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Installation and User Guide

ThinkThinkThinkServerThink

ThinkServer RD220 Types 3797, 3798, 3779, and 3729

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Installation and User Guide

Note: Before using this information and the product it supports, read the general information in Appendix B, “Notices,” on page 155 and the *Warranty and Support Information* document on the Lenovo® *ThinkServer Documentation* DVD.

First Edition (June 2009)

Contents

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information
（安全信息）。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας
(safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się
z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Important:

Each caution and danger statement in this document is labeled with a number. This number is used to cross reference an English-language caution or danger statement with translated versions of the caution or danger statement in the *Safety Information* document.

For example, if a caution statement is labeled “Statement 1”, translations for that caution statement are in the *Safety Information* document under “Statement 1.”

Be sure to read all caution and danger statements in this document before you perform the procedures. Read any additional safety information that comes with the server or optional device before you install the device.

Attention: The information in this document regarding installing and removing power supplies and connecting and disconnecting power refers to ac power supplies only. If the server contains dc power supplies, see the documentation that comes with the dc power supplies. In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply and to install and remove a dc power supply.

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.**
- **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:	**To Disconnect:**
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Statement 2:

CAUTION:
When replacing the lithium battery, use only the battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same 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 drives, 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.

Class 1 Laser Product
Laser Klasse 1
Laser Klass 1
Luokan 1 Laserlaite
Appareil À Laser de Classe 1

Statement 4:

≥ 18 kg (39.7 lb)

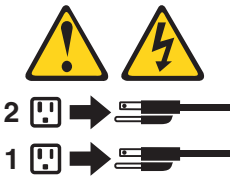
≥ 32 kg (70.5 lb)

≥ 55 kg (121.2 lb)

CAUTION:
Use safe practices when lifting.

Statement 5:

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



Statement 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 26:

CAUTION:
Do not place any object on top of rack-mounted devices.

This server is suitable for use on an IT power-distribution system whose maximum phase-to-phase voltage is 240 V under any distribution fault condition.

Important: This product is not suitable for use with visual display workplace devices according to Clause 2 of the German Ordinance for Work with Visual Display Units.

Chapter 1. Introduction

This *Installation and User Guide* is intended to use with your Lenovo® ThinkServer™ RD220 Types 3729, 3779, 3797, and 3798 server. This document contains information about:

- Setting up and cabling the server
- Starting and the server
- Installing options and replacing customer replaceable units (CRUs)
- Solving problems

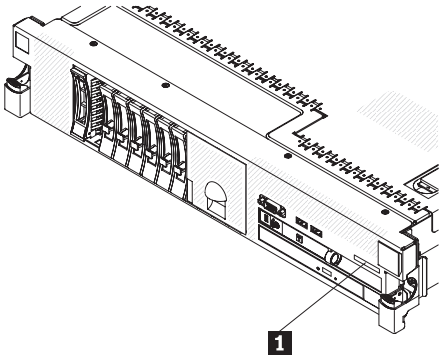
The server comes with the *ThinkServer EasyStartup* DVD to help you configure the hardware, install device drivers, and install the operating system.

The server comes with a limited warranty. For information about the terms of the warranty and getting service and assistance, see the *Warranty and Support Information* document on the *ThinkServer Documentation* DVD. You can obtain up-to-date information about the server and other Lenovo products at http://www.lenovo.com/thinkserver.

Record information about the server in the following table. You will need this information when you register the server with Lenovo.

Product name	ThinkServer RD220
Machine type	3729, 3779, 3797, and 3798
Model number	_____
Serial number	_____

The model number and serial number are on the ID label **1** on the bezel, as shown in the following illustration.



Note: The illustration in this document might differ slightly from your hardware.

For a list of supported optional devices for the server, see http://www.lenovo.com/thinkserver.

Notices and statements in this document

The caution and danger statements that appear in this document are also in the multilingual *Safety Information* document, which is on the Lenovo *ThinkServer Documentation* DVD. Each statement is numbered for reference to the corresponding statement in the *Safety Information* document.

The following notices and statements are used in this document:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Related documentation

The Lenovo *ThinkServer Documentation* DVD contains documentation for the server in Portable Document Format (PDF). The Lenovo *ThinkServer Documentation* DVD requires the following minimum hardware and software:

- Adobe® Acrobat Reader 5.0 (or later) or xpdf, which comes with Linux® operating systems

The following table describes the content and location of documentation that is provided with your server.

Table 1.

Document	Description	Location
Read Me First	This document directs you to the *ThinkServer Documentation* DVD for complete warranty and support information.	printed, provided in server packaging
Important Notices	This document includes safety and legal notices that you are expected to read before using the server.	printed, provided in server packaging
Rack Installation instructions	This document provides instructions on how to install your server in a rack.	English is printed and provided in server packaging. Additional languages are provided on the *ThinkServer Documentation* DVD and on the Lenovo Support Web site.

Table 1. (continued)

Document	Description	Location
Hardware Maintenance Manual	This document provides diagnostic information, parts listing, and replacement procedures for all field replaceable units (parts replaced by trained service personnel) as well as all customer replaceable units (CRUs).	Lenovo Support Web site: http://www.lenovo.com/support
Warranty and Support Information	This document includes the warranty statement and information about how to contact Lenovo Support.	Available on the *ThinkServer Documentation* DVD.
Safety Information	This document includes translations of all of the safety statements used in the ThinkServer documentation.	Available on the *ThinkServer Documentation* DVD.

Chapter 2. Server setup roadmap

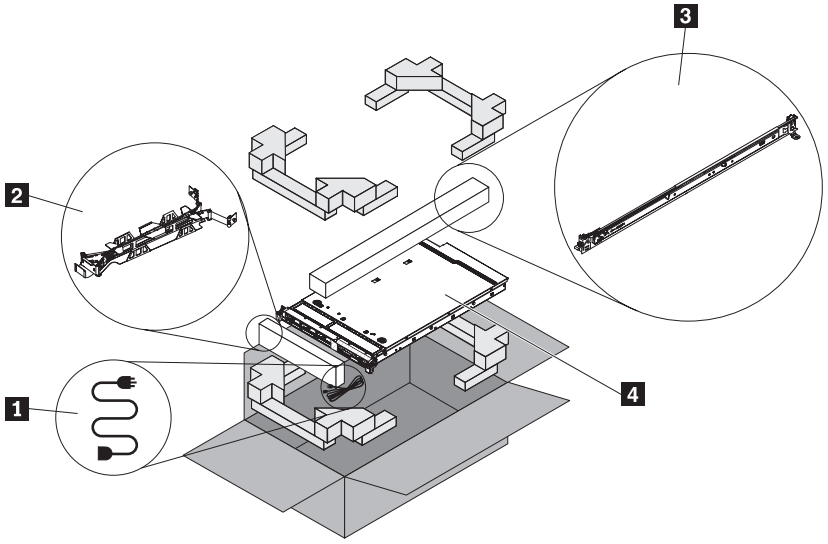
The installation process varies depending on the configuration of the server when it was delivered. In some cases, the server is fully configured and just needs to be installed in the rack, connected to power and the network, and started. In other cases, the server needs to have hardware features installed, requires hardware and firmware configuration, and requires the operating system to be installed.

Table 2. Server setup roadmap

Task	Where to find information
Unpack	Chapter 3, “What is included with your server,” on page 7
Install hardware features	Chapter 5, “Installing optional devices and replacing customer replaceable units,” on page 33
Install in the rack	*Rack Installation* instructions (printed and on *ThinkServer Documentation* DVD)
Connect Ethernet cable and power cords to network and power connectors	“Rear view” on page 22
Start the server to verify operation	“Turning on the server” on page 31
Review UEFI settings and customize as needed.	“Starting the Setup Utility program” on page 104
Configure RAID controllers and arrays	“RAID controllers” on page 110
Check for firmware updates.	“Using the EasyUpdate Firmware Updater tool” on page 119
Install operating system and basic drivers	“Using the *ThinkServer EasyStartup* DVD” on page 114
Install any additional drivers needed for added features	Refer to the instructions that came with the hardware option.
Configure Ethernet settings in operating system	See the operating system help. This step is not required if the operating system was installed using the ThinkServer EasyStartup program.
Test Integrated Management Module (requires the IMM Premium option)	“Using the Integrated Management Module” on page 119
Install remote management applications	“Installing ThinkServer EasyManage software” on page 121
Install applications	Refer to the documentation that accompanies the applications that you want to install.

Chapter 3. What is included with your server

The RD220 server package includes the server, rail kit and rail kit instructions, as well as printed documentation, the *ThinkServer Documentation* DVD, and software media.



1 Power cord
2 Cable management arm
3 Rail kit
4 Server

Features and technologies

The RD220 server offers the following features and technologies:

- **UEFI-compliant server firmware**

  UEFI replaces the basic input/output system (BIOS) and defines a standard interface between the operating system, platform firmware, and external devices. UEFI-compliant servers are capable of booting UEFI-compliant operating systems, BIOS-based operating systems, and BIOS-based adapters as well as UEFI-compliant adapters.

  Note: This server does not support DOS.

- **Integrated Management Module**

  The Integrated Management Module (IMM) combines service processor functions, video controller, and (when IMM Premium is installed) remote presence function in a single chip. The IMM provides advanced service-processor control, monitoring, and alerting function. If an environmental condition exceeds a threshold or if a system component fails, the IMM lights LEDs to help you diagnose the problem, records the error in the event log, and alerts you to the problem. IMM Premium provides a virtual presence capability for remote server management capabilities. The IMM provides remote server management through industry-standard interfaces:

  – Intelligent Platform Management Interface (IPMI) version 2.0

  – Simple Network Management Protocol (SNMP) version 3

  - Common Information Model (CIM)
  - Web browser
- **Remote presence capability and blue-screen capture**

  IMM Premium is required to enable the remote presence and blue-screen capture features. The remote presence feature provides the following functions:
  - Remotely viewing video with graphics resolutions up to 1280 x 1024 at 75 Hz, regardless of the system state
  - Remotely accessing the server, using the keyboard and mouse from a remote client
  - Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
  - Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

  The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating-system hang condition. A system administrator can use the blue-screen capture to assist in determining the cause of the hang condition.
- **IBM® Advanced Settings Utility (ASU) program**

  Use this program as an alternative to the UEFI Setup Utility for modifying UEFI settings. Use the ASU program online or out of band to modify UEFI settings from the command line without the need to restart the server to access the UEFI Setup Utility program. For more information about using this program, see “IBM Advanced Settings Utility program” on page 121.
- **Preboot diagnostics programs**

  The preboot diagnostics programs are stored on the integrated USB memory. It collects and analyzes system information to aid in diagnosing server problems. The diagnostics programs collect the following information about the server:
  - System configuration
  - Network interfaces and settings
  - Installed hardware
  - EasyLED diagnostics status
  - Service processor status and configuration
  - Vital product data, firmware, and UEFI (formerly BIOS) configuration
  - Hard disk drive health
  - RAID controller configuration
  - Event logs for RAID controllers and service processors

  The diagnostics programs create a merged log that includes events from all collected logs. The information is collected into a file that you can send to service and support. Additionally, you can view the information locally through a generated text report file. You can also copy the log to a removable media and view the log from a Web browser.

