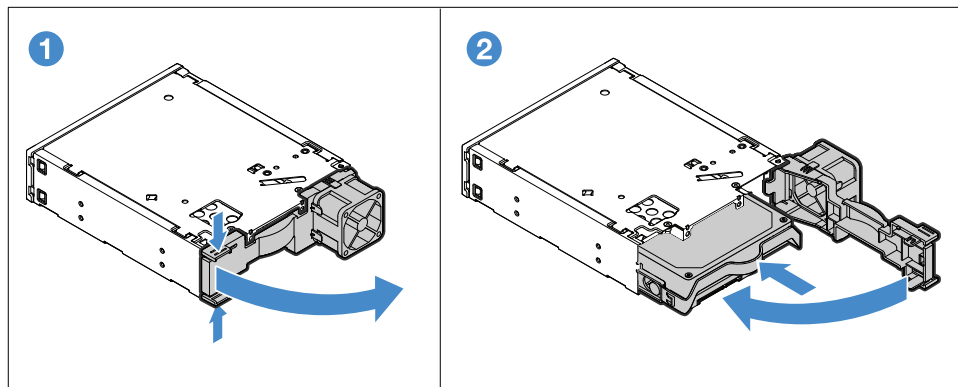


Figure 43. Installing the drive into the convertor kit

6. If needed, remove the drive bay retainer from the server. Push the retainer downwards to unlock it and then lift it out of the chassis.



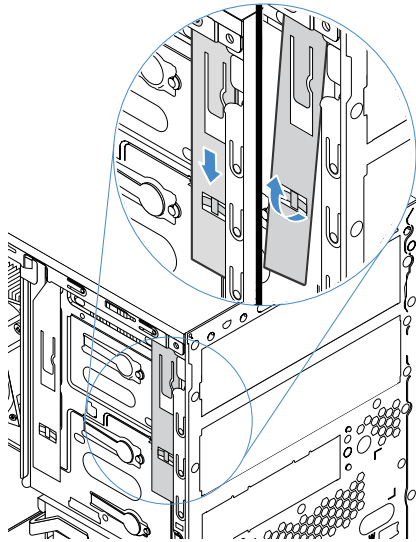


Figure 44. Removing the retainer

7. Install the retainer on the side of the 5.25-inch convertor kit.

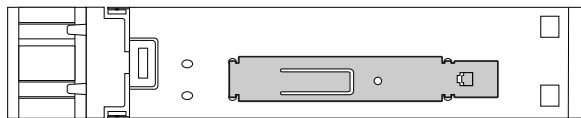


Figure 45. Installing the retainer

8. Slide the 5.25-inch convertor kit into the drive bay until it snaps into position.

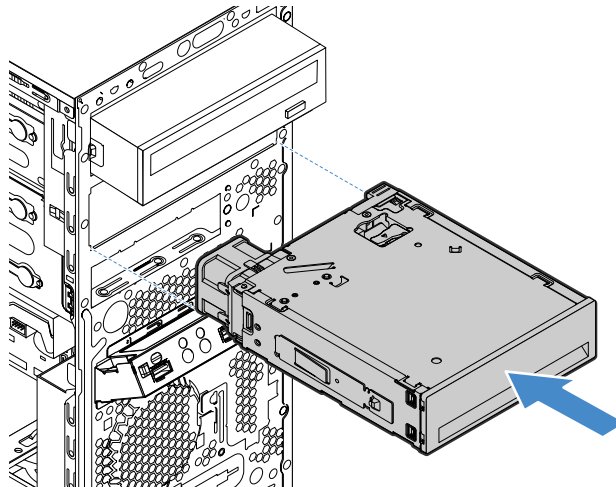


Figure 46. Installing the convertor kit into the drive bay

9. Connect cables to the drive and convertor kit.



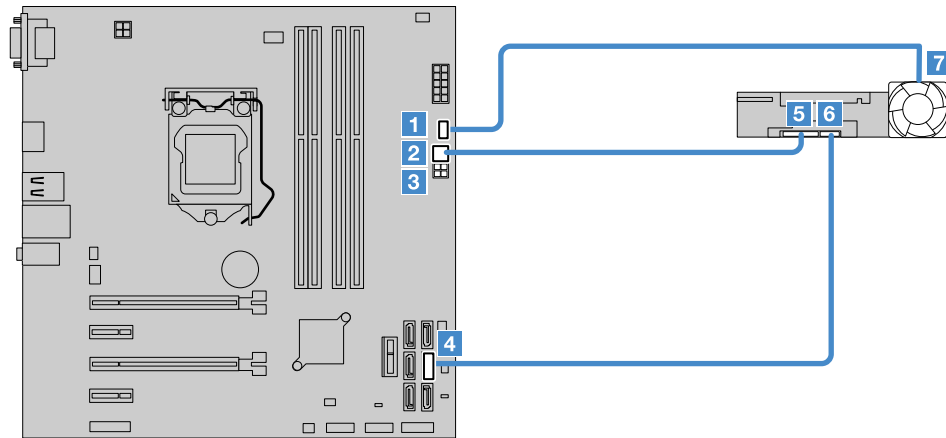
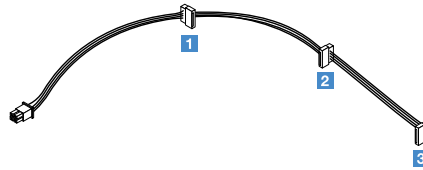


Figure 47. Connecting cables to the drive and convertor kit

Cable	From the system board	To the drive and convertor kit
HDD fan cable	<b>1</b> HDD fan connector	<b>7</b> HDD fan on the rear of the convertor kit
1-to-3 power cable	<b>2</b> or <b>3</b> 4-pin power connector	<b>5</b> Power connector on the drive
Signal cable	<b>4</b> SATA connector 3	<b>6</b> Signal connector on the drive

#### Notes:

- The 1-to-3 power cable provides three SATA power connectors **1**, **2**, and **3**. You can connect any one of the SATA connectors to the drive.



- If your server has no drive installed in drive bay 3, connect the signal cable from the drive to the SATA connector 2 on the system board. See “System board components” on page 19.

## Slim optical drive and storage drive in drive bay 5

Drive bay 5 of your server supports one of the following:

- Primary optical drive  
For instructions on how to remove or install the optical drive, see “Optical drive” on page 46.
- Slim optical drive and storage drive (2.5-inch/3.5-inch hard disk drive or 2.5-inch solid-state drive)  
The slim optical drive and storage drive are installed in a Lenovo ThinkServer TS150 3.5" HDD to 5.25" Tray Convertor with Slim ODD Kit (hereinafter called HDD and slim ODD convertor kit).
  - “Removing a slim optical drive and storage drive from drive bay 5” on page 63
  - “Installing a slim optical drive and storage drive into drive bay 5” on page 65

For information about drive bays and installation rules, see “Internal drives” on page 44.

### Removing a slim optical drive and storage drive from drive bay 5

To remove a slim optical drive and storage drive from drive bay 5, do the following:

- Prepare your server. See “Preparing your server and removing the server cover” on page 41.



2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. Disconnect the signal cables and power cables from the slim optical drive and storage drive.
4. Disconnect the HDD fan cable from the system board.
5. Press the release tab **1** and slide the HDD and slim ODD convertor kit out of the drive bay.

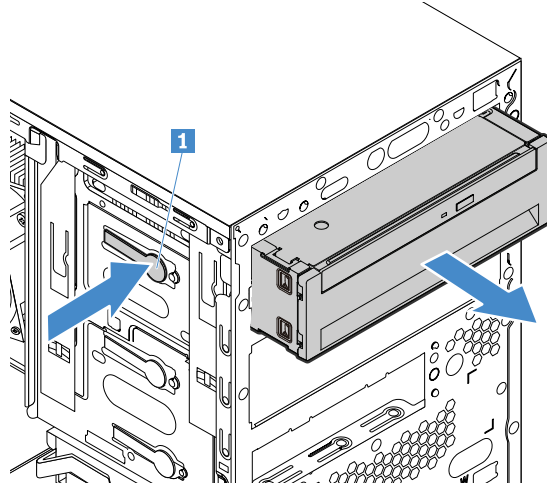


Figure 48. Removing the convertor kit from the drive bay

6. Press the release button **1** as shown and slide the slim optical drive out of the HDD and slim ODD convertor kit.

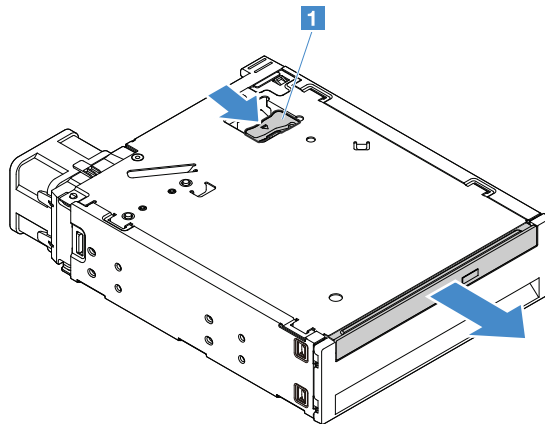


Figure 49. Removing the slim optical drive from the convertor kit

7. Remove the storage drive from the HDD and slim ODD convertor kit.
  - 1** Squeeze the release buttons as shown to open the rear cover of the convertor kit.
  - 2** Slide the drive out of the kit.



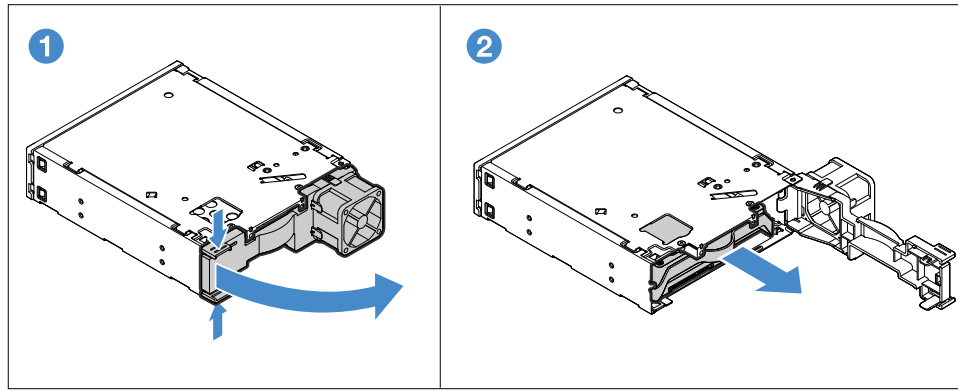


Figure 50. Removing the drive from the convertor kit

8. Flex two sides of the drive bracket to remove the storage drive from the drive bracket.
9. If needed, install a new slim optical drive and storage drive. See “Installing a slim optical drive and storage drive into drive bay 5” on page 65.
10. If you are instructed to return the old drives, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

#### Installing a slim optical drive and storage drive into drive bay 5

**Note:** For a 2.5-inch hard disk drive or solid-state drive, install the drive into a 2.5-inch to 3.5-inch drive adapter first. See “Installing a 2.5-inch drive into a 2.5-inch to 3.5-inch drive adapter” on page 45.

To install a slim optical drive and storage drive into drive bay 5, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. Slide the slim optical drive into the HDD and slim ODD convertor kit until it snaps into position.

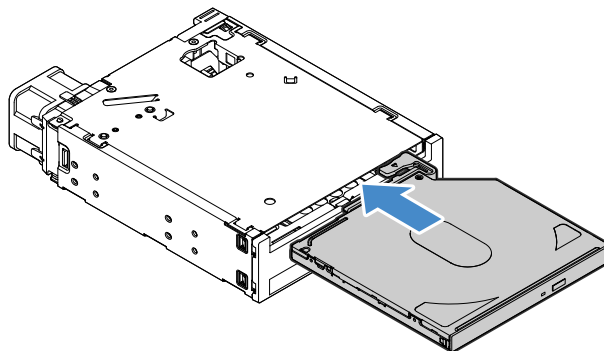


Figure 51. Installing the slim optical drive into the convertor kit

4. Flex the sides of the storage-drive bracket and align pins **1**, **2**, **3**, and **4** on the bracket with the corresponding holes in the storage drive. Do not touch the circuit board **5** on the bottom of the storage drive.



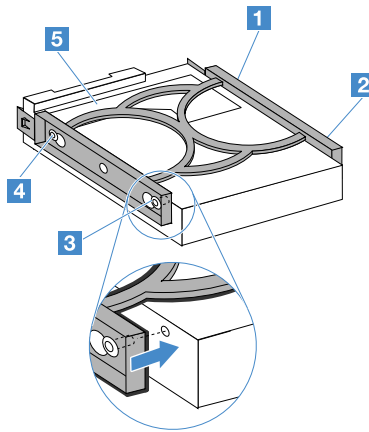


Figure 52. Installing the storage drive into the drive bracket

5. Install the storage drive into the HDD and slim ODD convertor kit.
  - 1 Squeeze the release buttons as shown to open the rear cover of the convertor kit.
  - 2 Slide the drive into the kit until it snaps into position. Then, close the rear cover.

