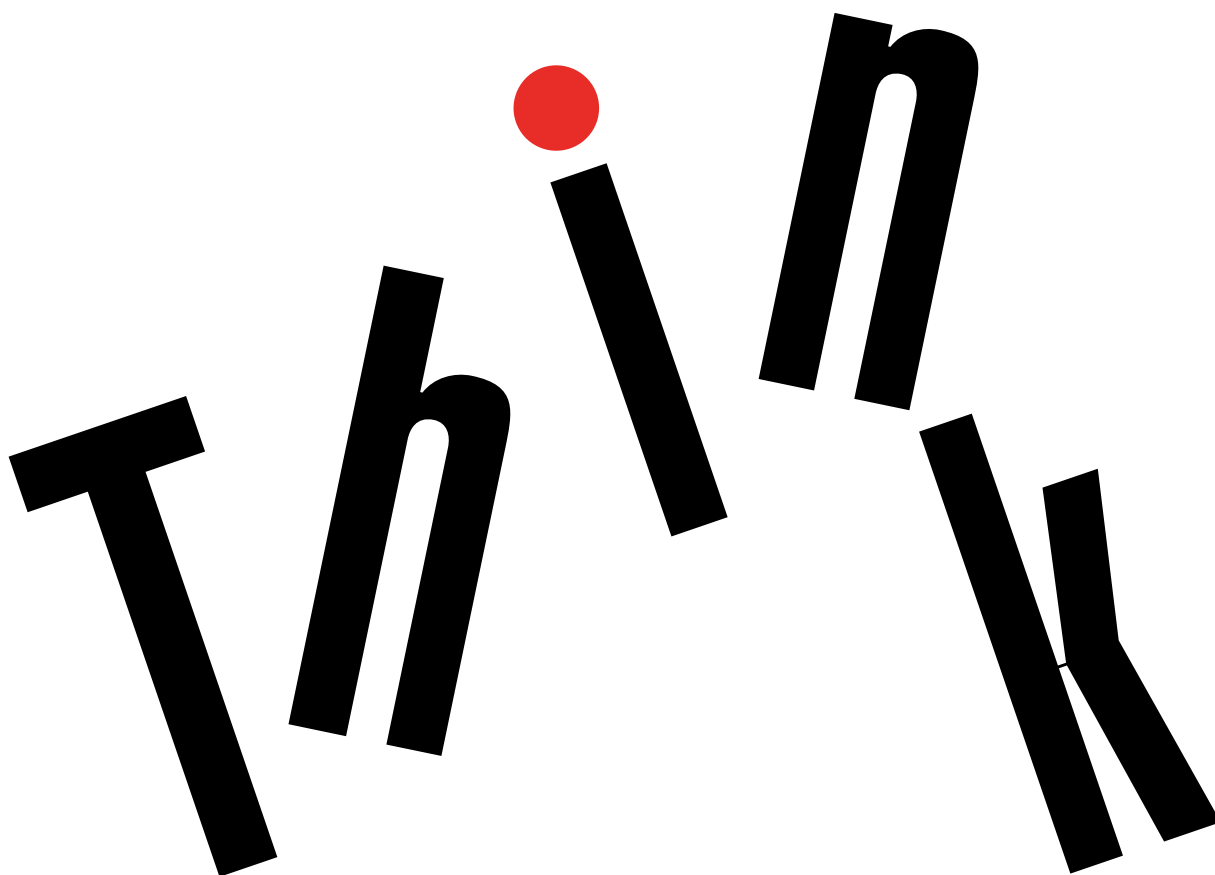


LenovoTM

ThinkServer[®]

ThinkServer TS450
User Guide and Hardware Maintenance
Manual



Machine Types: 70LY, 70M0, 70M1, and 70M2

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.

電子情報技術産業協会(JEITA) 表示

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

本製品およびオプションに電源コード・セットが付属する
場合は、それぞれ専用のものになっていますので他の電気
機器には使用しないでください。

Sixth Edition (November 2017)

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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 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



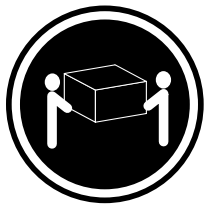
CAUTION:

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

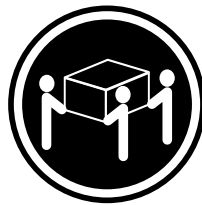
- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.

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

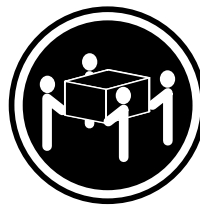
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following: Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.



≥ 18 kg (39.7 lb)



≥ 32 kg (70.5 lb)

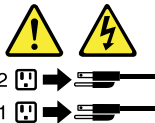


≥ 55 kg (121.2 lb)

CAUTION:

Statement 5

CAUTION:



Statement 6

CAUTION:

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:

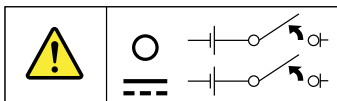
Some accessory or option board outputs exceed Class 2 or limited power source limits. You must install the appropriate interconnecting cabling in accordance with your local electrical code requirements.

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 mm² 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.

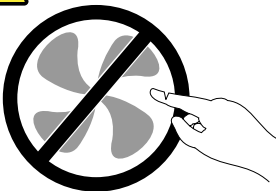


Statement 19



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
Lenovo Limited Warranty (LLW)	<p>The LLW contains the warranty terms that apply to the product you purchased from Lenovo®. The LLW is available at: http://www.lenovo.com/warranty/llw_02</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>
Worldwide Lenovo Support telephone list	<p>Telephone numbers are subject to change without notice. The most up-to-date telephone list for Lenovo Support is always available at: http://www.lenovo.com/support/phone</p> <p>If the telephone number for your country or region is not listed, contact your Lenovo reseller or Lenovo marketing representative.</p>
Most up-to-date information about the server	http://www.lenovo.com/thinkserver
Latest technical information	http://www.lenovo.com/support
Instructions on how to register your server with Lenovo	<p>Follow the instructions at: http://www.lenovo.com/register</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>
Product information label	<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 12.</p>

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

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 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 features installed, requires hardware and firmware configuration, and requires an operating system to be installed.

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 option. See the related topic in Chapter 5 “Replacing hardware” on page 47.
3. Connect the Ethernet cable and power cords to the server. See “Rear view of the server” on page 14 to locate the connectors.
4. Turn on the server to verify operation. See “Turning on the server” on page 5.
5. Review the Unified Extensible Firmware Interface (UEFI) Basic Input Output System (BIOS) settings and customize as needed. See “Using the Setup Utility program” on page 33.
6. Configure RAID and install the operating system and basic drivers. See “Using the ThinkServer EasyStartup program” on page 39 and “Configuring RAID” on page 41.
7. Install any additional drivers needed 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. You can skip this step if the operating system was installed using the ThinkServer EasyStartup program.
9. Check for firmware updates. To update the firmware, do one of the following:
 - 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.
 - Use the Firmware Updater program.
10. Install other applications. Refer to the documentation that comes with the applications that you want to install.

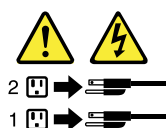
Turning on the server

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 panel” on page 13.

Turning off the server

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.



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.

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 10
- “Software programs” on page 11
- “Component locations” on page 12

In the box

Your shipping box contains the following items:

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

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, basic system management features, and advanced 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.

Dimension and weight	<ul style="list-style-type: none">• Width: 173 mm (6.81 inches)• Height: 430 mm (16.93 inches) without foot stands; 443.5 mm (17.46 inches) with foot stands• Depth: 566 mm (22.28 inches) including the front bezel• Weight<ul style="list-style-type: none">– Range of product weight without package: 18–26.5 kg (39.68–57.32 lb)– Maximum product package weight: 4.5 kg (9.92 lb)
Electrical input	Universal input: Low range: 100 to 127 V ac High range: 200 to 240 V ac Input frequency range: 50 to 60 Hz
Central Processing Unit (CPU)	Your server comes with one of the following CPUs (internal cache size varies by model): <ul style="list-style-type: none">• Intel® Xeon®• Intel Core™• Intel Pentium®
Memory	Your server has four memory slots. For more information, see “Memory module installation rules” on page 52.

Power supply	<p>The server might come with one of the following power supply configurations:</p> <ul style="list-style-type: none"> • One screw-secured, non-hot-swap 400-watt power supply assembly • One or two hot-swap 450-watt redundant power supplies <p>Note: If you are using uninterruptible power supplies (UPS), ensure that you use only pure-sine UPS with your ThinkServer server.</p>
System fans	<p>Your server comes with the following fans to provide proper system cooling and airflow:</p> <ul style="list-style-type: none"> • One heat sink and fan assembly • Two front system fans • One rear system fan
Internal drives	<p>Internal drives are devices that your server uses to read and store data. The internal drives supported by your server vary by model.</p> <ul style="list-style-type: none"> • Internal storage drive <ul style="list-style-type: none"> – Up to four 3.5-inch hot-swap Serial Advanced Technology Attachment (SATA) or Serial Attached SCSI (SAS) hard disk drives (HDDs) (SCSI is the acronym for Small Computer System Interface) – Five to eight 3.5-inch hot-swap SATA or SAS HDDs – Up to four 3.5-inch non-hot-swap SATA HDDs – Up to eight 2.5-inch hot-swap SATA or SAS HDDs – Up to sixteen 2.5-inch hot-swap SATA or SAS HDDs – Up to four 3.5-inch and eight 2.5-inch hot-swap SATA or SAS HDDs • Optical drive <ul style="list-style-type: none"> – Up to two optical drives – The server has two optical drive bays. The lower optical drive bay is installed with a SATA optical drive. • Tape drive (available on some models) <p>Your server supports RDX and LTO tape drives that enable you to store data on tape drive media. To install or remove a tape drive, see “Installing a tape drive” on page 65.</p> <p>Notes:</p> <ul style="list-style-type: none"> – If the server has only one tape drive installed, ensure that the optical drive is installed in the lower bay (the optical drive bay 1). – 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 tape drive media. For detailed information, refer to the user guide of the tape drive. The user guide is available for download at: http://www.lenovo.com/UserManuals
Expansion slots	<p>Your server has four expansion slots on the system board. For detailed information, see “System board components” on page 28.</p>

Input/Output (I/O) features

- Front panel
 - Two USB 3.0 connectors
- Rear panel:
 - Video Graphics Array (VGA) DB-15 connector
 - Six USB 3.0 connectors
 - RJ-45 Ethernet connector
 - DisplayPort® connector
 - Serial connector
 - Audio line-in connector
 - Audio line-out connector
 - Microphone connector

Ethernet connectivity

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 14.

Security features

- Server locks (see “Server locks” on page 17)
- Administrator password and power-on password to help protect unauthorized access to the server (see “Using passwords” on page 36)
- ThinkServer Trusted Platform Module (TPM), which is a security chip, to help enhance server security
- Hot-swap redundant power supplies to help avoid significant interruption to the operation of the system when a power supply fails (available on some models)
- Intrusion switch that informs you through an event in the system event log (SEL) when the server cover is not properly installed or closed

Basic system management features

- Ability to store the power-on self-test (POST) hardware test results
- 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 33.
- Hot-swap feature
Some models support hot-swap storage drives and hot-swap redundant power supplies. With the hot-swap feature, you can install, remove, or replace a storage drive or a failing power supply without turning off the server.
- Preboot Execution Environment (PXE)
The Intel PXE technology enables you to start 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 HDDs) or installed operating systems.
- 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 41.
- Status light-emitting diodes (LEDs) and diagnostic LEDs
For more information about the LEDs for your server, refer to the related topics in “Component locations” on page 12.
- Software programs
For more information about the software programs, see “Software programs” on page 11.

Operating environment

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

Table 1. Operating environment

Air temperature (operating)	5°C to 35°C (41°F to 95°F)
Air temperature (storage)	-40°C to 60°C (-40°F to 140°F) in original shipping package
Humidity (operating)	8% to 80% (non-condensing)
Humidity (storage)	10% to 90% (non-condensing)
Altitude	0 to 3048 m (0 to 10 000 ft) in an unpressurized environment

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 using the 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 Microsoft® Windows® and Linux® operating systems and device drivers on your server. The program works with your Windows or Linux operating system installation disc to automate the process of installing the operating system and associated device drivers. 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 39.

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 Firmware Updater.
2. Download the ISO image for Firmware Updater and the TXT file that contains the 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 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.

For detailed information about using the Lenovo ThinkServer Power Planner program, refer to the help system of the program.

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 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>

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.

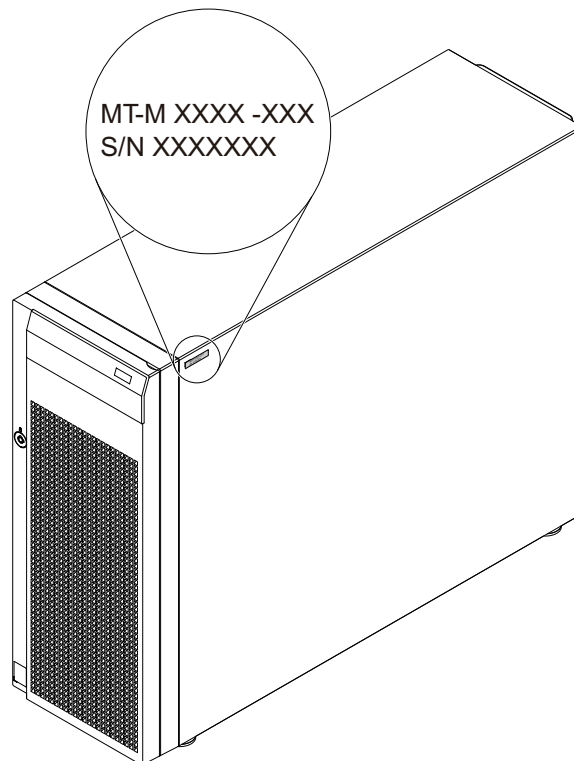


Figure 1. Machine type, model, and serial number label

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 illustrations in this topic.

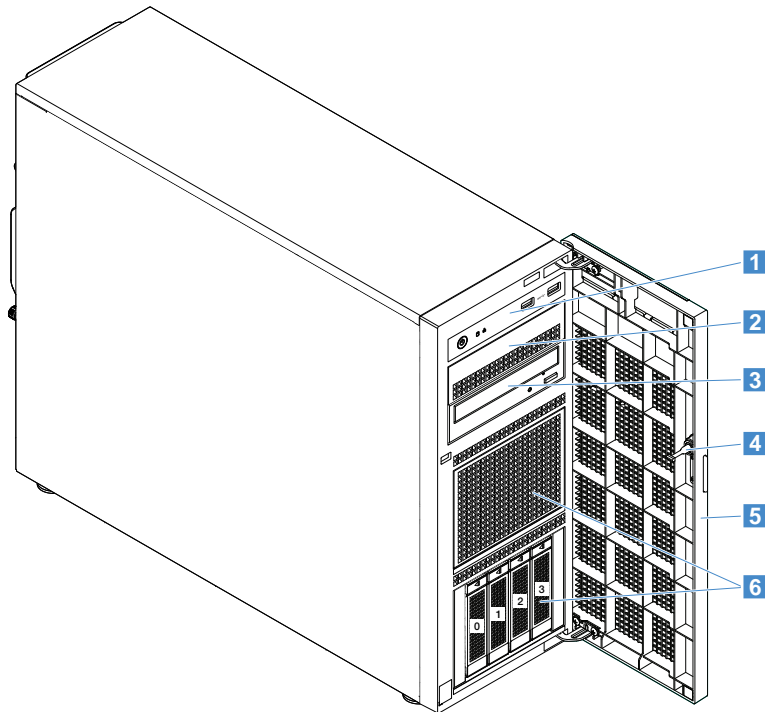


Figure 2. Server models with 3.5-inch drive bays

Item	Description
1 Front panel	See “Front panel” on page 13.
2 Optical drive bay 2	The optical drive bay 2 is for a secondary optical drive.
3 Optical drive bay 1	The optical drive bay 1 is for an optical drive or a tape drive.
4 Front door lock 5 Front door	You can lock the front door to protect the HDD cages from unauthorized access. The front door is available on some models.
6 3.5-inch-drive bays	The number of the installed drives in your server varies by model. The vacant drive bays are occupied by dummy trays or covered by an EMI-protective panel. When you install drives, follow the order of the drive bay numbers.

Front panel

The following illustration shows the control, connectors, and LEDs on the front panel of the server. To locate the front panel, see “Front view of the server” on page 13.

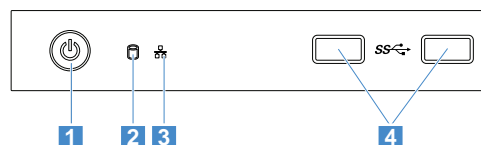


Figure 3. Front panel

1 Power button with power status LED	2 HDD status LED
3 Network Interface Controller (NIC) status LED	4 Front USB 3.0 connectors (2)

1 Power button with power status LED

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

Power status LED	Description
● Green	The server is on.
○ Off	The server is off.

2 HDD status LED

The HDD status LED helps you to determine the status of the HDD activity.

Note: The HDD status LED is available on server models without a discrete RAID card installed.

HDD status LED	Description
○ Off	The HDD is not in use.
● Blinking green	The HDD is active and data is being transferred.

3 NIC status LED

The NIC status LED indicates the LAN status for the Ethernet connector on the rear panel of the server.

NIC status LED	Description
● Green	The server is connected to a LAN.
○ Off	The server is disconnected from a LAN.
● Blinking green	The LAN is connected and active.

4 Front USB 3.0 connectors (2)

Used to attach a USB-compatible 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.

Rear view of the server

This topic provides information to help you locate the connectors and components on the rear of your server. The following illustration shows the rear view of the server with a screw-secured, non-hot-swap power supply assembly.

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

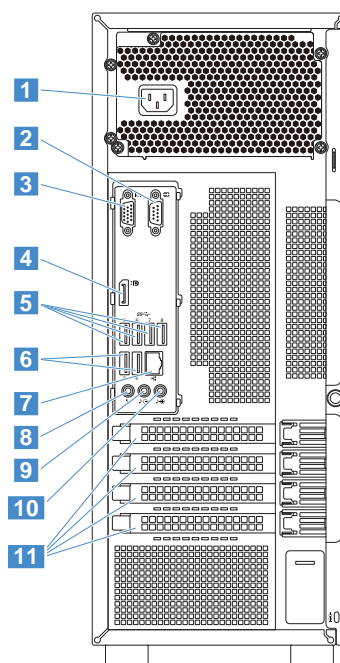


Figure 4. Rear view of the server

1 Power cord connector	2 Serial connector
3 VGA connector (DB-15)	4 DisplayPort connector
5 USB 3.0 connectors (4)	6 USB 3.0 connectors (2)
7 Ethernet connector (RJ-45)	8 Microphone connector
9 Audio line-out connector	10 Audio line-in connector
11 Expansion card area	

Your server model might have one or two hot-swap redundant power supplies. Each hot-swap redundant power supply has one power cord connector on the rear of the server. For each hot-swap redundant power supply, there might be one or two status LEDs on the power supply near the power cord connector. For information about the status LEDs, see “Hot-swap power supply status LEDs” on page 24.

1 Power cord connectors

Used to connect the power cord.

2 Serial connector

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

3 VGA connector (DB-15)

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

4 DisplayPort connector

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

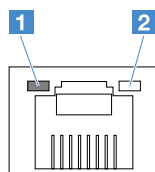
5 USB 3.0 connectors (4)

6 USB 3.0 connectors (2)

Used to attach a USB-compatible 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.

7 Ethernet connector (RJ-45)

Used to attach an Ethernet cable for a LAN. The Ethernet connector has two status LEDs to help you identify the Ethernet connectivity, activity, and connection speed.



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

8 Microphone connector

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

9 Audio line-out connector

Used to send audio signals from the computer to external devices, such as powered stereo speakers (speakers with built-in amplifiers), headphones, multimedia keyboards, or the audio line-in connector on a stereo system or other external recording device.

10 Audio line-in connector

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

11 Expansion card area

Your server has four expansion slots on the system board for you to install appropriate Peripheral Component Interconnect (PCI) cards or PCI Express (PCIe) cards. For detailed information, see “System board components” on page 28.

Note: If a ThinkServer Host Bus Adapter (HBA) is available, refer to its user guide for detailed information. The user guide is available for download at:

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

Server locks

Locking the server cover prevents unauthorized access to the inside of your server. Locking the front door (available on some models) prevents unauthorized access to the installed HDDs.

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

Padlock

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

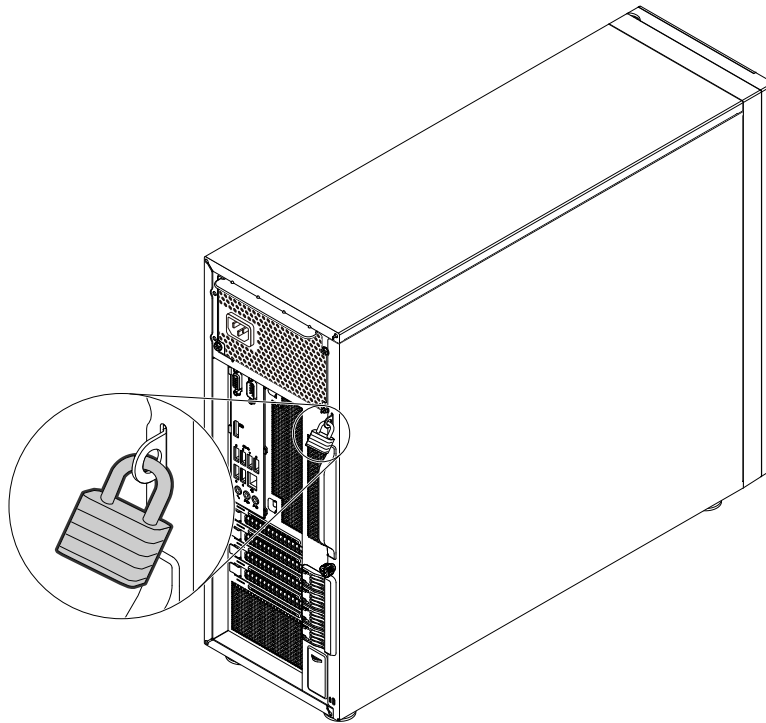


Figure 5. Padlock

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 server cover. This is the same type of lock used with many notebook computers. You can order such a cable lock directly from Lenovo by searching for **Kensington** at:

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

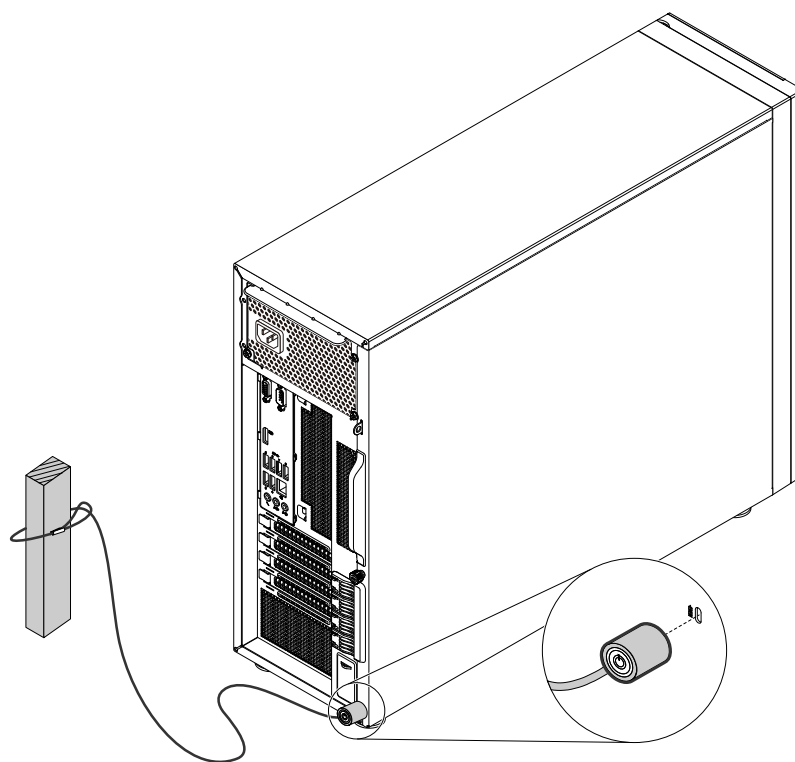


Figure 6. Kensington-style cable lock

Front door lock

You can remove the key attached on the rear of the server and use it to open or lock the front door of the server. The front door protects the HDD cages and prevents unauthorized access to the installed HDDs.

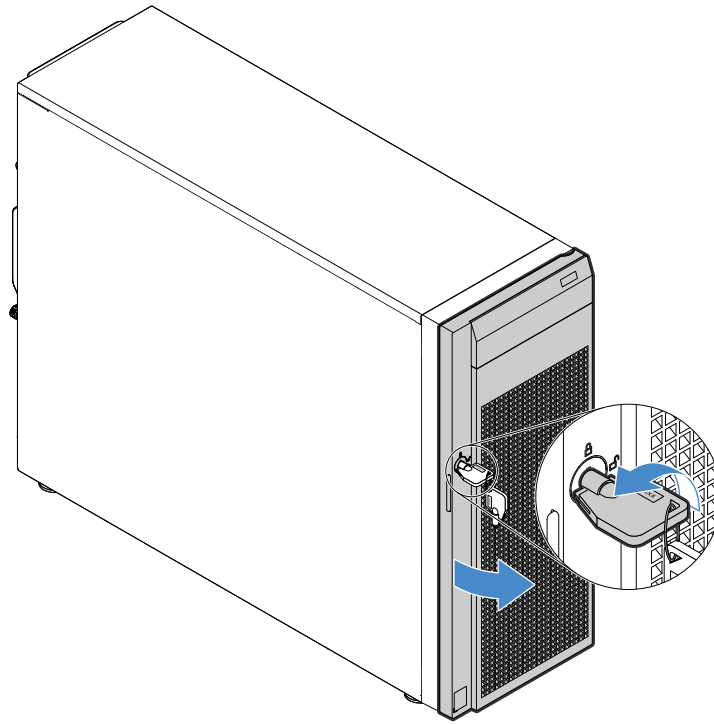


Figure 7. Front door lock

Server components

This topic provides information to help you locate the components of your server. For more information about major components, see the related topics in “Component locations” on page 12.