  For additional information about preboot diagnostics programs, see the *Hardware Maintenance Manual*.
- **EasyStartup DVD**

  The ThinkServer EasyStartup program guides you through the configuration of the hardware, the RAID controller, and the installation of the operating system and device drivers.
- **EasyManage DVD**

The ThinkServer EasyManage program helps you manage and administer your servers and clients through remote problem notification as well as monitoring and alerting.

- **Integrated network support**

  The server comes with two integrated Broadcom Gigabit Ethernet controllers, which support connection to a 10-Mbps, 100-Mbps, or 1000-Mbps network. For more information, see “Configuring the Gigabit Ethernet controller” on page 118.

- **Large data-storage and hot-swap capability**

  The server supports up to eight or twelve 2.5-inch hot-swap hard disk drives in the hot-swap bays (depending on the model and optional devices installed). With the hot-swap feature, you can add, remove, or replace hard disk drives without turning off the server.

- **EasyLED diagnostics**

  EasyLED diagnostics provides LEDs to help you diagnose problems. For more information, see “EasyLED diagnostics panel” on page 16

- **Memory mirroring**

  Memory mirroring improves the availability of memory by writing information to the main memory and redundant locations in a mirrored pair of DIMMs.

- **Large system-memory capacity**

  The memory bus supports up to 128 GB of system memory. The memory controller supports error correcting code (ECC) for up to 16 industry-standard PC3-10600R-999 (single-rank or dual-rank), 800, 1067, and 1333 MHz, DDR3 (third-generation double-data-rate), registered, synchronous dynamic random access memory (SDRAM) dual inline memory modules (DIMMs).

- **PCI adapter capabilities**

  The server supports up to four PCI interface slots. For more information, see “Installing a PCI adapter” on page 56.

- **Redundant connection**

  The addition of the optional Ethernet daughter card provides failover capability to a redundant Ethernet connection with the applicable application installed. If a problem occurs with the primary Ethernet connection and the optional Ethernet daughter card is installed on the server, all Ethernet traffic that is associated with the primary connection is automatically switched to the optional redundant Ethernet daughter card connection. If the applicable device drivers are installed, this switching occurs without data loss and without user intervention.

- **Redundant cooling and power capabilities**

  The server supports three hot-swap fans, which provide redundant cooling. Redundant cooling enables continued operation if one of the fans fails. The server supports up to two 675-watt ac power supplies, which provide redundancy and hot-swap capability for a typical configuration. If the maximum load on the server is less than 675 watts and a problem occurs with one of the power supplies, the other power supply can meet the power requirements.

- **RAID support**

  The server supports an internal RAID SAS Controller, which is required for you to use the hot-swap hard disk drives and to create redundant array of independent disks (RAID) configurations.

- **TCP/IP offload engine (TOE) support**

  The Ethernet controllers in the server support TOE, which is a technology that offloads the TCP/IP flow from the microprocessors and I/O subsystem to increase the speed of the TCP/IP flow. When an operating system that supports TOE is

running on the server and TOE is enabled, the server supports TOE operation. See the operating-system documentation for information about enabling TOE.

Note: As of the date of this document, the Linux operating system does not support TOE.

Specifications

The following information is a summary of the features and specifications of the server. Depending on the server model, some features might not be available, or some specifications might not apply.

Racks are marked in vertical increments of 4.45 cm (1.75 inches). Each increment is referred to as a unit, or "U." A 1-U-high device is 1.75 inches tall.

Notes:

1. Power consumption and heat output vary depending on the number and type of optional features that are installed and the power-management optional features that are in use.
2. The sound levels were measured in controlled acoustical environments according to the procedures specified by the American National Standards Institute (ANSI) S12.10 and ISO 7779 and are reported in accordance with ISO 9296. Actual sound-pressure levels in a given location might exceed the average values stated because of room reflections and other nearby noise sources. The declared sound-power levels indicate an upper limit, below which a large number of computers will operate.

Table 3. Features and specifications

Microprocessor:
- Dual Core or Quad Core Intel® Xeon, with integrated memory controller and Quick Path Interconnect (QPI) architecture
- Designed for XBGA 1366 socket
- Scalable up to four cores
- 32 KB instruction cache, 32 KB data cache, and 8 MB cache that is shared among the cores
- Support for up to two microprocessors
- Support for Intel Extended Memory 64 Technology (EM64T)

Note:
- Use the Setup utility to determine the type and speed of the microprocessors.
- For a list of supported microprocessors, see http://www.lenovo.com/thinkserver

Memory:
- Sixteen DIMM connectors (eight per microprocessor)
- Minimum: 1 GB DIMM per microprocessor
- Maximum: 96 GB
- Type: Registered ECC double-data-rate 3 (DDR3) -800, -1066, and -1033 DIMMs only (PC3–10600R-999, PC3–8500R-777)
- Sizes:
  - 1 GB single-rank, 2 GB single-rank or dual-rank, 4 GB dual-rank (PC3–10600R-999)
  - 8 GB quad-rank (PC3–8500R-777)

Drives:
CD/DVD: SATA interface 24x CD-RW/ 8x DVD combination

Expansion bays:
Eight 2.5-inch SAS hot-swap hard disk drive bays with option to add 4 more 2.5-inch SAS hot-swap hard disk drive bays

Expansion slots:
- Two PCI Express riser cards with two PCI Express x8 slots (x8 lanes) each, standard
- Support for the following optional riser cards:
  - One PCI Express x16 slot (x16 lanes)

Hot-swap fans:
Three. Provide redundant cooling.

Hot-swap power supplies:
675 watts (100 - 240 V ac)
- Minimum: One
- Maximum: Two - provide redundant power

Size (2 U):
- Height: 85.2 mm (3.346 in.)
- Depth: EIA flange to rear - 698 mm (27.480 in.), Overall - 729 mm (28.701 in.)
- Width: With top cover - 443.6 mm (17.465 in.), With front bezel - 482.0 mm (18.976 in.)
- Weight: approximately 21.09 kg (46.5 lb) to 29.03 kg (64 lb) depending upon configuration

Integrated functions:
- Integrated Management Module (IMM), which provides service processor control and monitoring functions, video controller, and (when IMM Premium is installed) remote keyboard, video, mouse, and remote hard disk drive capabilities
- Dedicated or shared management network connections
- Six-port Serial ATA (SATA) controller
- Serial over LAN (SOL) and serial redirection over Telnet or Secure Shell (SSH)
- One systems-management RJ-45 for connection to a dedicated systems-management network
- Support for remote management presence through a virtual media key (IMM Premium)
- One Broadcom dual-port 10/100/1000 Ethernet controller with TCP/IP Offload Engine (TOE) support (second identical Ethernet controller on an optional internal adapter card)
- One serial port, shared with the Integrated Management Module (IMM)
- Four Universal Serial Bus (USB) ports (two on front, two on rear of server), v2.0 supporting v1.1, plus one or more dedicated internal USB ports on the SAS riser card
- Two video ports (one on front and one on rear of server)
  Note: Maximum video resolution 1600 x 1200 at 60Hz
- One SATA tape connector, one USB tape connector, and one tape power connector on SAS riser card (some models)

Note: In messages and documentation, the term *service processor* refers to the Integrated Management Module (IMM)

Video controller:
- Matrox G200 video on system board
- Compatible with SVGA and VGA
- 8 MB DDR2 SDRAM video memory

RAID controller:
- ServeRAID™-BR10i SAS/SATA Controller that supports RAID levels 0, 1, 1E (standard)
- Upgradeable to ServeRAID-MR10i SAS/SATA Controller, which supports RAID levels 0, 1, 5, 6, 10, 50, 60

Note: The RAID controllers are installed in a PCI Express x8 mechanical slot (x4 electrical); however, the controllers run at x4 bandwidth.

Environment:
- Air temperature:
  - Server on: 10° to 35°C (50.0° to 95.0°F); altitude: 0 to 914.4 m (3000 ft). Decrease system temperature by 0.75°C for every 1000-foot increase in altitude.
  - Server off: 10° to 43°C (50.0° to 109.4°F); maximum altitude: 2133 m (7000 ft)
  - Shipment: -40° to +60°C (-40° to 140°F); maximum altitude: 2133 m (7000 ft)
- Humidity:
  - Server on/off: 8% to 80%
  - Shipment: 5% to 100%

Acoustical noise emissions:
- Declared sound power, idle: 6.3 bel
- Declared sound power, operating: 6.5 bel

Heat output:
Approximate heat output in British thermal units (Btu) per hour:
- Minimum configuration: 307 Btu per hour (194 watts)
- Maximum configuration: 2662 Btu per hour (675 watts)

Electrical input with hot-swap ac power supplies:
- Sine-wave input (50-60 Hz) required
- Input voltage range automatically selected
- Input voltage low range:
  - Minimum: 100 V ac
  - Maximum: 240 V ac
- Input voltage high range:
  - Minimum: 200 V ac
  - Maximum: 240 V ac
- Input kilovolt-amperes (kVA) approximately:
  - Minimum: 0.12 kVA
  - Maximum: 0.78 kVA

Software

Lenovo provides software to help get your server up and running.

EasyStartup

The ThinkServer EasyStartup program simplifies the process of your RAID controller and installing supported Windows® and Linux operating systems and device drivers on your server.The EasyStartup program is provided with your server on DVD. The DVD is self starting (bootable). The User Guide for the EasyStartup program is on the DVD and can be accessed directly from the program's interface. For additional information, see “Using the *ThinkServer EasyStartup* DVD” on page 114.

EasyManage

The ThinkServer EasyManage Core Server provides centralized hardware and software inventory management and secure automated system management through a centralized console. The ThinkServer EasyManage Agent enables other clients on the network to be managed by the centralized console. The ThinkServer EasyManage Core Server is supported on 32-bit Windows Server 2003 and 32-bit Windows Server 2008 products. The ThinkServer EasyManage Agent is supported on 32-bit and 64-bit Windows, Red Hat, and SUSE operating systems.