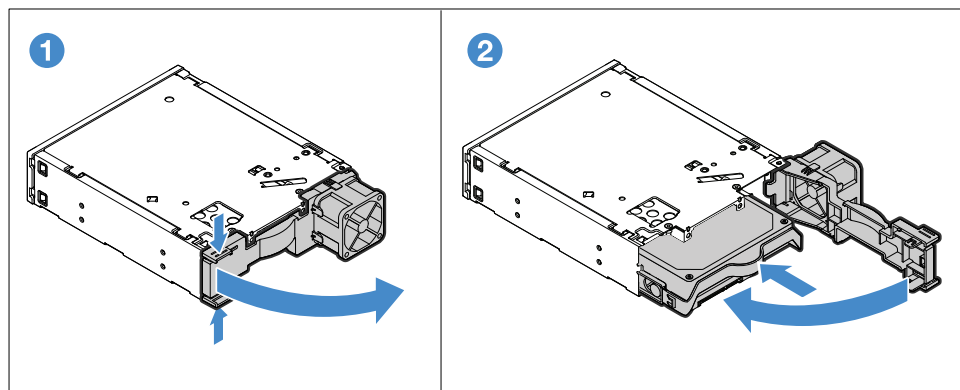


Figure 53. Installing the storage drive into the convertor kit

6. If needed, remove the drive bay retainer from the server. Push the retainer downwards to unlock it and then lift it out of the chassis.



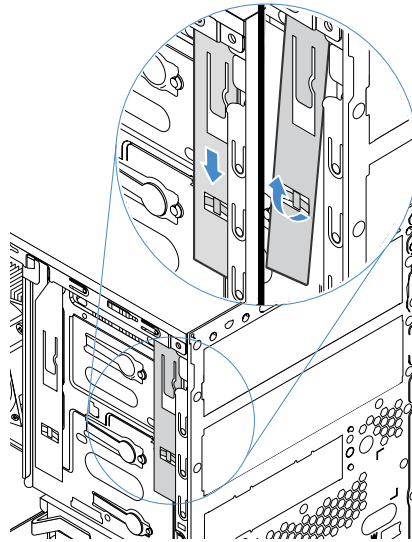


Figure 54. Removing the retainer

7. Install the retainer on the side of the HDD and slim ODD convertor kit.

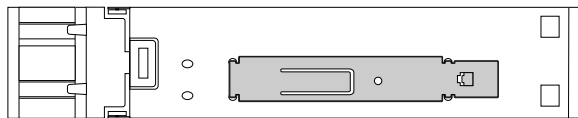


Figure 55. Installing the retainer

8. Slide the HDD and slim ODD convertor kit into the drive bay until it snaps into position.

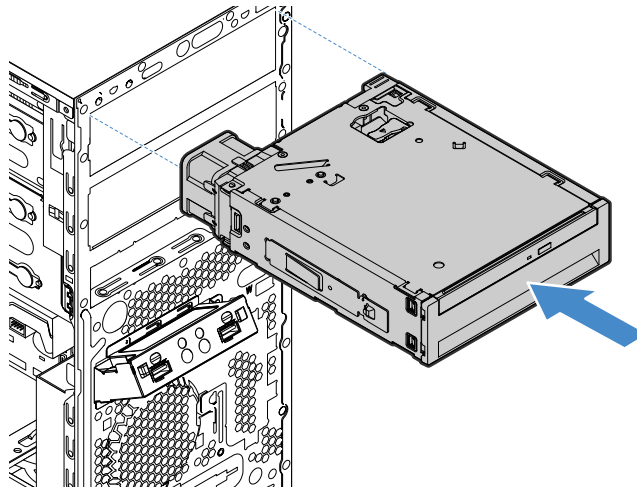


Figure 56. Installing the convertor kit into the drive bay

9. Connect cables to the drives and convertor kit.



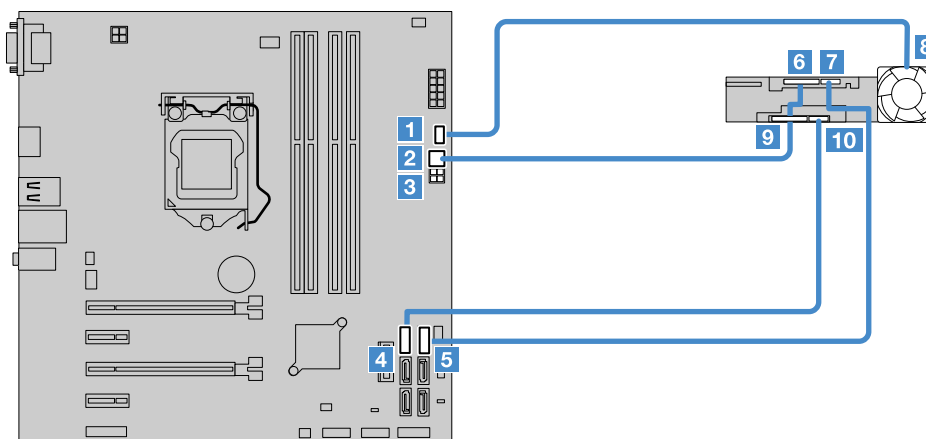
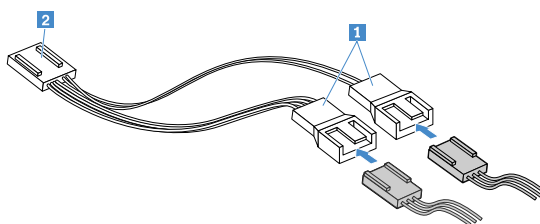


Figure 57. Connecting cables to the drives and converter kit

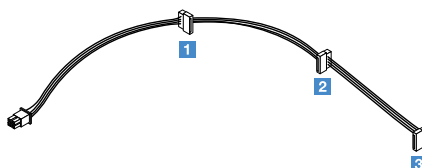
Cable	From the system board	To the drives and converter kit
HDD fan cable	<b>1</b> HDD fan connector	<b>8</b> HDD fan on the rear of the HDD and slim ODD kit
1-to-3 power cable	<b>2</b> or <b>3</b> 4-pin power connector	<b>6</b> and <b>9</b> Power connectors on the slim optical drive and storage drive
Signal cable	<b>4</b> SATA connector 4	<b>10</b> Signal connector on the storage drive
Signal cable	<b>5</b> SATA connector 5	<b>7</b> Signal connector on the slim optical drive

#### Notes:

- If your server already has a storage drive installed in drive bay 4, use the 1-to-2 fan power converter cable to connect the HDD fans. Connect connector **2** to the system board, and connect connectors **1** to the HDD fan cables respectively.



- The 1-to-3 power cable provides three SATA power connectors **1**, **2**, and **3**. You can use any two of the SATA connectors to connect the slim optical drive and storage drive.



- If your server has no drive installed in drive bay 3, connect the signal cable from the storage drive to the SATA connector 3 on the system board. See “System board components” on page 19.



## Memory module

**Note:** The memory modules are extremely sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 40 first and carefully perform the operation.

- “Memory module installation rules” on page 69
- “Removing the memory module” on page 70
- “Installing the memory module” on page 70

## Memory module installation rules

### Features

Your server has four memory slots.

- Each slot supports 4 GB, 8 GB, and 16 GB double data rate 4 (DDR4) unbuffered dual inline memory modules (UDIMMs) with Error Checking and Correcting (ECC) technology.
- The minimum system memory is 4 GB (only one 4 GB memory module installed).
- The maximum system memory is 64 GB (one 16 GB memory module installed in each memory slot).

### Guidelines

- Memory modules from different manufacturers are supported.
- All memory modules to be installed must be the same type with the same voltage.
- If your server comes with 2400 MHz memory modules and a microprocessor that supports a maximum of 2133 MHz memory, the data rate of your memory modules will be limited to 2133 MHz.
- If you mix memory modules with different frequencies in the same server, all the memory modules run at the speed of the memory module with the lowest frequency
- If you install memory modules with different capacity, install the memory module that has the highest capacity first.

### Installation order

The following illustration shows the installation order for the four memory slots. Install memory modules in the numerical order as shown.



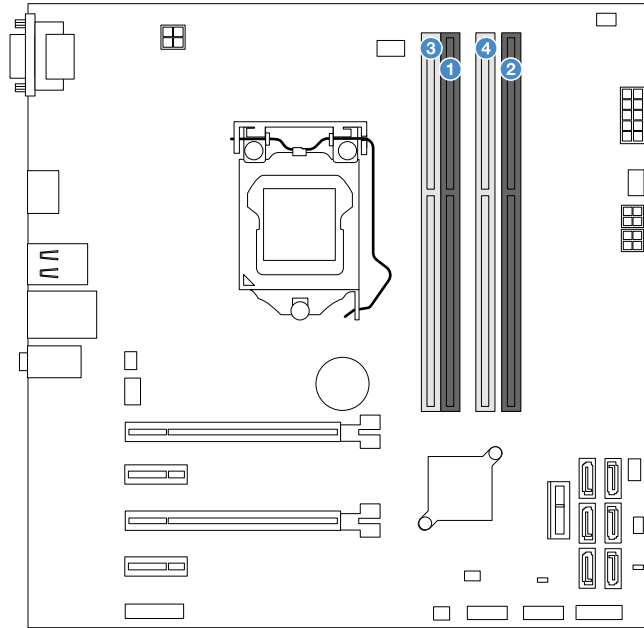


Figure 58. Memory module installation order

## Removing the memory module

To remove a memory module, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Lay the server on its side for easier operation.
3. Locate and remove the memory module. Open the retaining clips and gently pull the memory module out of the memory slot.

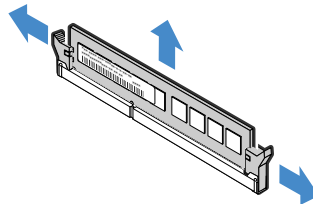


Figure 59. Removing a memory module

4. If you are instructed to return the old memory module, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

## Installing the memory module

**Note:** Ensure that you follow the memory module installation rules when performing the operation. See “Memory module installation rules” on page 69.

To install a memory module, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Lay the server on its side for easier operation.
3. Locate the memory slot on the system board and remove the memory dummy if necessary.



4. Open the retaining clips and install the memory module into the slot until the retaining clips are completely closed.

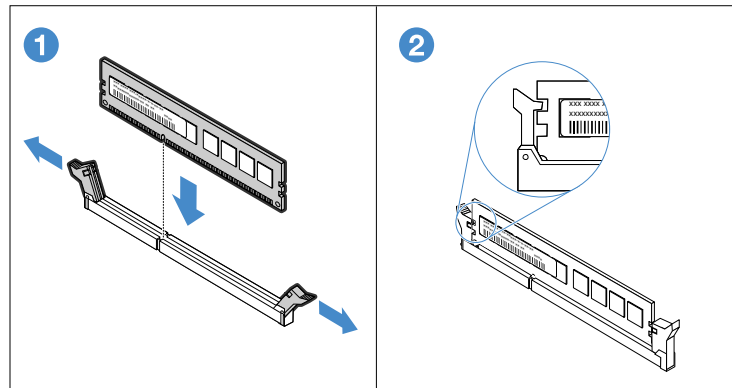


Figure 60. Installing the memory module

## PCIe card

This topic provides instructions on how to install or remove a PCIe card, such as a graphic card, a RAID card, an Ethernet card, and any other supported PCIe cards. Depending on the specific type, the PCIe card might look different from the illustrations in this topic.

**Note:** The PCIe card is extremely sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 40 first and carefully perform the operation.

- “Removing a PCIe card” on page 71
- “Installing a PCIe card” on page 72

## Removing a PCIe card

To remove a PCIe card, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the PCIe card to be removed. For PCIe slot locations, see “System board components” on page 19.
3. At the rear of the server, press the release button **1** to open the PCIe card latch **2**.