Your server comes with one of the following drive bay and backplane configurations:

Drive bay size	Drive bay quantity	Drive type	Backplane configuration
3.5-inch	4	Hot-swap, SATA/SAS 3.5-inch HDD or 2.5-inch SSD	One backplane
3.5-inch	8	Hot-swap, SATA/SAS 3.5-inch HDD or 2.5-inch SSD	Two backplanes: each supporting up to four drives
2.5-inch	8	Hot-swap, SATA/SAS HDD or SSD	One backplane
2.5-inch	16	Hot-swap, SATA/SAS HDD or SSD	Two backplanes: each supporting up to eight drives
3.5-inch	4	Non-hot-swap SATA HDDs	Not applied
2.5-inch/3.5-inch mixed	4 (3.5-inch) 8 (2.5-inch)	Hot-swap, SATA/SAS HDD or SSD	Two backplanes

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

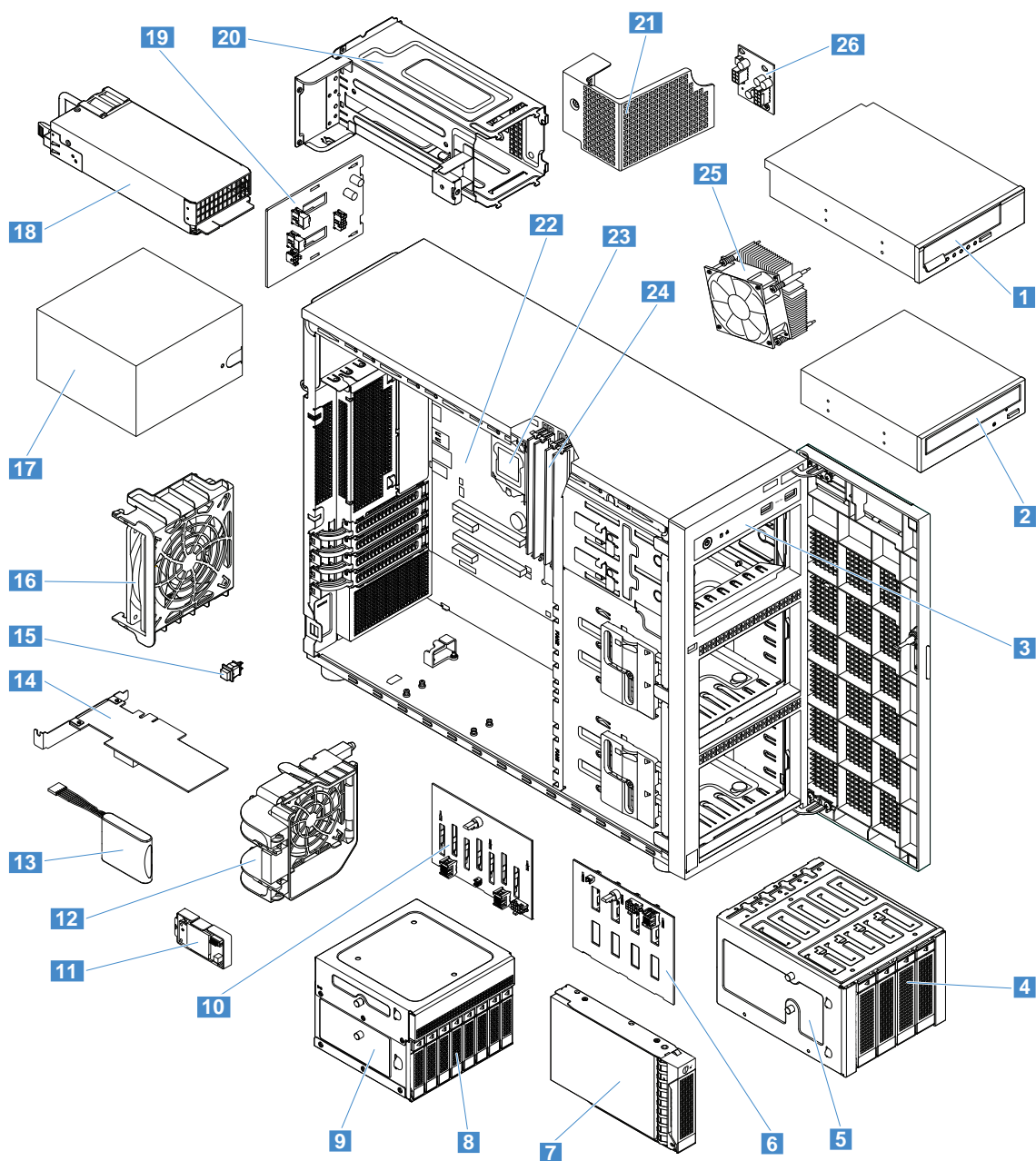


Figure 8. Server components

1 Tape drive* ¹	2 Optical drive ¹
3 Front panel board assembly ¹	4 3.5-inch hot-swap drive* ¹
5 3.5-inch hot-swap-drive cage* ²	6 3.5-inch-drive backplane* ²
7 3.5-inch non-hot-swap drive* ¹	8 2.5-inch hot-swap drive* ¹
9 2.5-inch hot-swap-drive cage* ²	10 2.5-inch-drive backplane* ²
11 Secure digital module (SD module)* ¹	12 Front system fans (2) ¹
13 ThinkServer RAID Super Capacitor Module* ¹	14 PCIe card ¹

15 Intrusion switch* ¹	16 Rear system fan ¹
17 Non-hot-swap power supply* ²	18 Hot-swap power supplies (2)* ¹
19 Power distribution board* ³	20 Hot-swap power supply cage* ¹
21 Power distribution board cage* ³	22 System board ³
23 CPU ³	24 Memory module (vary by model) ¹
25 Heat sink and fan assembly ²	26 Power conversion board* ²

Notes:

- * Available on some models
- ¹ Self-service CRUs: Parts to be installed or replaced by customer themselves.
- ² 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.
- ³ 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” on page iii. 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>

Hot-swap drive activity and status LEDs

Each hot-swap drive has two LEDs on the front.

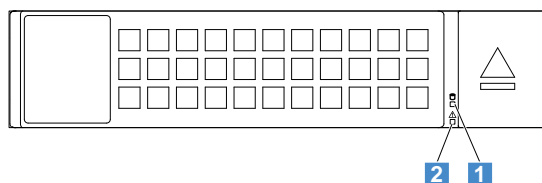


Figure 9. Hot-swap drive activity and status LEDs

1 Drive activity LED	2 Drive status LED	Description
○ Off	○ Off	The drive has failed or is not present.
● Green	○ Off	The drive is present but not in use.
● Blinking green	○ Off	The drive is active and data is being transferred.
● Green	● Blinking amber (blinking rapidly, about four flashes per second)	The RAID controller is identifying the drive.

1 Drive activity LED	2 Drive status LED	Description
<p>● Green</p>	<p>● Amber</p>	<p>One of the following situations:</p> <ul style="list-style-type: none"> The drive has failed. Replace the drive. The status of the drive is Unconfigured Bad. Replace the drive. <p>Notes:</p> <ul style="list-style-type: none"> This status is only for ThinkServer MegaRAID SAS configuration. Intel RSTe configuration doesn't support Unconfigured Bad status. If a drive in a RAID array is removed and then reinstalled while the server is on, the status of the drive will be identified as Unconfigured Bad. In this case, do not replace the drive. You can change the drive status into Unconfigured Good using the ThinkServer MegaRAID SAS Software. The status of the drive is Offline. You can change the drive status into Online using the ThinkServer MegaRAID SAS Software. <p>Note: This status is only for ThinkServer MegaRAID SAS configuration. Intel RSTe configuration doesn't support Offline status.</p> <p>For detailed information about using the ThinkServer MegaRAID SAS Software, refer to the <i>ThinkServer MegaRAID SAS Software User Guide</i>. You can obtain the most up-to-date documentation for your server from the Lenovo Web site at: http://www.lenovo.com/UserManuals</p>
<p>● Blinking green</p>	<p>● Blinking amber (blinking slowly, about one flash per second)</p>	<p>The drive is being rebuilt.</p>

Power conversion board

The power conversion board is available on server models with a non-hot-swap power supply assembly.

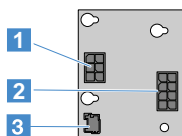


Figure 10. Power conversion board

1 6-pin power connector	2 8-pin power connector
3 2-pin power control connector	

1 6-pin power connector

Used to connect the connector on the non-hot-swap power supply assembly.

2 8-pin power connector

Used to connect the power connector on the backplane.

3 2-pin power control connector

Used to connect the connector on the front panel. You can use this connector to control the backplane power.

Power distribution board

The power distribution board is available on server models with hot-swap power supplies.

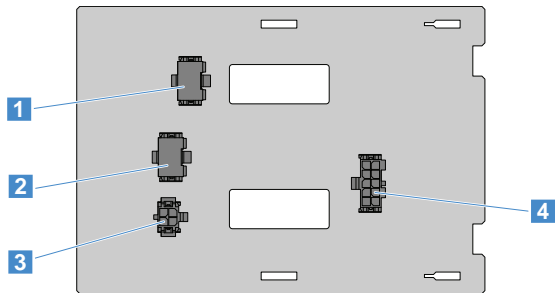


Figure 11. Rear view

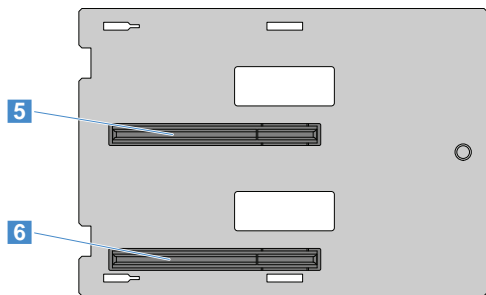


Figure 12. Front view

1 8-pin power connector	2 8-pin power connector
3 4-pin power connector	4 10-pin power connector
5 Slot 1	6 Slot 2

1 2 8-pin power connector

Used to connect the connectors on the backplane.

3 4-pin power connector

Used to connect the CPU power connector on the system board.

4 10-pin power connector

Used to connect the power connector on the system board.

5 6 4-pin power connector

Used to connect hot-swap power supplies.

Hot-swap power supply status LEDs

Each hot-swap power supply has three status LEDs.

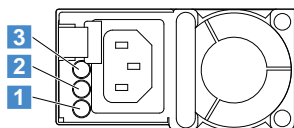


Figure 13. Hot-swap power supply status LEDs

1 Input status LED

Status	Description	Action
○ Off	The power supply is disconnected from the ac power source.	No action is needed.
● Green	The power supply is connected to the ac power source.	No action is needed.

2 Output status LED

Status	Description	Action
○ Off	The server is off or the power supply is not working properly.	If the power supply is not working properly, replace the power supply. See “Hot-swap power supply” on page 73.
● Blinking green (about one flash every two seconds)	The power supply is in cold redundancy active mode.	No action is needed.
● Blinking green (about two flashes each second)	The power supply is in cold redundancy sleep mode.	No action is needed.
● Green	The server is on and the power supply is working properly.	No action is needed.

3 Fault LED

Status	Description	Action
○ Off	The power supply is working properly.	No action is needed.
● Amber	The power supply has failed.	Replace the power supply. See “Hot-swap power supply” on page 73.

RAID card

This topic helps you locate the connectors on RAID cards. Your server supports the following RAID cards (supported type varies by server model):

- Lenovo ThinkServer RAID 520i PCIe Adapter (hereinafter referred to as RAID 520i Adapter)
- Lenovo ThinkServer RAID 720i PCIe Adapter (hereinafter referred to as RAID 720i Adapter)

Note: Depending on the configuration, the RAID card installed in your server might look slightly different from the illustrations in this topic.

Lenovo ThinkServer RAID 520i PCIe Adapter

The RAID 520i Adapter provides advanced SATA/SAS hardware RAID functions. The following illustration shows the connectors on the adapter.

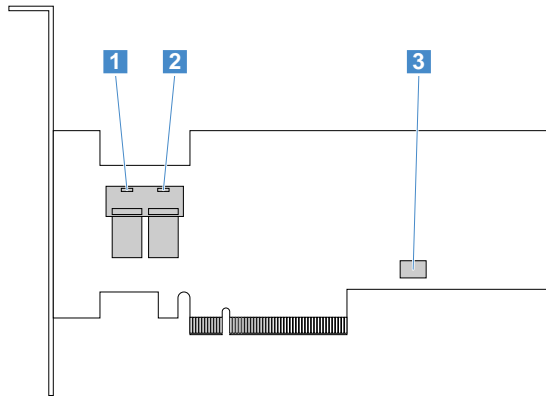


Figure 14. Lenovo ThinkServer RAID 520i PCIe Adapter

Connector	Description
1 Connector 0	Used to connect the mini-SAS signal cable connector on the backplane to support HDD 0-3.
2 Connector 1	Used to connect the mini-SAS signal cable connector on the backplane to support HDD 4-7.
3 J3 connector	Used to connect to a ThinkServer RAID 520i upgrade key.

Lenovo ThinkServer RAID 720i PCIe Adapter

The RAID 720i Adapter provides advanced SATA/SAS hardware RAID functions. The following illustration shows the connectors on the adapter.

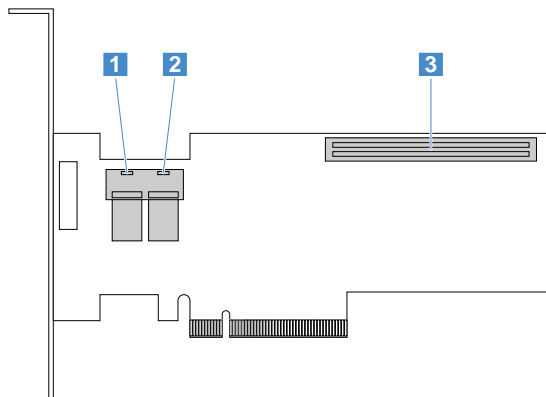


Figure 15. ThinkServer RAID 720i PCIe Adapter

Connector	Description
1 Connector 0	Used to connect the mini-SAS signal cable connector on the backplane to support HDD 0-3.
2 Connector 1	Used to connect the mini-SAS signal cable connector on the backplane to support HDD 4-7.
3 Thunderbolt Flash Module connector	Used to connect a Thunderbolt Memory module (hereinafter referred to as TMM).

Lenovo ThinkServer SAS 12G Expander PCIe Card

This topic helps you locate the connectors on the Lenovo ThinkServer SAS 12G Expander PCIe Card (hereinafter referred to as expander card). The expander card is available on some models.

Note: The expander card needs to be installed into the PCIe slot 3 on the system board.

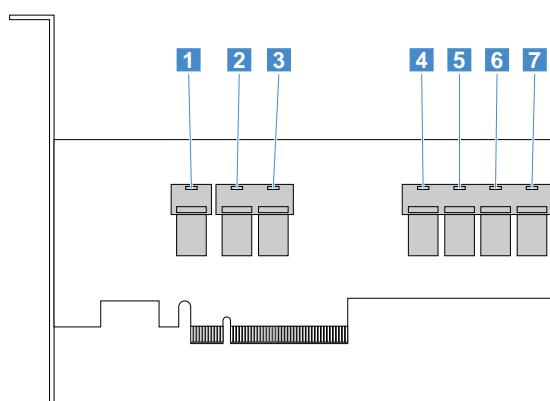


Figure 16. Lenovo ThinkServer SAS 12G Expander PCIe Card

1 Connector A	2 Connector B
3 Connector C	4 Connector D
5 Connector E	6 Connector F
7 Connector G	

To connect the expander card with RAID cards or backplanes, refer to the following table.

Expander card	RAID 520i Adapter	RAID 720i Adapter
Connector A	Connector 0	Connector 0
Connector B	Connector 1	Connector 1

Connectors C-G are used to connect the Mini-SAS connectors on the backplanes.

Backplane

Your server supports backplanes for up to four 3.5-inch drives and up to eight 2.5-inch drives.

To locate the backplanes, see “Server components” on page 19.

Backplane for up to four 3.5-inch drives

This topic provides information to help you locate the connectors on the backplane for up to four 3.5-inch drives.

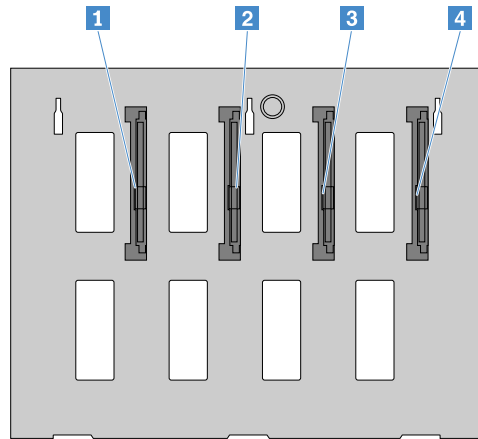


Figure 17. Front view

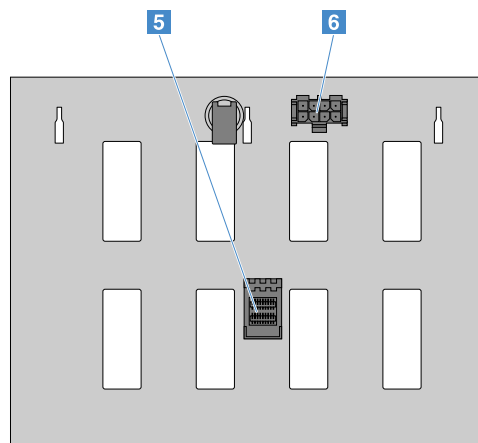


Figure 18. Rear view

1-4 Slot 0–slot 3

Used to connect 3.5-inch drives.

5 Mini-SAS signal cable connector

Used to connect the mini-SAS connector on the RAID card. You also can use a SATA to mini-SAS signal cable to connect the backplane to the SATA connectors on the system board.

6 8-pin power connector

Used to connect the power connector on the power distribution board, power conversion board, or system board.

Backplane for up to eight 2.5-inch drives

This topic provides information to help you locate the connectors on the backplane for up to eight 2.5-inch drives.

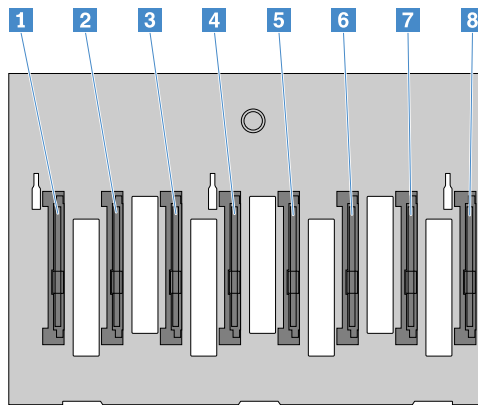


Figure 19. Front view

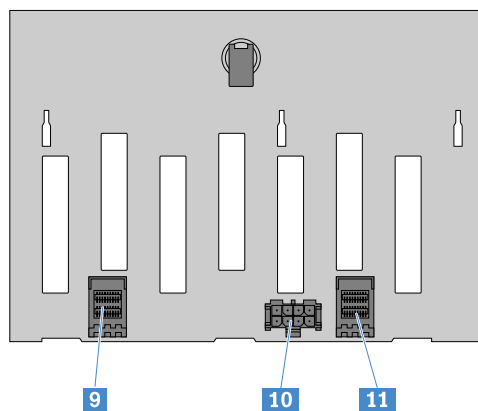


Figure 20. Rear view

1-8 Slot 0–slot 7

Used to connect 2.5-inch drives.

9 Mini-SAS signal cable connector 1

Used to connect the mini-SAS connector on the RAID card. You also can use a SATA to mini-SAS signal cable to connect the backplane to the SATA connectors on the system board.

10 8-pin power connector

Used to connect the power connector on the power distribution board, power conversion board, or system board.

11 Mini-SAS signal cable connector 0

Used to connect the mini-SAS connector on the RAID card. You also can use a SATA to mini-SAS signal cable to connect the backplane to the SATA connectors on the system board.

System board components

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

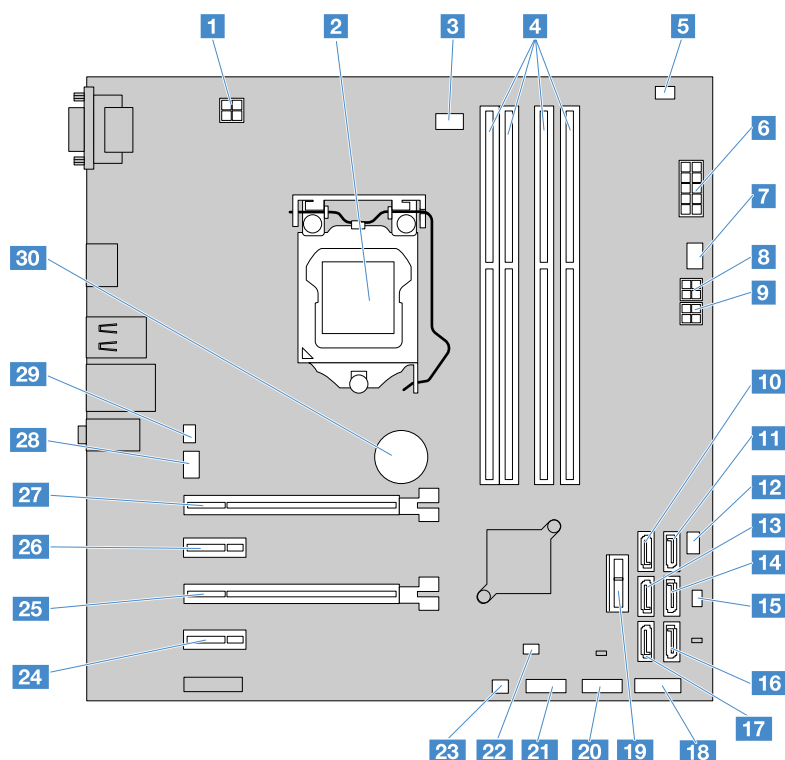


Figure 21. System board components

1 4-pin power connector	2 CPU socket
3 CPU fan connector	4 Memory slots
5 Thermal sensor connector	6 10-pin power connector
7 Front system fan 2 connector	8 HDD power connector 2
9 HDD power connector 1	10 SATA connector 4
11 SATA connector 5	12 Serial General Purpose Input/Output (SGPIO) connector
13 SATA connector 2	14 SATA connector 3
15 Front system fan 1 connector	16 SATA connector 1
17 SATA connector 0	18 Front panel connector
19 Front USB 3.0 connector	20 USB 2.0 connector
21 USB 2.0 connector	22 Clear CMOS jumper
23 HDD LED connector	24 PCIe slot 4
25 PCIe slot 3	26 PCIe slot 2
27 PCIe slot 1	28 Rear system fan connector
29 Intrusion switch connector	30 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 install the CPU.

3 CPU fan connector

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

4 Memory slots

Used to install memory modules. For detailed information, see “Memory module installation rules” on page 52.

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 Front system fan 2 connector

Used to connect the cable of the front system fan 2.

8 HDD power connector 2

Used to connect the power cables for HDDs, optical drive, or tape drive.

9 HDD power connector 1

Used to connect the power cables for HDDs, optical drive, or tape drive.

10 11 13 14 16 17 SATA connectors

Used to connect the HDD, optical drive, or tape drive.

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.

12 Serial General Purpose Input/Output (SGPIO) connector

Used to connect the SGPIO connector of the mini-SAS signal cable with four SATA connectors and one SGPIO connector.

15 Front system fan 1 connector

Used to connect the front system fan 1.

18 Front panel connector

Used to connect the front panel board.

19 Front USB 3.0 connector

Used to connect the front USB cable.

20 21 USB 2.0 connectors

Used to connect the signal cable for the RDX tape drive or the SD module.

22 Clear CMOS jumper

Used to clear CMOS and turn the BIOS settings into the factory default settings.

Note: Clearing CMOS does not erase your BIOS passwords.

To clear CMOS, do the following:

1. Remove all media from the drives and turn off all attached devices and the server. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the server.
2. Remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
3. Lay the server on its side for easier operation.
4. Locate the Clear CMOS jumper on the system board.
5. Move the Clear CMOS jumper from the default normal position (pin 1 and pin 2) to the short-circuited position (pin 2 and pin 3).
6. Reconnect the server to an ac power source and turn on the server. Then, wait more than 10 seconds.
7. When you hear beeps, turn off the server. Then, move the Clear CMOS jumper back to the normal position (pin 1 and pin 2).
8. Reinstall the server cover and connect the power cords. See “Completing the parts replacement” on page 111.
9. Connect the server to an ac power source and turn on the server. The clearing CMOS process is completed.

23 HDD LED connector

Used to connect cable from the HDD status LED on the front panel.

24 25 26 27 PCIe slots

Slot	Physical slot size	Negotiable link bandwidth	Supported card length and height
24 PCIe slot 4	x1	x1	Full-length, full height
25 PCIe slot 3	x16	x4, x1	Full-length, full height
26 PCIe slot 2	x1	x1	Full-length, full height
27 PCIe slot 1	x 16	x8, x4, x1	Full-length, full height

28 Rear system fan connector

Used to connect the rear system fan.

28 Intrusion switch connector

Used to connect the intrusion switch.

30 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.

Chapter 4. Configuring the server

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

- “Using the Setup Utility program” on page 33
- “Using the ThinkServer EasyStartup program” on page 39
- “Configuring RAID” on page 41
- “Configuring the Ethernet controllers” on page 39

Using the Setup Utility program

This topic provides information about 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

This topic provides instructions on how to start 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, you need to type the correct password to enter the Setup Utility program. For password information, see “Using passwords” on page 36.

Setup Utility program interface

This topic provides information about the menus and items in the Setup Utility program.

Depending on the version of your system BIOS, 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. Do not change the value of unfamiliar items to avoid unexpected problems. If you consider changing the server configuration, proceed with extreme caution. Setting the configuration improperly 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 components” on page 28.
- If you have changed any hardware in the server, you might need to reflash the BIOS.

The following menus are listed on the **BIOS Setup Utility** screen:

- “Main menu” on page 34.
- “Devices menu” on page 34.
- “Advanced menu” on page 34.
- “Power menu” on page 34.

- “Security menu” on page 35.
- “Startup menu” on page 35.
- “Exit menu” on page 36.

Main menu

After entering the Setup Utility program, you can see the **Main** menu, which lists basic information about the BIOS, total memory size, and system date and time.