Reliability, availability, and serviceability features

Three important computer design features are reliability, availability, and serviceability (RAS). The RAS features help to ensure the integrity of the data that is stored in the server, the availability of the server when you need it, and the ease with which you can diagnose and correct problems.

Your server has the following RAS features:

- 1-year parts and 1-year labor or 3-year labor and 3-year labor limited warranty
- Automatic error retry and recovery
- Automatic restart on nonmaskable interrupt (NMI)
- Automatic restart after a power failure
- Backup basic input/output system switching under the control of the Integrated Management Module (IMM)
- Built-in monitoring for fan, power, temperature, voltage, and power-supply redundancy
- Cable-presence detection on most connectors
- Advanced ECC memory protection
- Diagnostic support for RAID and Ethernet adapters
- Error codes and messages
- Error correcting code (ECC) L2 cache and system memory
- Hot-swap cooling fans with speed-sensing capability
- Hot-swap hard disk drives
- Information and EasyLED diagnostics LED panels
- Integrated Management Module (IMM)
- Menu-driven setup, system configuration, and redundant array of independent disks (RAID) configuration programs
- Microprocessor built-in self-test (BIST), internal error signal monitoring, configuration checking, and microprocessor and voltage regulator module failure identification through EasyLED diagnostics
- Memory mirroring support (hot-sparing and memory mirroring are mutually exclusive of each other)
- Redundant Ethernet capabilities with failover support

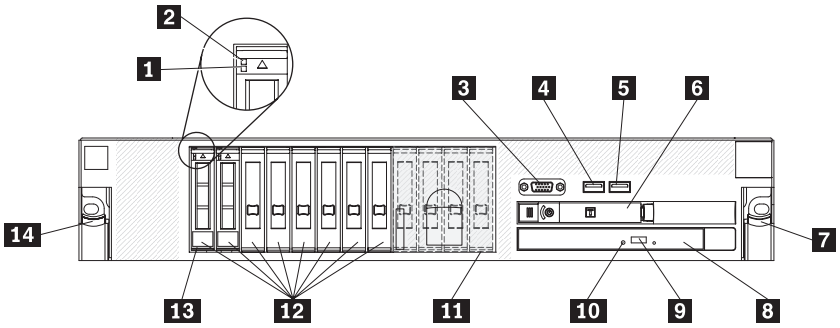
- Parity checking on the small computer system interface (SCSI) bus and PCI buses
- Power management: Compliance with Advanced Configuration and Power Interface (ACPI)
- Power-on self-test (POST)
- Hardware Failure Protection alerts on memory, microprocessors, SCSI hard disk drives, fans, and power supplies
- Redundant hot-swap power supplies and redundant hot-swap fans (some models)
- Redundant Network Interface Card (NIC) support
- Remind button to temporarily turn off the system-error LED
- Remote system problem-determination support
- ROM-based diagnostics
- ROM checksums
- Serial Presence Detection (SPD) on memory, VPD, power supply, and hard disk drives backplane
- Single-DIMM isolation of excessive correctable error or multi-bit error by the Unified Extensible Firmware Interface (UEFI- (formerly called BIOS))
- Standby voltage for system-management features and monitoring
- Startup (boot) from LAN through remote initial program load (RIPL) or dynamic host configuration protocol/boot protocol (DHCP/BOOTP)
- System auto- from the configuration menu
- System-error logging (POST and IMM)
- System-management monitoring through the Inter IC protocol
- Upgradeable POST, Unified Extensible Firmware Interface (UEFI), diagnostics, IMM firmware, and read-only memory (ROM) resident code, locally or over the LAN
- Vital product data (VPD) on microprocessors, system board, power supplies, SAS/SATA (hot-swap-drive) backplane, and power backplane

Chapter 4. Server controls, LEDs, and power

This section describes the controls and light-emitting diodes (LEDs) and how to turn the server on and off.

Front view

The following illustration shows the controls, light-emitting diodes (LEDs), and connectors on the front of the server.



1	Hard disk drive status LED (amber)	8	CD/DVD drive (optical drive)
2	Hard disk drive activity LED (green)	9	CD/DVD eject button
3	Video connector	10	CD/DVD drive activity LED
4	USB 1 connector	11	Bay 1
5	USB 2 connector	12	Hard disk drive bays
6	Operator information panel	13	Bay 0
7	Rack release latch	14	Rack release latch

Hard disk drive activity LED: Each hot-swap hard disk drive has an activity LED. When this LED is flashing, it indicates that the drive is in use.

Hard disk drive status LED: Each hot-swap hard disk drive has a status LED. When this LED is lit, it indicates that the drive has failed. When this LED is flashing slowly (one flash per second), it indicates that the drive is being rebuilt as part of a RAID configuration. When the LED is flashing rapidly (three flashes per second), it indicates that the controller is identifying the drive.

Video connector: Connect a monitor to this connector. The video connectors on the front and rear of the server can be used simultaneously.

USB connectors: Connect a USB device, such as USB mouse, keyboard, or other USB device, to either of these connectors.

Operator information panel: This panel contains controls, LEDs, and connectors. For information about the controls, LEDs, and connectors on the operator information panel, see “Operator information panel” on page 16.

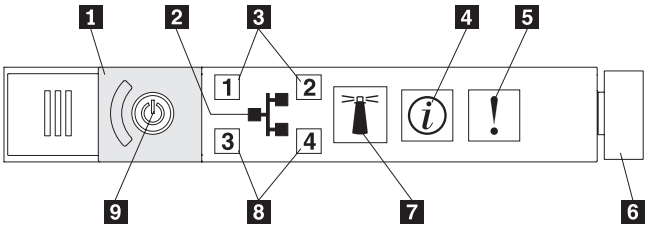
CD/DVD-eject button: Press this button to release a CD or DVD from the CD-RW/DVD drive.

CD/DVD drive activity LED: When this LED is lit, it indicates that the CD-RW/DVD drive is in use.

Rack release latches: Press these latches to release the server from the rack.

Operator information panel

The following controls, LEDs, and connectors are on the operator information panel:



1	Power-control button cover	6	Release latch
2	Ethernet icon LED	7	Locator button/locator LED
3	Ethernet activity LEDs	8	Ethernet activity LEDs
4	Information LED	9	Power-control button/power-on LED
5	System-error LED		

- **Ethernet icon LED:** This LED lights the Ethernet icon.
- **Ethernet activity LEDs:** When any of these LEDs is lit, it indicates that the server is transmitting to or receiving signals from the Ethernet LAN that is connected to the Ethernet port that corresponds to that LED.
- **Information LED:** When this LED is lit, it indicates that a noncritical event has occurred. An LED on the diagnostics panel is also lit to help isolate the error.
- **System-error LED:** When this LED is lit, it indicates that a system error has occurred. An LED on the diagnostics panel is also lit to help isolate the error.
- **Release latch:** Slide this latch to the left to access the diagnostics panel, which is behind the operator information panel.
- **Power-control button and power-on LED:** Press this button to turn the server on and off manually or to wake the server from a reduced-power state. The states of the power-on LED are as follows:

  Off: AC power is not present, or the power supply or the LED itself has failed.

  Flashing rapidly (4 times per second): The server is turned off and is not ready to be turned on. The power-control button is disabled. Approximately 3 minutes after the server is connected to ac power, the power-control button becomes active.

  Flashing slowly (once per second): The server is turned off and is ready to be turned on. You can press the power-control button to turn on the server.

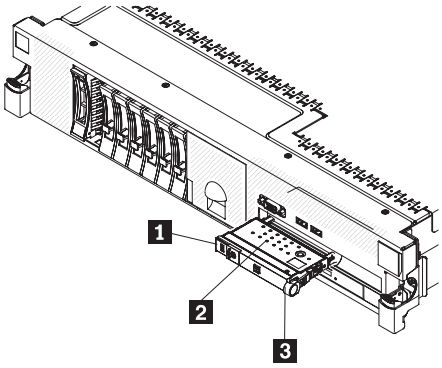
  Lit: The server is turned on.

  Fading on and off: The server is in a reduced-power state. To wake the server, press the power-control button or use the IMM Web interface. For information about logging on to the IMM Web interface, see “Logging on to the Web interface” on page 125.

EasyLED diagnostics panel

The EasyLED diagnostics panel is located on the top of the operator information panel.

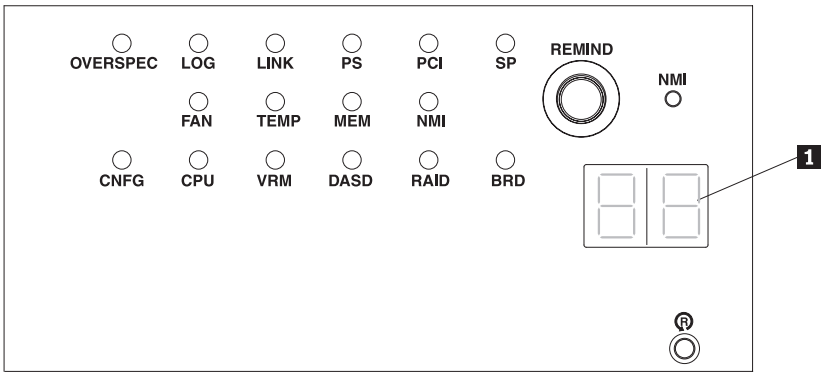
To access the diagnostics panel, slide the blue release button on the operator information panel to the left. Pull forward on the operator panel until the hinge of the panel is free of the server chassis. Then pull down on the operator panel, so that you can view the diagnostics panel information.



1	Operator information panel
2	Diagnostic LEDs
3	Release latch

The following illustration shows the controls and LEDs on the diagnostics panel.

Note: Diagnostics LEDs remain lit only while the server is connected to power.



A checkpoint code (See checkpoint code display 1) is either a byte or a word value produced by UEFI and sent to the I/O port indicating the point at which the system stopped during the boot block and Power-On Self Test (POST). It does not provide error codes or suggest replacement components. These codes can be used by Lenovo Support for more in depth troubleshooting.

- **Remind button:** This button places the system-error LED on the front panel into Remind mode. In Remind mode, the system-error LED flashes once every 2 seconds until the problem is corrected, the system is restarted, or a new problem occurs.

  By placing the system-error LED indicator in Remind mode, you acknowledge that you are aware of the last failure but will not take immediate action to correct the problem. The remind function is controlled by the IMM.
- **NMI button:** Press this button to force a nonmaskable interrupt to the microprocessor, if directed to do so by service and support.
- **Check-point code display:** During POST, this display indicates server firmware progress. The display does not provide error codes or suggest components to be replaced. Checkpoint codes can be used by Lenovo Support for further troubleshooting. See the *Hardware Maintenance Manual* for more information about checkpoint codes.