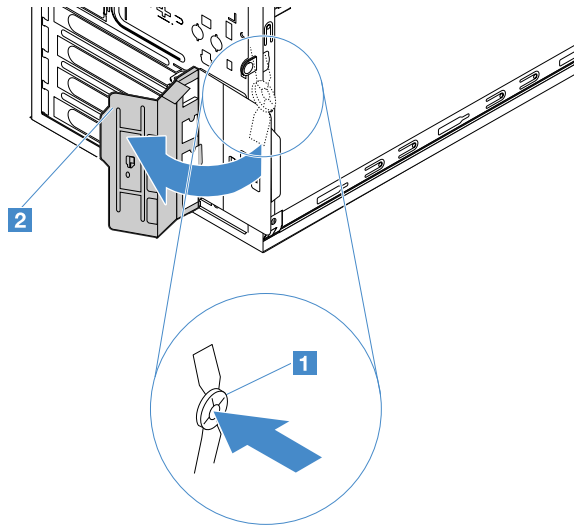


Figure 61. Opening the PCIe card latch

4. Grasp the PCIe card and gently pull it out of the slot.

**Note:** If the card is secured by a retaining clip, disengage the card retaining clip first.

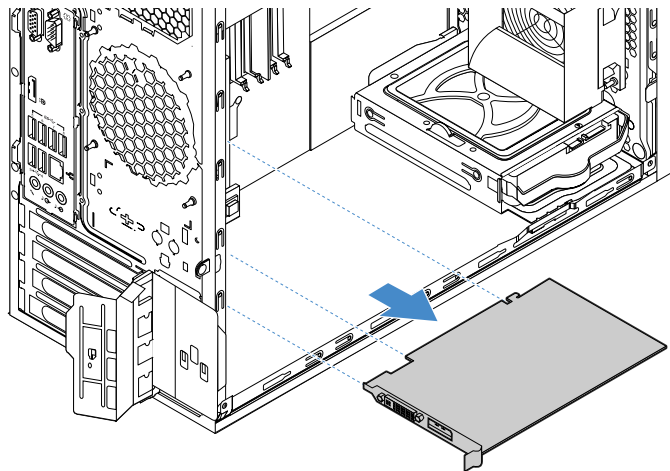


Figure 62. Removing the PCIe card

5. Install a new PCIe card or install a PCIe card slot bracket to cover the place.
6. If you are instructed to return the old PCIe card, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

## Installing a PCIe card

To install a PCIe card, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. At the rear of the server, press the release button **1** to open the PCIe card latch **2**.



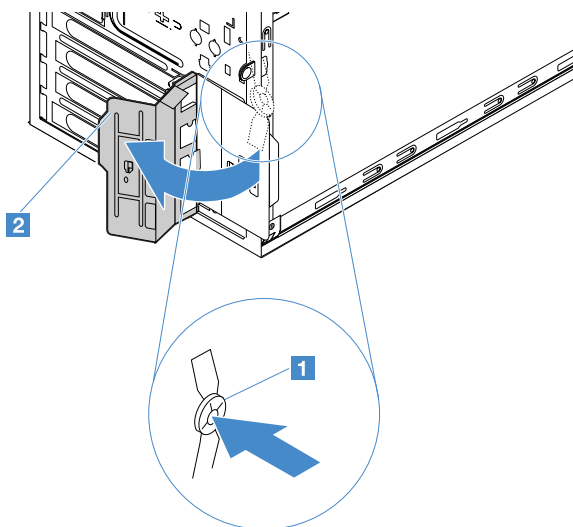


Figure 63. Opening the PCIe card latch

3. Locate an appropriate PCIe slot for the PCIe card, and remove the metal slot bracket. For detailed information about the PCIe slots, see “System board components” on page 19.

**Note:** To avoid any interference during installation, ensure that the memory-slot retaining clips are closed if you install a PCIe x16 card into PCIe slot 1.

4. Install the PCIe card into the PCIe slot, and pivot the card latch to the closed position.

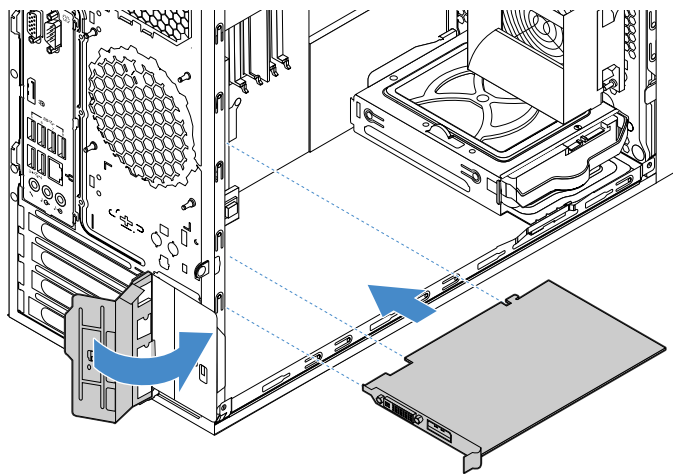


Figure 64. Installing the PCIe card

5. Depending on the type of the PCIe card, you might need to connect any required cables. Refer to the documentation that comes with the PCIe card for specific information.

To install a required device driver for the PCIe card, go to the Lenovo Support Web site at <http://www.lenovo.com/drivers>. Download the driver for the PCIe card and the readme file, and follow the instructions in the readme file to install the driver.



## Lenovo ThinkServer RAID 520i upgrade key

The Lenovo ThinkServer RAID 520i upgrade key (hereinafter referred to as RAID 520i key) activates the RAID 5 level for advanced SATA or SAS hardware RAID. You can purchase a RAID 520i key from Lenovo and install it to the RAID upgrade key connector on the Lenovo ThinkServer RAID 520i RAID Adapter.

- “Removing the RAID 520i key” on page 74
- “Installing the RAID 520i key” on page 74

### Removing the RAID 520i key

#### Notes:

- Removing the upgrade key might impact your RAID configurations. Back up your data before you begin to avoid any data loss due to a RAID configuration change.
- If you remove the RAID 520i key, the hardware RAID 5 will be disabled.

To remove the RAID 520i key, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the Lenovo ThinkServer RAID 520i PCIe Adapter. See “Server components” on page 16.
3. Remove the RAID 520i key from the Lenovo ThinkServer RAID 520i PCIe Adapter.

**Note:** If necessary, remove the RAID card first for easier operation. Then, reinstall the RAID card. See “PCIe card” on page 71.

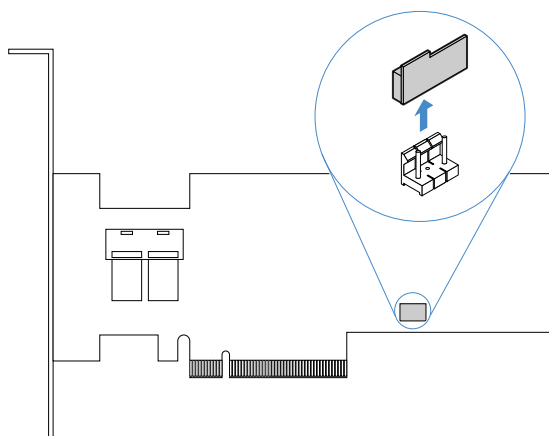


Figure 65. Removing the RAID 520i key

4. If you are instructed to return the old RAID 520i key, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

The hardware RAID 5 is not available without the RAID 520i key. Therefore, you might need to reconfigure RAID for your server. For information about configuring hardware RAID, refer to the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at:

<http://www.lenovo.com/support>

### Installing the RAID 520i key

To install the RAID 520i key, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the Lenovo ThinkServer RAID 520i PCIe Adapter. See “Server components” on page 16.



3. Touch the static-protective package that contains the RAID 520i key to any unpainted surface on the outside of the server. Then, take the RAID 520i key out of the package.

**Note:** Carefully handle the RAID 520i key by its edges.

4. Insert the RAID 520i key into the J3 connector on the Lenovo ThinkServer RAID 520i PCIe Adapter. Ensure that the RAID 520i key is securely seated on the RAID card.

**Note:** If necessary, remove the RAID card first for easier operation. Then, reinstall the RAID card. See “PCIe card” on page 71.

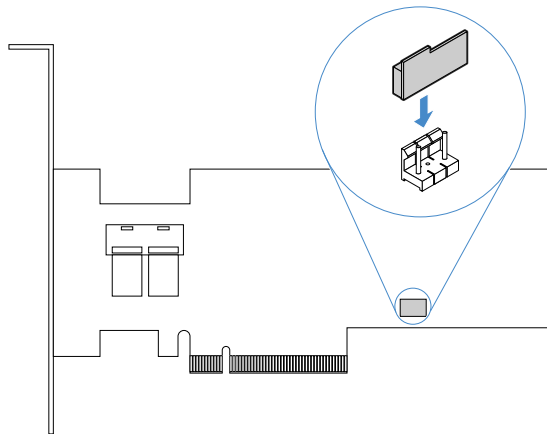


Figure 66. Installing the RAID 520i key

After installing the RAID 520i key, you might need to configure RAID to activate RAID 5 for your server. Back up your data before you begin to avoid any data loss due to a RAID configuration change. For information about configuring hardware RAID, refer to the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at:

<http://www.lenovo.com/support>

## Front USB assembly

- “Removing the front USB assembly” on page 75
- “Installing the front USB assembly” on page 76

### Removing the front USB assembly

To remove the front USB assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. Locate the front USB assembly. See “Server components” on page 16.
4. Disconnect the front USB assembly cable.
5. Remove the screw that secures the front USB assembly. Then, slide the front USB assembly to the right a little bit and remove it from the chassis.



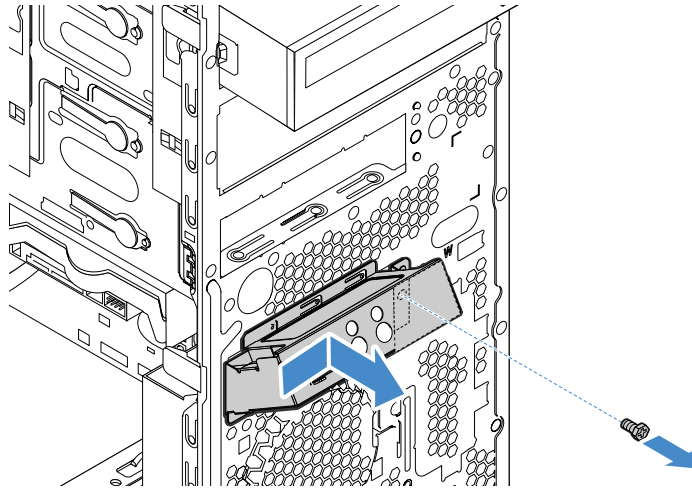


Figure 67. Removing the front USB assembly

6. To install a new front USB assembly, see “Installing the front USB assembly” on page 76.
7. If you are instructed to return the old front USB assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

## Installing the front USB assembly

To install a new front USB assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. Remove the old front USB assembly in your server. See “Removing the front USB assembly” on page 75.
4. Route the cable of the new front USB assembly through the corresponding square hole in the front of the chassis.
5. Position the front USB assembly onto the chassis and slide it to the left as shown. Then, install the screw to secure the front USB assembly in place.

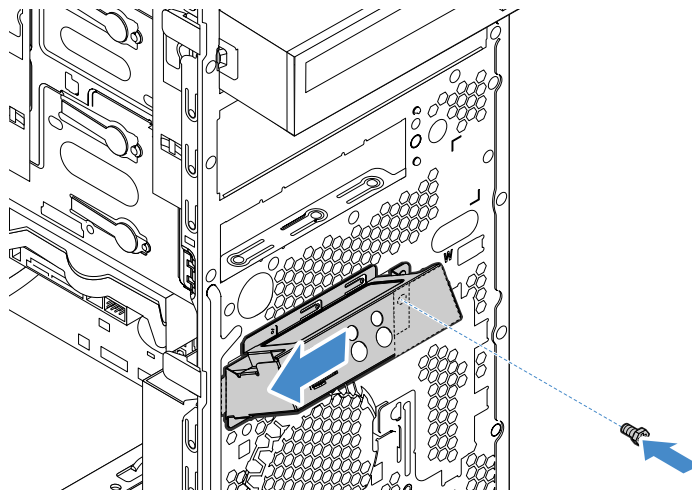


Figure 68. Installing the front USB assembly



6. Connect the front USB assembly cable to the front USB 3.0 connector on the system board. See “Server components” on page 16.

## Thermal sensor

- “Removing the thermal sensor” on page 77
- “Installing the thermal sensor” on page 77

### Removing the thermal sensor

To remove the thermal sensor, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. See “Removing the front bezel” on page 42.
3. Locate the thermal sensor. See “Server components” on page 16.
4. Disconnect the thermal sensor cable.
5. On the inner side of the chassis, press the upper retaining clip as shown and then push the clip outward to disengage the thermal sensor from the chassis.