Devices menu

You can view or change various devices 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. For more information, enter the corresponding submenu and refer to the instructions on the screen.

Menu item	Description
Serial Port Setup	View and set serial connector configuration parameters.
USB Setup	View and set USB configuration parameters.
ATA Drive Setup	View and set SATA HDD configuration parameters.
Video Setup	View and set the primary video adapter type.
Audio Setup	Enable or disable the onboard audio controller.
Network Setup	Enable or disable the onboard Ethernet controller and other network functions.

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. For more information, enter the corresponding items and refer to the instructions on the screen.

Menu item	Description
CPU Setup	View and set CPU configuration parameters.
Intel® Manageability	View and set Intel vPRO features.
Intel SIPP Support	Enable or disable the Intel SIPP Support feature.
CPU CRID Support	Enable or disable the CPU CRID Support feature.
Chipset CRID support	Enable or disable the Chipset CRID Support feature.

Power menu

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

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

Menu item	Description
After Power Loss	View and configure the system performance after ac power source is removed and restored.
Enhanced Power Saving Mode	Enable or disable Enhanced Power Saving Mode.
Intelligent Cooling Engine (ICE)	Enable the system to enter the lower acoustic level or better thermal level.
Automatic Power On	Enable or disable the Automatic Power On function.

Security menu

You can set passwords and configure the TPM function 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
Administrator Password	View the status of an administrator password.
Power-On Password	View the status of a user password.
Set Administrator Password	Set an administrator password to protect against unauthorized access to your server. See “Using passwords” on page 36.
Set Power-On Password	Set a user password to protect against unauthorized access to your server. See “Using passwords” on page 36.
Chassis Intrusion Detection	Enable or disable the Chassis Intrusion Detection feature.
TCG Feature Setup	Configure the TPM function. See “Configuring the TPM function” on page 38.
System Event Log	View and clear the system event log.
Secure Boot	View and set secure boot configuration parameters.

Startup menu

The **Startup** menu in the Setup Utility program provides an interface to help you view or change the server startup options, including the startup sequence and boot priority for various devices. After the server restarts, changes in the startup options take effect.

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 HDD, 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 38.

The **Startup** menu contains various configuration submenus and items. For each submenu and item, press **Enter** to show selectable options and select a desired option by using the up and down arrow keys or type desired values from the keyboard. Some items are displayed on the menu only if the server supports the corresponding features.

The **Startup** menu contains the following submenus:

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

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

- **CSM:** If you select **Enabled**, you can install a non-UEFI operating system. If you select **Disabled**, you can install a UEFI operating system.
- **Boot Mode:** Choose the boot policy.
- **Boot Priority:** Set the boot priority of operating systems.
- **Options Keys Display:** If you select **Enabled**, the option keys will be displayed on the logo screen. If you select **Disabled**, the option keys will not be displayed on the logo screen.
- **Options Keys Display Style:** This item controls the option keys display style when you select **Enabled** for the **Option Keys Display** item.
 - If you select **Legacy**, the message “Press F1 to enter Setup, F12 to display Boot Menu” will be displayed on the logo screen.
 - If you select **Normal**, the message “To interrupt normal startup, press Enter” will be displayed on the logo screen.

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 38.

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

Menu item	Description
Save Changes and Exit	Save changes and exit the Setup Utility program.
Discard Changes and Exit	Discard changes, load previous values, and then exit the Setup Utility program.
Load Optimal Defaults	Restore the user default values for all the items.
OS Optimized Defaults	Select Enabled 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, the server cannot be used 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 that you use a strong password that cannot be easily compromised.

Notes:

1. The Setup Utility program passwords are not case sensitive.
2. The server supports Setup Utility program passwords that consist of up to 20 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

Besides the alphabetic characters (a-z) and numeric characters (0-9), the server also supports characters typed using special keys on the keyboard for a password. Refer to the help message on the screen when setting a password to determine the valid special characters.

Setting, changing, or deleting a password

This topic provides instructions on how to set, change, or delete a password in the Setup Utility program.

To set, change, or delete a password in the Setup Utility program, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 33.
2. On the **Security** menu, select **Set Administrator Password** to set an administrator password or select **Set Power-On Password** to set a user password.
3. See “Password considerations” on page 37. Then, follow the instructions on the screen to set or change a password.
4. If you want to delete a password, type your current password. Press Enter when you are prompted to type a new password. Then, press Enter to confirm the new password. The previous password will be cleared.

Note: For security reasons, it is recommended that you always set a password for your server.

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 components” on page 28. Then, set a new password for 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 33.
2. On the **Security** menu, select **TCG Feature Setup**, and then press Enter.
3. Select **TCG Security Features**. Then, set the **TPM Support** to **Active**.
4. Press F10 to save settings and exit the Setup Utility program. The server will restart in order to enable the TPM function.

Selecting a startup device

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

Note: Not all discs, HDDs, 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 33.
2. On the **Startup** menu, follow the instructions on the screen to set the startup device depending on your needs. You also can set the boot priority for various devices. See “Startup menu” on page 35.
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.

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. To exit the Setup Utility program, you also can do the following:

- 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 36.

Updating the BIOS

This topic provides instructions on how to update the BIOS.

System programs are the basic layer of software built into your server. System programs include the POST, the UEFI BIOS, and the Setup Utility program. The POST is a set of tests and procedures that are performed

each time you turn on your server. The UEFI BIOS is a layer of software that translates instructions from other layers of software into electrical signals that the server hardware can execute. You can use the Setup Utility program to view or change the configuration settings of your server. See “Using the Setup Utility program” on page 33.

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 can update the server firmware by downloading an update package and following the instructions on the Web page.

You also can use the Firmware Updater program to help you keep the server firmware up-to-date. See “Server setup procedure” on page 5.

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 contain the support for 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.

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 TXT file that contains installation instructions.
3. Print the TXT file and follow the instructions to update (flash) the BIOS.
4. Check and reconfigure the BIOS settings for your specific needs based on your note or refer to “Using the Setup Utility program” on page 33 after the BIOS update process is completed.

Configuring the Ethernet controllers

The Ethernet controllers are integrated on the system board. They provide an interface for connecting to a 10 Mbps, 100 Mbps, or 1000 Mbps network and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the network.

You do not have to set any jumpers or configure the Ethernet controllers. However, you must install a device driver to enable the operating system to recognize the controllers.

The device drivers for onboard Ethernet controllers are available for download at:
<http://www.lenovo.com/drivers>

Using the ThinkServer EasyStartup program

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

Windows or Linux operating system installation disc to automate the process of installing the operating system and associated device drivers.

To download the ThinkServer EasyStartup program 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 or 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
- RAID configuration utility
- Device drivers provided based on the server model and detected devices
- Selectable partition size and file system type
- Support for multiple operating systems
- Ability to install the operating system and device drivers in an unattended mode to save time
- Ability to create a reusable response file that can be used with similarly configured Lenovo servers to make future installations even 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 using 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 38.
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** when you are prompted with the Lenovo License Agreement. Read the Lenovo License Agreement carefully. In order to continue, you must agree those terms by clicking **Agree**. Then, the Date and time window opens.
4. Set the current date and time and click **OK**. The Start option window opens.
5. The Start option window provides the following selections:
 - Continue to the main interface.
 - Install the operating system using a pre-existing response file.
 - Configure RAID using a pre-existing 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:

1. 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 information about the RAID controllers, 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.
2. Before using the ThinkServer EasyStartup program to install an operating system, ensure that any external storage devices and fiber channels are configured properly.

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

Menu item	Description
Home	Provide general information about the program.
Compatibility notes	Provide information about the operating systems and server configurations supported by the version of the program you are using.
User Guide	Provide information about the features of the program and instructions on how to use the program.
Hardware list	Display a list of hardware devices detected by the program.
Configure RAID	Instruct you to configure RAID or view the current RAID configuration and make changes if needed.
Install operating system	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.
Driver download	Provide the supported device drivers for download.
About	Provide the version information and legal notices.

Configuring RAID

This topic provides information about RAID and the utility programs that are available for you to configure RAID.

This topic contains the following items:

- “About RAID” on page 42
- “RAID for your server” on page 43
- “Configuring onboard SATA software RAID” on page 44
- “Configuring advanced SATA or SAS hardware RAID” on page 46

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 HDDs 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 HDDs are set up to use RAID technology, they are in a RAID array. This array distributes data across multiple HDDs, 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 HDDs.

- **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 HDDs.

- **RAID 6:** block-level striping with distributed parity

RAID 6 uses distributed parity, with two independent parity blocks per stripe, and disk striping. A RAID 6 virtual drive can survive the loss of any two drives without losing data. A RAID 6 drive group is similar to a

RAID 5 drive group. Blocks of data and parity information are written across all drives. The parity information is used to recover the data if one or two drives fail in the drive group.

RAID 6 requires a minimum number of three HDDs.

- **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 HDDs and also requires an even number of drives, for example, six HDDs or eight HDDs.

- **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 HDDs.

- **RAID 60:** a combination of RAID 0 and RAID 6

RAID 60 uses distributed parity, with two independent parity blocks per stripe in each RAID set, and disk striping. A RAID 60 virtual drive can survive the loss of two drives in each of the RAID 6 sets without losing data. RAID 60 works best with data that requires high reliability, high request rates, high data transfers, and medium-to-large capacity.

RAID 60 requires a minimum number of six HDDs.

For detailed information about RAID, refer to “Introduction to RAID” in the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at: <http://www.lenovo.com/support>

RAID for your server

Note: Before configuring RAID for your server, ensure that you use HDDs that are of the same type (SATA or SAS) and have the same capacity within a single RAID array.

Your server supports the following two types of RAID configurations:

- **Onboard SATA software RAID configuration**

The onboard SATA software RAID controller is integrated on the Intel C220 chip on the system board. If your server has SATA HDDs that are connected to the system board, you can use the Intel Rapid Storage Technology enterprise program to configure RAID. By default, your server supports onboard SATA software RAID levels 0, 1, 5, and 10.

For detailed information, see “Configuring onboard SATA software RAID” on page 44.

- **Advanced SATA/SAS hardware RAID configuration (requires a RAID card)**

Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. You also can 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 24 and “PCIe card” on page 54 for more information.

The RAID card provides the WebBIOS Configuration Utility program to help you configure RAID independently of the operating system. You also can install the MegaRAID Storage Manager program and

the StorCLI Configuration Utility program to help you manage the RAID array and RAID controller in an operating system environment. The supported RAID levels are RAID 0, 1, and 10 by default. For the ThinkServer RAID 520i PCIe Adapter, to activate RAID 5 and RAID 50 levels, install a RAID 5 key on the RAID card. For the ThinkServer RAID 720i PCIe Adapter, to activate RAID 6 and RAID 60 levels, you need to install a TMM on the RAID card.

For detailed information, see “Configuring advanced SATA or SAS hardware RAID” on page 46.

Notes:

- For server models with more than four HDDs or models that use SAS HDDs, a RAID card must be installed.
- When the CPU utilization is high, it is recommended that you install a RAID card instead of using the integrated software RAID controller for RAID 5 configuration.
- The ThinkServer EasyStartup program simplifies the process of configuring supported RAID and installing supported operating systems and device drivers.

Before configuring RAID for your server, observe the following precautions:

1. Use HDDs that have the same capacity within a single RAID array.
2. Use HDDs that are of the same type (SATA or SAS) within a single RAID array.
3. Depending on the operating system, the primary RAID might be limited to 2 TB total drive capacity.

Configuring onboard SATA software RAID

- “Enabling the onboard SATA RAID functionality” on page 44
- “Creating RAID volumes” on page 44
- “Deleting RAID volumes” on page 45
- “Resetting disks to non-RAID” on page 45
- “Marking disks as spare” on page 45

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 33.
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

This section describes how to use the Intel Rapid Storage Technology enterprise option ROM configuration utility to create RAID volumes.

To create RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.
2. Use the up and down arrow keys to select **Create RAID Volume** and press Enter.
3. Type a proper RAID volume name in the **Name** field and press Tab.
4. Use the arrow keys to select a RAID level in the **RAID Level** field and press Tab.

5. If appropriate, use the arrow keys to select a stripe size in the **Stripe Size** field and press Tab.
6. Type a volume size in the **Capacity** field and press Tab.
7. Press Enter to initiate volume creation.
8. When prompted, press Y to accept the warning message and create the volume.
9. If desired, return to step 2 to create additional RAID volumes.
10. When finished, select **Exit** and press Enter.

Deleting RAID volumes

This section describes how to use the Intel Rapid Storage Technology enterprise option ROM configuration utility to delete RAID volumes.

To delete RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.
2. Use the up and down arrow keys to select **Delete RAID Volume** and press Enter.
3. Use the arrow keys to select the RAID volume to be deleted and press Delete.
4. When prompted, press Y to confirm the deletion of the selected RAID volume. Deleting a RAID volume will reset the hard disk drives to non-RAID.
5. After deleting a RAID volume, you can:
 - Return to step 2 to delete additional RAID volumes.
 - See “Creating RAID volumes” on page 44 for RAID volume creation.
 - Use the up and down arrow keys to select **Exit** and press Enter.

Resetting disks to non-RAID

This section describes how to reset your HDDs to non-RAID.

To reset your HDDs to non-RAID, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.
2. Use the up and down arrow keys to select **Reset Disks to Non-RAID** and press Enter.
3. Use the arrow keys and the space key to mark individual physical hard disk drives to be reset, and then press Enter to complete the selection.
4. When prompted, press Y to confirm the reset action.
5. After resetting the HDDs to non-RAID, you can:
 - See “Deleting RAID volumes” on page 45 for RAID volume deletion.
 - See “Creating RAID volumes” on page 44 for RAID volume creation.
 - 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 also can 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 24 and “PCIe card” on page 54 for more information.

Note: For server models with more than four HDDs or models that use SAS HDDs, a RAID card must be installed.

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 39 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>

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 47
- “Getting familiar with important guidelines” on page 47
- “Preparing your server in advance and removing the server cover” on page 49
- “Removing and installing hardware” on page 50
- “Completing the parts replacement” on page 111

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.

Purchasing ThinkServer options

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 you use the server, be sure to 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/documents/LNVO-DOCS>. Reading and understanding the safety instructions reduces the risk of personal injury and damage to your product.
- When you install your new server, take the opportunity to 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 then follow the instructions on the Web page. See “Server setup procedure” on page 5 for more information.
- Before you install optional hardware devices, ensure that the server is working properly. If the server is not working properly, see Chapter 6 “Troubleshooting and diagnostics” on page 113 to do basic troubleshooting. If the problem cannot be solved, see Chapter 7 “Getting information, help, and service” on page 119.
- 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 have been 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 hard disk 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 you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.
- When working inside the server, you might find some tasks easier if you lay the server on its side.

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, 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 PCIe cards, memory modules, system boards, and CPUs) by its edges or its 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, ensure that you follow these guidelines:

- All drive bays and PCIe 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 PCIe card, save the EMI shield or dummy tray from the drive bay or save the PCIe card slot bracket in case 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.

- If the server has redundant power, each of the power supply bay has a redundant power supply installed, or one bay has a redundant power supply while the other bay is covered by a shield.
- 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 for more than 30 minutes might damage server components.
- Properly route the cables. For some options, such as PCIe cards, follow the cabling instructions that come with the options in addition to the instructions in this manual.
- Ensure that you replace a failing fan as soon as you remove the old one.
- When replacing a hot-swap drive, install the new hot-swap drive as soon as you remove the old one.

Working inside the server with the power on

Attention: Static electricity that is released to internal server components when the server is turned on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an ESD wrist strap or other grounding system when you work inside the server with the power on.

The server supports hot-swap devices and is designed to operate safely while it is turned on and the cover is removed. Follow these guidelines when you work inside the server with the power on:

- Avoid wearing loose-fitting clothing on your forearms. Button long-sleeved shirts before working inside the server; do not wear cuff links while you are working inside the server.
- Do not allow your necktie or scarf to hang inside the server.
- Remove jewelry, such as bracelets, necklaces, rings, and loose-fitting wrist watches.
- Remove items from your shirt pocket, such as pens and pencils. These items might fall into the server as you lean over it.
- Avoid dropping any metallic objects into the server, such as paper clips, hairpins, and screws.

Preparing your server in advance 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 47.

Note: You do not have to remove the server cover before removing or installing the following hot-swap components:

- Hot-swap drives
- Hot-swap power supply

To remove the server cover, do the following:

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 17.

5. Remove the server cover.

- 1 Loosen the thumbscrew that secures the server cover. The thumbscrew is an integrated part of the server cover. Do not try to remove the thumbscrew from the server cover.
- 2 Slide the server cover to the rear until it is stopped.
- 3 Pivot the server cover outward to remove it.

Note: It is recommended that you wait three to five minutes to let the server cool before removing the server cover.

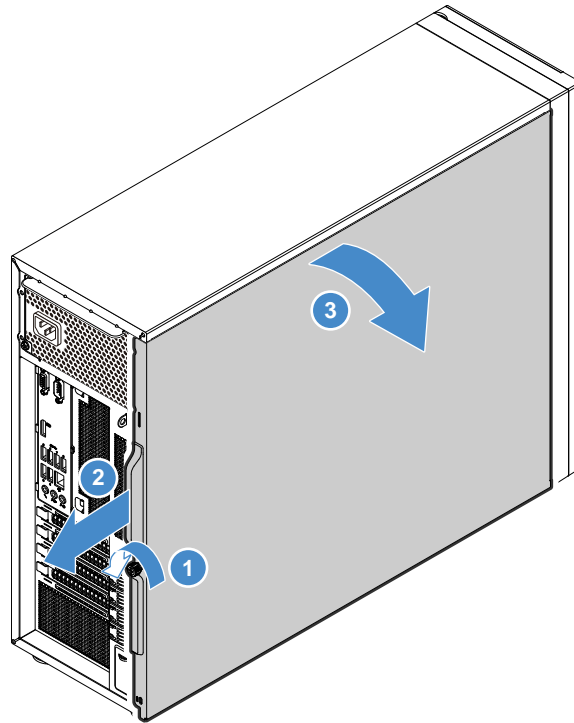


Figure 22. Removing the server cover

To install the server cover, see “Completing the parts replacement” on page 111.

Attention: For proper cooling and airflow, install the server cover before turning on the server. Operating the server with the server cover removed for more than 30 minutes might damage server components.

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 by adding new hardware devices, such as memory modules, PCIe cards, or other server options, and maintain your server by replacing the failing hardware devices.

If you are handling a server option, refer to the appropriate installation and or removal instructions in this topic along with the instructions that come with the option.

Notes:

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

Front bezel

- “Removing the front bezel” on page 51
- “Installing the front bezel” on page 51

Removing the front bezel

To remove the front bezel, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Release the three plastic tabs on the left side. Then, pivot the front bezel and the front door (available on some models) as shown to remove it from the chassis.

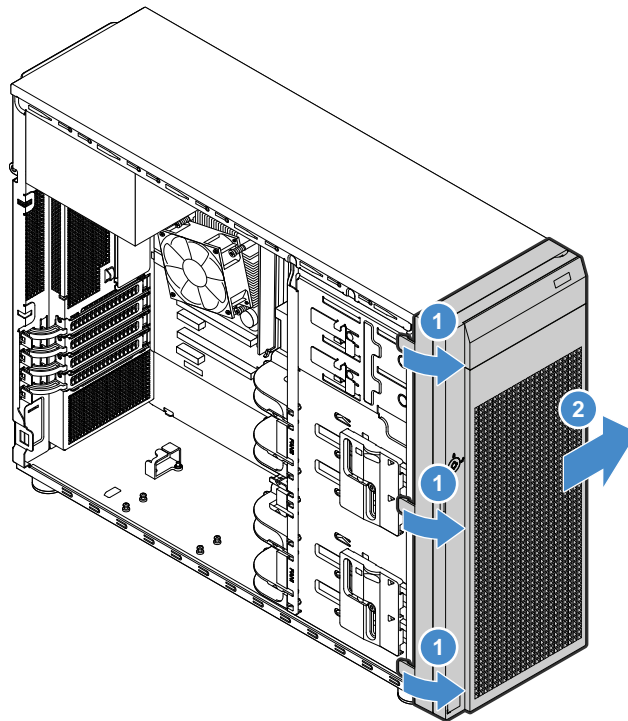


Figure 23. Removing the front bezel

Installing the front bezel

To install the front bezel, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
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 and front door (available on some models) inward until the front bezel snaps into position on the left side.

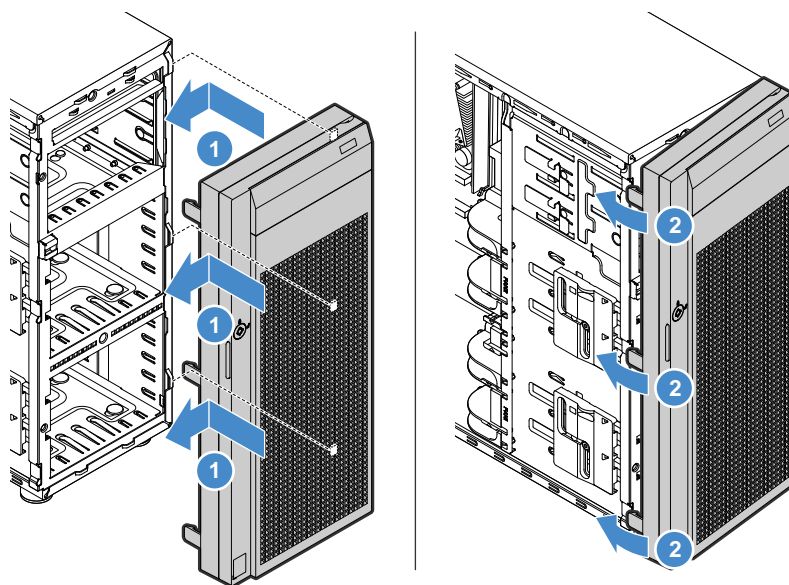


Figure 24. Installing the front bezel

Memory module

- “Memory module installation rules” on page 52
- “Removing a memory module” on page 53
- “Installing a memory module” on page 53

Note: The memory modules are sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 48 first and carefully perform the operation.

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.
- The maximum system memory is 64 GB (one 16 GB memory module installed in each of the four memory slots).

Notes:

- All memory modules to be installed must be the same type with the same voltage and frequency.
- When you install memory modules with different capacity, install the memory module that has the highest capacity first.

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

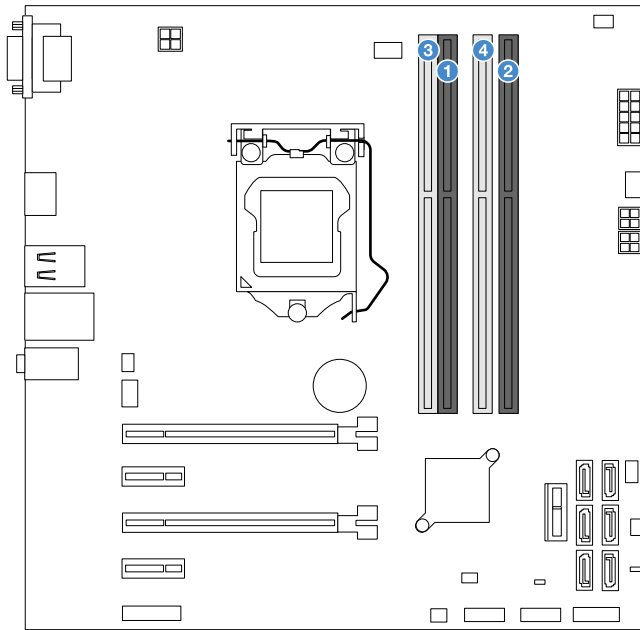


Figure 25. Memory module installation order

Removing a memory module

To remove a memory module, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Locate and remove the memory module.

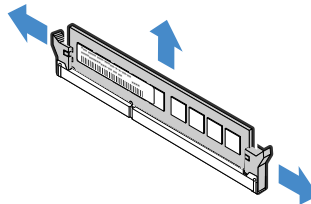


Figure 26. Removing a memory module

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 a memory module

Note: Ensure that you follow the memory module installation rules when performing the operation. See “Memory module installation rules” on page 52.

To install a memory module, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Locate the memory slots on the system board and remove the memory dummy if necessary.

4. Ensure that the retaining clips are fully open. Then install the memory module into the slot until the retaining clips are completely closed.

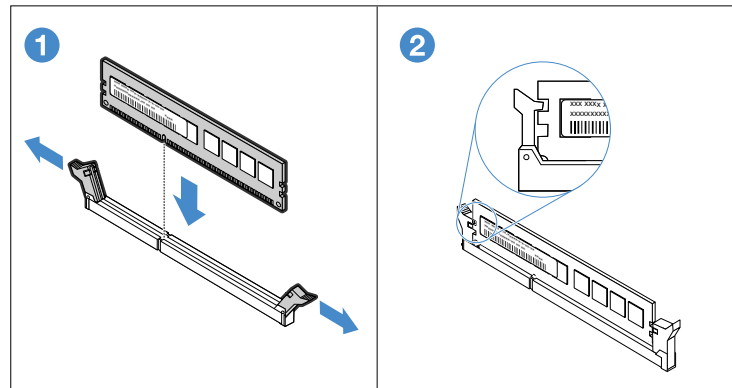


Figure 27. Installing the memory module

PCIe card

This topic provides instructions on how to install or remove a PCIe card, such as an Ethernet card, a Host Bus Adapter, and any other supported PCIe cards.

- “Removing a PCIe card” on page 54
- “Installing a PCIe card” on page 55

The installation or the removal procedure is based on the scenario that you want to install a full-height, half-length PCIe card. The procedure is similar if you want to install a full-height, full-length PCIe card.

Note: The PCIe card is extremely sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 48 first and carefully perform the operation.

Notes:

- Depending on the specific type, the PCIe card might look different from the illustrations in this topic.
- Use any documentation that comes with the PCIe card and follow those instructions in addition to the instructions in this topic.

Removing a PCIe card

To remove a PCIe card, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Locate the PCIe card you want to remove. Depending on the type of a PCIe card, you might also need to disconnect all cables from a PCIe card, the system board, or the hot-swap drive backplane.
4. If the PCIe card is secured by a retaining clip, disengage the card from the retaining clip first.
5. Open the card latch as shown. Then, grasp a PCIe card by its edges and carefully pull it out of the PCI Express card slot.

Note: The PCIe card fits tightly into the PCI Express card slot. If necessary, alternate moving each side of the PCIe card a small and equal amount until it is completely removed from the slot.