There are two types of checkpoint codes: field programmable gate array (FPGA) hardware checkpoint codes and UEFI checkpoint codes. The UEFI checkpoint codes might change because of code sequence and timing changes or when the server firmware is updated.

- **Reset button:** Press this button to reset the server and run the power-on self-test (POST). You might have to use a pen or the end of a straightened paper clip to press the button. The reset button is in the lower right-hand corner of the diagnostics panel.

For more information about EasyLED diagnostics, see the *Hardware Maintenance Manual*.

The following table lists the LEDs on the EasyLED diagnostics panel and suggested actions to solve the detected problems.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

LED	Description	Action
None, but the system-error LED is lit.	An error has occurred and cannot be diagnosed, or the IMM has failed. The error is not represented by an EasyLED diagnostics LED.	Use the Setup utility to check the system-event log for information about the error.
OVER SPEC	The server was shut down due to a power-supply overload condition on one of the power channels. The power supplies are using more power than the maximum rating.	1. If any of the 12v power channel error LEDs (A, B, C, D, E, or AUX) on the system board are lit also, see "Power problems" on page 138. (See "System-board LEDs" on page 27 for the location of the power channel error LEDs.) 2. Check the power supply LEDs for an error indication (AC LED and DC LED are not both lit, or the power-supply error LED is lit). Swap power supplies 1 and 2 with each other. • If the error follows the power supply, replace the failed power supply. • If the error remains with the power bay, (trained service technician only) replace the system board. 3. Remove optional devices from the server.
LOG	An error message has been written to the system-event log	Check the IMM system event log and the system-error log for information about the error. Replace any components that are identified in the error logs.
LINK	Reserved.	
PS	A power supply has failed.	1. Check the power supply LEDs for an error indication (AC LED and DC LED are not both lit). See Table 16 on page 149 for more information. 2. Make sure that the failing power supply is correctly seated. 3. Replace the failed power supply.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the** *Hardware Maintenance Manual* **to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

LED	Description	Action
PCI	An error has occurred on a PCI bus or on the system board. An additional LED will be lit next to a failing PCI slot.	1. Check the LEDs on the PCI slots to identify the component that is causing the error. 2. Check the system-event log for information about the error. 3. If you cannot isolate the failing adapter through the LEDs and the information in the system-event log, remove one adapter at a time from the failing PCI bus, and restart the server after each adapter is removed. 4. Call for service.
SP™	The service processor (the IMM) has failed.	1. Remove power from the server; then, reconnect the server to power and restart the server. 2. Update the firmware on the IMM. 3. Call for service
FAN	A fan has failed, is operating too slowly, or has been removed. The TEMP LED might also be lit.	Replace the failing fan, which is indicated by a lit LED near the fan connector on the system board.
TEMP	The system temperature has exceeded a threshold level. A failing fan can cause the TEMP LED to be lit.	1. Check the error log to identify where the over-temperature condition was measured. If a fan has failed, replace it. 2. Make sure that the room temperature is not too high. See Table 3 on page 11 for temperature information. 3. Make sure that the air vents are not blocked. 4. Call for service.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

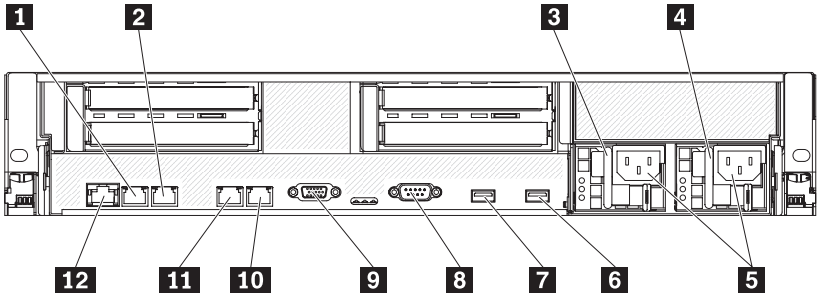
LED	Description	Action
MEM	When only the MEM LED is lit, a memory error has occurred. When the MEM and CNFG LEDs are lit, the memory configuration is not valid.	1. Determine whether the CNFG LED is also lit. If it is, run the memory test exerciser to isolate the problem (see *Hardware Maintenance Manual* for more information). a. If the test reports that a memory error has occurred, replace the failing DIMM, which is indicated by the lit LED on the system board. b. If the test reports the memory configuration is invalid, repopulate the DIMMs to a supported configuration. 2. If the CNFG LED is not lit, one of the following conditions should be present: • The server did not boot and a failing DIMM LED is lit. a. Check for a PFA log event in the System Event Log (SEL) b. Reseat the DIMM. c. If the problem remains, move the DIMM to a different slot. 1) If the DIMM LED lights up on the system board that corresponds to this new DIMM socket, replace the DIMM. 2) If the DIMM LED lights up on the system board that corresponds to the original DIMM socket, replace the system board (trained service technician only). • The server booted and the failing DIMM is disabled and the LED is lit. a. If the LEDs are lit by two DIMMs, check the System Event Log for PFA on one of the DIMMs, then replace that DIMM. Otherwise, replace both DIMMs. b. If the LED is lit by only one DIMM, replace that DIMM. c. Re-enable the DIMM sockets in the server firmware settings.
NMI	A nonmaskable interrupt has occurred, or the NMI button has been pressed.	Check the system-event log for information about the error.
CNFG	A hardware configuration error has occurred. (This LED is used with the MEM and the CPU LEDs.)	

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

LED	Description	Action
CPU	When only the CPU LED is lit, a microprocessor has failed. When the CPU and CNFG LEDs are lit, the microprocessor configuration is not valid.	1. Determine whether the CNFG LED is also lit. If the CNFG LED is not lit, a microprocessor has failed. a. Make sure that the failing microprocessor, which is indicated by a lit LED on the system board, is installed correctly. See the *Hardware Maintenance Manual* for information about installing a microprocessor. b. If the failure remains, call service. 2. If the CNFG LED is lit, then an invalid microprocessor configuration has occurred. a. Make sure that the microprocessors are compatible with each other. They must match in speed and cache size. To compare the microprocessor information, run the Setup utility and select **System Information**, then select **System Summary**, and then select **Processor Details**. b. (Trained service technician only) Replace an incompatible microprocessor. c. If the failure remains, call for service.
VRM	Reserved.	
DASD	A hard disk drive error has occurred. A hard disk drive has failed or is missing.	1. Check the LEDs on the hard disk drives for the drive with a lit status LED and reseat the hard disk drive. 2. Reseat the hard disk drive backplane. 3. Remove and reinstall the hard disk drive backplanes. See the *Hardware Maintenance Manual* for information about removing and installing a hard disk drive backplane. 4. Replace the hard disk drive backplane for the failing drive or drives. 5. Call for service.
RAID	Reserved	
BRD	An error has occurred on the system board.	1. Check the LEDs on the system board to identify the component that is causing the error. 2. Check the system-event log for information about the error. 3. Replace any failed or missing replaceable components, such as the battery or PCI riser-card assembly. 4. If a voltage regulator has failed, replace the system board.

Rear view

The following illustration shows the connectors and LEDs on the rear of the server.



1	Ethernet 3 (optional) connector	7	USB 3 connector
2	Ethernet 4 (optional) connector	8	Serial connector
3	Power supply 1 connector	9	Video connector
4	Power supply 2 connector	10	Ethernet 2 connector
5	Power cord connectors	11	Ethernet 1 connector
6	USB 4 connector	12	Systems-management (Ethernet)

Ethernet connectors: Use any of these connectors to connect the server to a network.

Power-cord connector: Connect the power cord to this connector.

USB connectors: Connect a USB device, such as USB mouse, keyboard, or other USB device, to any of these connectors.

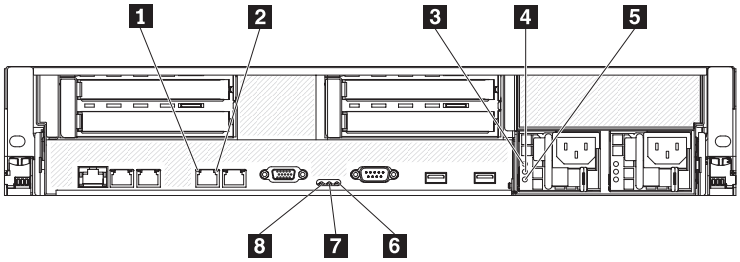
Serial connector: Connect a 9-pin serial device to this connector. The serial port is shared with the Integrated Management Module (IMM). The IMM can take control of the shared serial port to perform text console redirection and to redirect serial traffic, using Serial over LAN (SOL).

Video connector: Connect a monitor to this connector. The video connectors on the front and rear of the server can be used simultaneously.

Note: The maximum video resolution is 1280 x 1024 at 75 Hz.

Systems-management Ethernet connector: Use this connector to connect the server to a network for systems-management information control. This connector is used only by the IMM.

The following illustration shows the LEDs on the rear of the server:



1	Ethernet activity LED	5	Power-supply error LED (amber)
2	Ethernet link LED	6	System-error LED (amber)
3	AC power LED (green)	7	Locator LED (blue)
4	DC power LED (green)	8	Power-on LED (green)

Ethernet activity LEDs: When these LEDs are lit, they indicate that the server is transmitting to or receiving signals from the Ethernet LAN that is connected to the Ethernet port.

Ethernet link LEDs: When these LEDs are lit, they indicate that there is an active link connection on the 10BASE-T, 100BASE-TX, or 1000BASE-TX interface for the Ethernet port.

AC power LED: Each hot-swap power supply has an ac power LED and a dc power LED. When the ac power LED is lit, it indicates that sufficient power is coming into the power supply through the power cord. During typical operation, both the ac and dc power LEDs are lit. For any other combination of LEDs, see the *Hardware Maintenance Manual*.

DC power LED: Each hot-swap power supply has a dc power LED and an ac power LED. When the dc power LED is lit, it indicates that the power supply is supplying adequate DC power to the system. During typical operation, both the ac and dc power LEDs are lit. For any other combination of LEDs, see the *Hardware Maintenance Manual*.

Power-supply error LED: When the power-supply error LED is lit, it indicates that the power supply has failed.

System-error LED: When this LED is lit, it indicates that a system error has occurred. An LED on the diagnostics panel is also lit to help isolate the error.

Power-on LED: Press this button to turn the server on and off manually or to wake the server from a reduced-power state. The states of the power-on LED are as follows:

Off: AC power is not present, or the power supply or the LED itself has failed.