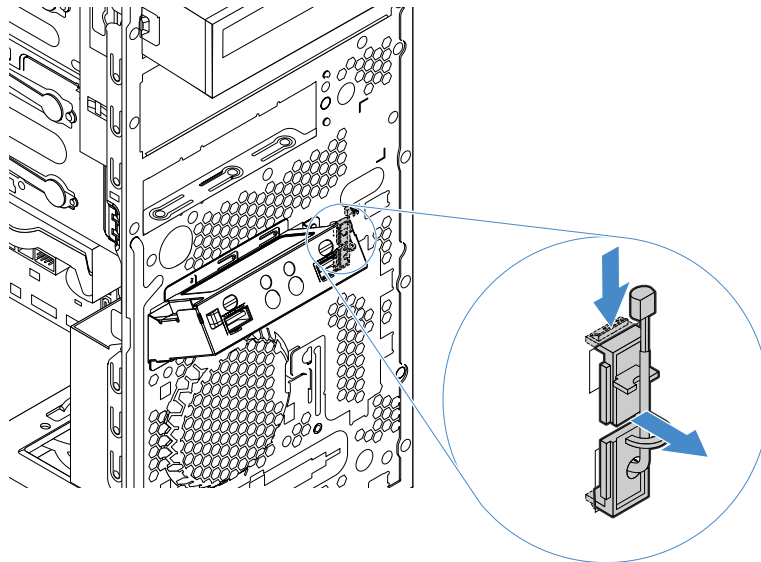


Figure 69. Removing the thermal sensor

6. To install a new thermal sensor, see “Installing the thermal sensor” on page 77.
7. If you are instructed to return the old thermal sensor, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

### Installing the thermal sensor

To install a new thermal sensor, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the old thermal sensor in your server. See “Removing the thermal sensor” on page 77.
3. Insert the cable of the new thermal sensor into the lower hole **1** in the chassis. Align the two retaining clips with the two holes **1** and **2** in the chassis. Then, push the two retaining clips into the two holes until the thermal sensor is secured into place.



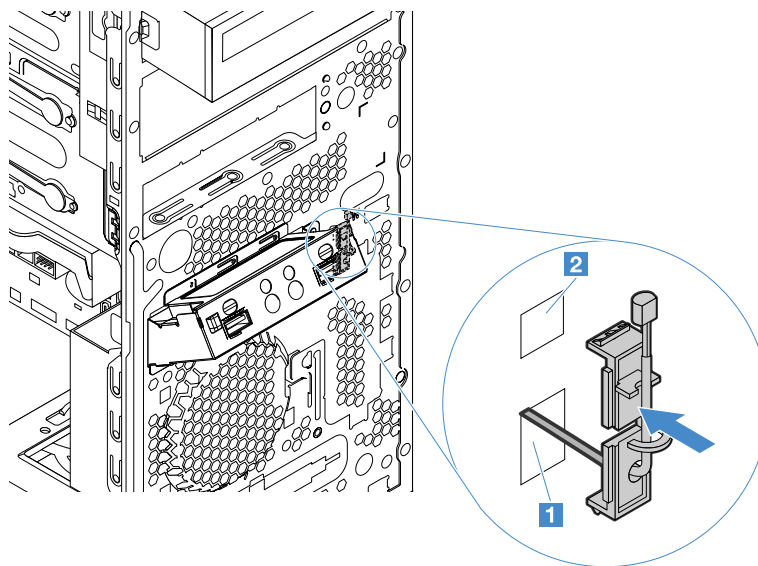


Figure 70. Installing the thermal sensor

4. Connect the thermal sensor cable to the thermal sensor connector on the system board. See “System board components” on page 19.

## SD module

- “Removing the SD module” on page 78
- “Installing the SD module” on page 79

### Removing the SD module

To remove the SD module, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Lay the server on its side for easier operation.
3. Locate the SD module. See “Server components” on page 16.
4. Disconnect the SD module cable.
5. Remove the SD module from the SD module bracket.

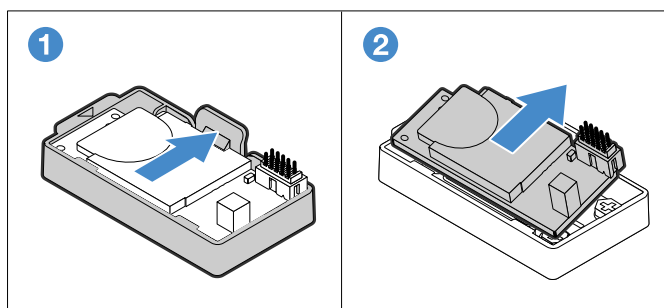


Figure 71. Removing the SD module

6. Both sides of the SD module support the installation of an SD card. If any SD card is installed, remove the card.



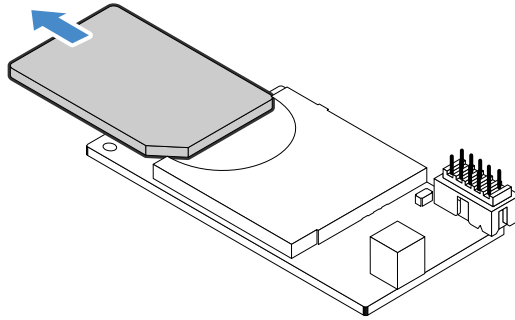


Figure 72. Removing an SD card

7. Remove the SD module from the server chassis if necessary.
8. To install a new SD module and SD card, see “Installing the SD module” on page 79.
9. If you are instructed to return the old SD module, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

## Installing the SD module

To install an SD module, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Lay the server on its side for easier operation.
3. Position the SD module bracket into your server and then install the three screws to secure the bracket in place.

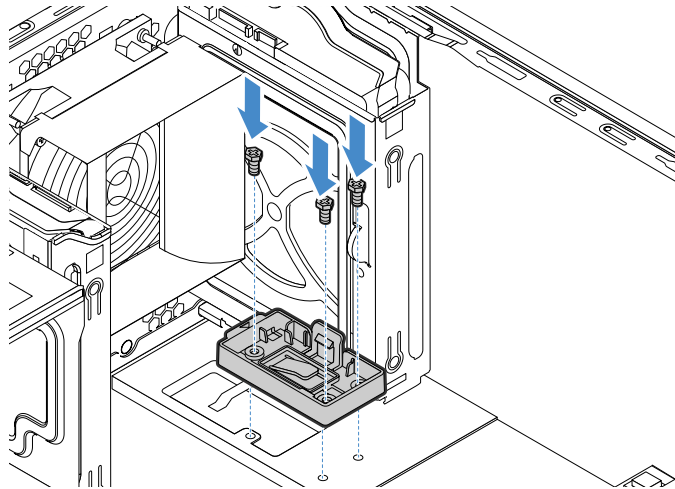


Figure 73. Installing the SD module bracket

4. Insert an SD card into the SD module until you hear a click.

**Note:** The SD module supports up to two SD cards. You can install a secondary SD card into the SD module on the other side of the SD module.



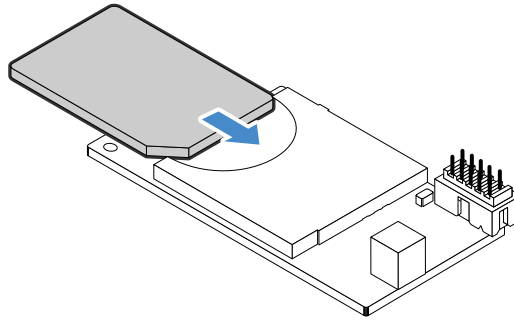


Figure 74. Installing an SD card

5. Install the SD module into the SD module bracket.

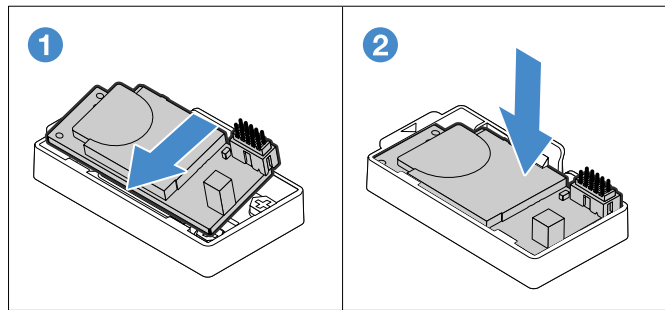


Figure 75. Installing the SD module

6. Connect the SD module cable to an available USB 2.0 connector on the system board. See “System board components” on page 19.

## Front fan assembly

- “Removing the front fan assembly” on page 80
- “Installing the front fan assembly” on page 81

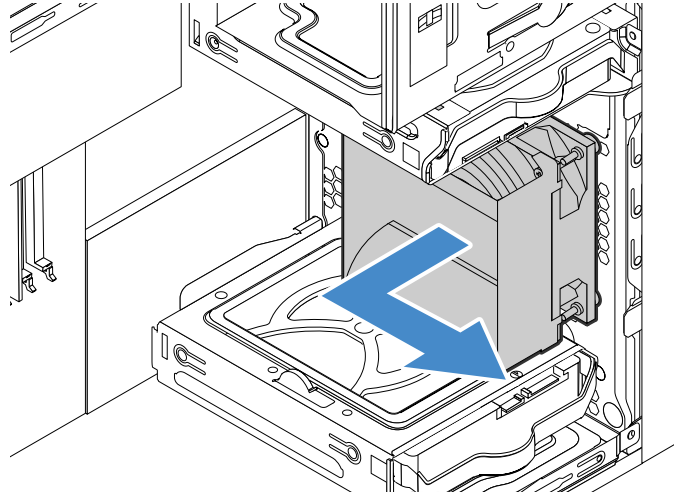
### Removing the front fan assembly

To remove the front fan assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. “Removing the front bezel” on page 42.
3. Locate the front fan assembly. See “Server components” on page 16.
4. Disconnect the cable of the front fan assembly.
5. The front fan assembly is attached to the chassis by four rubber mounts. Break or cut the rubber mounts and gently pull the front fan assembly out of the chassis.

**Note:** A new front fan assembly comes with four new rubber mounts.





*Figure 76. Removing the front fan assembly*

6. To install a new front fan assembly, see “Installing the front fan assembly” on page 81.
7. If you are instructed to return the old front fan assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

### **Installing the front fan assembly**

To install a new front fan assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the front bezel. “Removing the front bezel” on page 42.
3. Remove the old front fan assembly in your server. See “Removing the front USB assembly” on page 75.
4. Align the rubber mounts of the new front fan assembly with the corresponding holes in the chassis and push the rubber mounts through the holes.
5. Carefully pull on the tips of the rubber mounts until the front fan assembly is secured in place.



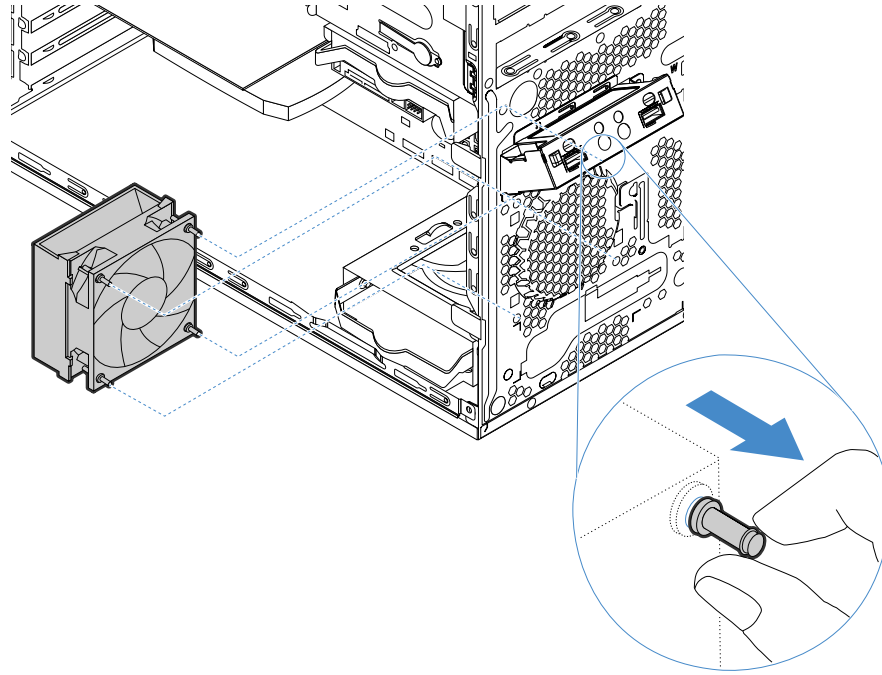


Figure 77. Installing the front fan assembly

6. Connect the front fan assembly cable to the front system fan connector on the system board. See “System board components” on page 19.

## Rear fan assembly

- “Removing the rear fan assembly” on page 82
- “Installing the rear fan assembly” on page 83

### Removing the rear fan assembly

To remove the rear fan assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the rear fan assembly. See “Server components” on page 16.
3. Disconnect the cable of the rear fan assembly.
4. The rear fan assembly is attached to the chassis by four rubber mounts. Break or cut the rubber mounts and gently pull the rear fan assembly out of the chassis.