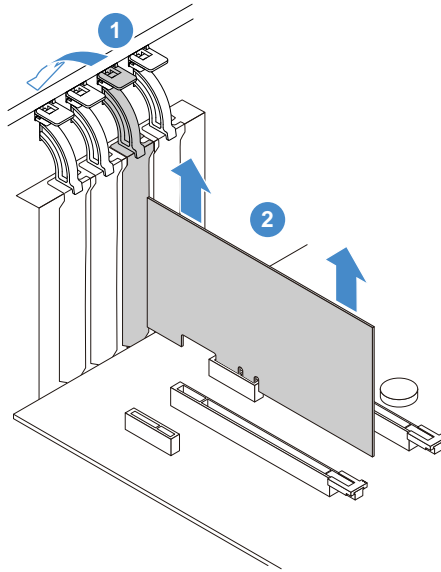


Figure 28. Removing a PCIe card

6. Install a new PCIe card to replace the old one or install a PCIe card slot bracket to cover the place. See “Installing a PCIe card” on page 55.
7. 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 and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Locate a PCIe slot on the system board for installing a PCIe card. See “System board components” on page 28 to identify the different types of PCIe slots in your server.
4. Open the card latch. Position the new PCIe card over the PCIe slot, and then carefully press the PCIe card straight down until it is securely seated in the slot. Close the card latch as shown to secure the PCIe card in place.

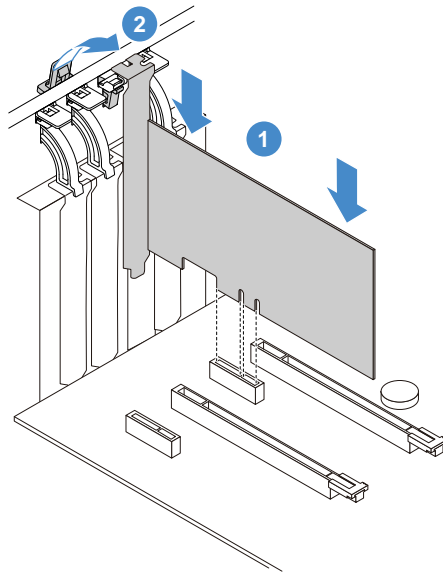


Figure 29. Installing a PCIe card

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 its README file, and follow the instructions in the README file to install the driver.

Optical drive

- “Removing the optical drive” on page 57
- “Installing the optical drive” on page 58

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. Your server has two optical drive bays. If only one optical drive is installed in the lower bay, the upper bay is covered by a metal EMI shield on the chassis and also a plastic shield on the front bezel. When you install a secondary optical drive, save the removed EMI shield from the chassis and plastic shield from the front bezel in case you later remove the drive and need the shields to cover the drive bay.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new optical drive as soon as you remove the failing one or the protective shields.

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.

Before you begin, review the following optical drive installation rules:

- The server has two optical drive bays. If the server has only one optical drive installed, ensure that the optical drive is installed in the lower bay (optical drive bay 1). The upper bay is for a secondary optical drive only.
- The following table provides information about the recommended power connector and connector on the system board for the installed optical drive. See “Server components” on page 19 for the locations of the optical drive bays and “System board components” on page 28 for the locations of the connectors on the system board.

Drive bay	Drive	Power connector	Connector on the system board
Optical drive bay 1 (lower bay)	An optical drive installed	4-pin power connector	SATA 4 connector
Optical drive bay 2 (upper bay)	An optical drive installed in some models	4-pin power connector	SATA 5 connector

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

Removing the optical drive

To remove the optical drive, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Open the front door (available on some models).
3. Disconnect cables from the rear of the optical drive.
4. Pivot the release button outward and push the optical drive from the rear until it is projected from the front of the chassis. Then, hold the optical drive and completely slide it out of the chassis.

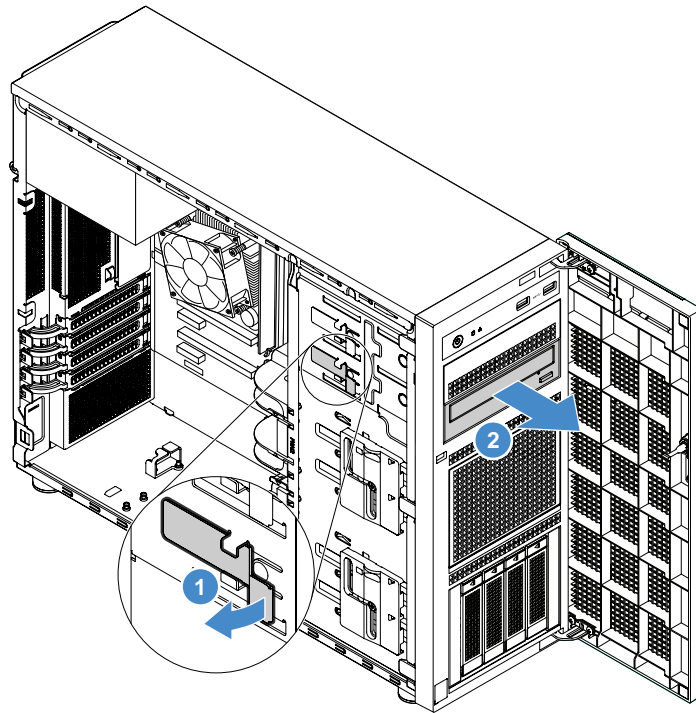


Figure 30. Removing the optical drive

5. Install a new optical drive or an EMI-protective 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 the optical drive

To install the optical drive, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. If you are installing a secondary optical drive in the upper optical drive bay, remove the front bezel first. See “Removing the front bezel” on page 51. Then, insert two fingers into the holes in the EMI shield and carefully pull the EMI shield out of the chassis.

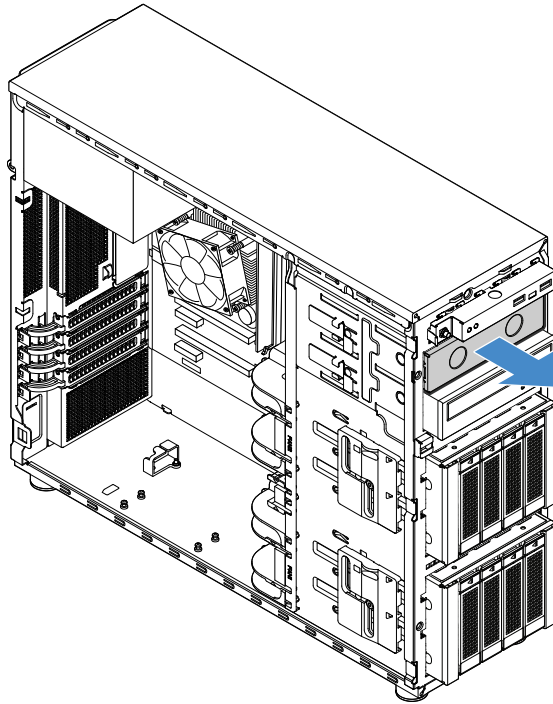


Figure 31. Removing the EMI shield for the upper optical drive bay

3. If needed, press the tabs and pivot the plastic shield outward to remove it.

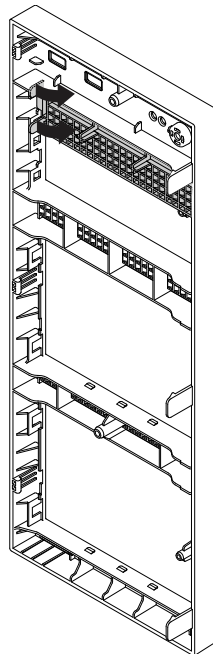


Figure 32. Removing the plastic shield

4. Hold the optical drive in correct orientation. Then, pivot the release button outward and slide it into the optical drive bay until it snaps into position.

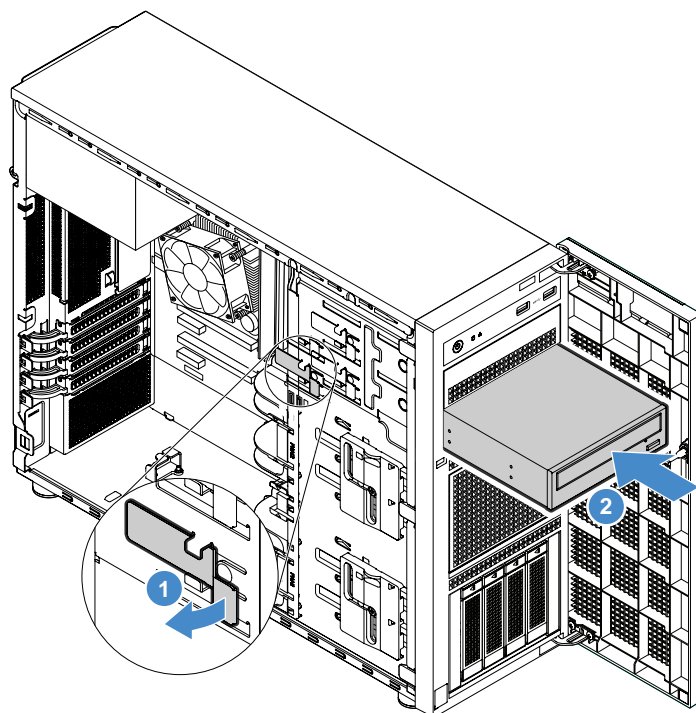


Figure 33. Installing the optical drive

5. Connect the power and signal cables from the optical drive to the system board.

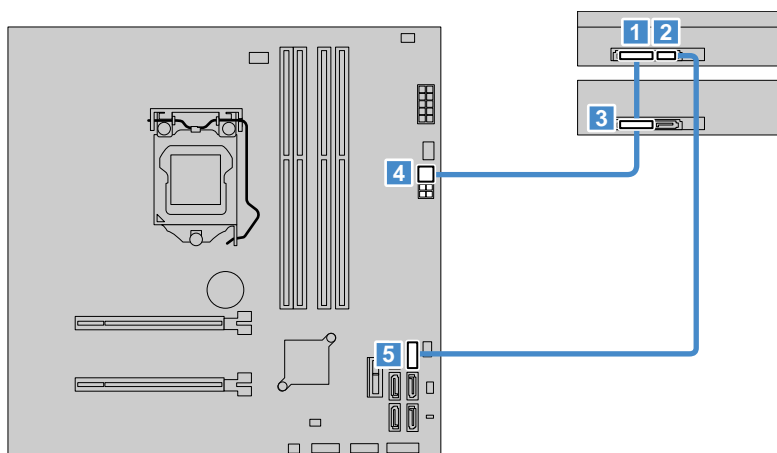


Figure 34. Connecting the power and signal cables from the optical drive to the system board

- 1** Power connector on the rear of the optical drive
- 2** SATA connector on the rear of the optical drive
- 3** Power connector on the rear of the tape drive
- 4** HDD power connector 2 on the system board
- 5** SATA connector on the system board

Non-hot-swap drive

This topic applies only to server models that support non-hot-swap drives. See “Features and specifications of your server” on page 7 for more information about the supported non-hot-swap drives.

- “Removing a non-hot-swap drive” on page 61
- “Installing a non-hot-swap drive” on page 63

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. The number of the installed HDDs in your server varies depending on the server model. The vacant bays are covered by an EMI-protective panel.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new non-hot-swap drive as soon as you remove the failing one.

HDD installation rules:

- Follow the order of the HDD drive bays when installing an HDD. See “Server components” on page 19 to locate the HDD bays in your server.
- For RAID configuration, the HDDs must be the same type with the same capacity if they are within a single RAID array. For more information, see “Configuring RAID” on page 41.
- For HDDs with different capacities, install the HDD by following the order of the HDD bays as well as the order from the lowest capacity to the highest capacity.

Removing a non-hot-swap drive

To remove a non-hot-swap drive, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Use the front door key to unlock the front door (available on some models), and then open the front door. The non-hot-swap drives are installed in the lower drive cage.
3. Remove the front system fan 1. See “Installing the front system fan 1” on page 87.
4. Locate the appropriate drive bay. Then, disconnect the SATA signal cable and the power cable from the rear of the non-hot-swap drive. See “Front view of the server” on page 13.
5. Use a screwdriver to turn the handle lock **1** to the unlocked position. The handle opens automatically.

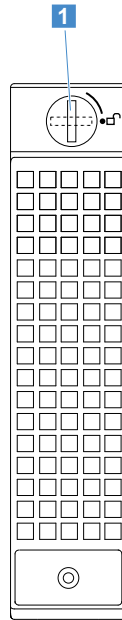
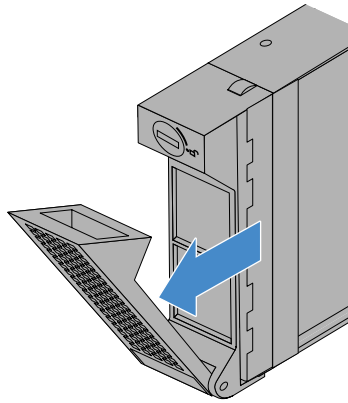


Figure 35. Opening the handle of the non-hot-swap drive or the dummy tray

6. Pull the handle and carefully slide the non-hot-swap drive or the dummy tray out of the front of the chassis.

Figure 36. Removing the non-hot-swap drive or the dummy tray



7. Remove the four screws and then remove the failing drive from the drive tray.

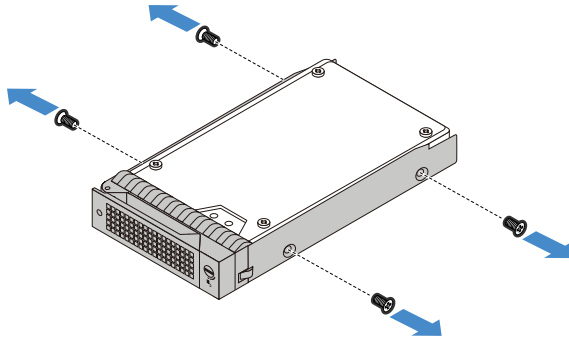


Figure 37. Removing the drive from the drive tray

8. Install a new non-hot-swap drive or dummy tray to cover the drive bay. See “Installing a non-hot-swap drive” on page 63.
9. If you are instructed to return the old non-hot-swap drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing a non-hot-swap drive

To install a non-hot-swap drive, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Use the front door key to unlock the front door (available on some models), and then open the front door.
3. Remove the front system fan 1. See “Installing the front system fan 1” on page 87.
4. Locate the appropriate non-hot-swap-drive bay. See “Front view of the server” on page 13.
5. Align the holes in the drive tray with the corresponding ones in the new non-hot-swap drive. Then, install the four screws to secure the drive to the drive tray.

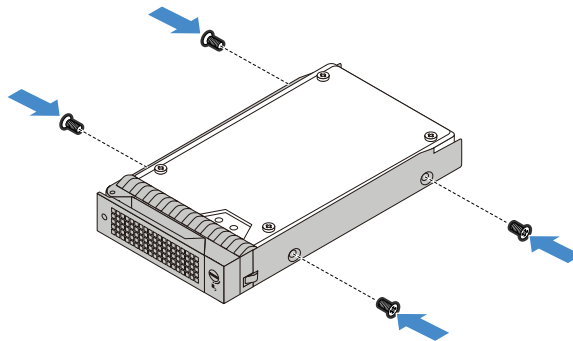


Figure 38. Installing the drive to the drive tray

6. Slide the new non-hot-swap drive into the drive bay until it snaps into position.

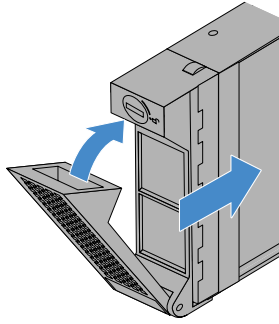


Figure 39. Installing the drive

7. Connect the SATA signal cable and power cable to the new non-hot-swap drive.

Tape drive

Your server supports RDX and LTO tape drives.

- “Removing a tape drive” on page 64
- “Installing a tape drive” on page 65

Removing a tape drive

To remove a tape drive, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Open the front door (available on some models).
3. Locate the upper optical drive bay. Then, disconnect the signal cable and the power cable from the rear of the tape drive.
4. Pivot the release button outward and push the tape drive from the rear until it is projected from the front of the chassis. Then, hold the tape drive and completely slide it out of the chassis.

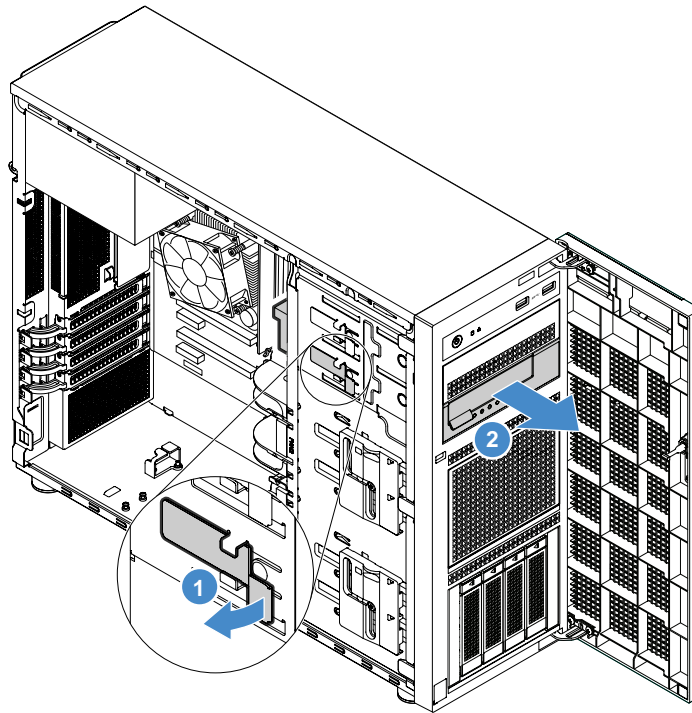


Figure 40. Removing the tape drive

5. 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 and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Open the front door (available on some models).
3. If needed, remove the old tape drive. See “Removing a tape drive” on page 64.
4. The tape drive must be installed into the lower optical drive bay. If the lower bay is covered by an EMI shield, remove the front bezel and the EMI shield. See “Removing the front bezel” on page 51 and “Installing the optical drive” on page 58
5. If needed, press the tabs and pivot the plastic shield outward to remove it.

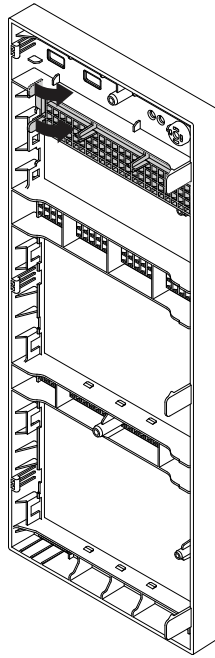


Figure 41. Removing the plastic shield

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

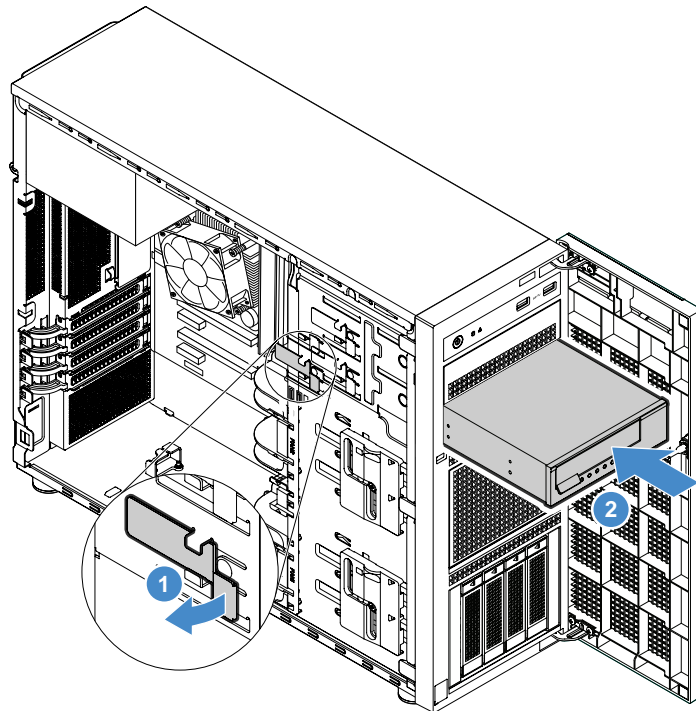


Figure 42. Installing the tape drive

7. Connect the power and signal cables from the tape drive to the system board.

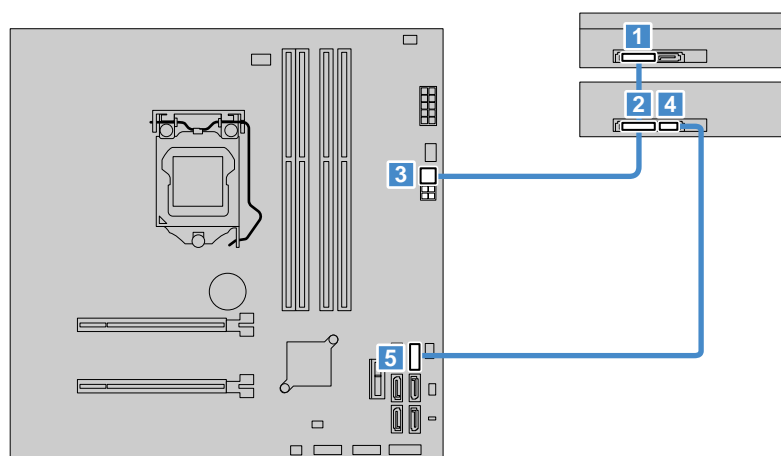


Figure 43. Connecting the power and signal cables from the tape drive to the system board

- 1** Power connector on the rear of the optical drive
- 2** Power connector on the rear of the tape drive
- 3** HDD power connector 2 on the system board
- 4** SATA connector on the rear of the RDX tape drive
- 5** USB 2.0 connector on the system board

Note: For the LTO tape drive, connect the signal cable to the connector **4** on the LTO tape drive. Then, connect the other end of signal cable to the connector on the RAID card.

8. Save the removed EMI-protective shield from the chassis and plastic shield from the front bezel in case you later remove the drive and need the shields to cover the drive bay.

Solid-state drive (2.5-inch)

You can install or remove a hot-swap SSD without turning off the server, which helps you avoid significant interruption to the operation of the system.

- “Removing a 2.5-inch SSD from a 3.5-inch HDD bay” on page 68
- “Installing a 2.5-inch SSD into a 3.5-inch HDD bay” on page 69

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. The number of the installed HDDs or SSDs in your server varies depending on the server model. The vacant bays are occupied by dummy trays. When you install a hot-swap HDD or SSD, save the removed dummy tray from the drive bay in case you later remove the hot-swap HDD or SSD and need the dummy tray to cover the place.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new hot-swap HDD or SSD as soon as you remove the failing one or the dummy tray.

Before you begin, review the following SSD installation rules:

- Follow the order of the HDD bays when installing an SSD. See “Front view of the server” on page 13 to locate the HDD bays in your server.

- For RAID configuration, the SSDs must be the same type with the same capacity if they are within a single RAID array. For more information, see “Configuring RAID” on page 41.
- For SSDs with different capacities, install the SSD by following the order of the HDD bays as well as the order from the lowest capacity to the highest capacity.

Removing a 2.5-inch SSD from a 3.5-inch HDD bay

To remove a 2.5-inch SSD, do the following:

1. Use the front door key to unlock the front door (available on some models), and then open the front door.
2. Locate the appropriate HDD bay. See “Front view of the server” on page 13.
3. Remove the 3.5-inch drive bracket with the SSD. See “Removing a hot-swap drive” on page 71.
4. Remove the five screws that secure the SSD and the drive adapter. Then, remove the SSD and the drive adapter from the bracket.

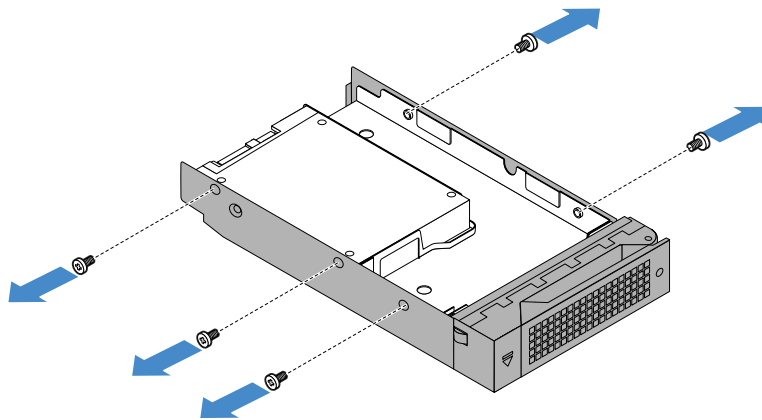


Figure 44. Removing the screws that secure the SSD and the drive adapter

5. Remove the two screws that secure the SSD. Then, lift the SSD up to remove it from the drive adapter.

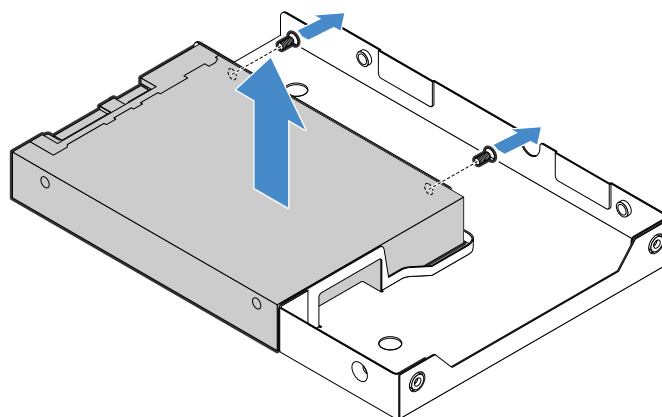


Figure 45. Removing the SSD from the drive adapter

6. Install a new SSD. See “Installing a 2.5-inch SSD into a 3.5-inch HDD bay” on page 69.
7. If you are instructed to return the old solid-state drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing a 2.5-inch SSD into a 3.5-inch HDD bay

To install a 2.5-inch SSD into a 3.5-inch HDD bay, do the following:

1. Use the front door key to unlock the front door (available on some models), and then open the front door.
2. Locate the appropriate HDD bay. See “Front view of the server” on page 13.
3. Remove the 3.5-inch drive bracket with the SSD or dummy tray. See “Removing a hot-swap drive” on page 71.
4. Position the 2.5-inch SSD into the 3.5-inch to 2.5-inch drive adapter as shown in the following illustration.