Flashing rapidly (4 times per second): The server is turned off and is not ready to be turned on. The power-control button is disabled. Approximately 3 minutes after the server is connected to ac power, the power-control button becomes active.

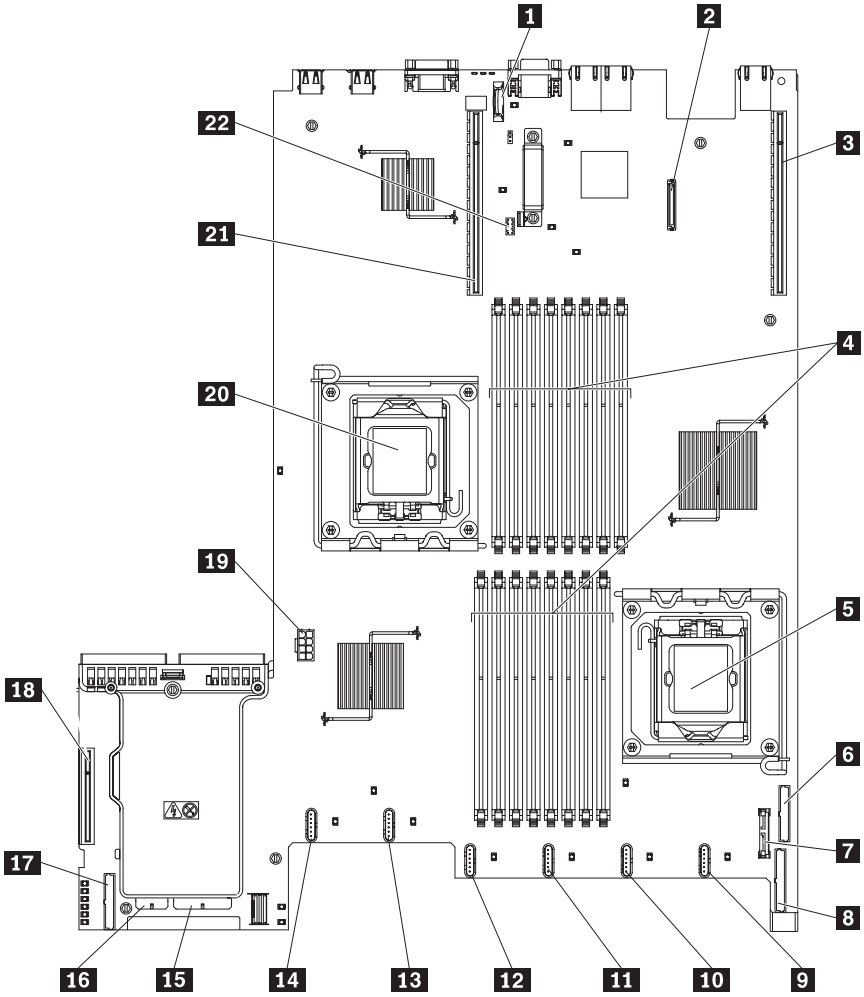
Flashing slowly (once per second): The server is turned off and is ready to be turned on. You can press the power-control button to turn on the server.

Lit: The server is turned on.

Fading on and off: The server is in a reduced-power state. To wake the server, press the power-control button or use the IMM Web interface. For information about logging on to the IMM Web interface, see “Logging on to the Web interface” on page 125.

System-board internal connectors

The following illustration shows the internal connectors on the system board.



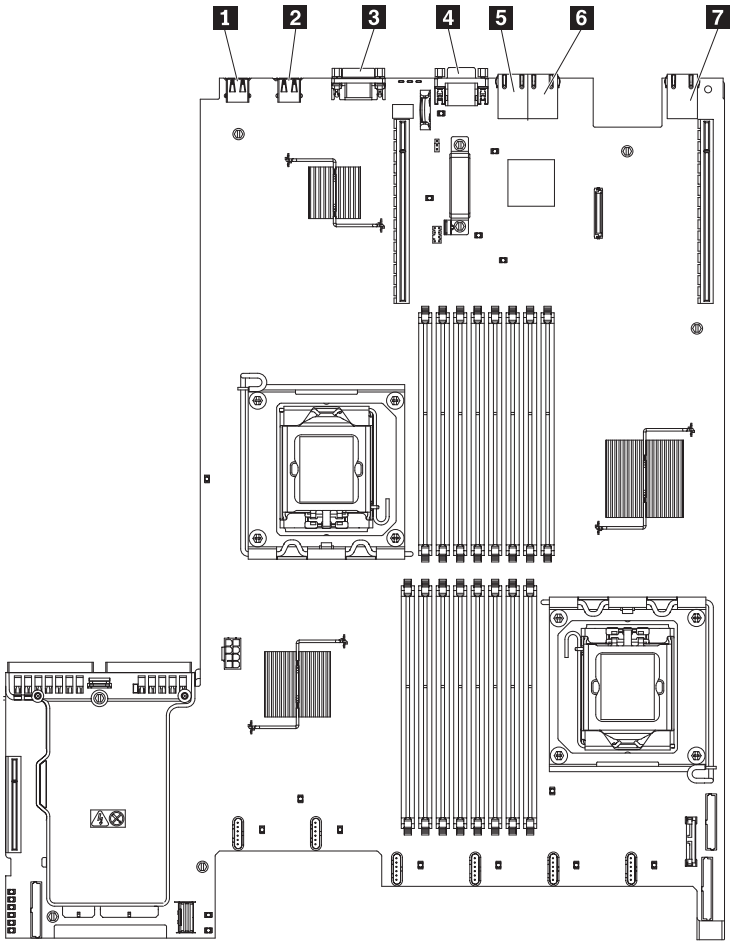
1	Battery	12	Fan connector 2
2	Optional two-port Ethernet card connector	13	Reserved
3	PCI riser connector 1	14	Fan connector 3
4	DIMM connectors	15	Hot-swap SAS/SATA power connector backplane 1 and 2
5	Microprocessor 1	16	Hot-swap SAS/SATA power connector optional backplane 3
6	Operator information panel connector	17	Hot-swap SAS/SATA configuration cable connector
7	Optical drive connector	18	SAS riser-card connector
8	Front video/USB connector	19	Auxiliary power for PCI Express graphics adapter connector
9	Reserved	20	Microprocessor 2
10	Fan connector 1	21	PCI riser connector 2

11 Reserved

22 Virtual media key connector

System-board external connectors

The following illustration shows the external input/output connectors on the system board.



1 USB connector 4
2 USB connector 3
3 Serial connector
4 Video connector
5 Ethernet connector 2
6 Ethernet connector 1
7 Systems management Ethernet connector

System-board switches and jumpers

Any switches or jumpers on the system board that are not shown in the illustration are reserved. See the section about recovering the unified extensible firmware interface (UEFI) code in the *Hardware Maintenance Manual* for information about using the UEFI boot recovery jumper.

The following illustration shows the switches and jumpers on the system board.

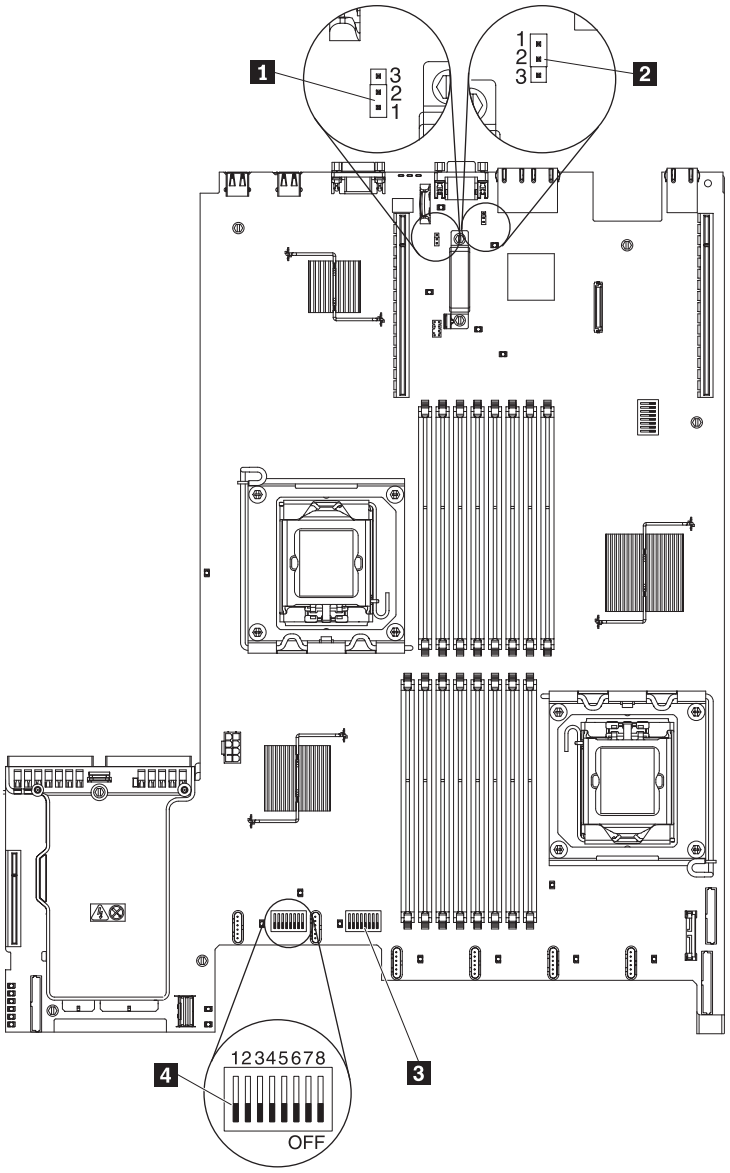


Table 4. Callout descriptions

	Jumper name	Jumper setting
1	UEFI boot recovery jumper (J29)	• Pins 1 and 2: Normal (default) Loads the primary server firmware (formerly called BIOS) ROM page. • Pins 2 and 3: Loads the secondary (backup) server firmware ROM page.
2	IMM recovery jumper (J147)	• Pins 1 and 2: Normal (default) Loads the primary IMM firmware ROM page. • Pins 2 and 3: Loads the secondary (backup) IMM firmware ROM page.
3	SW4 switch block (reserved)	
4	SW3 switch block	

Table 4. Callout descriptions (continued)

Notes:

1. If no jumper is present, the server responds as if the pins are set to 1 and 2.
2. Changing the position of the UEFI boot recovery jumper from pins 1 and 2 to pins 2 and 3 before the server is turned on alters which flash ROM page is loaded. Do not change the jumper pin position after the server is turned on. This can cause an unpredictable problem.