**Note:** A new rear fan assembly comes with four new rubber mounts.



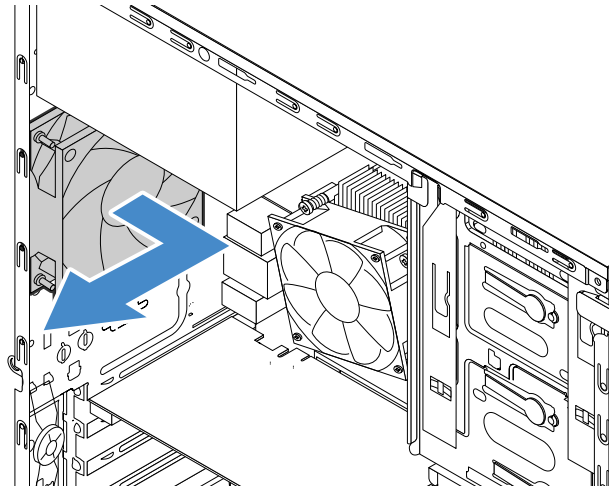


Figure 78. Removing the rear fan assembly

5. To install a new rear fan assembly, see “Installing the front fan assembly” on page 81.
6. If you are instructed to return the old rear fan assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

## Installing the rear fan assembly

To install a new rear fan assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the old rear fan assembly in your server. See “Removing the rear fan assembly” on page 82.
3. Align the rubber mounts of the new rear fan assembly with the corresponding holes in the chassis and push the rubber mounts through the holes.
4. Carefully pull on the tips of the rubber mounts until the rear fan assembly is secured in place.

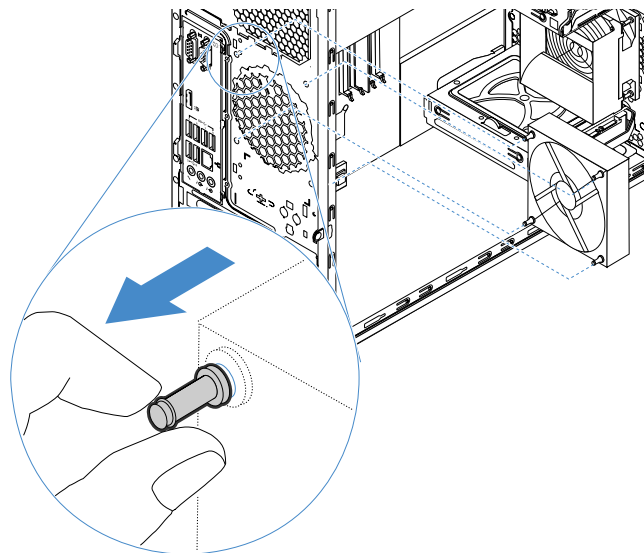


Figure 79. Installing the rear fan assembly



5. Connect the rear fan assembly cable to the rear system fan connector on the system board. See “System board components” on page 19.

## Intrusion switch

- “Removing the intrusion switch” on page 84
- “Installing the intrusion switch” on page 84

### Removing the intrusion switch

To remove the intrusion switch, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the intrusion switch. See “Server components” on page 16.
3. Disconnect the intrusion switch cable from the system board.
4. Remove the screw that secures the intrusion switch and remove the intrusion switch from the chassis.

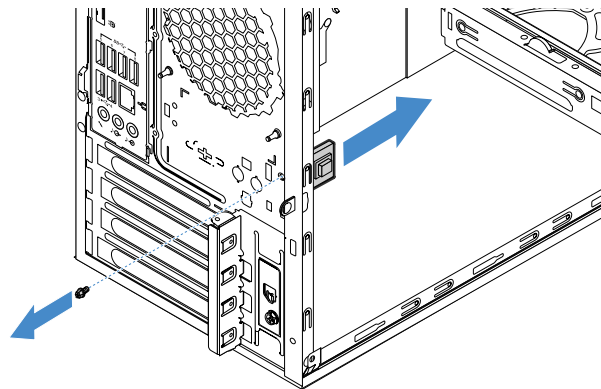


Figure 80. Removing the intrusion switch

5. To install a new intrusion switch, see “Installing the intrusion switch” on page 84.
6. If you are instructed to return the old intrusion switch, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

### Installing the intrusion switch

To install a new intrusion switch, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the old intrusion switch in your server if necessary. See “Removing the intrusion switch” on page 84.
3. Align the screw hole in the new intrusion switch with the corresponding hole in the chassis. Then install the screw to secure the intrusion switch to the chassis.



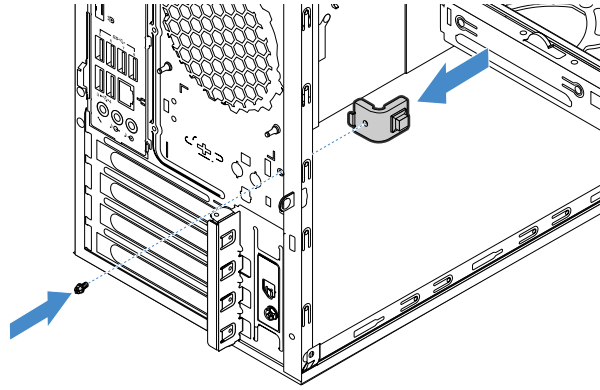


Figure 81. Installing the intrusion switch

4. Connect the intrusion switch cable to the intrusion switch connector on the system board. See “System board components” on page 19.

## Power supply assembly

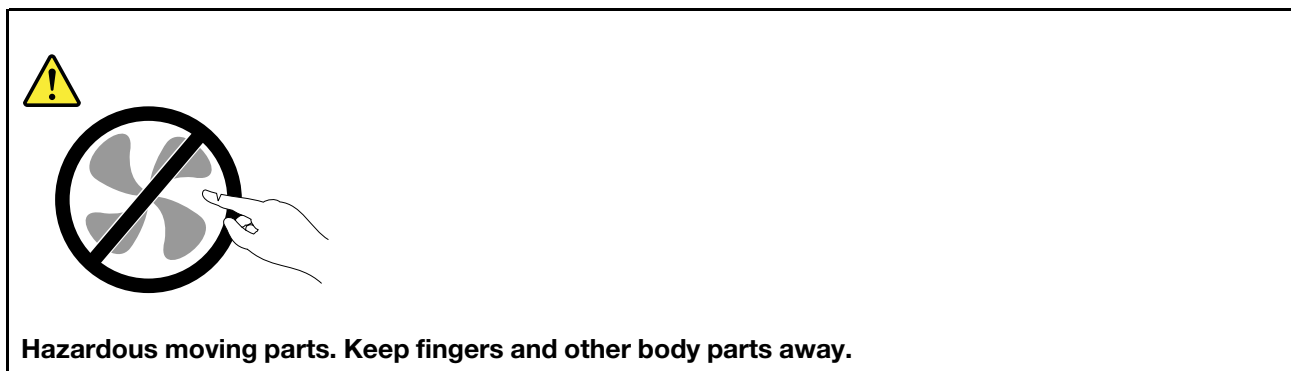
Your server supports one of the following power supply configurations:

- 250-watt non-hot-swap power supply (80 PLUS Bronze)
- 400-watt non-hot-swap power supply (80 PLUS Platinum)

**Note:** To support a discrete graphic adapter, you must select the 400-watt non-hot-swap power supply.

- “Removing the power supply assembly” on page 86
- “Installing the power supply assembly” on page 86

Although there are no moving parts in your server after the power cord has been disconnected, the following warnings are required for your safety and proper Underwriters Laboratories (UL) certification.



### CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



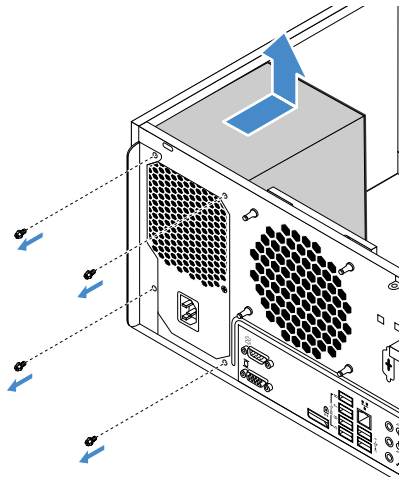


**Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.**

## Removing the power supply assembly

To remove the power supply assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the power supply assembly. See “Server components” on page 16.
3. Disconnect the power supply assembly cables from the system board.
4. Remove the four screws, slide the power supply assembly a little bit forward, and then lift it out of the server chassis.



*Figure 82. Removing the power supply assembly*

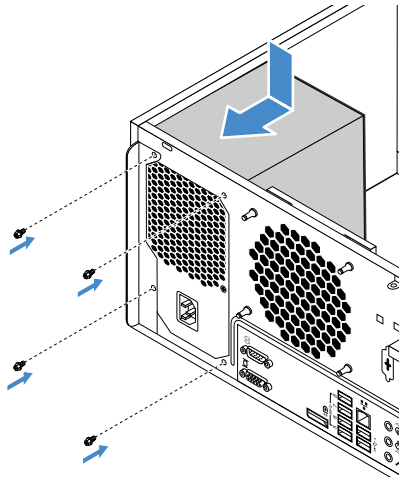
5. To install a new power supply assembly, see “Installing the power supply assembly” on page 86.
6. If you are instructed to return the old power supply assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

## Installing the power supply assembly

To install a new power supply assembly, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Remove the old power supply assembly. See “Removing the power supply assembly” on page 86.
3. Align the screw holes in the new power supply assembly with those in the server chassis, and then install four screws to secure the power supply assembly to the chassis.





*Figure 83. Installing the power supply assembly*

4. Connect the power supply assembly cables to the system board. For detailed information about the connectors, see “System board components” on page 19.

## Coin-cell battery

Your server has a special type of memory that maintains the date, time, and configuration information for built-in features. The coin-cell battery keeps the information active when you turn off the server. The coin-cell battery normally requires no charging or maintenance throughout its life; however, no battery lasts forever. If the coin-cell battery fails, the date, time, and configuration information, including passwords, are lost and an error message is displayed when you turn on the server.

- “Removing the coin-cell battery” on page 88
- “Installing the coin-cell battery” on page 88





**Danger of explosion if battery is incorrectly replaced.**

When replacing the lithium coin cell battery, use only the same or an equivalent type that is recommended by the manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

**Do not:**

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

The following statement applies to users in the state of California, U.S.A.

**California Perchlorate Information:**

Products containing manganese dioxide lithium coin cell batteries may contain perchlorate.

Perchlorate Material - special handling may apply, See <http://www.dtsc.ca.gov/hazardouswaste/perchlorate>

## Removing the coin-cell battery

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

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the coin-cell battery. See “Server components” on page 16.
3. Remove the coin-cell battery.

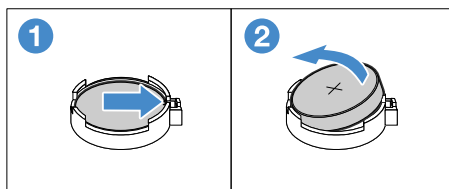


Figure 84. Removing the coin-cell battery

4. To install a new coin-cell battery, see “Installing the coin-cell battery” on page 88.
5. Dispose of the failing battery as required by local ordinances or regulations.

## Installing the coin-cell battery

To install a new coin-cell battery, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Locate the coin-cell battery in your server and remove it.  
See “Server components” on page 16 and “Removing the coin-cell battery” on page 88.
3. Install the new coin-cell battery.



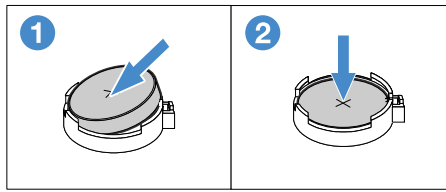


Figure 85. Installing the new coin-cell battery

4. Reinstall the server cover and connect the cables. See “Completing the parts replacement” on page 96.
5. Turn on the server and all attached devices.

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

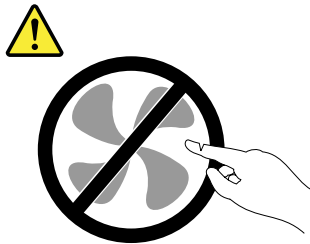
6. Use the Setup Utility program to set the date, time, and any passwords. See Configuring the server.

## For service technician only: replacing the heat sink and fan assembly

**Attention:** This procedure must be performed only by trained service personnel of Lenovo. Do not open your server or attempt any repair before reading and understanding “Read this first: safety information” on page iii and “Getting familiar with important guidelines” on page 39.

### CAUTION:

**Hazardous moving parts. Keep fingers and other body parts away.**



### CAUTION:



**The heat sinks and CPUs might be very hot. Turn off the server and wait several minutes to let the server cool before removing the server cover.**

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

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Lay the server on its side for easier operation.
3. Locate the heat sink and fan assembly. See “Server components” on page 16.
4. Disconnect the heat sink and fan assembly cable from the system board.
5. Follow the following sequence to remove the screws, and then lift the heat sink and fan assembly off 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**.