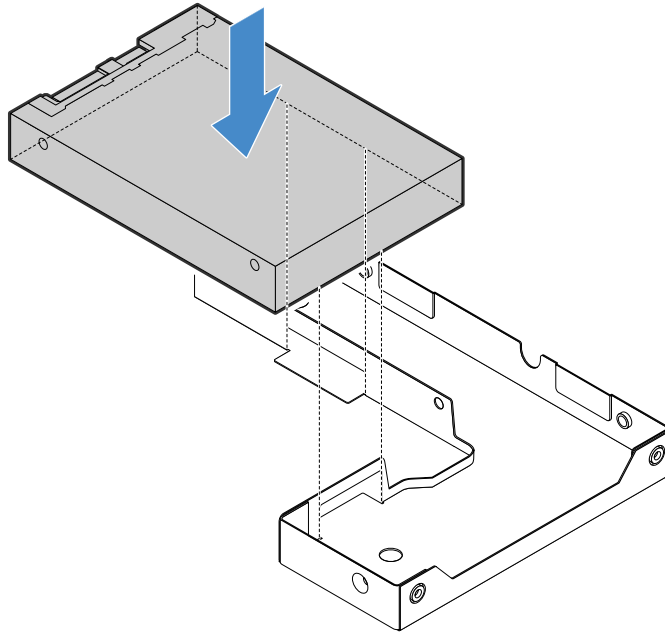


Figure 46. Positioning the 2.5-inch SSD into the drive adapter

5. Align the two screw holes in the SSD with the corresponding holes in the drive adapter. Then, install the two screws to secure the SSD to the drive adapter.

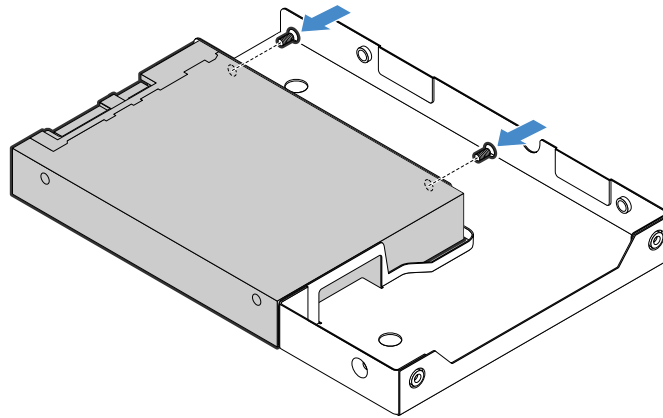


Figure 47. Installing the screws to secure the SSD to the drive adapter

6. Position the drive adapter with the SSD into the 3.5-inch drive bracket. Align the screw holes in the drive adapter and the SSD with the corresponding holes in the bracket. Then, install the five screws to secure the drive adapter and the SSD into the bracket.

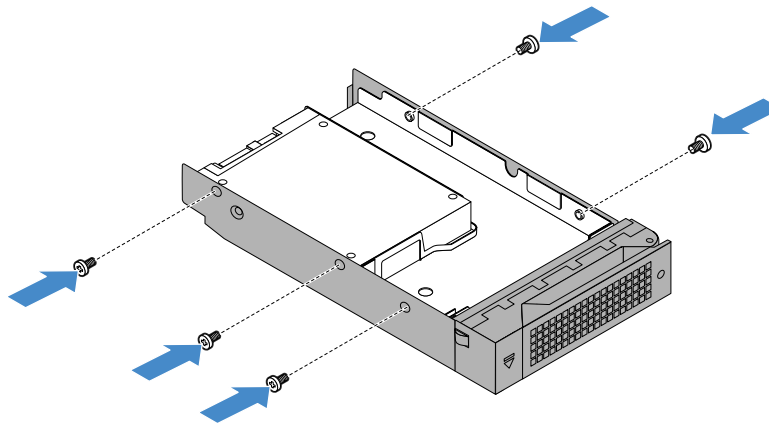


Figure 48. Installing the screws to secure the drive adapter and the SSD to the bracket

7. Slide the bracket with the SSD into the drive bay from the front until it snaps into position and then completely close the handle. See “Installing a hot-swap drive” on page 72.
8. Check the HDD status LEDs to ensure that the SSD is operating properly. You might have to restart the server for the newly installed SSD to be recognized. See “Hot-swap drive activity and status LEDs” on page 21. If the SSD is faulty, reinstall or replace it until it is operating properly.
9. Save the removed dummy tray in case you later remove the solid-state drive and need a dummy tray to cover the drive bay.

Hot-swap drive

You can install or replace a hot-swap drive without turning off the server, which helps you avoid significant interruption to the operation of the system.

- “Removing a hot-swap drive” on page 71

- “Installing a hot-swap drive” on page 72

The EMI integrity and cooling of the server are protected by having all drive bays covered or occupied. The number of the installed drives in your server varies depending on the server model. The vacant bays are either covered by an EMI-protective panel or occupied by dummy trays. When installing a drive, save the removed dummy tray in case that you later remove the drive and need the dummy tray to cover the place.

Attention: An unoccupied drive bay without any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage. To maintain the EMI integrity and cooling of the server, install a new drive as soon as you remove the failing one or the dummy tray.

Hot-swap drive installation rules

- When you install drives, follow the order of the drive bay numbers. See “Front view of the server” on page 13 to locate the drive bays in your server.
- For RAID configuration, the drives must be the same type with the same capacity if they are within a single RAID array. For more information, see “Configuring RAID” on page 41.

Removing a hot-swap drive

To remove a hot-swap drive, do the following:

1. Use the front door key to unlock the front door (available on some models), and then open the front door.
2. Locate the drive you want to remove and press the release button **1** to open the handle of the drive.

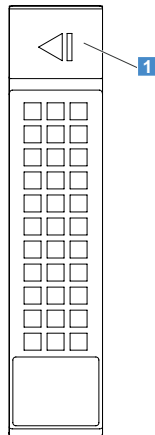


Figure 49. Opening the handle of a drive

3. If you are removing a dummy tray, locate the appropriate drive bay. Then, press the circled area **1** to open the handle of the dummy tray.

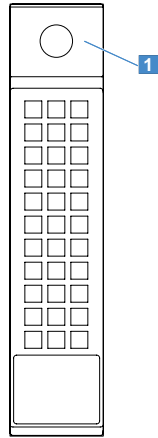


Figure 50. Opening the handle of a dummy tray

4. Pull the handle and carefully slide the drive or the dummy tray out of the chassis. Save the removed dummy tray in case that you later remove the drive and need a dummy tray to cover the drive bay.

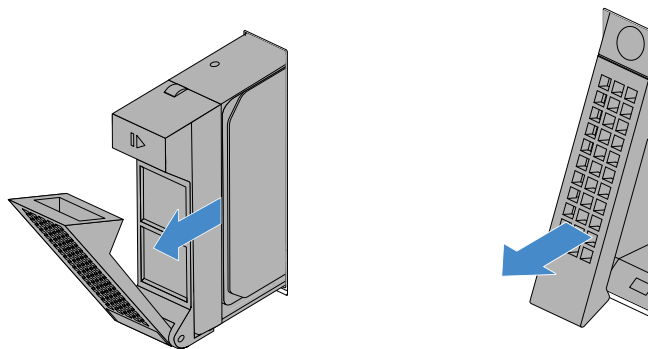


Figure 51. Removing the drive or dummy tray

5. Install a new drive or a dummy tray to cover the drive bay. See “Installing a hot-swap drive” on page 72.
6. 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.
7. Close and lock the front door.

Installing a hot-swap drive

To install or replace a hot-swap drive, do the following:

1. Use the front door key to unlock the front door (available on some models), and then open the front door.
2. Remove a drive or a dummy tray. See “Removing a hot-swap drive” on page 71.
3. Slide the new drive into the drive bay until it snaps into position. Then, completely close the handle.

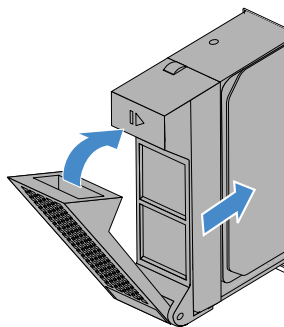


Figure 52. Installing the drive

4. Check the drive status LEDs to ensure that the drive is operating properly. You might have to restart the server for the newly installed drive to be recognized. See “Hot-swap drive activity and status LEDs” on page 21. If the drive is faulty, reinstall it until it is operating properly.
5. Close and lock the front door.

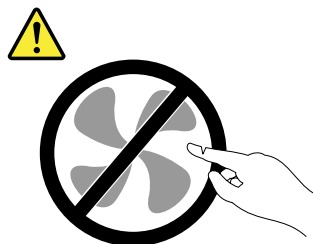
Hot-swap power supply

The hot-swap power supplies help you avoid significant interruption to the operation of the system when a power supply fails. You can install or replace a power supply without turning off the server.

- “Removing a hot-swap power supply” on page 74
- “Installing a hot-swap power supply” on page 74

CAUTION:

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



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.

Note: To maintain the EMI integrity and cooling of the server, install a new hot-swap redundant power supply as soon as you remove the failing one or cover the other bay with a shield if you use one power supply to provide power.

Removing a hot-swap power supply

To remove a hot-swap redundant power supply, do the following:

1. Locate the failing power supply in the rear of your server and disconnect the power cord from the failing hot-swap redundant power supply.
2. Press the release tab in the direction as shown and carefully pull the handle at the same time to slide the failing hot-swap power supply out of the chassis.

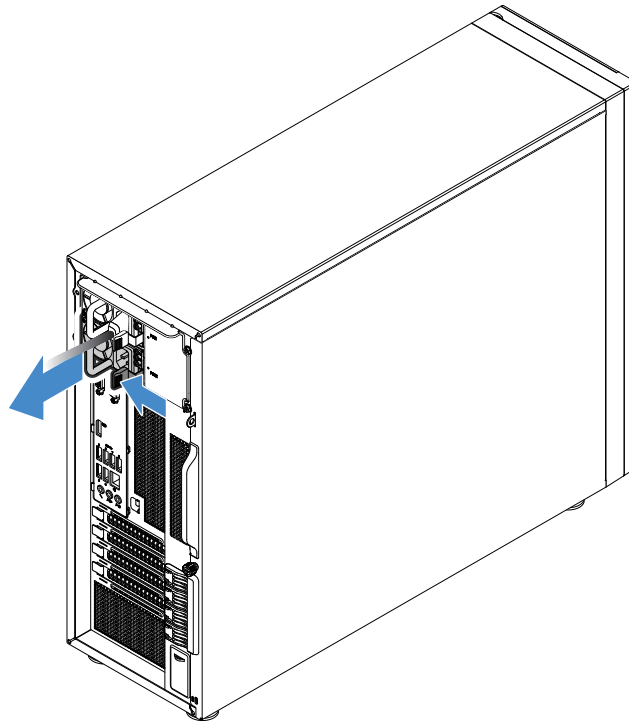


Figure 53. Removing a hot-swap redundant power supply

3. If you are instructed to return the old hot-swap power supply, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing a hot-swap power supply

To install a hot-swap power supply, do the following:

1. Do one of the following:
 - If you are replacing a failed hot-swap power supply, remove a hot-swap power supply. See “Removing a hot-swap power supply” on page 74.
 - If you are installing a second hot-swap power supply to the server, remove the EMI shield first. Insert two fingers into the holes in the EMI shield and carefully pull the EMI shield out of the chassis. Store the shield in case you later remove the power supply and need the shield to cover the bay.

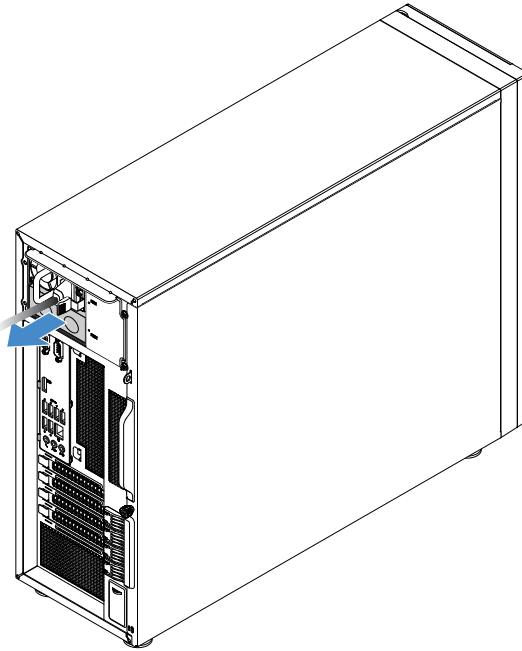


Figure 54. Removing the protective shield for the power supply bay

2. Note the orientation of the hot-swap power supply, and then slide it into the chassis until it snaps into position.

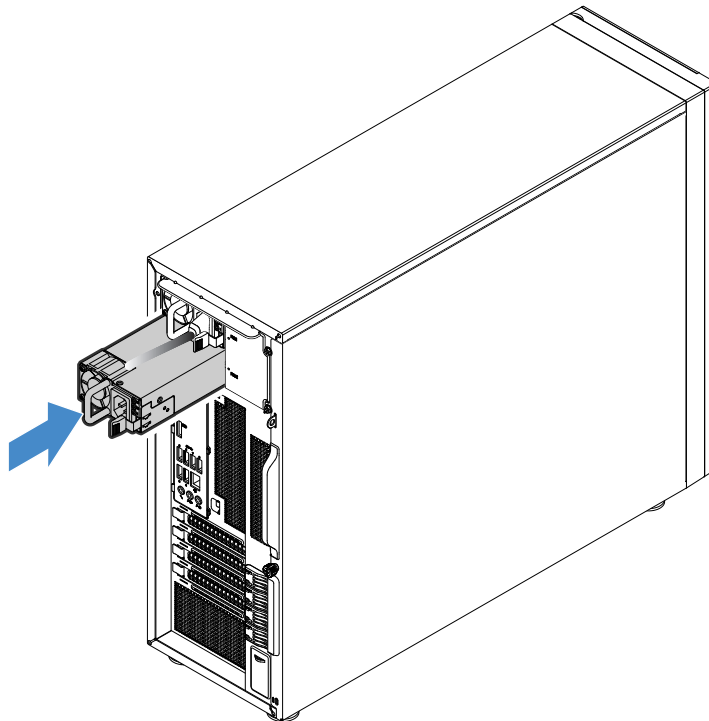


Figure 55. Installing a hot-swap power supply

3. Check the status LED near the power cord connector. For information about the status LEDs, see “Hot-swap power supply status LEDs” on page 24.

Power conversion board

- “Removing the power conversion board” on page 76
- “Installing the power conversion board” on page 76

Removing the power conversion board

To remove the power conversion board, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Locate the power conversion board. Then, disconnect the power cables from the power conversion board.
3. Remove the screw that secures the power conversion board. Then, slide the power conversion board to the front of the chassis until it is released from the retention posts on the chassis, and then carefully remove the board out of the chassis.

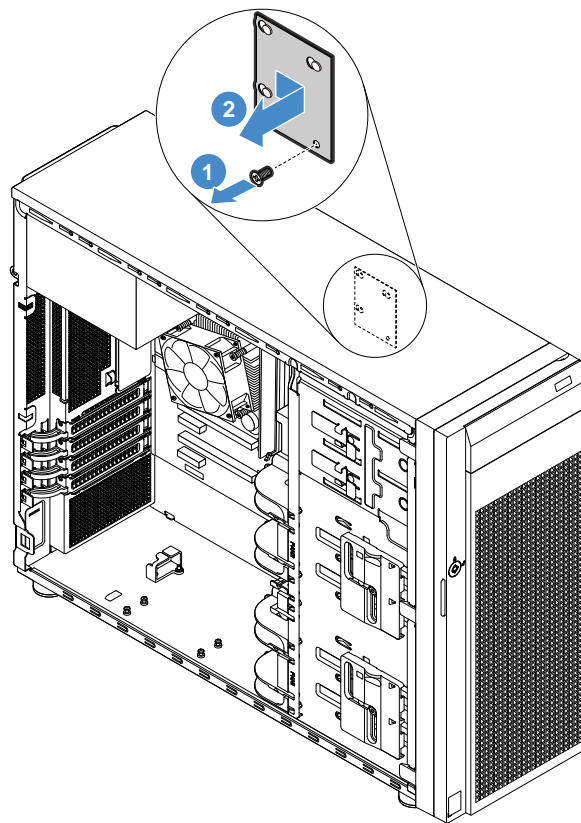


Figure 56. Removing the power conversion board

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

Installing the power conversion board

To install the power conversion board, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Remove the power conversion board. See “Removing the power conversion board” on page 76.

3. Position the new power conversion board into the chassis so that the three retention posts on the chassis pass through the corresponding holes in the power conversion board. Then, slide the new power conversion board to the rear of the chassis until the power conversion board is securely seated. Ensure that the screw hole in the new power conversion board is aligned with the mounting stud on the chassis. Then, install the screw to secure the new power conversion board in place.

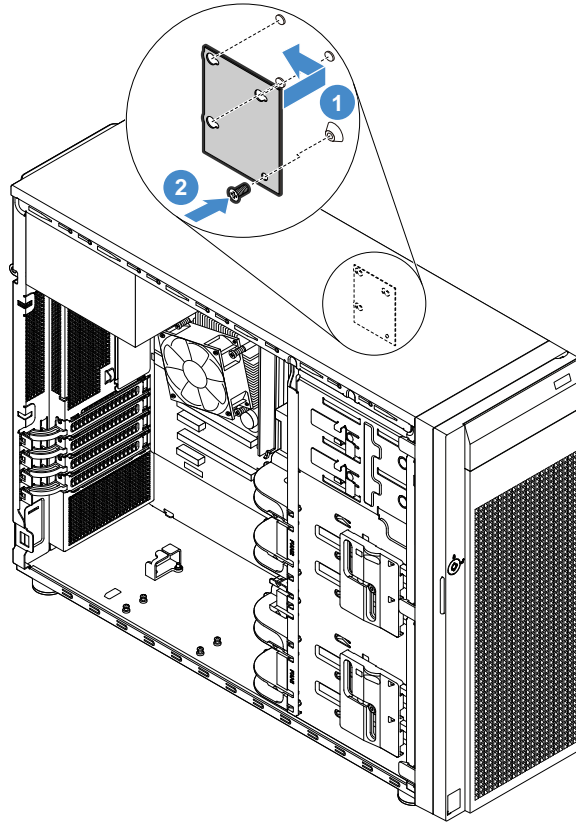


Figure 57. Installing the power conversion board

4. Connect the power cables to the new power conversion board.

Backplane

This topic applies only to server models that have hot-swap HDDs installed.

- “Removing the backplane” on page 77
- “Installing the backplane” on page 79
- “Connecting cables for the backplane” on page 80

Notes:

- The backplane is sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 48 first and carefully perform the operation.
- The removing or installing procedure is based on the backplane for up to four 3.5-inch drives. The procedure is similar if your server is installed with the backplane for up to eight 2.5-inch drives.

Removing the backplane

To remove the backplane, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Remove the front bezel. See “Removing the front bezel” on page 51.
3. Remove the front system fan 1. See “Removing the front system fan 1” on page 86.
4. Remove all the installed hot-swap HDDs and dummy trays (if any) from the HDD cage, then disconnect all the cables from the backplane. See “Removing a hot-swap drive” on page 71.
5. Lift the release latch and slide the HDD cage out of the chassis.

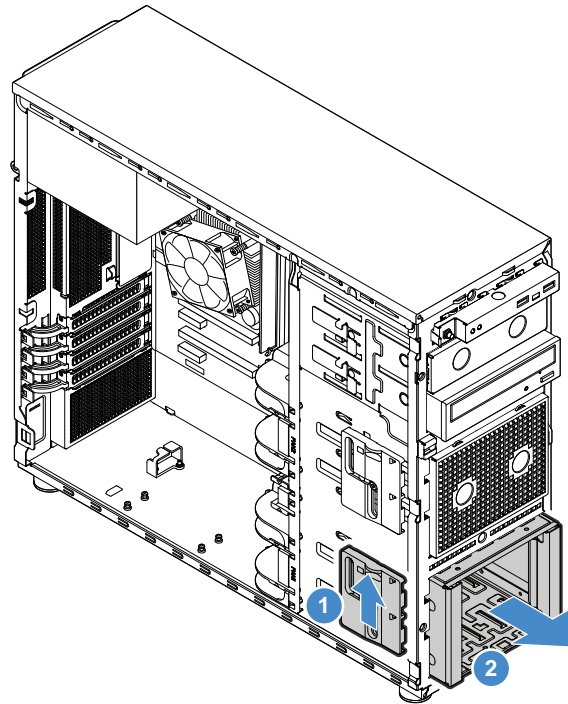


Figure 58. Removing the HDD cage

6. Open the plugger that secures the backplane, carefully lift the backplane a little bit up to release it from the HDD cage, and then remove the backplane.

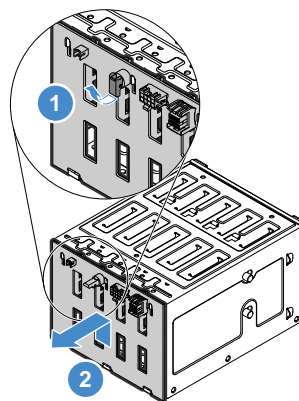


Figure 59. Removing the backplane

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

Installing the backplane

To install the backplane, do the following:

1. Remove the backplane. See “Removing the backplane” on page 77.
2. Position the new backplane on the HDD cage so that the tabs on the HDD cage are inserted into the corresponding holes in the new backplane. Then, move the backplane in the direction downward, and then close the plugger to secure the backplane into position.

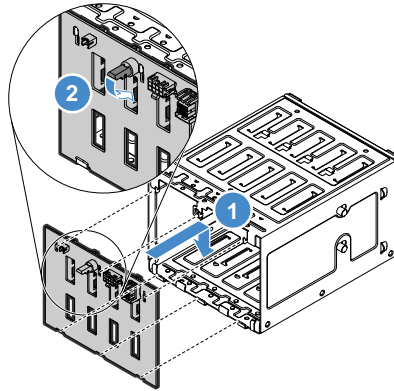


Figure 60. Installing the backplane to the HDD cage

3. Slide the HDD cage into the chassis from the front until it snaps into position.

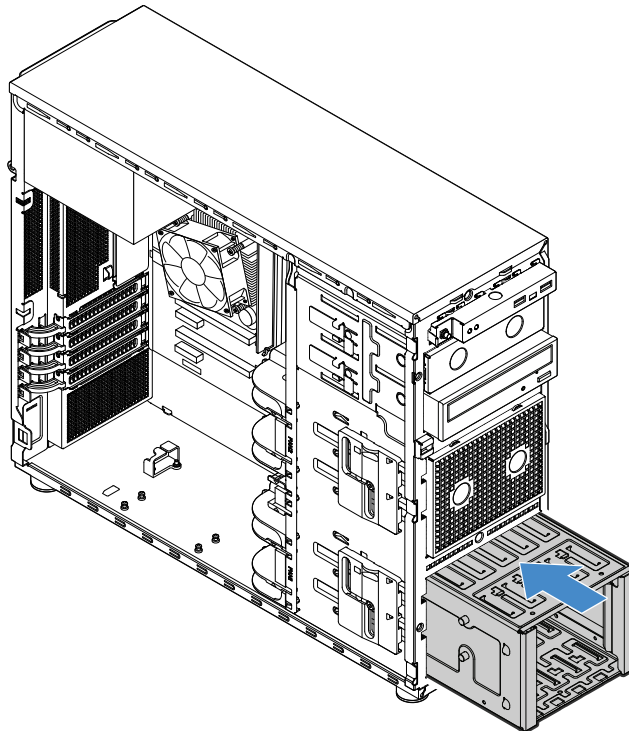


Figure 61. Installing the HDD cage

4. Reinstall all the hot-swap HDDs and dummy trays (if any) in the HDD cage. See “Installing a hot-swap drive” on page 72.
5. Reconnect the cables to the backplane. Refer to the cable connection in the following pages.

Connecting cables for the backplane

Connecting cables for server models with one backplane installed (supporting up to four SATA hot-swap HDDs)

For this server configuration, you can use the mini-SAS signal cable that has four SATA connectors and one SGPIO connector for cable connection. To connect cables, do the following:

1. Use a power cable to connect the connector on the backplane and the HDD power connector on the system board.
2. Connect the signal cable as shown.

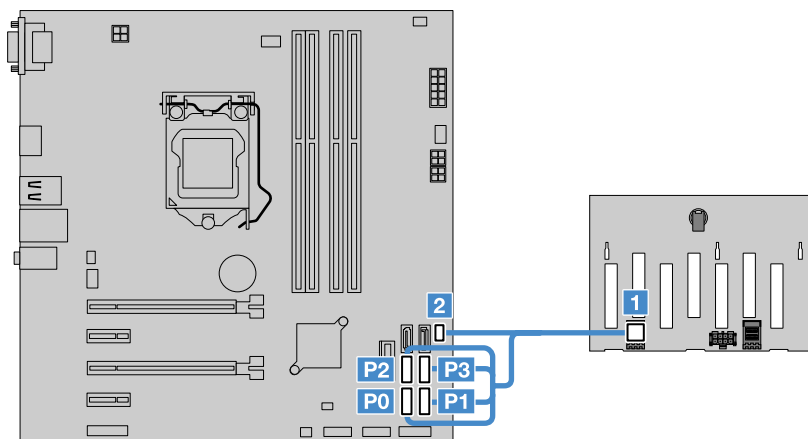


Figure 62. Connecting signal cables from backplane to the system board

- 1** Mini-SAS signal cable connector 0 on the backplane
- 2** SATA SGPIO connector on the system board
- P0** Connect connector P0 to the SATA connector 0 on the system board
- P1** Connect connector P1 to the SATA connector 1 on the system board
- P2** Connect connector P2 to the SATA connector 2 on the system board
- P3** Connect connector P3 to the SATA connector 3 on the system board

Connecting cables for server models with two backplanes installed

To connect cables, do the following:

1. Connect signal cables for servers with two backplanes by doing one of the following:
 - For server models with two 3.5-inch backplanes and a RAID card, use two mini-SAS signal cables to connect the mini-SAS connectors on the backplane and the ports on the RAID card.