Table 5 describes the function of each switch on the switch block.

Table 5. Switch block 3, switches 1 - 8

Switch number	Default value	Switch description
8	Off	Reserved.
7	Off	Reserved.
6	Off	Reserved.
5	Off	Power-on password override. Changing the position of this switch bypasses the power-on password check the next time the server is turned on and starts the Setup utility so that you can change or delete the power-on password. You do not have to move the switch back to the default position after the password is overridden. Changing the position of this switch does not affect the administrator password check if an administrator password is set. See “Passwords” on page 107 for additional information about the power-on password.
4	Off	Reserved.
3	Off	Reserved.
2	Off	Reserved.
1	Off	Reserved.Clear

Clear CMOS. When this switch is toggled to On, it clears the CMOS data, which clears the power-on password.

Important:

1. Before you change any switch settings or move any jumpers, turn off the server; then, disconnect all power cords and external cables. (Review the information in “Safety” on page vii, “Installation guidelines” on page 33, “Handling static-sensitive devices” on page 35, and “Turning off the server” on page 31.)
2. Any system-board switch or jumper blocks that are not shown in the illustrations in this document are reserved.

System-board LEDs

The following illustration shows the light-emitting diodes (LEDs) on the system board.

Note: Error LEDs remain lit only while the server is connected to power.

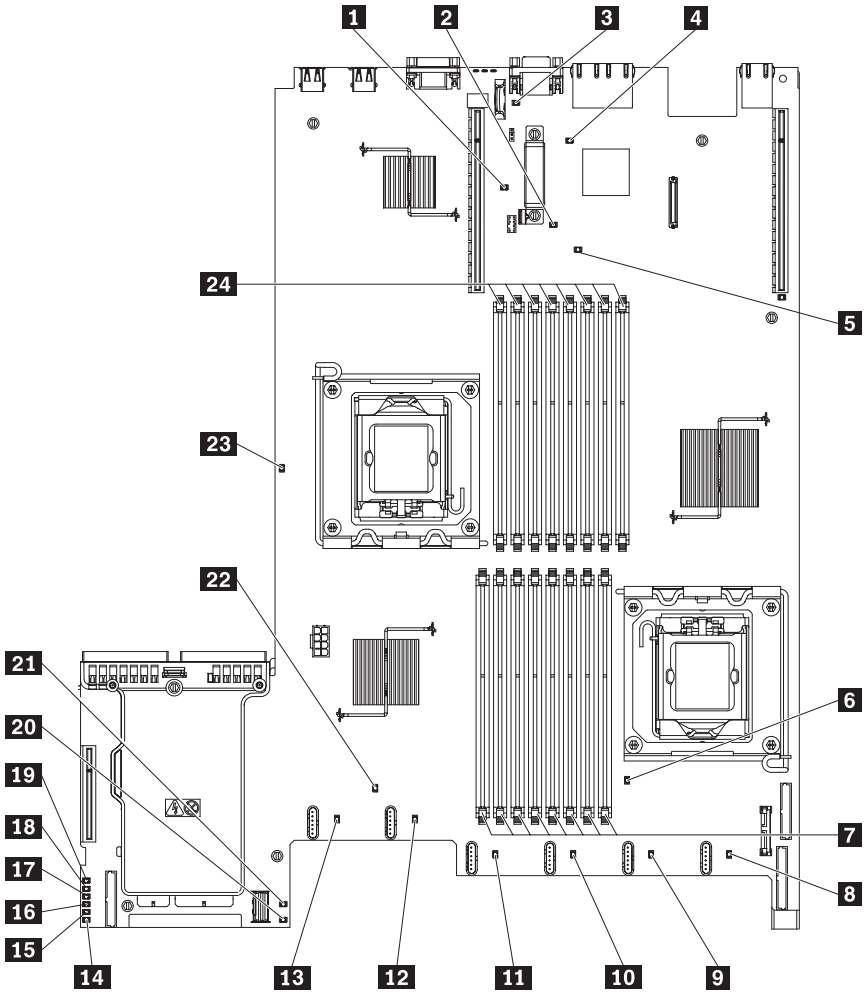


Table 6. Callout descriptions

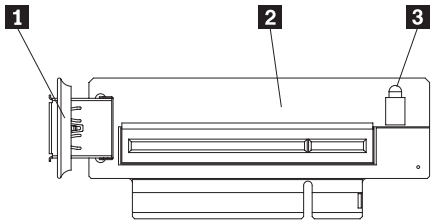
1	PCI riser 2 LED	13	Fan 3 error LED
2	Enclosure manager heartbeat LED	14	Power channel A LED
3	Battery error LED	15	Power channel B LED
4	IMM heartbeat LED	16	Power channel C error LED
5	PCI riser 1 LED	17	Power channel D error LED
6	Microprocessor 1 error LED	18	Power channel E error LED
7	DIMMs 1 - 8 error LEDs	19	Power channel F error LED
8	Reserved	20	240 - V AUX channel error LED
9	Fan 1 error LED	21	SAS riser missing LED
10	Reserved	22	System-board error LED
11	Fan 2 error LED	23	Microprocessor 2 error LED
12	Reserved	24	DIMMs 9-16 error LEDs

SAS riser-card connectors and LEDs

The following illustrations show the connectors and LEDs on the SAS riser cards.

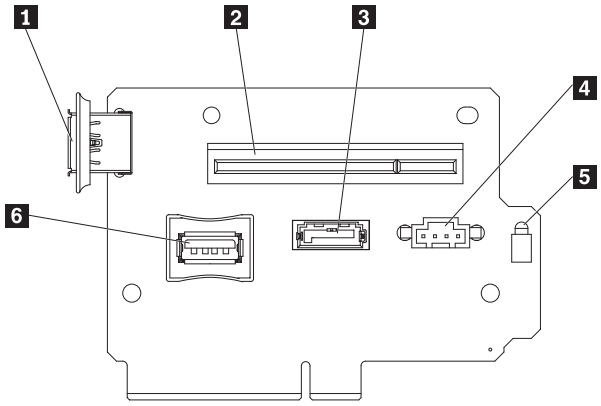
Note: Error LEDs remain lit only while the server is connected to power.

A 12-drive-capable model server or a diskless model server contains the following riser card:



1 USB connector
2 PCI Express RAID adapter
3 SAS error LED

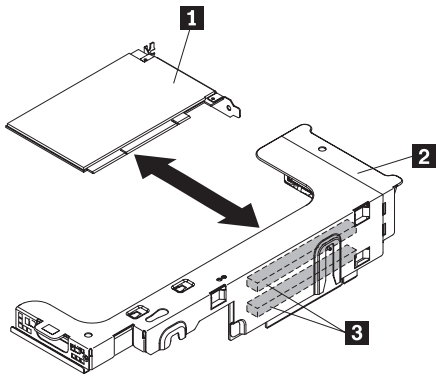
A tape-enabled model server contains the following riser card:



1 USB connector
2 PCI Express RAID adapter
3 SATA tape signal
4 Tape power
5 SAS error LED
6 USB tape

PCI riser-card adapter connectors

The following illustration shows the connectors on the PCI riser card for user-installable PCI adapters.

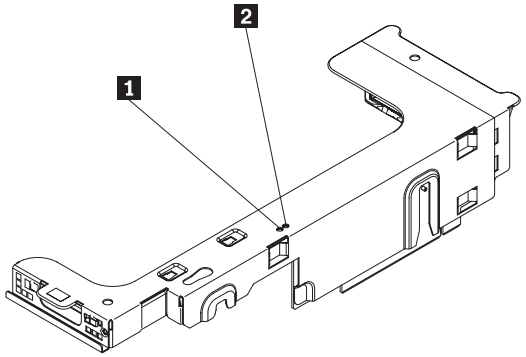


1 Adapter
2 PCI riser-card assembly
3 Adapter connectors

PCI riser-card assembly LEDs

The following illustration shows the light-emitting diodes (LEDs) on the PCI riser-card assembly.

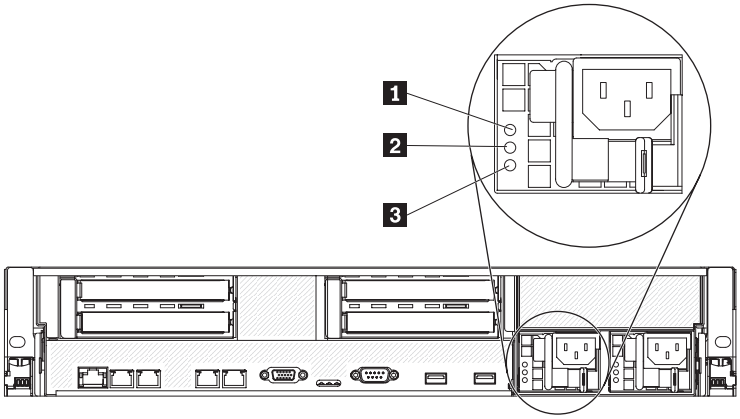
Note: Error LEDs remain lit only while the server is connected to power.



1 Lower PCI slot error LED
2 Upper PCI slot error LED

Power-supply LEDs

The following illustration shows the power-supply LEDs on the rear of the server. For more information about solving power-supply problems, see the *Hardware Maintenance Manual*.



1 AC power LED (green)
2 DC power LED (green)
3 Power-supply error LED (amber)

Server power features

When the server is connected to a power source but is not turned on, the operating system does not run, and all core logic except for the Integrated Management Module (IMM) is shut down; however, the server can respond to requests from the IMM, such as a remote request to turn on the server. The power-on LED flashes to indicate that the server is connected to power but is not turned on.

Turning on the server

Approximately 3 minutes after the server is connected to power, the power-control button becomes active, and one or more fans might start running to provide cooling while the server is connected to power. You can turn on the server and start the operating system by pressing the power-control button. If a power failure occurs while the server is turned on, the server will restart automatically when power is restored.

For 32-bit operating systems only: Some memory is reserved for various system resources and is unavailable to the operating system. The amount of memory that is reserved for system resources depends on the operating system, the configuration of the server, and the configured PCI options.

Turning off the server

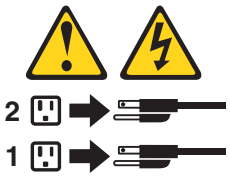
When you turn off the server and leave it connected to power, the server can respond to requests from the IMM, such as a remote request to turn on the server. While the server remains connected to power, one or more fans might continue to run. To remove all power from the server, you must disconnect it from the power source.

Important: To view the error LEDs on the system board, leave the server connected to a power source.