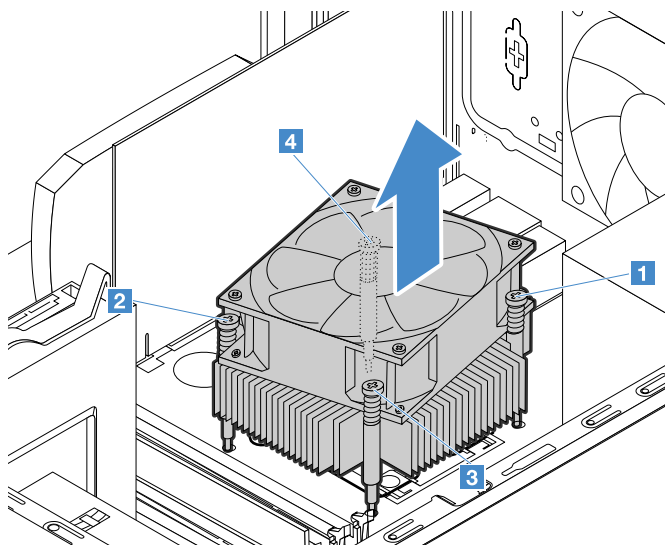


Figure 86. Removing the heat sink and fan assembly

**Notes:**

- 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.
  - Do not touch the thermal grease while handling the heat sink and fan assembly.
6. Align the four screws on the new heat sink and fan assembly with the corresponding screw holes in the system board. Properly place the heat sink and fan assembly so that you can easily connect its cable to the CPU fan connector on the system board.
  7. 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**.



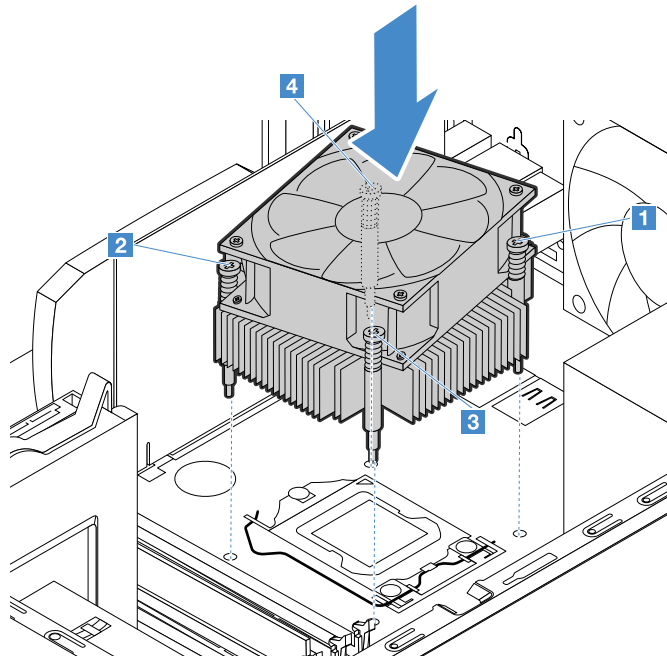


Figure 87. Installing the heat sink fan assembly

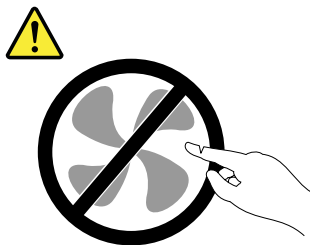
8. Connect the heat sink and fan assembly cable to the CPU fan connector on the system board. See “System board components” on page 19.

## For service technician only: replacing the CPU

**Attention:** This procedure must be performed only by trained service personnel of Lenovo. Do not open your server or attempt any repair before reading and understanding “Read this first: safety information” on page iii and “Getting familiar with important guidelines” on page 39.

### CAUTION:

**Hazardous moving parts. Keep fingers and other body parts away.**



### CAUTION:



**The heat sinks and CPUs might be very hot. Turn off the server and wait several minutes to let the server cool before removing the server cover.**

To replace the CPU, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.



2. Lay the server on its side for easier operation.
3. Locate the system board and disconnect the CPU fan cable from the system board. See “System board components” on page 19.
4. Remove the heat sink and fan assembly. See “For service technician only: replacing the heat sink and fan assembly” on page 89.
5. Remove the CPU from the CPU socket.
  - ❶ Release the small handle as shown.
  - ❷ Lift the handle upward until the handle and the CPU retainer are in the fully open position.
  - ❸ Hold the CPU by its sides and carefully lift it straight up and out of the CPU socket.

**Notes:**

- Do not touch the gold contacts on the bottom of the CPU.
- Do not drop anything onto the CPU socket while it is exposed. The socket pins must be kept as clean as possible.

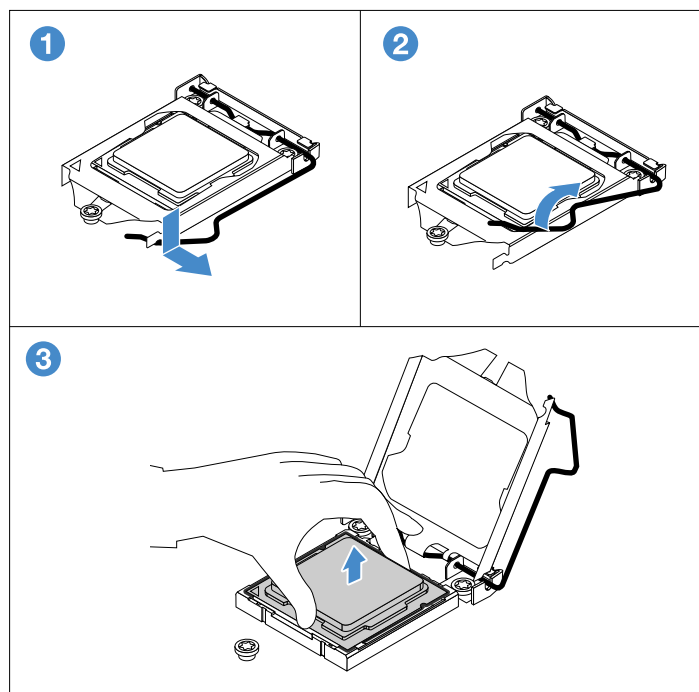


Figure 88. Removing the CPU

6. Hold the new CPU by its sides, align the notches **❶** with the tabs **❷**, and align the small triangle **❸** with the beveled corner **❹** of the socket. Then, carefully lower the CPU straight down into the CPU socket.



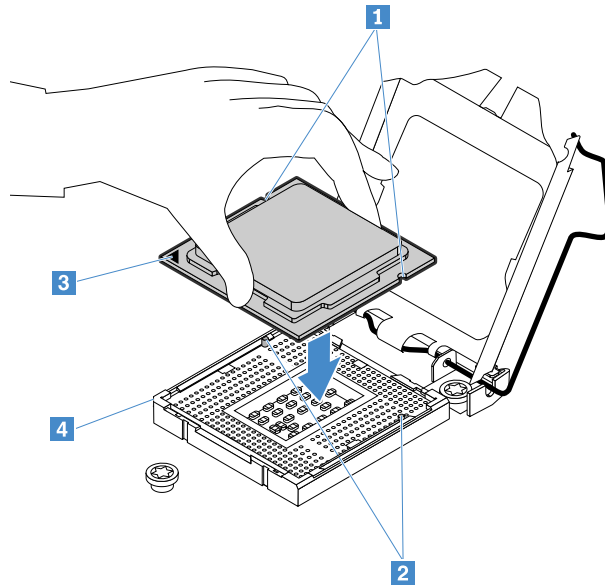


Figure 89. Installing the CPU

7. Close the CPU retainer and lock it into position with the small handle to secure the CPU in the socket.

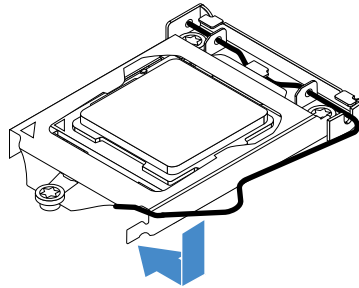


Figure 90. Closing the CPU retainer

8. Reinstall the heat sink and fan assembly. See “For service technician only: replacing the heat sink and fan assembly” on page 89.
9. Reconnect all cables that were disconnected from the system board. See “System board components” on page 19.
10. If you are instructed to return the CPU, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

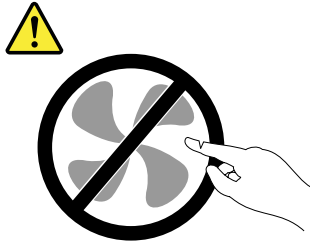
## For service technician only: replacing the system board

**Attention:** This procedure must be performed only by trained service personnel of Lenovo. Do not open your server or attempt any repair before reading and understanding “Read this first: safety information” on page iii and “Getting familiar with important guidelines” on page 39.

### CAUTION:

**Hazardous moving parts. Keep fingers and other body parts away.**





**CAUTION:**



**The heat sinks and CPUs might be very hot. Turn off the server and wait several minutes to let the server cool before removing the server cover.**

To replace the system board, do the following:

1. Prepare your server. See “Preparing your server and removing the server cover” on page 41.
2. Lay the server on its side for easier operation.
3. To access the system board, do the following in order:
  - a. “Removing the memory module” on page 70
  - b. “Removing a PCIe card” on page 71
  - c. “Removing the coin-cell battery” on page 88
  - d. “For service technician only: replacing the heat sink and fan assembly” on page 89

**Note:** Place the heat sink and fan assembly on its side so that the thermal grease on the bottom of it does not get in contact with anything.

4. Record the cable routing and cable connections. Then disconnect all cables from the system board.
5. Remove the eight screws that secure the system board by following the numerical sequence as shown. Then carefully lift the system board out of the chassis.



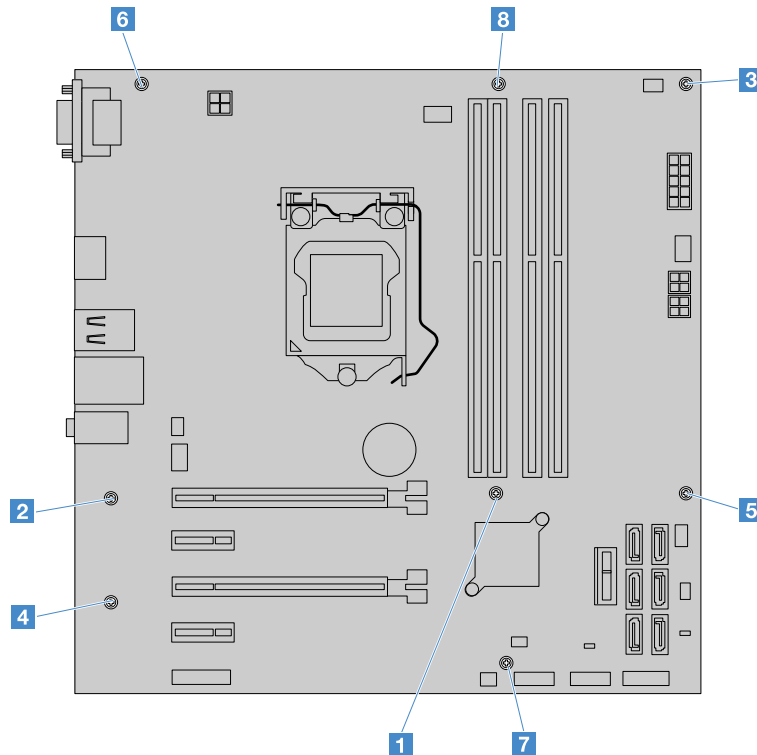


Figure 91. Removing the system board

6. Place the old system board on a clean, flat, and static-protective surface.
7. Note the orientation of the new system board and carefully place it into the chassis. Ensure that the rear connectors on the system board are inserted into the corresponding holes in the rear panel. Then, align the eight screws in the system board with those in the chassis, and install the eight screws in the reverse sequence as you remove them.
8. Pivot the CPU socket cover as shown to remove it from the new system board.

**Note:** Do not drop anything onto the CPU socket while it is exposed. The socket pins must be kept as clean as possible.

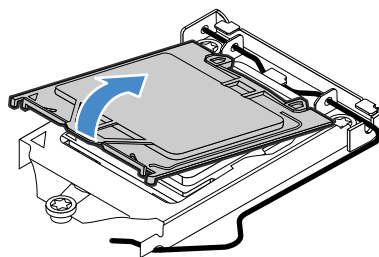


Figure 92. Removing the CPU socket cover

9. Remove the CPU from the old system board, and install it onto the new system board. See “For service technician only: replacing the CPU” on page 91.
10. Use a cleaning pad to wipe the thermal grease from the heat sink and the top of the CPU. Dispose of the cleaning pad after all of the thermal grease is removed.
11. Carefully apply appropriate amount of thermal grease to the top of the CPU in the shape of a cross or a circle as shown.



**Notes:**

- Do not touch the thermal grease.
- Keep the thermal grease off the system board.