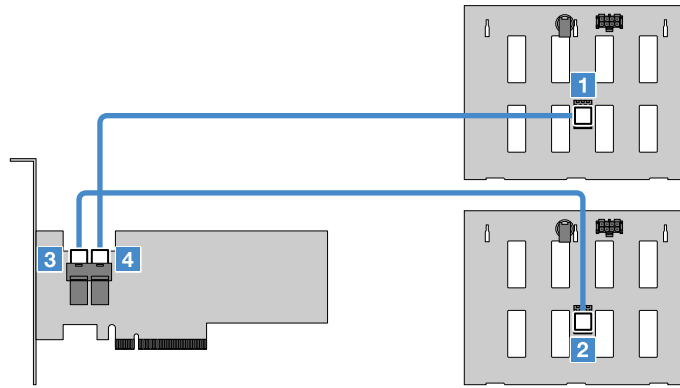


Figure 63. Connecting signal cables from the backplanes to the RAID card

- 1** Mini-SAS signal cable connector on the backplane on the upper HDD cage
- 2** Mini-SAS signal cable connector on the backplane on the lower HDD cage
- 3** Connector 0 on the RAID card
- 4** Connector 1 on the RAID card

- For server models with two 2.5-inch backplanes and an expander card, use mini-SAS signal cables to connect the mini-SAS connectors on the backplane and expander card. See “Lenovo ThinkServer SAS 12G Expander PCIe Card” on page 26.
 - For server models with one 3.5-inch and one 2.5-inch backplanes and an expander card, use mini-SAS signal cables to connect the mini-SAS connectors on the backplane and expander card. See “Lenovo ThinkServer SAS 12G Expander PCIe Card” on page 26.
2. Use a power cable to connect the power connector on the backplane on the lower HDD cage and the HDD power connector on the system board.
 3. Use the other power cable to connect the power connector on the backplane on the upper HDD cage and the power connector on the power distribution board or on the power conversion board.

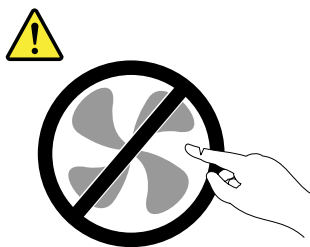
Non-hot-swap power supply

This topic applies only to server models that come with a non-hot-swap power supply.

- “Removing the non-hot-swap power supply” on page 82
- “Installing the non-hot-swap power supply” on page 82

CAUTION:

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



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 non-hot-swap power supply

To remove the non-hot-swap power supply, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Disconnect cables from the non-hot-swap power supply.
3. Remove the four screws at the rear of the chassis that secure the power supply, and then push the power supply from the rear until it is released from the metal retaining tab. Then, carefully lift it out of the chassis.

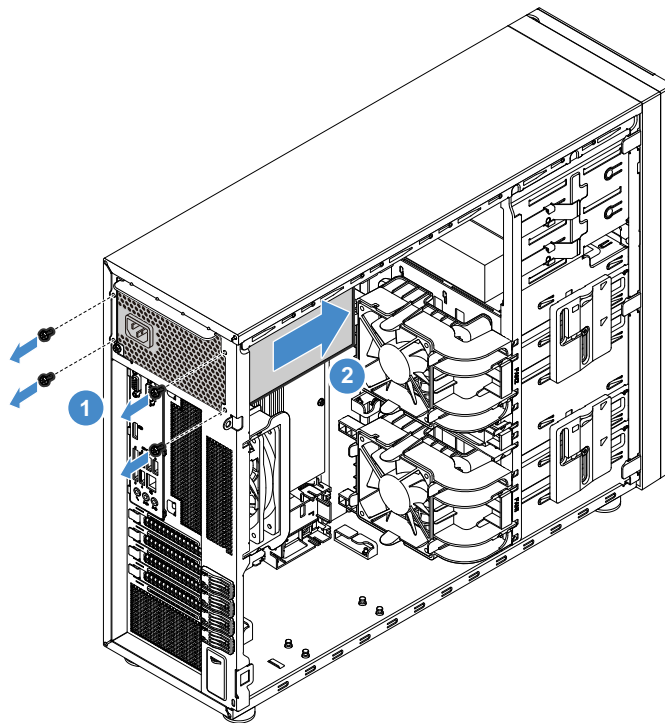


Figure 64. Removing the non-hot-swap power supply

4. If you are instructed to return the old non-hot-swap power supply, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the non-hot-swap power supply

To install the non-hot-swap power supply, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.

2. If needed, remove the non-hot-swap power supply. See “Removing the non-hot-swap power supply” on page 82.
3. Install the new non-hot-swap power supply into the chassis so that the four screw holes in the new non-hot-swap power supply are aligned with the corresponding holes in the rear of the chassis. Then, install the four screws to secure the new non-hot-swap power supply in place.

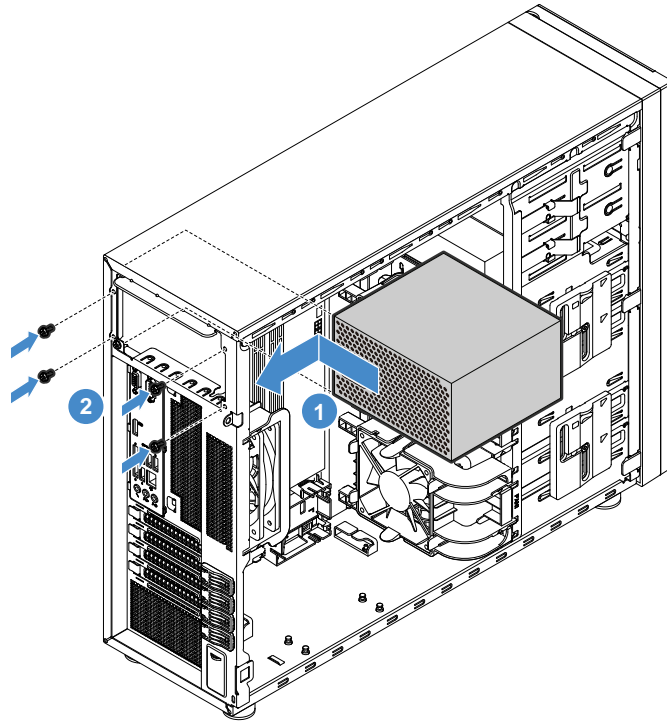


Figure 65. Installing the non-hot-swap power supply

4. Connect cables to the new non-hot-swap power supply. Then, properly route the cables and secure the cables with the cable clips and ties in the chassis.

Intrusion switch

This topic applies only to server models that have the intrusion switch installed.

- “Removing the intrusion switch” on page 83
- “Installing the intrusion switch” on page 84

Removing the intrusion switch

To remove the intrusion switch, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Locate the intrusion switch. Then, disconnect the cable from the intrusion switch.
3. Press the two tabs on the intrusion switch towards each other and carefully push the intrusion switch outward at the same time to remove it from the frame.

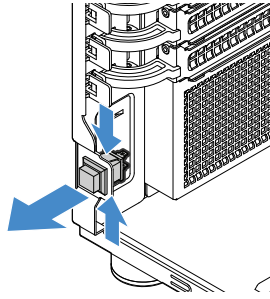


Figure 66. Removing the intrusion switch

Installing the intrusion switch

To install the intrusion switch, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. If needed, remove the old intrusion switch. See “Removing the intrusion switch” on page 83.
3. Insert the tab on the intrusion switch frame into the corresponding hole in the chassis until the intrusion switch is securely seated.

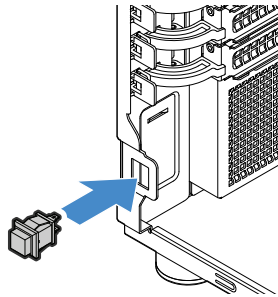


Figure 67. Installing the intrusion switch

4. Connect the cable of the new intrusion switch to the system board. See “System board components” on page 28.

Front panel board assembly

- “Removing the front panel board assembly” on page 84
- “Installing the front panel board assembly” on page 85

Note: The front panel board assembly is sensitive to ESD. Ensure that you read and understand “Handling static-sensitive devices” on page 48 first and carefully perform the operation.

Removing the front panel board assembly

To remove the front panel board assembly, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Remove the front bezel. See “Removing the front bezel” on page 51.
3. Locate the front panel board assembly and disconnect cables from the system board. See “Server components” on page 19.

4. Press the release tab in the direction as shown and push the front panel board assembly from the rear until it is projected from the chassis. Then, carefully remove the front panel board assembly from the chassis and pull the cables out of the chassis.

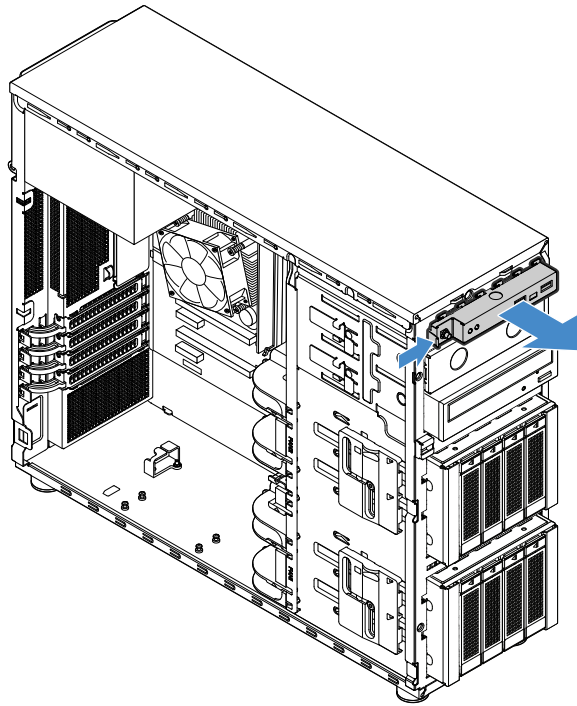


Figure 68. Removing the front panel board assembly

5. Disconnect cables from the front panel board assembly. Then, install a new front panel board assembly. See “Installing the front panel board assembly” on page 85.
6. If you are instructed to return the old front panel board assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the front panel board assembly

To install the front panel board assembly, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Remove the front bezel. See “Removing the front bezel” on page 51.
3. Connect cables to the new front panel board assembly and route cables through the corresponding hole in the chassis. Then, slide the new front panel board assembly into the chassis until it snaps into position.

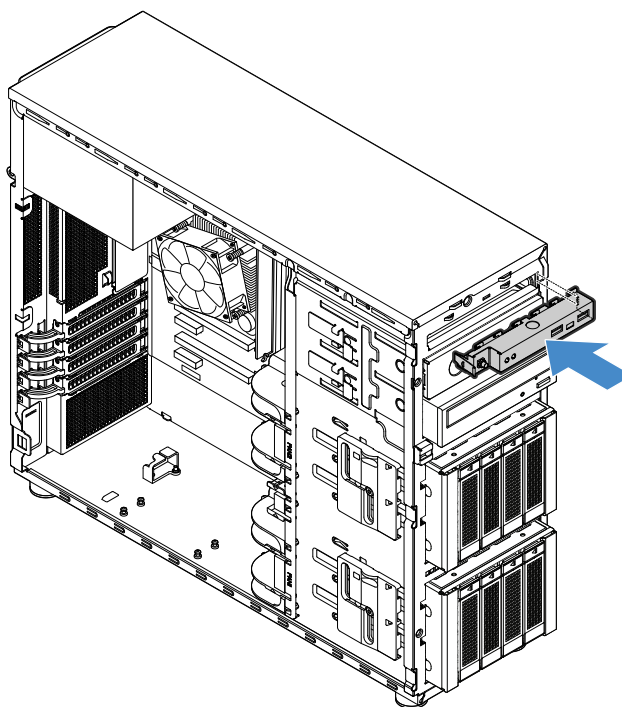


Figure 69. Installing the front panel board assembly

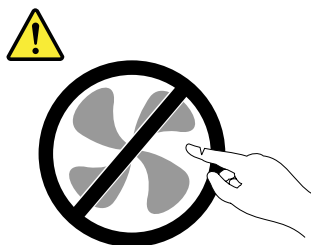
4. Connect cables to the front panel connector, front USB 3.0 connector, and the HDD LED connectors on the system board separately. See “System board components” on page 28.

Front system fan

- “Removing the front system fan 1” on page 86
- “Installing the front system fan 1” on page 87

CAUTION:

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



Removing the front system fan 1

To remove the front system fan 1, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Locate the front system fan 1. Then, disconnect the front system fan 1 cable from the front system fan 1 connector on the system board. See “System board components” on page 28.
3. Press the two tabs of the front system fan 1 towards each other and carefully slide the front system fan 1 out of the chassis simultaneously.

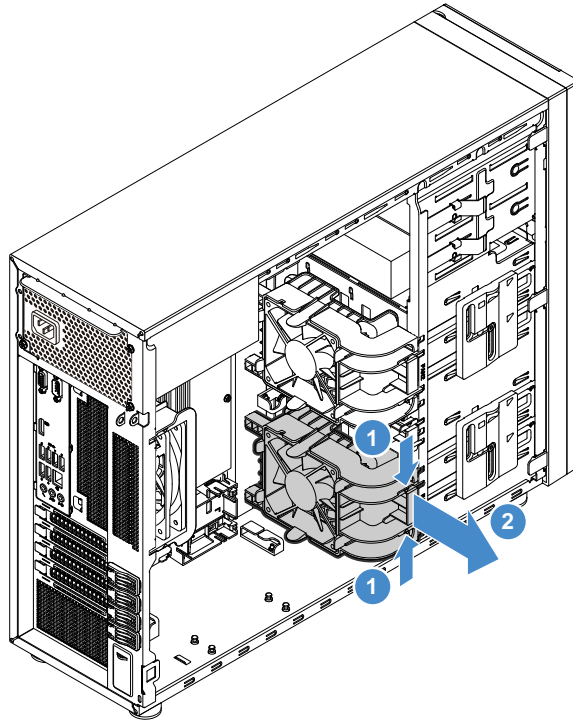


Figure 70. Removing the front system fan 1

4. If you are instructed to return the old front system fan 1, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the front system fan 1

To install the front system fan 1, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. If needed, remove the old front system fan 1. See “Removing the front system fan 1” on page 86.
3. Position the new front system fan 1 into the chassis so that the two tips **1** are aligned with the corresponding holes in the mounting area. Meanwhile, ensure that the two posts **2** of the front system fan 1 are aligned with the corresponding holes in the inner side of the chassis. Then, carefully slide the front system fan 1 into the chassis until it snaps into position.

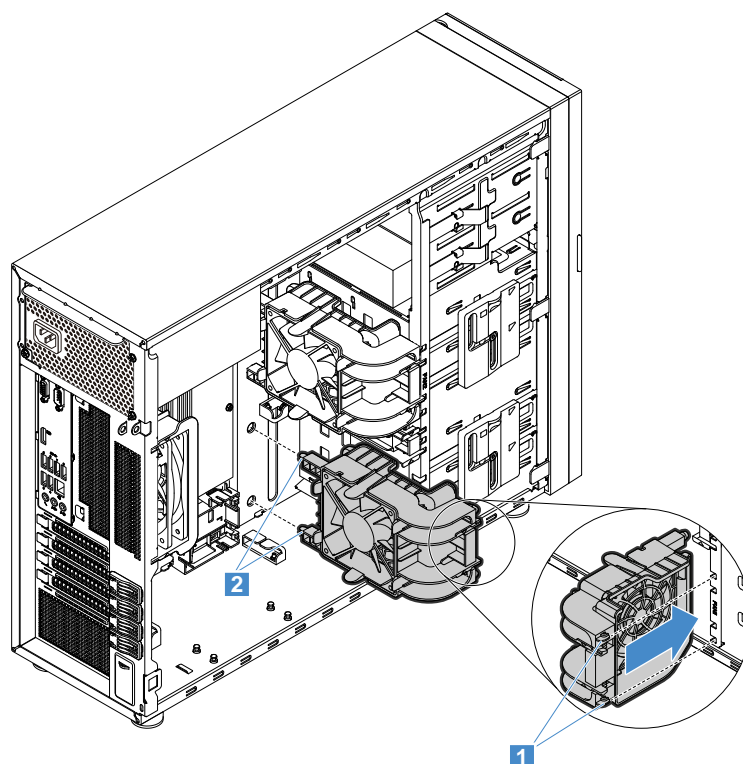


Figure 71. Installing the front system fan 1

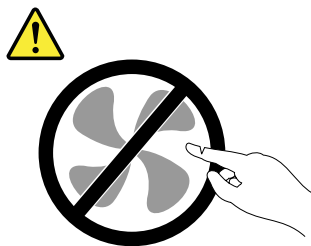
4. Connect the new front system fan 1 cable to the front system fan 1 connector on the system board. See “System board components” on page 28.

Rear system fan

- “Removing the rear system fan” on page 88
- “Installing the rear system fan” on page 89

CAUTION:

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



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

Removing the rear system fan

To remove the rear system fan, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Locate the rear system fan. Then, disconnect the rear system fan cable from the rear system fan connector on the system board. See “System board components” on page 28.

3. Press the two tabs of the rear system fan towards each other and carefully slide the rear system fan out of the chassis simultaneously.

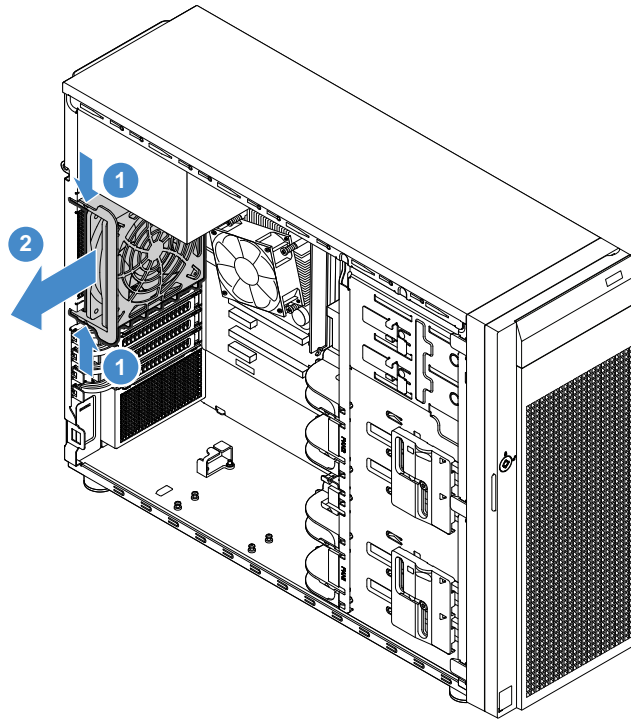


Figure 72. Removing the rear system fan

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

Installing the rear system fan

To install the rear system fan, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. If needed, remove the rear system fan. See “Removing the rear system fan” on page 88.
3. Position the new rear system fan into the chassis so that the two tips on the rear system fan are aligned with the corresponding holes in the mounting area. Then, carefully slide the rear system fan into the chassis until it snaps into position.

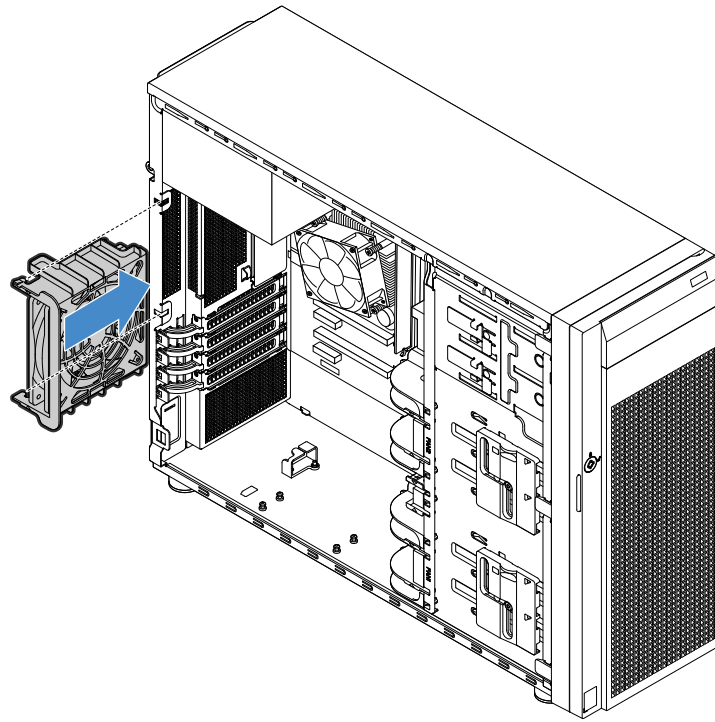


Figure 73. Installing the rear system fan

4. Connect the new rear system fan cable to the rear system fan connector on the system board. See “System board components” on page 28.

Heat sink and fan assembly

- “Removing the heat sink and fan assembly” on page 90
- “Installing the heat sink and fan assembly” on page 91

CAUTION:



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

Removing the heat sink and fan assembly

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

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Locate the heat sink and fan assembly. Then, disconnect the cable of the heat sink and fan assembly from the CPU fan connector on the system board. See “Server components” on page 19.

Note: If there is any PCIe card installed on the system board, it might block your access to the heat sink and fan assembly. In this case, remove the PCIe card. See “Removing a PCIe card” on page 54.

4. Remove the four screws that secure the heat sink and fan assembly to the system board. It is recommended that you carefully remove the four screws from the system board using the following method to avoid any possible damage to the system board.
 - a. Partially remove screw **1**, then completely remove screw **2**, and then return to screw **1** and completely remove it.
 - b. Partially remove screw **3**, then completely remove screw **4**, and then return to screw **3** and completely remove it.

Note: The four screws are integrated parts of the heat sink and fan assembly. Do not try to remove the four screws from the heat sink and fan assembly.

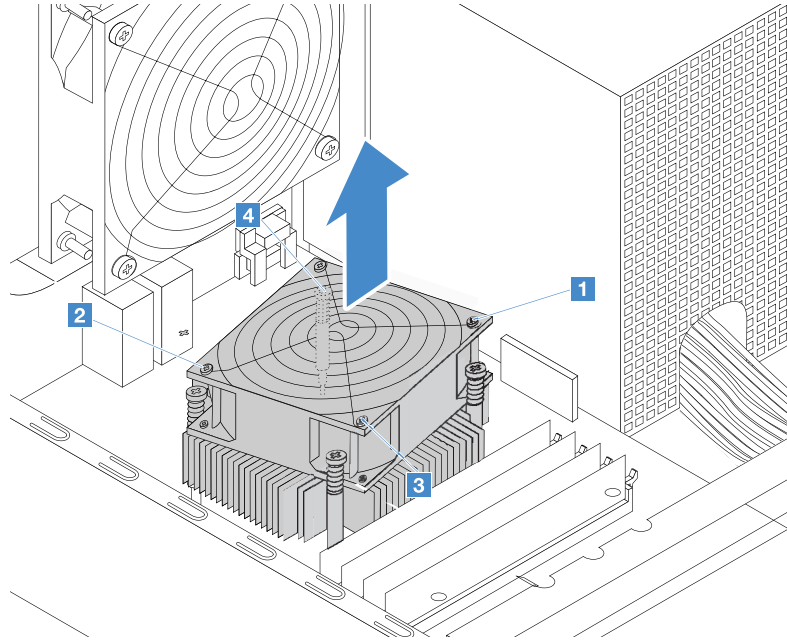


Figure 74. Removing the screws that secure the heat sink and fan assembly

5. Gently twist the heat sink and fan assembly to free it from the CPU, and then lift the heat sink and fan assembly off the system board.
6. If you are instructed to return the old heat sink and fan assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the heat sink and fan assembly

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

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. If needed, remove the heat sink and fan assembly from the system board. See “Removing the heat sink and fan assembly” on page 90.

Notes:

- When handling the heat sink and fan assembly, do not touch the thermal grease on the bottom of it.
- Before installing the new heat sink and fan assembly, use the cleaning pad that comes with the new heat sink and fan assembly to wipe the thermal grease from the top of the CPU. Dispose of the cleaning pad after all thermal grease is removed from the CPU.

4. Place the new heat sink and fan assembly on the system board so that screws on the new heat sink and fan assembly are inserted into the corresponding holes on the system board. Note the orientation of the new heat sink and fan assembly and ensure that you properly place it so that you can easily connect the heat sink and fan assembly cable to the CPU fan connector on the system board.
5. Install the four screws to secure the new heat sink and fan assembly on the system board. It is recommended that you carefully install the four screws using the following method to avoid any possible damage to the system board.
 - a. Partially tighten screw **1**, then firmly tighten screw **2**, and then return to screw **1** and firmly tighten it. Do not over-tighten the screws.
 - b. Partially tighten screw **3**, then firmly tighten screw **4**, and then return to screw **3** and firmly tighten it. Do not over-tighten the screws.

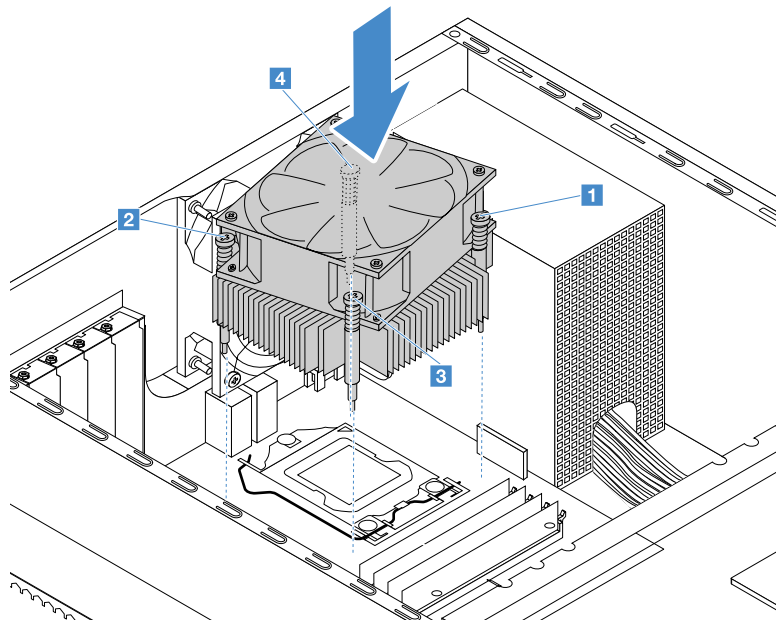


Figure 75. Installing the screws to secure the heat sink and fan assembly and the backplane

6. Connect the heat sink and fan assembly cable to the CPU fan connector on the system board. See “System board components” on page 28.