Some operating systems require an orderly shutdown before you turn off the server. See your operating-system documentation for information about shutting down the operating system.

Statement 5:

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



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

- You can 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 will be turned off automatically.
- You can press the power-control button to start an orderly shutdown of the operating system and turn off the server, if your operating system supports this feature.
- If the operating system stops functioning, you can press and hold the power-control button for more than 4 seconds to turn off the server.
- The IMM can turn off the server as an automatic response to a critical system failure.
- You can turn off the server through a request from the IMM.

Chapter 5. Installing optional devices and replacing customer replaceable units

This chapter provides hardware installation and replacement procedures for customer replaceable units.

Installation guidelines

Before you install optional devices, read the following information:

- Read the safety information that begins on page vii, “Handling static-sensitive devices” on page 35, and the guidelines in this section. This information will help you work safely.
- When you install your new server, take the opportunity to download and apply the most recent firmware updates. This step will help 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, complete the following steps:
  1. Go to: http://www.lenovo.com/support.
  2. Enter your product number (machine type and model number) or select **Servers and Storage** from the **Select your product** list.
  3. Select **Servers and Storage** from the **Brand** list.
  4. From **Family** list, select **ThinkServer RD220**, and click **Continue**.
  5. Click **Downloads and drivers** to download firmware updates.

  .
- Before you install optional hardware, make sure that the server is working correctly. Start the server, and make sure that the operating system starts, if an operating system is installed, or that a 19990305 error code is displayed, indicating that an operating system was not found but the server is otherwise working correctly. If the server is not working correctly, refer to the *Hardware Maintenance Manual* for diagnostic information.
- Observe good housekeeping in the area where you are working. Place removed covers and other parts in a safe place.
- If you must start the server while the cover is removed, make sure that no one is near the server and 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:
  - Make sure 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.
- Make sure that you have an adequate number of properly grounded electrical outlets for the server, monitor, and other devices.
- Back up all important data before you make changes to disk drives.
- Have a small flat-blade screwdriver available.
- To view the error LEDs on the system board and internal components, leave the server connected to power.

- You do not have to turn off the server to install or replace hot-swap fans, redundant hot-swap ac power supplies, or hot-plug Universal Serial Bus (USB) devices. However, you must turn off the server before performing any steps that involve removing or installing adapter cables or non-hot-swap optional devices or components.
- Blue on a component indicates touch points, where you can grip the component to remove it from or install it in the server, open or close a latch, and so on.
- Orange on a component or an orange label on or near a component indicates that the component can be hot-swapped, which means that if the server and operating system support hot-swap capability, you can remove or install the component while the server is running. (Orange can also indicate touch points on hot-swap components.) See the instructions for removing or installing a specific hot-swap component for any additional procedures that you might have to perform before you remove or install the component.
- When you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.
- For a list of supported optional devices for the server, see http://www.lenovo.com/thinkserver.

System reliability guidelines

To help ensure proper system cooling and system reliability, make sure that the following requirements are met:

- Each of the drive bays has a drive or a filler panel and electromagnetic compatibility (EMC) shield installed in it.
- If the server has redundant power, each of the power-supply bays has a power supply installed in it.
- There is adequate space around the server to allow the server cooling system to work properly. Leave approximately 50 mm (2.0 in.) 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, replace the server cover before you turn on the server. Operating the server for extended periods of time (more than 30 minutes) with the server cover removed might damage server components.
- You have followed the cabling instructions that come with optional adapters.
- You have replaced a failed fan within 48 hours.
- You have replaced a hot-swap fan within 30 seconds of removal.
- You have replaced a hot-swap drive within 2 minutes of removal.
- You do not operate the server without the air baffles installed. Operating the server without the air baffles might cause the microprocessors to overheat.
- Microprocessor 2 air baffle and DIMM air baffle are installed.
- The EasyLED diagnostics panel is not pulled out of the server.

Working inside the server with the power on

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

The server supports hot-plug, hot-add, and 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 a server that is turned 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, that could fall into the server as you lean over it.
- Avoid dropping any metallic objects, such as paper clips, hairpins, and screws, into the server.

Handling static-sensitive devices

Attention: Static electricity can damage the server and other electronic devices. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them.

To reduce the possibility of damage from electrostatic discharge, observe the following precautions:

- 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 wrist strap, if one is available. Always use an electrostatic-discharge wrist strap or other grounding system when working inside the server with the power on.
- Handle the device carefully, holding it 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 damage it.
- While the device is still in its static-protective package, touch it to an unpainted metal surface on the outside of the server for at least 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into the server without setting down the device. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on the server cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

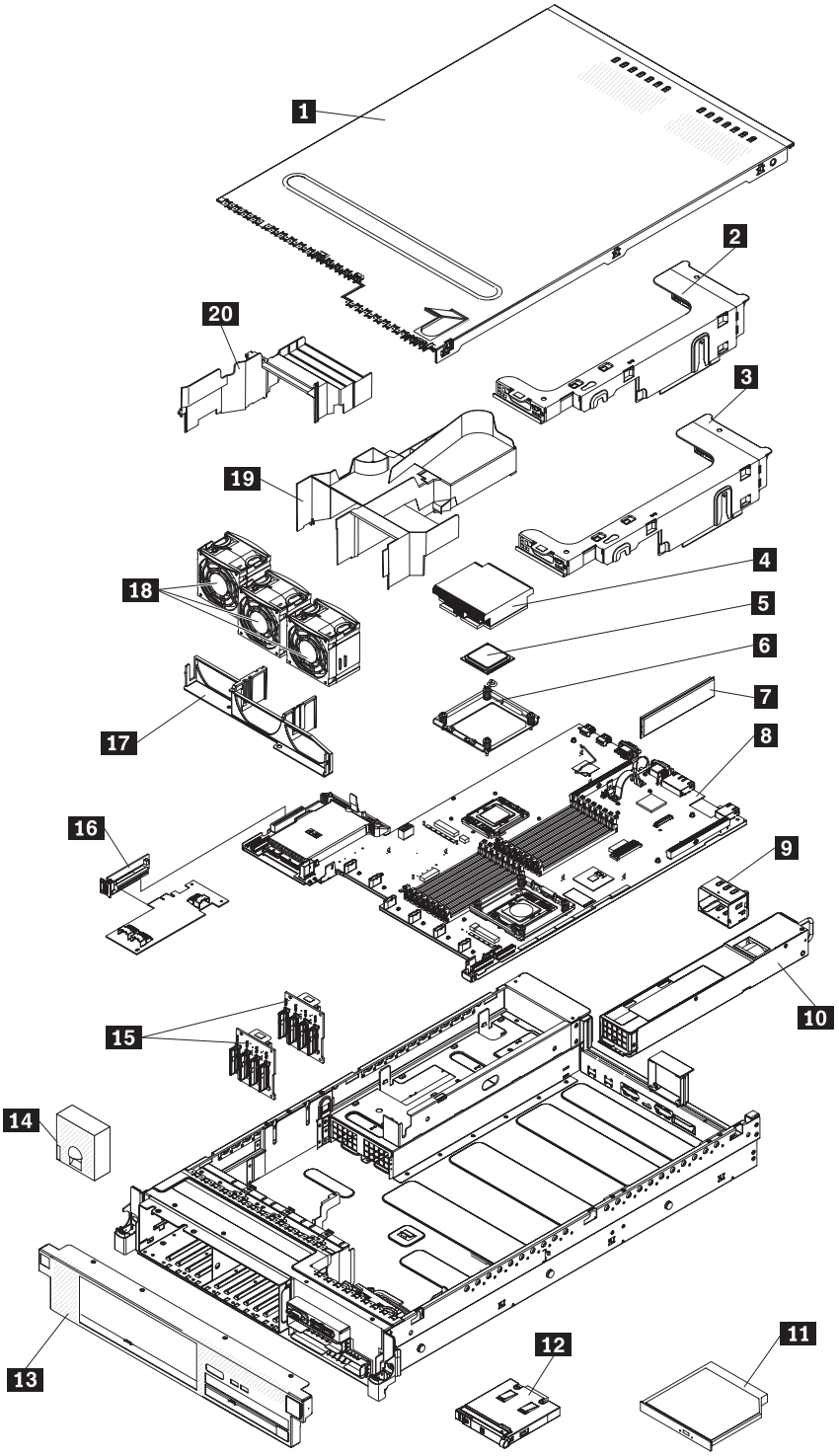
Major components of the server

Blue on a component indicates touch points, where you can grip the component to remove it from or install it in the server, open or close a latch, and so on.

Orange on a component or an orange label on or near a component indicates that the component can be hot-swapped, which means that if the server and operating system support hot-swap capability, you can remove or install the component while the server is running. (Orange can also indicate touch points on hot-swap components.) See the instructions for removing or installing a specific hot-swap component for any additional procedures that you might have to perform before you remove or install the component.

The following illustrations show the major components in the server.

Note: The illustrations in this document might differ slightly from your hardware.



1 Cover
2 PCI riser-card assembly
3 PCI riser-card assembly
4 Heat sink
5 Microprocessor
6 Heat-sink retention module
7 DIMM
8 System board
9 Power-supply filler panel
10 Power supply
11 CD/DVD drive
12 Operator information panel
13 Front bezel (some models)
14 4-drive filler panel
15 SAS hard disk drive backplanes
16 SAS riser card
17 Fan bracket
18 Fans
19 DIMM air baffle
20 Microprocessor 2 air baffle

Removing the cover

Important: Before you install optional hardware, make sure that the server is working correctly. Start the server, and make sure that the operating system starts, if an operating system is installed, or that a 19990305 error code is displayed, indicating that an operating system was not found but the server is otherwise working correctly. If the server is not working correctly, see the *Hardware Maintenance Manual* for diagnostic information.