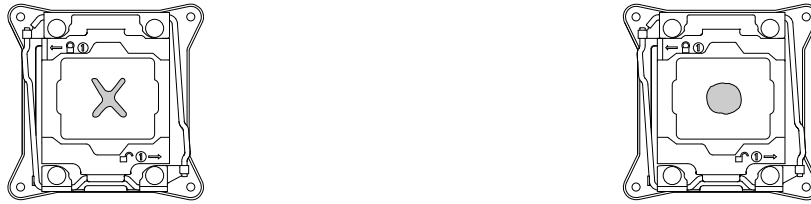


Figure 93. Applying the thermal grease to the top of the microprocessor

12. Reinstall the heat sink and fan assembly on the new system board. See “For service technician only: replacing the heat sink and fan assembly” on page 89.
13. Reinstall other parts that you have removed one by one in the reversed sequence as you remove them. See “Removing and installing hardware” on page 42.
14. Connect all cables to the system board. See “System board components” on page 19.

If you are instructed to return the old system board, follow all packaging instructions and use any packaging materials that are supplied to you for shipping. The old system board must be returned with a CPU socket cover to protect the pins during shipping and handling.

To install the CPU socket cover, do the following:

1. After you have removed the CPU from the old system board, close the CPU retainer and then lock the small handle to secure the retainer in place.
2. Note the orientation of the socket cover, and install one side of the socket cover into the CPU socket. Then, carefully press the other side of the socket cover downward until it snaps into position.

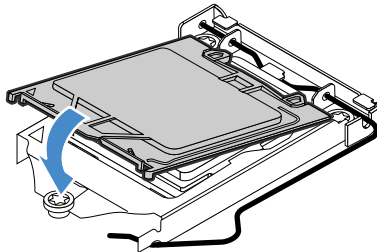


Figure 94. Installing the socket cover

3. Carefully check the four corners of the socket cover to ensure that the cover is seated securely.

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## Completing the parts replacement

To complete the parts replacement, do the following:

1. Ensure that all components have been reassembled correctly and that no tools or loose screws are left inside your server.
2. Correctly connect the cables in the server. Refer to the cable connecting information for each component in Replacing hardware.



3. Install the front bezel. “Installing the front bezel” on page 43.
4. Install the server cover. Align the rail guides on the cover with the rails on the chassis and slide the cover to the front of the server until it snaps into position. Then, install two screws to secure the cover to the server.

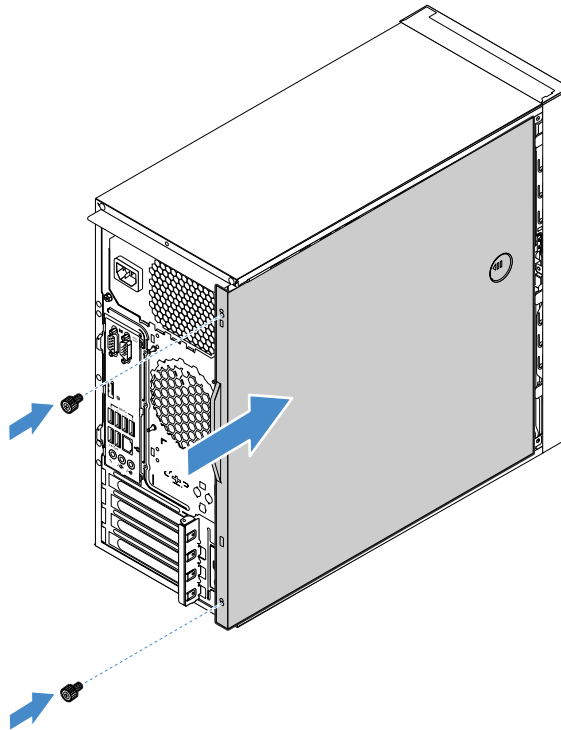


Figure 95. Installing the server cover

5. Reconnect all the external cables.

**Attention:** To avoid component damage, connect the power cords last.

6. Update the server configuration.
  - Download and install the latest device drivers: <http://www.lenovo.com/drivers>
  - Update the BIOS configuration: “Using the Setup Utility program” on page 25
  - Update the RAID configuration: “Configuring RAID” on page 33
  - Update your system firmware: Chapter 2 “Server setup road map” on page 5







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## Chapter 6. Troubleshooting and diagnostics

This chapter provides basic troubleshooting and diagnostic information to help you solve problems that might occur when using your server.

If your server encounters a problem, try to solve the problem by using the information in this chapter. If the problem persists, you can get support from Lenovo. See Chapter 7 “Getting information, help, and service” on page 105.

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### Troubleshooting procedure

Use the following information as a general procedure for diagnosing and troubleshooting problems you experience with your server:

1. Verify that the power cords and the cables for all attached devices are connected correctly and securely.
2. Verify that the server and all attached devices that require ac power are connected to properly grounded, functioning electrical outlets.
3. Verify that all installed hardware and attached devices are enabled in the BIOS settings of your server. For information about accessing and changing the BIOS settings, see “Using the Setup Utility program” on page 25.
4. If the server is not working after you have added new software or installed/replaced a component, remove or reinstall it to see if the problem could be solved.
5. Turn on the server and press Esc as soon as you see the logo screen to view any diagnostic messages.
6. Download and use a diagnostic program to diagnose problems. See “Lenovo ThinkServer Diagnostics” on page 10.
7. Refer to “Basic troubleshooting tables” on page 99 and follow the instructions for the type of problem you are experiencing. If the basic troubleshooting information does not help you resolve a problem, continue with the next step.
8. Try using a previous server configuration to see if a recent change to hardware or software settings has caused a problem. Before restoring your previous configuration, capture your current configuration in case the older configuration settings do not solve the problem or have adverse effect.
9. Use an antivirus program to see if your server has been infected by a virus. If the program detects a virus, remove the virus.
10. If none of these actions solve the problem, seek technical assistance. See Chapter 7 “Getting information, help, and service” on page 105.

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### Basic troubleshooting tables

The problems and troubleshooting actions described in this section are meant only as a guide. They are not definitive problem-solving techniques.

Follow the suggested actions for the corresponding symptom. If none of these actions solve the problem, see “Troubleshooting procedure” on page 99 for the subsequent steps. If the problem still persists, seek technical assistance. See Chapter 7 “Getting information, help, and service” on page 105.

#### Notes:

- If you are instructed to remove, install, or replace any CRUs, refer to the related procedure in Chapter 5 “Replacing hardware” on page 39.



- If an action step is preceded by “(Trained service technician only),” this action step is reserved for a trained service technician and must be performed only by a trained service technician.

## Lenovo ThinkServer EasyStartup program problems

Symptom	Action
The disc with the ThinkServer EasyStartup ISO image does not start.	<ol style="list-style-type: none"> <li>1. Ensure that: <ul style="list-style-type: none"> <li>• The server supports the ThinkServer EasyStartup program and has a bootable optical drive.</li> <li>• You have set the optical drive with the disc as the first startup device.</li> </ul> </li> <li>2. Verify whether the optical drive or the disc has problems. See “Optical drive problems” on page 101.</li> </ol>
The USB flash drive with the ThinkServer EasyStartup ISO image does not start.	<ol style="list-style-type: none"> <li>1. Ensure that: <ul style="list-style-type: none"> <li>• The server supports the ThinkServer EasyStartup program.</li> <li>• You have set the USB flash drive as the first startup device.</li> </ul> </li> <li>2. Verify whether the USB flash drive has problems. See “USB device problems” on page 103.</li> </ol>
The operating system installation program continuously loops.	Make more space available on the storage drive.
The Lenovo ThinkServer EasyStartup program cannot start the operating system medium.	Ensure that the operating system medium is supported by the Lenovo ThinkServer EasyStartup program version you are using. For a list of the supported operating systems, refer to the user guide and compatibility notes for the Lenovo ThinkServer EasyStartup program. See “Using the ThinkServer EasyStartup program” on page 31.



## Optical drive problems

Symptom	Action
The optical drive is not recognized.	<ol style="list-style-type: none"><li>1. Ensure that:<ul style="list-style-type: none"><li>• The related cables and connectors are not damaged and the connector pins are not bent.</li><li>• The optical drive is securely connected to the correct SATA connector on the system board and the SATA connector is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 25.</li><li>• All cables and jumpers (if any) are installed correctly.</li><li>• The correct device driver is installed for the optical drive.</li></ul></li><li>2. Run any optical drive diagnostic programs if you have.</li><li>3. Reinstall the optical drive and reconnect cables.</li><li>4. Replace the signal cable for the optical drive.</li><li>5. Replace the power cable for the optical drive.</li><li>6. Replace the optical drive.</li><li>7. (Trained service technician only) Replace the system board.</li></ol>
A disc is not working correctly.	<ol style="list-style-type: none"><li>1. Ensure that the disc is in the optical drive with the shiny side facing down.</li><li>2. Ensure that the disc surface is clean and not scratched.</li><li>3. Check the disc or package for regional coding. You might need to purchase a disc with coding for the region where you are using the product.</li><li>4. Restart the disc player program.</li><li>5. Restart the server.</li><li>6. Run any optical drive diagnostic programs if you have.</li><li>7. Reinstall the optical drive and reconnect cables.</li><li>8. Replace the signal cable for the optical drive.</li><li>9. Replace the optical drive.</li></ol>



## Storage drive problems

Symptom	Action
A newly installed non-hot-swap storage drive is not recognized.	<ol style="list-style-type: none"><li>1. Ensure that:<ul style="list-style-type: none"><li>• The drive is installed into the correct drive bay.</li><li>• The signal cable and connector are not damaged.</li><li>• The drive is securely connected to the correct SATA connector on the system board and the SATA connector is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 25.</li><li>• All cables and jumpers (if any) are installed correctly.</li></ul></li><li>2. Run any diagnostic programs (if you have) to test the drive.</li><li>3. Reinstall the drive and reconnect cables.</li><li>4. Replace the signal cable for the drive.</li><li>5. Replace the power cable for the drive.</li><li>6. Replace the drive.</li></ol>
Multiple storage drives fail.	<ol style="list-style-type: none"><li>1. Run any diagnostic programs (if you have) to test the drives.</li><li>2. Ensure that the cable connections are correct.</li><li>3. Reinstall the drives and reconnect cables.</li><li>4. Replace the affected cables.</li><li>5. Replace the failing drives.</li><li>6. (Trained service technician only) Replace the system board if you suspect a problem with the system board.</li></ol>

## Memory module problems

Symptom	Action
The amount of system memory that is displayed is less than the total capacity of the installed physical memory modules and you suspect a memory module problem.	<ol style="list-style-type: none"><li>1. Ensure that:<ul style="list-style-type: none"><li>• All memory modules are the correct type supported by the server. See “Memory module installation rules” on page 69.</li><li>• You followed the memory module installation rules. See “Memory module installation rules” on page 69.</li><li>• All memory modules are seated correctly and securely.</li><li>• The system firmware is up-to-date.</li></ul></li><li>2. Reinstall the memory modules.</li><li>3. Replace the suspect memory modules.</li><li>4. (Trained service technician only) Replace the system board.</li></ol>



## USB device problems

Symptom	Action
A USB device does not work.	<ol style="list-style-type: none"><li>1. Ensure that:<ul style="list-style-type: none"><li>• The USB cable is securely connected to the server. If the USB device is connected to a USB hub, disconnect the device from the hub and connect it directly to the server.</li><li>• The device drivers are installed correctly.</li><li>• The USB controller is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 25.</li></ul></li><li>2. Restart the server.</li><li>3. Replace the USB device.</li></ol>







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## Chapter 7. Getting information, help, and service

This chapter contains information about help, service, and technical assistance for products manufactured by Lenovo and where to go for additional information about Lenovo and Lenovo products.

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### Information resources

You can use the information in this topic to access useful resources for your Lenovo product.

### Using the documentation

To get the information about your Lenovo system, optional devices, and installed software, if any, go to the Lenovo Support Web site at <http://www.lenovo.com/support>.

For more information about your server documentation, see “Server documentation” on page 2.

If you suspect a software problem, refer to the documentation, including readme files and online help, that comes with the operating system or software program.

### ThinkServer Web site

The ThinkServer Web site provides up-to-date information and services to help you buy, use, upgrade, and maintain your server. You can visit the ThinkServer Web site at:

<http://www.lenovo.com/thinkserver>

### 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

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### Help and service

This topic contains information about obtaining help and service.

### Before you call

Before you call, do the following to try to solve the problem by yourself:

- Check all cables to ensure that they are connected.
- Check the power switches to ensure that the system and optional devices are turned on.
- Use the troubleshooting information in this manual. See Chapter 6 “Troubleshooting and diagnostics” on page 99.



- Check for the updated information, new device drivers, and hints and tips on the Lenovo Support Web site at:  
<http://www.lenovo.com/support>
- Download the diagnostic program from the Lenovo Web site, and then run it. See “Lenovo ThinkServer Diagnostics” on page 10.

If possible, be at your product when you call. Have the following information available:

- Machine type and model
- Serial numbers of your Lenovo hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

## Calling for service

During the warranty period, you can get help and information by telephone through the Customer Support Center.