Note: If the heat sink and fan assembly cable is long, loosely wrap it.

Secure digital module

The SD module provides an easy way for data storage. You can install two SD cards into the SD module.

- “Removing the SD module” on page 92
- “Installing the SD module” on page 94

Note: If you remove the SD module, you cannot install SD cards into your server for storage.

Removing the SD module

To remove the SD module, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.

2. Locate the SD module. Then, disconnect the SD module cable from the system board. See “System board components” on page 28.
3. Press the tab on the chassis and move the SD module assembly as shown at the same time. Then, remove the SD module assembly out of the chassis.

Note: Carefully handle the SD module by its edges.

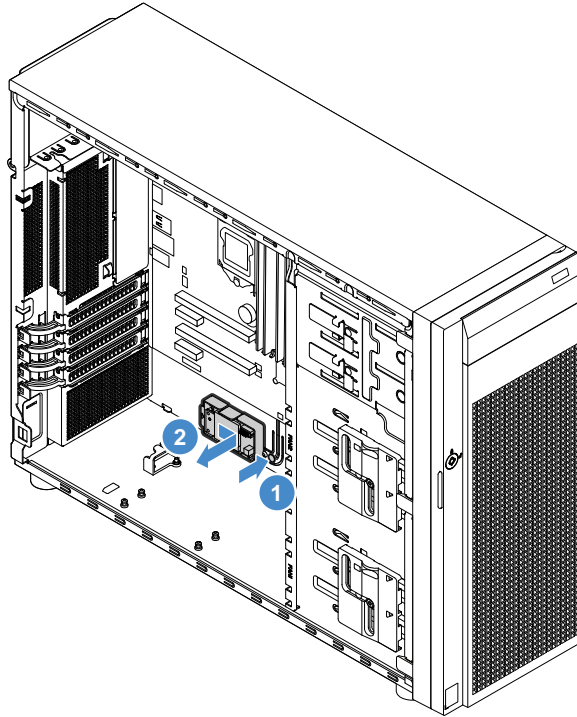


Figure 76. Removing the SD module assembly

4. Remove the SD module from the SD module bracket.

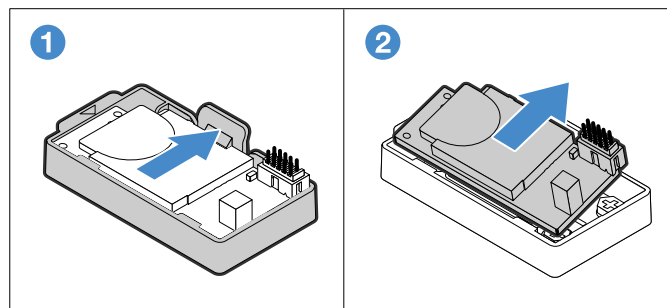


Figure 77. Removing the SD module from the SD module bracket

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

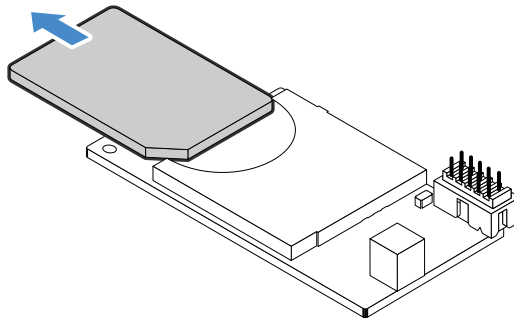


Figure 78. Removing an SD card

6. Remove the SD module from the server chassis if necessary.
7. 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 the SD module, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Insert the SD card into the SD card slot. The card might stop before it is completely installed into the SD module. Ensure that you insert the card firmly until you hear a click.
3. Install the SD module into the SD module bracket.

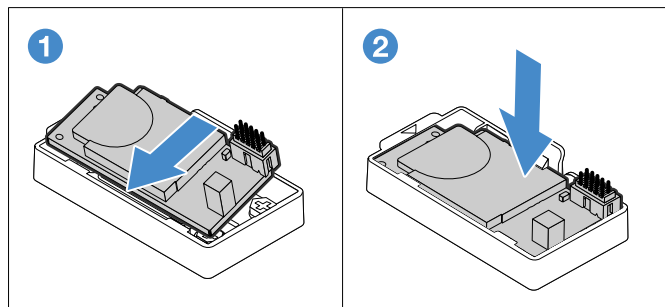


Figure 79. Installing the SD module into the SD module bracket

4. Position the SD module assembly on the chassis so that the pins on the chassis pass through the corresponding holes in the SD module bracket. Then, move the SD module assembly as shown until it is secured on the chassis.

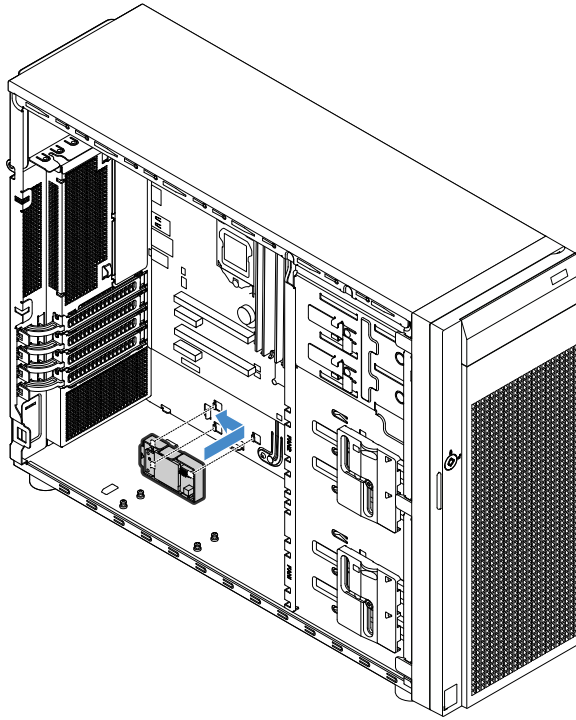


Figure 80. Installing the SD module assembly

5. Connect the SD module to the USB 2.0 connector on the system board. See “System board components” on page 28.

ThinkServer RAID Super Capacitor Module

The ThinkServer RAID Super Capacitor Module protects the cache memory on the installed ThinkServer RAID card.

- “Removing the ThinkServer RAID Super Capacitor Module” on page 95
- “Installing the ThinkServer RAID Super Capacitor Module” on page 96

Note: Use any documentation that comes with the ThinkServer RAID Super Capacitor Module and follow those instructions in addition to the instructions in this topic.

Removing the ThinkServer RAID Super Capacitor Module

To remove the ThinkServer RAID Super Capacitor Module, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Disconnect the cable of the ThinkServer RAID Super Capacitor Module from the RAID card.
3. Gently press the tab on the ThinkServer RAID Super Capacitor Module bracket and remove the ThinkServer RAID Super Capacitor Module assembly as shown at the same time.

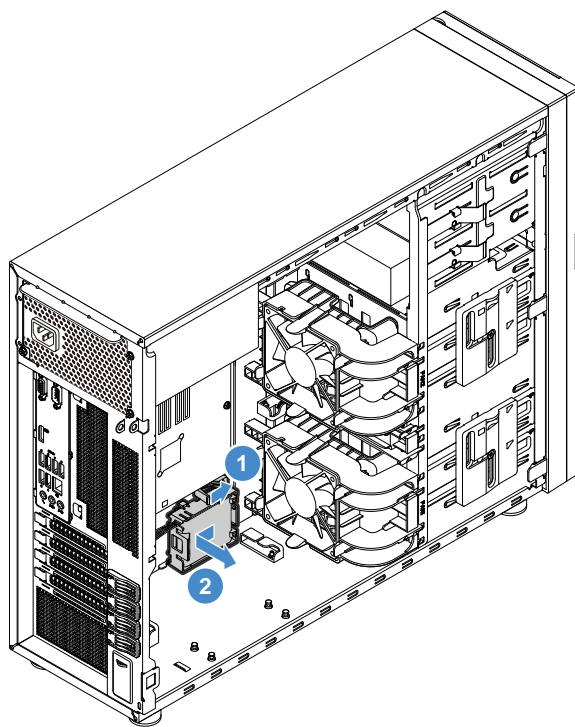


Figure 81. Removing the ThinkServer RAID Super Capacitor Module assembly from the chassis

4. Gently press the tab on the ThinkServer RAID Super Capacitor Module bracket as shown and remove the ThinkServer RAID Super Capacitor Module from the bracket at the same time.

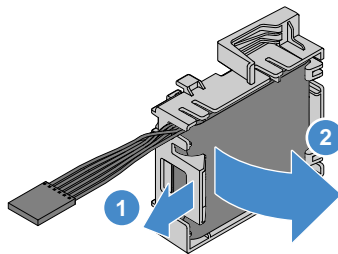


Figure 82. Removing the ThinkServer RAID Super Capacitor Module from the bracket

5. If you are instructed to return the old ThinkServer RAID Super Capacitor Module, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the ThinkServer RAID Super Capacitor Module

To install the ThinkServer RAID Super Capacitor Module, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Note the orientation of the ThinkServer RAID Super Capacitor Module. Then, gently press the tab on the ThinkServer RAID Super Capacitor Module bracket as shown and install the ThinkServer RAID Super Capacitor Module into the bracket at the same time.

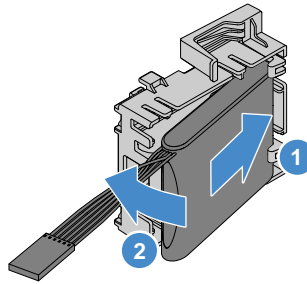


Figure 83. Installing the ThinkServer RAID Super Capacitor Module into the bracket

3. Position the ThinkServer RAID Super Capacitor Module assembly on the chassis so that the tabs on the assembly pass through the corresponding holes in the chassis. Then, move the ThinkServer RAID Super Capacitor Module assembly as shown until it is secured on the chassis.

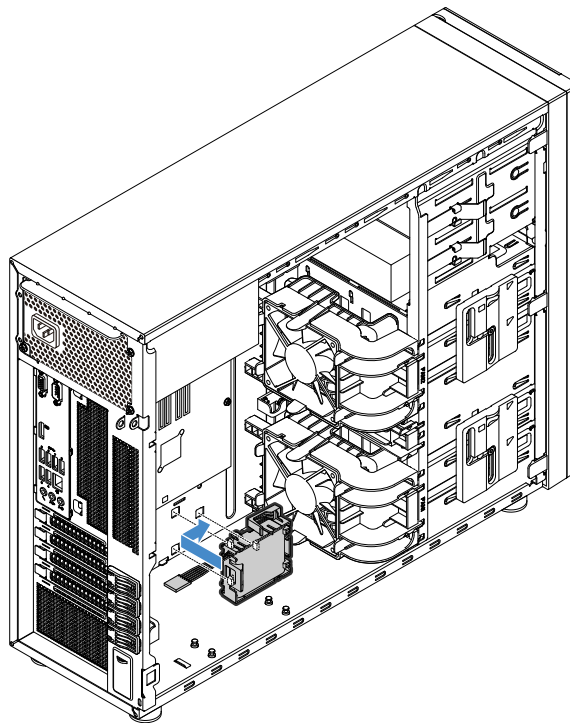


Figure 84. Installing the ThinkServer RAID Super Capacitor Module assembly into the chassis

4. Connect the ThinkServer RAID Super Capacitor Module to the TFM connector on the Lenovo ThinkServer RAID 720i PCIe Adapter.

Thunderbolt Memory Module

This topic applies only to Lenovo ThinkServer RAID 720i PCIe Adapter that supports the TMM. There are the following two types of TMM:

- ThinkServer RAID 720i Modular Flash
- ThinkServer RAID 720i Modular DRAM Upgrade

The TMM works as the cache memory of the installed Lenovo ThinkServer RAID 720i PCIe Adapter.

- “Removing the TMM” on page 98

- “Installing the TMM” on page 98

Removing the TMM

To remove the TMM, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Remove the Lenovo ThinkServer RAID 720i PCIe Adapter. See “Removing a PCIe card” on page 54.
3. Press the two release tabs **1** and lift the TMM straight up and out of the Lenovo ThinkServer RAID 720i PCIe Adapter.

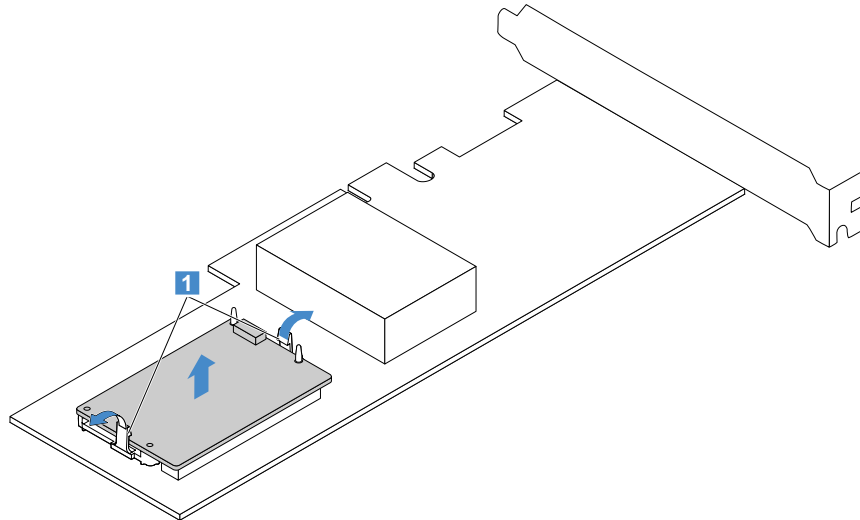


Figure 85. Removing the TMM

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

Installing the TMM

To install the TMM, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Remove the Lenovo ThinkServer RAID 720i PCIe Adapter. See “Removing a PCIe card” on page 54.
3. Position the TMM above the Lenovo ThinkServer RAID 720i PCIe Adapter and align the two holes in the TMM with the two pins on the adapter. Then, lower the TMM straight down until it is securely seated.

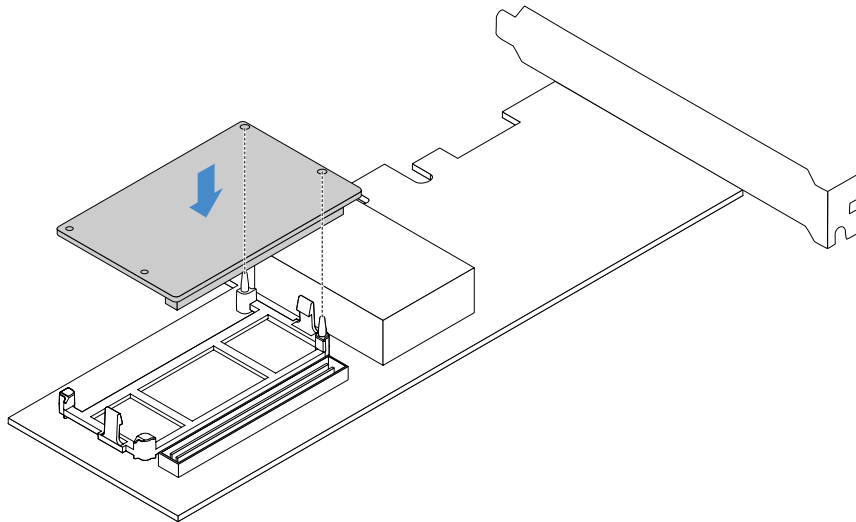


Figure 86. Installing the TMM

4. Install the Lenovo ThinkServer RAID 720i PCIe Adapter with the TMM. See “Installing a PCIe card” on page 55.

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. If your server has the Lenovo ThinkServer RAID 520i PCIe Adapter installed, you can purchase a RAID 520i key and install it to the J3 connector on the RAID card. For information about connectors on the RAID card, see “RAID card” on page 24.

- “Removing the RAID 520i key” on page 99
- “Installing the RAID 520i key” on page 100

Removing the RAID 520i key

Notes:

- If you remove the RAID 520i key, the hardware RAID 5 will be disabled.
- 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.

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

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Locate the Lenovo ThinkServer RAID 520i PCIe Adapter. See “Server components” on page 19.
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 54.

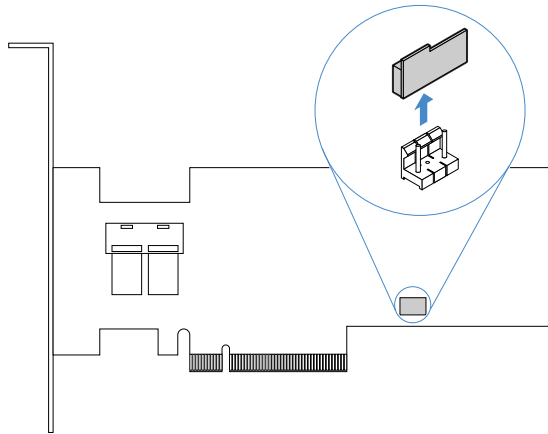


Figure 87. Removing the RAID 520i key

4. If you are instructed to return the old RAID 510i key, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Because the hardware RAID 5 is not available without the RAID 520i key, 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

Attention: Installing 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.

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

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Locate the Lenovo ThinkServer RAID 520i PCIe Adapter. See “Server components” on page 19.
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 510i 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 “Installing a PCIe card” on page 55.

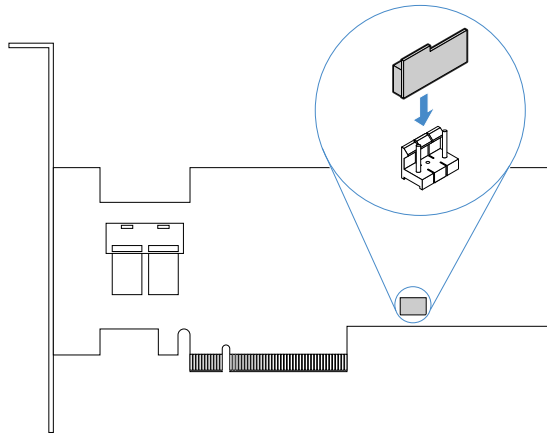


Figure 88. Installing the RAID 520i key

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>

CPU

- “Removing the CPU” on page 101
- “Installing the CPU” on page 102

CAUTION:



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

Note: Ensure that the new CPU is the correct type your server supports. See “Memory module installation rules” on page 52.

Removing the CPU

To remove the CPU, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Remove the heat sink and fan assembly. See “Removing the heat sink and fan assembly” on page 90.
4. Remove the CPU from the CPU socket.
 - 1 Release the small handle as shown.
 - 2 Lift the handle upward until the handle and the CPU retainer are in the fully open position.
 - 3 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.

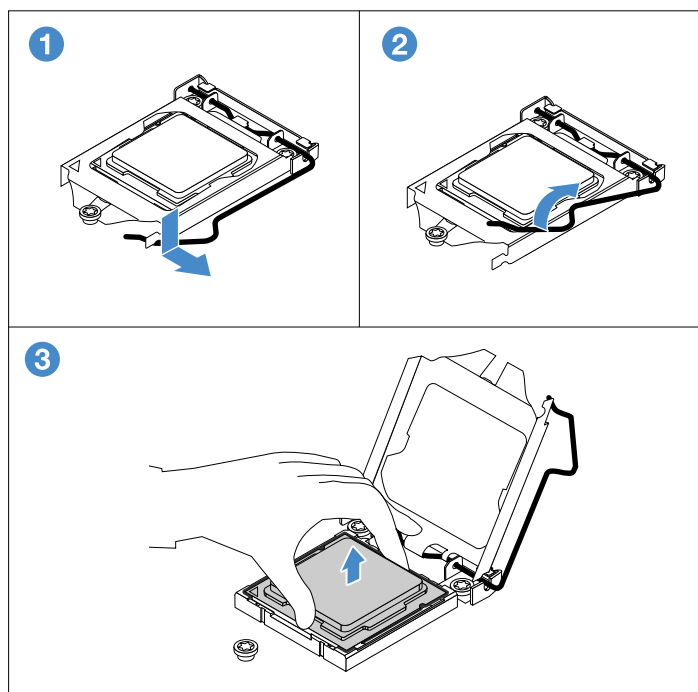


Figure 89. Removing the CPU

5. Install a new CPU. See “Installing the CPU” on page 102.
6. If you are instructed to return the old CPU, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the CPU

To install the CPU, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Remove the heat sink and fan assembly. See “Removing the heat sink and fan assembly” on page 90.
4. If needed, remove the CPU. See “Removing the CPU” on page 101.
5. Remove the protective cover that protects the gold contacts on the bottom of the new CPU.

Note: Do not touch the pins on the CPU socket and the gold contacts on the bottom of the new CPU.

6. Hold the new CPU by its sides, align the notches **1** with the tabs **2**, and align the small triangle **3** with the small triangle **4**. Then, carefully lower the CPU straight down into the CPU socket.

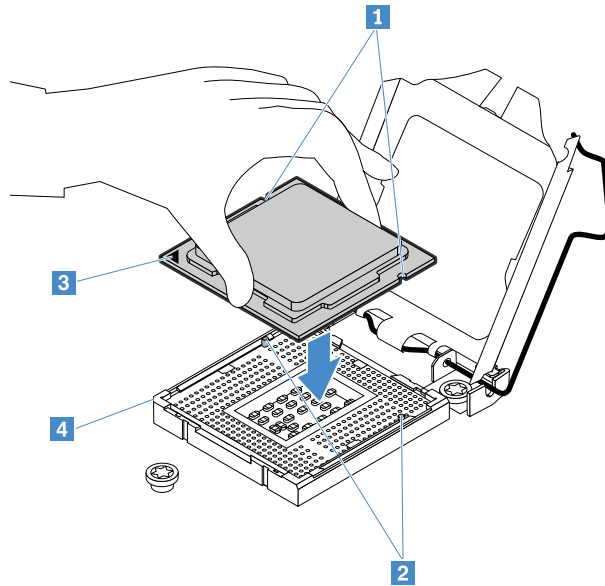


Figure 90. Installing the CPU

7. Gently close the CPU retainer, press down the small handle, and then push the handle inward to lock the retainer into position and secure the new CPU in the socket.

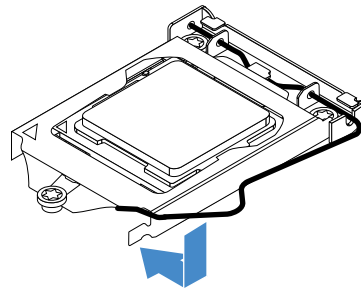


Figure 91. Securing the CPU in the socket

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 104
- “Installing the coin-cell battery” on page 104



Danger of explosion if battery is improperly 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 and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Locate the coin-cell battery. See “Server components” on page 19.

Note: If there is any PCIe card installed on the system board, it might block your access to the coin-cell battery. In this case, remove the PCIe card. See “Removing a PCIe card” on page 54.

4. Remove the old coin-cell battery.

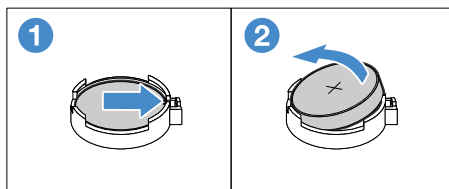


Figure 92. Removing the coin-cell battery

5. Dispose of the old coin-cell battery as required by local ordinances or regulations.

Installing the coin-cell battery

Note: After you install the coin-cell battery, you must reset passwords, reset system date and time, and reconfigure the server.

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

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. If needed, remove the old coin-cell battery. See “Removing the coin-cell battery” on page 104.
4. Install a new coin-cell battery.

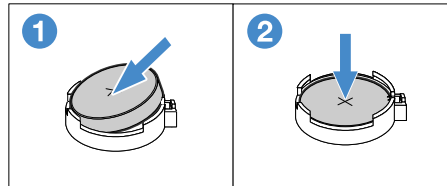


Figure 93. Installing the coin-cell battery

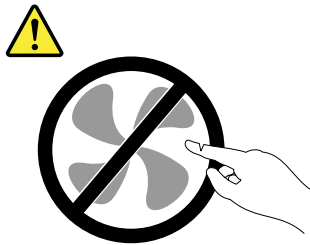
Power distribution board

This topic applies only to server models that come with hot-swap redundant power supplies.

- “Removing the power distribution board” on page 105
- “Installing the power distribution board ” on page 106

CAUTION:

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



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 distribution board

To remove the power distribution board, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.

2. Disconnect the power cables from the power distribution board.
3. Remove the hot-swap redundant power supply. See “Removing a hot-swap power supply” on page 74.
4. Remove the screw that secures the power distribution board cage and then remove the cage. Pull the power distribution board outward to release it from the power supply cage, and then remove the power distribution board out of the chassis.

Note: Carefully handle the power distribution board by its edges.

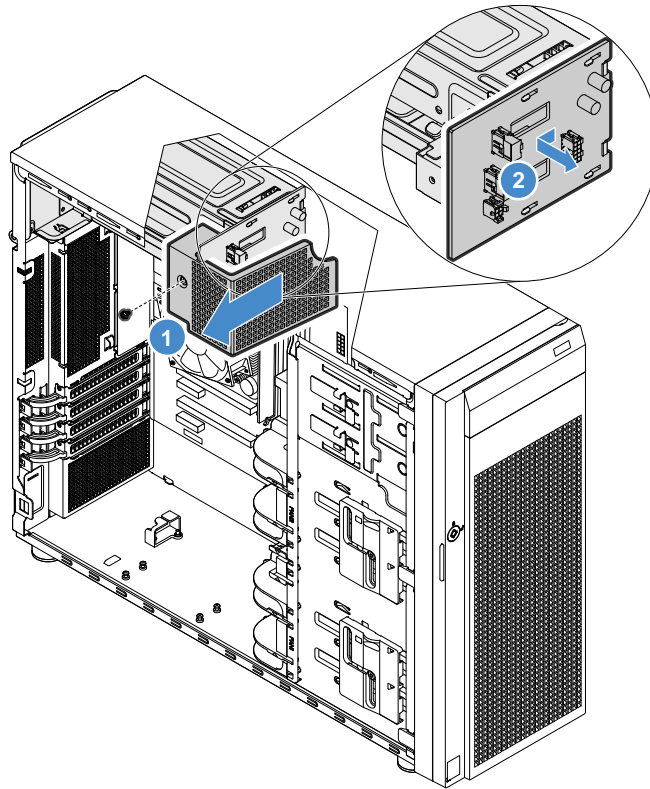


Figure 94. Removing the power distribution board

5. If you are instructed to return the old power distribution board, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the power distribution board

To remove the power distribution board, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.
2. Lay the server on its side for easier operation.
3. Remove the hot-swap redundant power supply. See “Removing a hot-swap power supply” on page 74.
4. Hold the power distribution board by its edges and position it to the power supply cage. Ensure that four tabs on the power supply cage are inserted into the corresponding holes in the power distribution board. Then, pull the power distribution board inward.

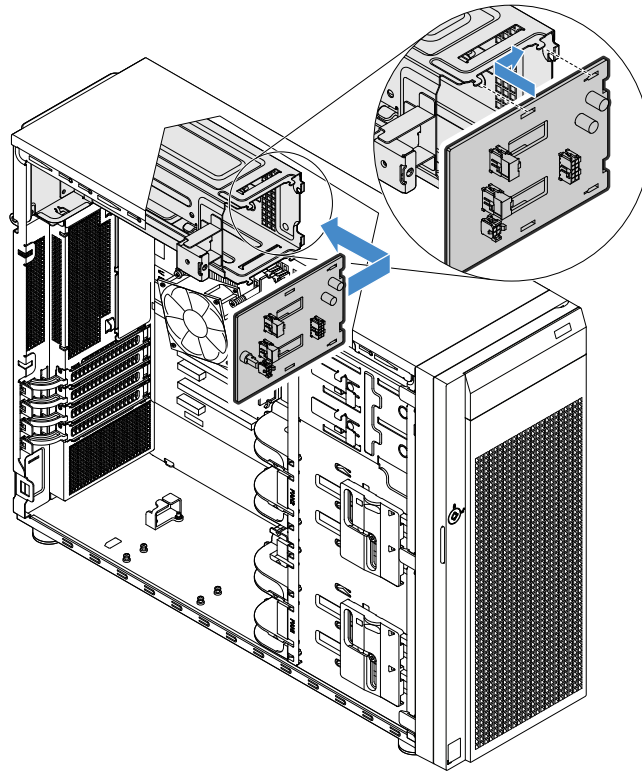


Figure 95. Installing the power distribution board

5. Position power distribution board cage to the power supply cage. Ensure that the hole in the power distribution board cage is aligned with the one in the power supply cage. Then, install the screw to secure the power distribution board cage.

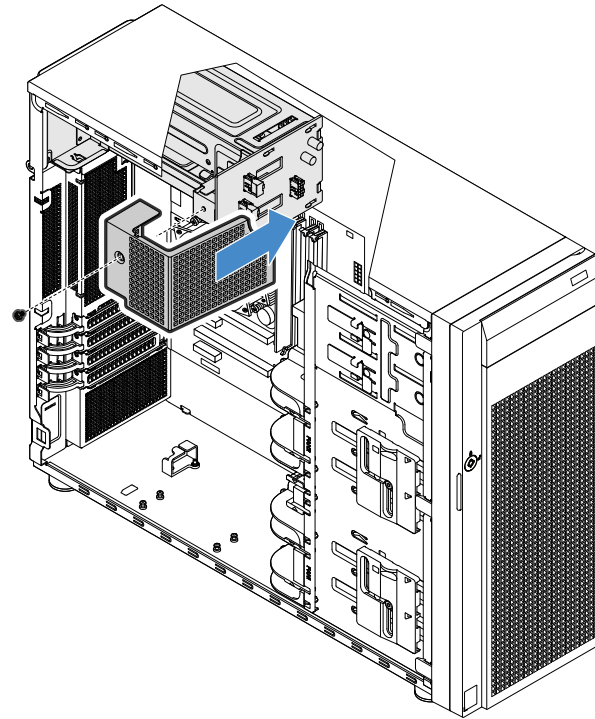


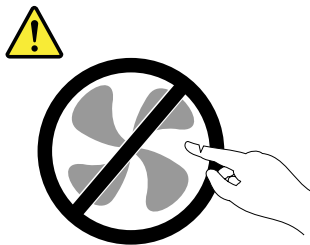
Figure 96. Installing the power distribution board cage

6. Connect the power cables to the new power distribution board. Then, properly route the cables and secure the cables with the cable clips and ties in the chassis.

For service technician only: replacing the system board

CAUTION:

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



CAUTION:



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

To replace the system board, do the following:

1. Prepare your server and remove the server cover. See “Preparing your server in advance and removing the server cover” on page 49.

2. Lay the server on its side for easier operation.
3. Record the cable routing and cable connections. Then, disconnect all cables from the system board.
4. To access the system board, do the following in order:
 - a. “Removing the rear system fan” on page 88
 - b. “Removing a PCIe card” on page 54
 - c. “Removing a memory module” on page 53
 - d. “Removing the heat sink and fan assembly” on page 90
 - e. “Removing the CPU” on page 101
 - f. “Removing the coin-cell battery” on page 104
5. Remove the eight screws that secure the system board following the recommended numerical sequence as shown. Then, carefully remove the system board out of the chassis.

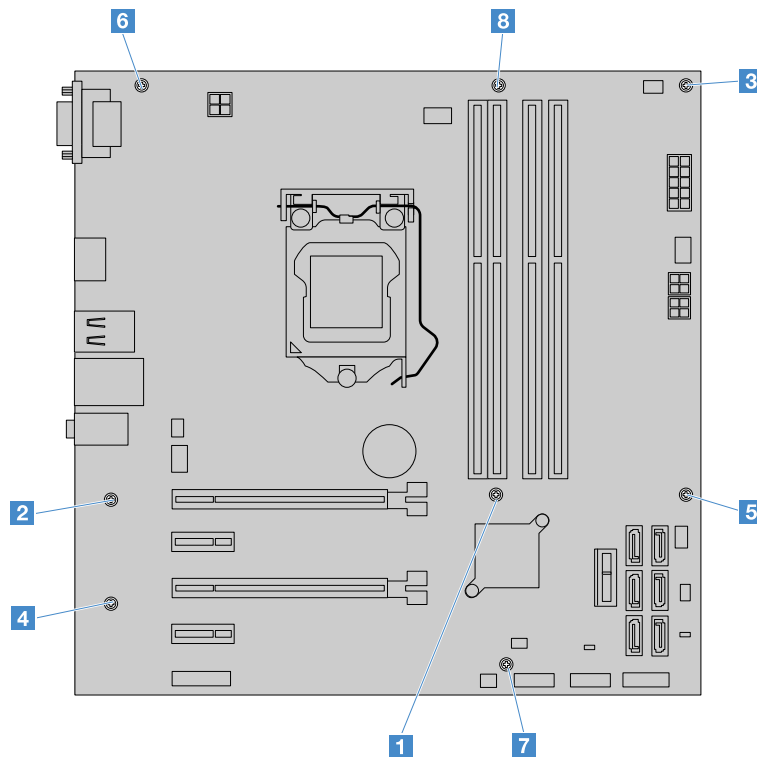


Figure 97. Removing the screws that secure the system board

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 new system board are inserted into the corresponding holes in the rear panel and the eight screw holes in the new system board are aligned with the corresponding mounting studs on the chassis. Then, install the eight screws following the recommended numerical sequence in the reverse sequence as you remove them to secure the new system board in place.
8. For the new system board, remove the CPU socket cover from the CPU socket.

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

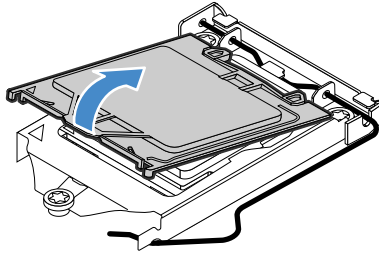


Figure 98. Removing the CPU socket cover

9. Remove the CPU from the old system board and install it on the new system board. See “CPU” on page 101.
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. Use one of the following methods to apply appropriate amount of thermal grease to the top of the CPU in the shape of a cross or a circle as shown. Using too much or too little thermal grease can cause a thermal problem due to imperfect contact with the components.

Notes:

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

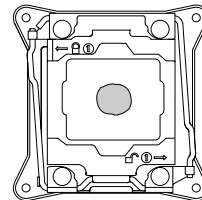
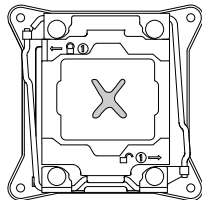


Figure 99. Applying the thermal grease to the top of the CPU

12. Install the heat sink and fan assembly on the new system board. See “Installing the heat sink and fan assembly” on page 91.
13. Reinstall all parts that you have removed one by one in the reversed sequence as you remove them. Connect all cables to the new system board.
14. Return the old system board. The old system board must be returned with a CPU socket cover to protect the pins on the CPU socket during shipping and handling. Use the CPU socket cover removed from the new system board.
To install a CPU socket cover on the old system board, do the following:
 - a. After you have removed the CPU from the old system board, close the CPU retainer, press down the small handle, and then push the handle inward to lock the retainer into position.
 - b. 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.

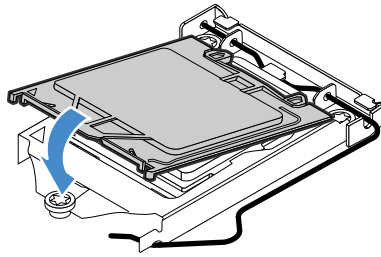


Figure 100. Installing the CPU socket cover

15. 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.

Completing the parts replacement

To complete the parts replacement, do the following:

1. Ensure that all components have been reassembled properly and that no tools or loose screws are left inside your server.
2. Properly route and secure the cables in the server. Refer to the cable connecting and routing information for each component. See Chapter 5 “Replacing hardware” on page 47.
3. Position the server cover on the chassis so that the rail on the bottom of the server cover engages the bottom rail on the chassis. Then, align the six tabs **1** on the server cover with the corresponding holes in the top edge of the chassis. Pivot the server cover to close it.

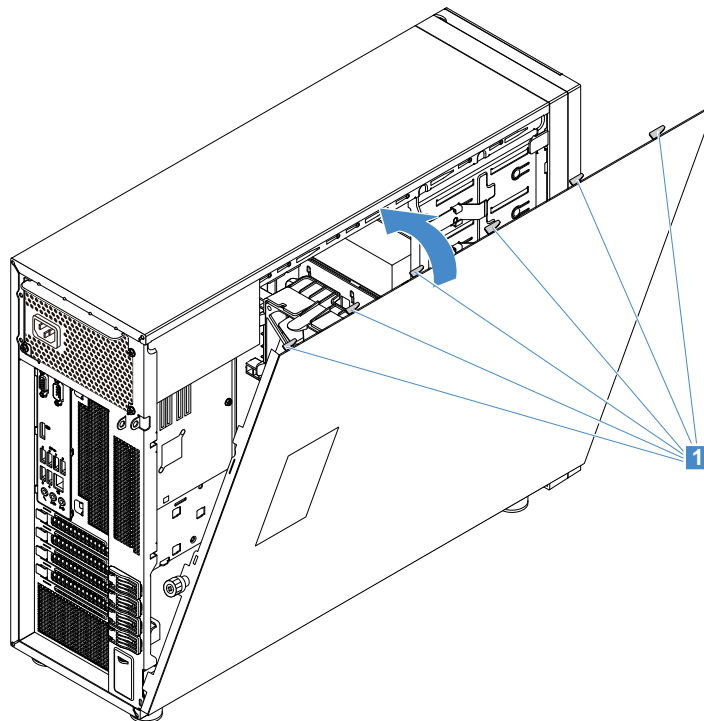


Figure 101. Closing the server cover

4. Slide the server cover to the front of the chassis until it snaps into position.

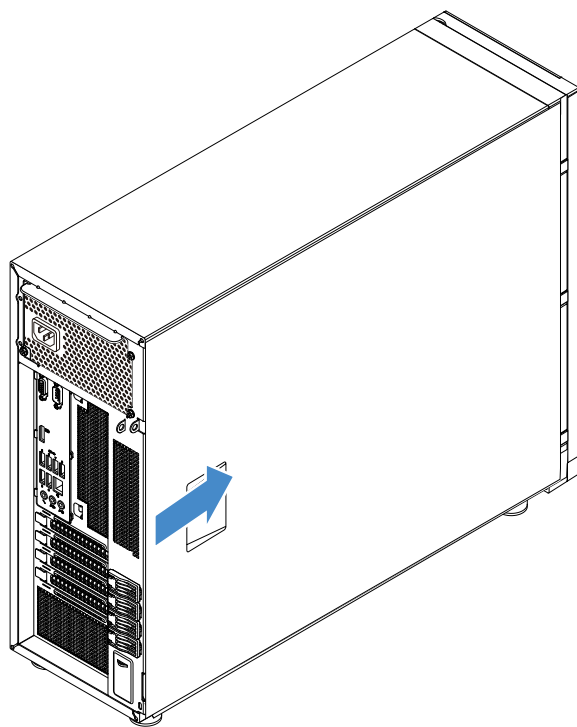


Figure 102. Installing the server cover

5. Tighten the thumbscrew on the server cover to secure the server cover in place.

Note: For safety consideration, ensure that you use a tool, for example a screwdriver, to tighten the thumbscrew and always ensure that the thumbscrew is securely installed. Also, do not over-tighten the thumbscrew.

6. Lock the server cover and server front door (available on some models) to ensure the security. See “Server locks” on page 17.
7. Reconnect all the external cables.

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

8. Update the server configuration.
 - Download and install the latest device drivers. You can visit the Lenovo Web site at <http://www.lenovo.com/drivers>.
 - Update the BIOS configuration: “Using the Setup Utility program” on page 33
 - Update the RAID configuration: “Configuring RAID” on page 41
 - Update your system firmware: “Server setup procedure” on page 5

Chapter 6. Troubleshooting and diagnostics

This chapter provides information about basic troubleshooting and diagnostic methods to help you solve problems that might occur in the server.

If you cannot diagnose and correct a problem by using the information in this chapter, see Chapter 7 “Getting information, help, and service” on page 119 for additional troubleshooting resources.

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 properly 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 more information about accessing and changing the BIOS settings, see “Using the Setup Utility program” on page 33.
4. View the status and diagnostic LEDs to identify the system and device status and diagnose problems. See “Viewing the status and diagnostic LEDs” on page 113.
5. If the server is not working after you have added new software, installed a new optional device, or replaced a piece of hardware, remove or reinstall the software or device to see if the problem could be solved.
6. Turn on the server and press Esc as soon as you see the logo screen to view any diagnostic messages.
7. Download and use a diagnostic program to diagnose problems. See “Lenovo ThinkServer Diagnostics” on page 11.
8. Refer to “Basic troubleshooting tables” on page 113 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.
9. 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.
10. Use an antivirus program to see if your server has been infected by a virus. If the program detects a virus, remove the virus.
11. If none of these actions solve the problem, seek technical assistance. See Chapter 7 “Getting information, help, and service” on page 119.

Viewing the status and diagnostic LEDs

Your server has status and diagnostic LEDs on the front panel, the rear panel (Ethernet status LEDs), the system board, the hot-swap HDDs (if supported), and the optical drives. The various LEDs help you easily identify the system and device status and diagnose problems. For information about the LEDs, refer to the related topics in “Component locations” on page 12.

Basic troubleshooting tables

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

Follow the suggested actions for the corresponding symptom in the order in which they are listed until the problem is solved. If none of these actions solve the problem, see “Troubleshooting procedure” on page 113 for the subsequent steps you should check after using the information in this topic. If the problem cannot be solved by yourself, seek technical assistance. See Chapter 7 “Getting information, help, and service” on page 119.

Note:

Notes:

- If you are instructed to remove, install, or replace any CRUs, refer to the related procedure in Chapter 5 “Replacing hardware” on page 47.
- 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.

ThinkServer EasyStartup program problems

Symptom	Action
The disc with the ThinkServer EasyStartup ISO image does not start.	<ol style="list-style-type: none"> 1. Ensure that: <ul style="list-style-type: none"> • The server supports the ThinkServer EasyStartup program and has a bootable optical drive installed or a bootable external optical drive attached. • You have set the optical drive with the disc as the first startup device. See “Selecting a startup device” on page 38. 2. Verify if the optical drive or the disc has problems. See “Optical drive problems” on page 115.
The USB flash drive with the ThinkServer EasyStartup ISO image does not start.	<ol style="list-style-type: none"> 1. Ensure that: <ul style="list-style-type: none"> • The server supports the ThinkServer EasyStartup program. • You have set the USB flash drive as the first startup device. See “Selecting a startup device” on page 38. 2. Verify if the USB flash drive has problems. See “USB device problems” on page 117.
The operating system installation program continuously loops.	Make more space available on the HDD.
The ThinkServer EasyStartup program cannot start the operating system media.	<ol style="list-style-type: none"> 1. Ensure that the operating system media is supported by the ThinkServer EasyStartup program version your are using. For a list of the supported operating systems, refer to the user guide and compatibility notes for the ThinkServer EasyStartup program through the program main interface. See “Starting the ThinkServer EasyStartup program” on page 40. 2. Verify if the optical drive or the disc has problems. See “Optical drive problems” on page 115.

Optical drive problems

Symptom	Action
The optical drive is not recognized.	<ol style="list-style-type: none">1. Ensure that:<ul style="list-style-type: none">• The signal cable and connector are not damaged and the connector pins are not bent.• 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 33.• All cables and jumpers (if any) are installed properly.• The correct device driver is installed for the optical drive.2. Run any optical drive diagnostic programs if you have.3. Reinstall the optical drive and reconnect cables.4. Replace the signal cable for the optical drive.5. Replace the optical drive.6. (Trained service technician only) Replace the system board.
A disc is not working properly.	<ol style="list-style-type: none">1. Ensure that the disc is in the optical drive with the shiny side facing down.2. Ensure that the disc surface is clean and not scratched.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.4. Restart the disc player program.5. Restart the server.6. Run any optical drive diagnostic programs if you have.7. Reinstall the optical drive and reconnect cables.8. Replace the signal cable for the optical drive.9. Replace the optical drive.

Storage drive problems

Note: The status LEDs on each hot-swap storage drive help you easily identify a problem. See “Hot-swap drive activity and status LEDs” on page 21.

Symptom	Action
A newly installed non-hot-swap storage drive is not recognized.	<ol style="list-style-type: none"> Ensure that: <ul style="list-style-type: none"> The signal cable and connector are not damaged. The non-hot-swap storage 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 33. All cables and jumpers (if any) are installed properly. If you have any diagnostic programs, run the diagnostic programs to test the storage drive. Reinstall the non-hot-swap storage drive and reconnect cables. Replace the signal cable for the non-hot-swap storage drive. Replace the non-hot-swap storage drive.
A newly installed hot-swap storage drive is not recognized.	<ol style="list-style-type: none"> Ensure that the drive is installed into the correct drive bay. Restart the server. Remove the drive from the bay, wait 45 seconds, and reinsert the drive into the bay, making sure that the drive connects to the hot-swap drive backplane. If you have any diagnostic programs, run the diagnostic programs to test the storage drive. Ensure that the hot-swap drive backplane is properly seated. When it is properly seated, the drive assemblies properly connect to the backplane without bowing or causing movement of the backplane. Ensure that the cable connection is correct. Reconnect the backplane power cable and repeat step 1 through step 4. Reconnect the backplane signal cable and repeat step 1 through step 4. If you suspect a problem with the backplane signal cable or the backplane: <ol style="list-style-type: none"> Replace the affected backplane signal cable. Replace the affected backplane.
Multiple storage drives fail.	<ol style="list-style-type: none"> If you have any diagnostic programs, run the diagnostic programs to test the storage drives. Ensure that the cable connection is correct. See “Connecting cables for the backplane” on page 80 and “Installing a non-hot-swap drive” on page 63. Reconnect the power cable. Reconnect the signal cable. Replace the affected signal cable. For hot-swap storage drives, if you suspect a problem with the backplane, replace the affected backplane.

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">1. Ensure that:<ul style="list-style-type: none">• All memory modules are the correct type supported by the server. See “Features and specifications of your server” on page 7.• You follow the memory module installation rules. See “Memory module installation rules” on page 52.• All memory modules are seated properly and securely.• The system firmware is up-to-date.2. If you have any diagnostic programs, run the diagnostic programs to test the memory modules.3. Reinstall the memory modules.4. Replace the suspect memory modules.5. (Trained service technician only) Replace the system board.

USB device problems

Symptom	Action
A USB device does not work.	<ol style="list-style-type: none">1. Ensure that:<ul style="list-style-type: none">• 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.• The device drivers are installed properly.• The USB controller is enabled in the Setup Utility program. See “Using the Setup Utility program” on page 33.2. Restart the server.3. Replace the USB device.

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.

Information resources

You can use the information in this topic to access useful resources relating to your needs when using the 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 also 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

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 buttons 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 113.
- 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 Web site, and then run it. See “Lenovo ThinkServer Diagnostics” on page 11.

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 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 computer might be eligible for International Warranty Service, which automatically entitles you to obtain warranty service throughout the warranty period. Service will be performed by service providers authorized to perform warranty service.

Service methods and procedures vary by country, and some services might not be available in all countries. International Warranty Service is delivered through the method of service (such as depot, carry-in, or on-site service) that is provided in the servicing country. Service centers in certain countries might not be able to service all models of a particular machine type. In some countries, fees and restrictions might apply at the time of service.

To determine whether your computer is eligible for International Warranty Service and to view a list of the countries 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>

Appendix A. Regulatory information

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

Export classification notice

This product is subject to the United States Export Administration Regulations (EAR) and has an Export Classification Control Number (ECCN) of 4A994.b. It can be re-exported except to any of the embargoed countries in the EAR E1 country list.

Electronic emission notices

The following information refers to the Lenovo ThinkServer machine types 70LY, 70M0, 70M1, and 70M2.

Federal Communications Commission (FCC) Statement

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.

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

Japan VCCI Class A compliance 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

This is a Class A product based on the standard of the Voluntary Control Council for Interference (VCCI). If this equipment is used in a domestic environment, radio interference may occur, in which case the user may be required to take corrective actions.

Japanese statement for ac power consumption for JEITA harmonics guideline

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

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

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

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:

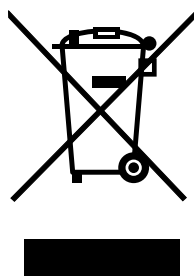
<http://www.lenovo.com/recycling>

Recycling and disposal information for Japan is available at:

<http://www.lenovo.com/recycling/japan>

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 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, informando o modelo, número de série e cidade, a fim de enviarmos as instruções para o correto descarte do seu produto Lenovo.

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.

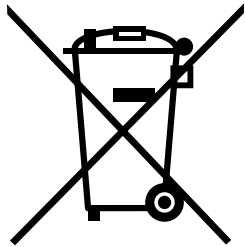
Battery recycling information for Taiwan



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

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

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>.

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

Turkish RoHS

The Lenovo product meets the requirements of the Republic of Turkey Directive on the Restriction of the Use of Certain Hazardous Substances in Waste Electrical and Electronic Equipment (WEEE).

Türkiye AEEE Yönetmeliğine Uygunluk Beyanı

Bu Lenovo ürünü, T.C. Çevre ve Orman Bakanlığı'nın "Atık Elektrik ve Elektronik Eşyalarda Bazı Zararlı Maddelerin Kullanımının Sınırlandırılmasına Dair Yönetmelik (AEEE)" direktiflerine uygundur.

AEEE Yönetmeliğine Uygundur.

Ukraine RoHS

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

India RoHS

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

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	X	○	○	○	○	○
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	○	○	○	○	○
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，装有电池的组套件）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.

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 ⁶⁺)	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
機架	○	○	○	○	○	○
外部蓋板	○	○	○	○	○	○
機械組零件	—	○	○	○	○	○
空氣傳動設備	—	○	○	○	○	○
冷卻組零件	—	○	○	○	○	○
內存模塊	—	○	○	○	○	○
處理器模塊	—	○	○	○	○	○
電纜組零件	—	○	○	○	○	○
電源	—	○	○	○	○	○
儲備設備	—	○	○	○	○	○
電路卡	—	○	○	○	○	○
光碟機	—	○	○	○	○	○
雷射器	—	○	○	○	○	○
<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. Additional statements

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

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

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

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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 2. Limits for particulates and gases

Contaminant	Limits
Particulate	<ul style="list-style-type: none"> The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2¹. 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. The deliquescent relative humidity of the particulate contamination must be more than 60%². The room must be free of conductive contamination such as zinc whiskers.
Gaseous	<ul style="list-style-type: none"> Copper: Class G1 as per ANSI/ISA 71.04-1985³ Silver: Corrosion rate of less than 300 Å in 30 days
<p>¹ 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>² 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>³ 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.

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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
BMC	Baseboard Management Controller
CPU	central processing unit
CRT	Cathode Ray Tube
CRU	Customer Replaceable Unit
DDR4	double data rate 4
DHCP	Dynamic Host Configuration Protocol
ECC	Error Checking and Correcting
EMI	electromagnetic interface
ESD	electrostatic discharge
GPGPU	general-purpose computing on graphics processing units
GUI	graphical user interface
HBA	Host Bus Adapter
HDD	hard disk drive
HII	Human Interface Infrastructure
HTML	Hypertext Markup Language
IPMI	Intelligent Platform Management Interface
I/O	Input/Output
LED	light-emitting diode
LLW	Lenovo Limited Warranty
LRDIMM	load reduction dual inline memory module
Mbps	megabits per second
NOS	network operating system
PCIe	PCI Express
PDA	personal digital assistant
PDF	Portable Document Format
PECI	Platform Environment Control Interface
POST	power-on self-test
PXE	Preboot Execution Environment

Abbreviation or acronym	Full term
RAID	Redundant Array of Independent Disks
RAS	Reliability, availability, and serviceability
RDIMM	registered dual inline memory module
ROM	read-only memory
SAS	Serial Attached SCSI (Small Computer System Interface)
SATA	Serial Advanced Technology Attachment
SCCM	System Center Configurations Management
SD	Secure digital
SEL	system event log
SMI	system management interrupt
SSD	solid-state drive
StorCLI	Storage Command Line Tool
TCG	Trusted Computing Group
TPM	ThinkServer Trusted Platform Module
TSM	ThinkServer System Manager
UEFI	Unified Extensible Firmware Interface
UPS	uninterruptible power supply
VGA	video graphics array

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