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.

The warranty does not cover the following:

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

For the warranty type and duration for your product, go to <http://www.lenovo.com/warranty>. You must retain your proof of purchase to obtain warranty service.

For warranty service, consult the worldwide Lenovo Support telephone list. Telephone numbers are subject to change without notice. The most up-to-date telephone list for Lenovo Support is always available on the Web site at <http://www.lenovo.com/support/phone>. If the telephone number for your country or region is not listed, contact your Lenovo reseller or Lenovo marketing representative.

## Using other services

If you relocate your server to a country where your server machine type is sold, your server 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 where service is available, go to <http://www.lenovo.com/support>, click **Warranty**, and follow the instructions on the screen.

For technical assistance with the installation of or questions related to Service Packs for your installed Windows product, refer to the Microsoft Product Support Services Web site at <http://support.microsoft.com/directory> or you can contact the Customer Support Center. Some fees might apply.

## Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for hardware, operating systems, and application programs; network setup and configuration services; upgraded or extended hardware repair services; and custom installation services. Service availability and service names might vary by country or region. For more information about these services, go to the Lenovo Web site at: <http://www.lenovo.com>







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## Appendix A. Regulatory information

The latest compliance information is available at <http://www.lenovo.com/compliance>.

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### 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.

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### Electronic emission notices

#### Federal Communications Commission (FCC) Supplier's Declaration of Conformity (SDoC) - United States

The following information refers to the Lenovo ThinkServer machine types 70LU, 70LV, 70LW, 70LX, 70UA, 70UB, 70UC, and 70UD.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. 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*  
*7001 Development Drive*  
*Morrisville, NC 27560*  
*U.S.A.*  
*Email: FCC@lenovo.com*



#### Industry Canada Compliance Statement

CAN ICES-3(A)/NMB-3(A)

#### United Kingdom telecommunications safety requirement



## Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

### European Union - Compliance to the Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility. 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 A equipment according to European Standards harmonized in the Directives in compliance. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Lenovo, Einsteinova 21, 851 01 Bratislava, Slovakia



**Warning:** This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

### German Class A compliance statement

#### *Deutschsprachiger EU Hinweis:*

#### *Hinweis für Geräte der Klasse A 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 A 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, für Geräte der Klasse A.*

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 A.

Nach der EN 55032: „Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen.“

Nach dem EMVG: „Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministers für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind.“ (Auszug aus dem EMVG, Paragraph 3, Abs. 4). Dieses Genehmigungsverfahren ist nach Paragraph 9 EMVG in Verbindung mit der entsprechenden Kostenverordnung (Amtsblatt 14/93) kostenpflichtig.

Anmerkung: Um die Einhaltung des EMVG sicherzustellen sind die Geräte, wie in den Handbüchern angegeben, zu installieren und zu betreiben.

### Korea Class A compliance statement

A급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다

### Russia Electromagnetic Interference (EMI) Class A statement

#### ВНИМАНИЕ!

Настоящее изделие относится к оборудованию класса А. При использовании в бытовой обстановке это оборудование может нарушать функционирование других технических средств в результате создаваемых промышленных радиопомех. В этом случае от пользователя может потребоваться принятие адекватных мер.

### Taiwan Class A compliance statement

#### 警告使用者

此為甲類資訊技術設備，於居住環境中使用時，可能會造成射頻擾動，在此種情況下，使用者會被要求採取某些適當的對策。

### Lenovo product service information for Taiwan

委製商/進口商名稱: 台灣聯想環球科技股份有限公司  
進口商地址: 台北市南港區三重路 66 號 8 樓  
進口商電話: 0800-000-702

## Japanese electromagnetic compatibility statements

### Japan VCCI Class A statement

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用する  
と電波妨害を引き起こすことがあります。この場合には使用者が適切な  
対策を講ずるよう要求されることがあります。 V C C I - A

### Japanese electrical appliance and material safety law statement (for detachable AC power cord)

本製品およびオプションに電源コード・セット付属する場合は、  
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。



## JEITA harmonics guideline - Japanese statement for AC power consumption (W)

定格入力電力表示

(社) 電子情報技術参照委員会 家電・汎用品高調波抑制対策ガイドライン  
実行計画書に基づく定格入力電力値： W

お手持ちのユニットの定格入力電力値（W）はユニットの電源装置に貼付されている電源仕様ラベルを  
ご参照下さい

## JEITA harmonics guideline - Japanese statement of compliance for products less than or equal to 20A 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

## JEITA harmonics guideline - Japanese statement of compliance for products more than 20A

本製品は、1相当たり20Aを超える機器ですが、個々のユニットが「高調波電流規格 JIS C 61000-3-2適合品」であり、  
本製品はその組み合わせであるため、「高調波電流規格 JIS C 61000-3-2適合品」として  
います。

---

## Eurasian compliance mark





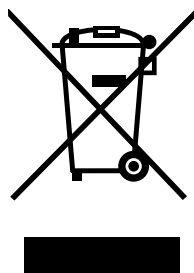
---

## Appendix B. 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 a variety of programs and services to assist equipment owners in recycling their IT products. For information on recycling Lenovo products, go to <http://www.lenovo.com/recycling>. The latest environmental information about our products 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 & Handling Rules, 2011). 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 órgãos 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](mailto: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**



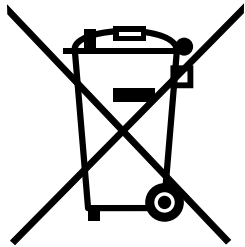
廢電池請回收



---

## 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/lenovo/environment>



---

## Battery recycling information for the United States and Canada

This product may contain a lithium or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal or batteries outside the United States, go to <http://www.lenovo.com/recycling> or contact your local waste disposal facility.



**US & Canada Only**

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## Requirement for batteries containing perchlorate

The following statement applies to users in the state of California, U.S.A.

California Perchlorate Information:

Products containing manganese dioxide lithium coin cell batteries may contain perchlorate.

Perchlorate Material - special handling may apply, See [www.dtsc.ca.gov/hazardouswaste/perchlorate](http://www.dtsc.ca.gov/hazardouswaste/perchlorate)



## Appendix C. Restriction of Hazardous Substances (RoHS) Directive

This topic provides statements about the Restriction of Hazardous Substances (RoHS) Directive. The latest environmental information is available at <http://www.lenovo.com/ecodeclaration>.

### China RoHS

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
机架	○	○	○	○	○	○
外部盖板	○	○	○	○	○	○
机械组合件	○	○	○	○	○	○
空气传动设备	X	○	○	○	○	○
冷却组合件	X	○	○	○	○	○
内存模块	X	○	○	○	○	○
处理器模块	X	○	○	○	○	○
键盘	X	○	○	○	○	○
调制解调器	X	○	○	○	○	○
监视器	X	X	○	○	○	○
鼠标	X	○	○	○	○	○
电缆组合件	X	○	○	○	○	○
电源	X	○	○	○	○	○
存储设备	X	○	○	○	○	○
电池匣组合件	X	○	○	○	○	○
电池	X	○	○	○	○	○
有mech的电路卡	X	○	○	○	○	○
无mech的电路卡	X	○	○	○	○	○
激光器	X	○	○	○	○	○
本表格依据 SJ/T 11364 的规定编制。 ○：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。						

**环保使用期限（EPUP）的免责条款：**EPUP 规定的具体期限仅为符合中华人民共和国的相应的法律规定，并非代表 Lenovo 向客户提供保证或负有任何义务。EPUP 中假定客户按照操作手册在正常情况下使用本产品。对于本产品中配备的某些组合件（例如，装有电池的组件）的 EPUP，其效力可能低于本产品的 EPUP。

Environmental Protection Use Period (EPUP) Disclaimer: The number provided as the EPUP is provided solely to comply with applicable laws of the People's Republic of China. It does not create any warranties or liabilities on behalf of Lenovo to customer. The EPUP assumes that the product will be used under normal conditions in accordance with the Lenovo operating manual. Certain assemblies inside this product (for example, assemblies that contain a battery) may have an EPUP which is lower than the EPUP on this product.



---

## European Union RoHS

Lenovo products sold in the European Union, on or after 3 January 2013 meet 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 progress on RoHS, go to:

[http://www.lenovo.com/social\\_responsibility/us/en/RoHS\\_Communication.pdf](http://www.lenovo.com/social_responsibility/us/en/RoHS_Communication.pdf)

---

## India RoHS

RoHS compliant as per E-waste (Management) Rules.

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## Ukraine RoHS

Цим підтверджуємо, що продукція Леново відповідає вимогам нормативних актів України, які обмежують вміст небезпечних речовин



## Taiwan BSMI RoHS declaration

單元 Unit	限用物質及其化學符號 Restricted substances and its chemical symbols					
	鉛Lead (PB)	汞Mercury (Hg)	鎘Cadmium (Cd)	六價鉻 Hexavalent chromium (Cr <sup>6+</sup> )	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
機架	○	○	○	○	○	○
外部蓋板	○	○	○	○	○	○
機械組零件	—	○	○	○	○	○
空氣傳動設備	—	○	○	○	○	○
冷卻組零件	—	○	○	○	○	○
內存模組	—	○	○	○	○	○
處理器模組	—	○	○	○	○	○
電纜組零件	—	○	○	○	○	○
電源供應器	—	○	○	○	○	○
儲備設備	—	○	○	○	○	○
電路卡	—	○	○	○	○	○
光碟機	—	○	○	○	○	○
<p>備考1. “超出0.1 wt %” 及 “超出0.01 wt %” 係指限用物質之百分比含量超出百分比含量基準值。            Note1 : “exceeding 0.1wt%” and “exceeding 0.01 wt%” indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition.</p> <p>備考2. “○” 係指該項限用物質之百分比含量未超出百分比含量基準值。            Note2 : “○” indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.</p> <p>備考3. “—” 係指該項限用物質為排除項目。            Note3 : The “—” indicates that the restricted substance corresponds to the exemption.</p>						







---

## Appendix D. Addition statements

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### Important notes

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

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

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

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

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

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

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

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

---

### Particulate contamination

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



Table 3. Limits for particulates and gases

Contaminant	Limits
Particulate	<ul style="list-style-type: none"> <li>The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2<sup>1</sup>.</li> <li>Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282.</li> <li>The deliquescent relative humidity of the particulate contamination must be more than 60%<sup>2</sup>.</li> <li>The room must be free of conductive contamination such as zinc whiskers.</li> </ul>
Gaseous	<ul style="list-style-type: none"> <li>Copper: Class G1 as per ANSI/ISA 71.04-1985<sup>3</sup></li> <li>Silver: Corrosion rate of less than 300 Å in 30 days</li> </ul>
<p><sup>1</sup> ASHRAE 52.2-2008 - <i>Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size</i>. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.</p> <p><sup>2</sup> The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.</p> <p><sup>3</sup> ANSI/ISA-71.04-1985. <i>Environmental conditions for process measurement and control systems: Airborne contaminants</i>. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.</p>	

## German Ordinance for Work gloss statement

The product is not suitable for use with visual display work place devices according to clause 2 of the German Ordinance for Work with Visual Display Units.

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.



---

## Appendix E. Notices

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



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## Appendix F. Abbreviations and acronyms

The following table lists major abbreviations and acronyms used in this document together with their full terms.

Abbreviation or acronym	Full term
BIOS	Basic Input Output System
CPU	central processing unit
CRT	Cathode Ray Tube
CRU	Customer Replaceable Unit
DDR4	double data rate 4
ECC	Error Checking and Correcting
EMI	electromagnetic interference
ESD	electrostatic discharge
FCC	Federal Communications Commission
GPU	graphics processing units
HBA	Host Bus Adapter
HDD	hard disk drive
HTML	Hypertext Markup Language
ICE	Intelligent Cooling Engine
I/O	Input/Output
LAN	local area network
LED	light-emitting diode
LLW	Lenovo Limited Warranty
Mbps	megabits per second
NOS	network operating system
PCIe	Peripheral Component Interconnect Express
PDF	Portable Document Format
POST	power-on self-test
PXE	Preboot Execution Environment
RAID	Redundant Array of Independent Disks
RAS	Reliability, availability, and serviceability
RDIMM	registered dual inline memory module
ROM	read-only memory
RoHS	Restriction of Hazardous Substances Directive



<b>Abbreviation or acronym</b>	<b>Full term</b>
RSTe	Intel Rapid Storage Technology enterprise
SAS	Serial Attached SCSI (Small Computer System Interface)
SATA	Serial Advanced Technology Attachment
SD	Secure digital
SEL	system event log
SSD	solid-state drive
StorCLI	Storage Command Line Tool
TCG	Trusted Computing Group
TPM	ThinkServer Trusted Platform Module
UDIMM	unbuffered dual inline memory
UEFI	Unified Extensible Firmware Interface
VGA	video graphics array



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