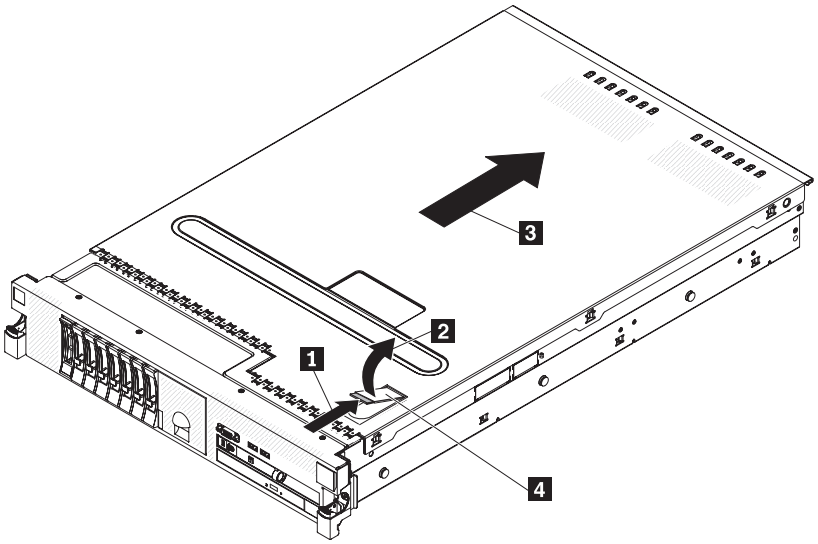
To remove the cover, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. If you are planning to view the error LEDs that are on the system board and components, leave the server connected to power and go directly to step 4 on page 38.
3. If you are planning to install or remove a microprocessor, memory module, PCI adapter, battery, or other non-hot-swap optional device, turn off the server and all attached devices and disconnect all external cables and power cords (see “Turning off the server” on page 31).

4. Press down on the left and right side latches and pull the server out of the rack enclosure until both slide rails lock.

   Note: You can reach the cables on the rear of the server when the server is in the locked position.

   The following illustration shows how to remove the cover.



5. Press the blue latch **1** on the end of the cover-release latch **4** and lift the cover-release latch **2**. Slide the cover forward **3** and lift the cover off the server. Set the cover aside.

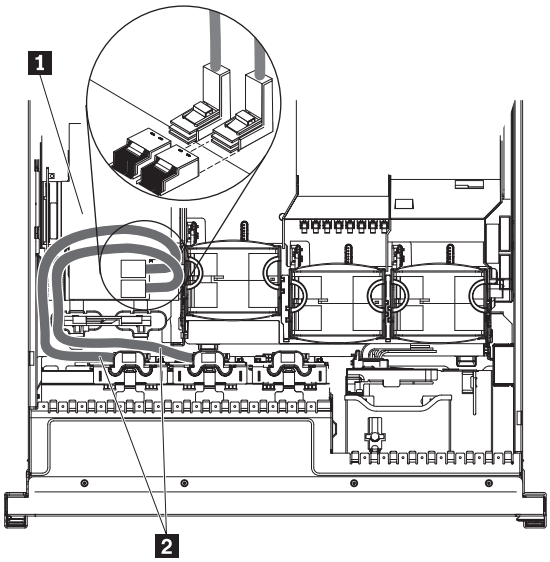
Attention: For proper cooling and airflow, replace the cover before you turn on the server. Operating the server for extended periods of time (over 30 minutes) with the cover removed might damage server components.

Internal cable routing and connectors

The following illustration shows the internal routing and connectors for the two SAS signal cables (in server models with eight SAS drive bays).

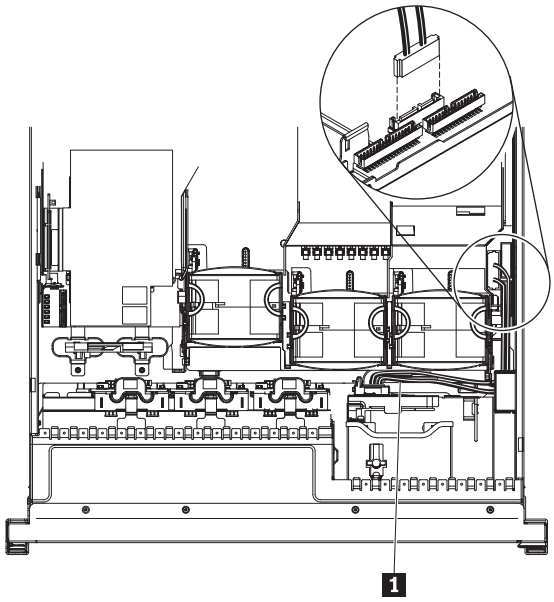
Notes:

1. To connect the SAS signal cables, make sure that you first connect the signal cable, and then the power cable and signal cable.
2. To disconnect the SAS signal cables, make sure that you first disconnect the power cable, and then the signal cable and configuration cable.

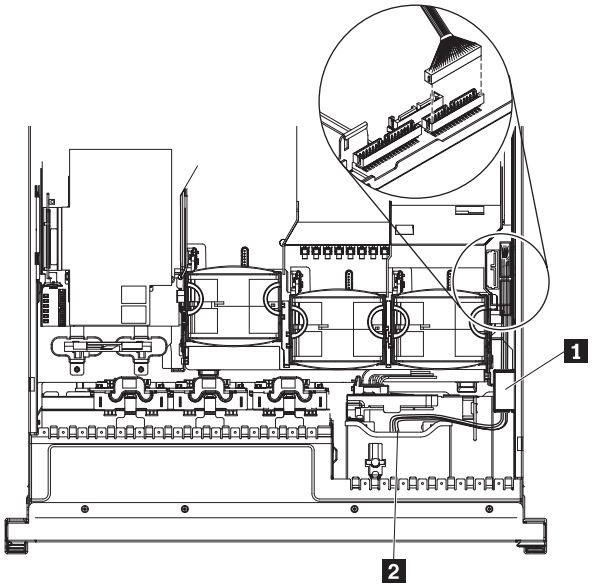


1 ServeRAID- MR10i SAS/SATA controller
2 SAS signal cables

The SATA cable is a combination power and signal cable with a shared connector on both ends. The following illustration shows the internal routing and connector for the SATA cable 1 .



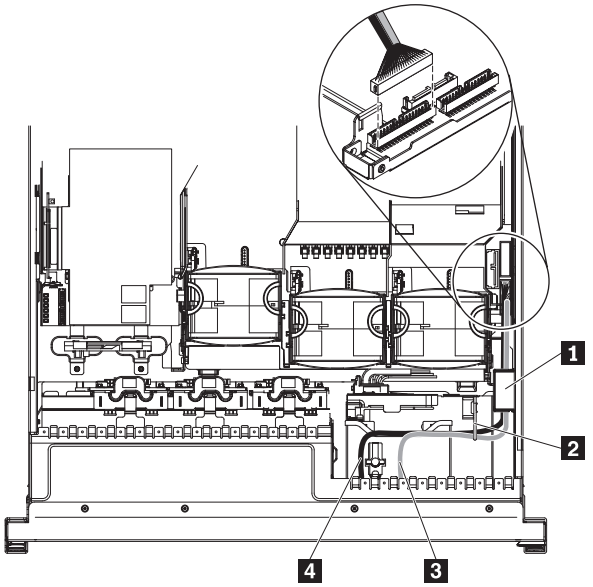
The following illustration shows the internal routing and connector for the operator information panel cable.



1	Top cover latch receptacle
2	Operator panel cable

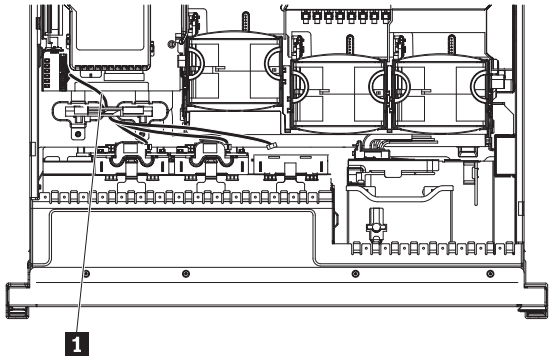
The following illustration shows the internal routing and connector for the USB/video cable.

Note: The USB cable is routed under the video cable and then both the USB and video cables are routed under the cable retention tab and the top cover latch receptacle.

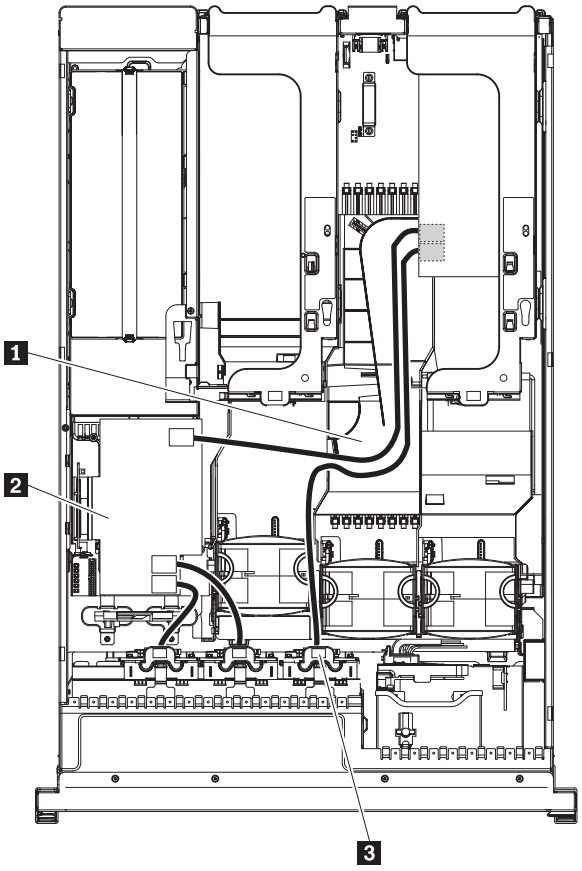


1	Top cover latch receptacle
2	Cable retention tab
3	Video cable
4	USB cable

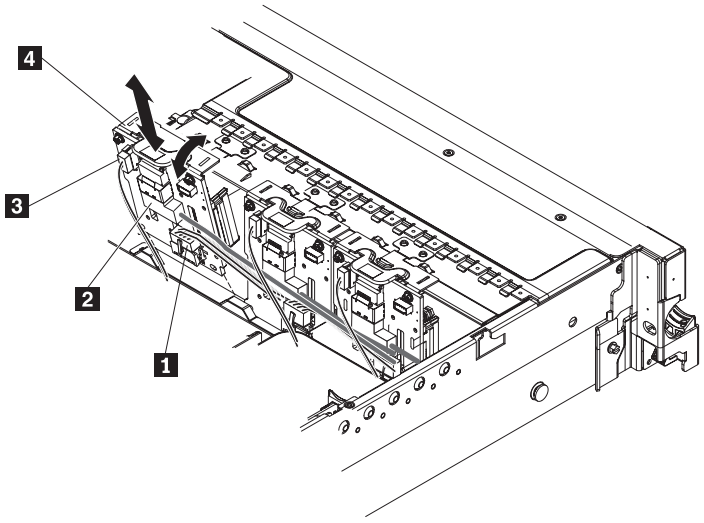
The following illustration shows the internal routing for the configuration cable (3 backplane connectors) **1** .



The following illustrations show the internal routing for the SAS hard disk drive backplane cables.



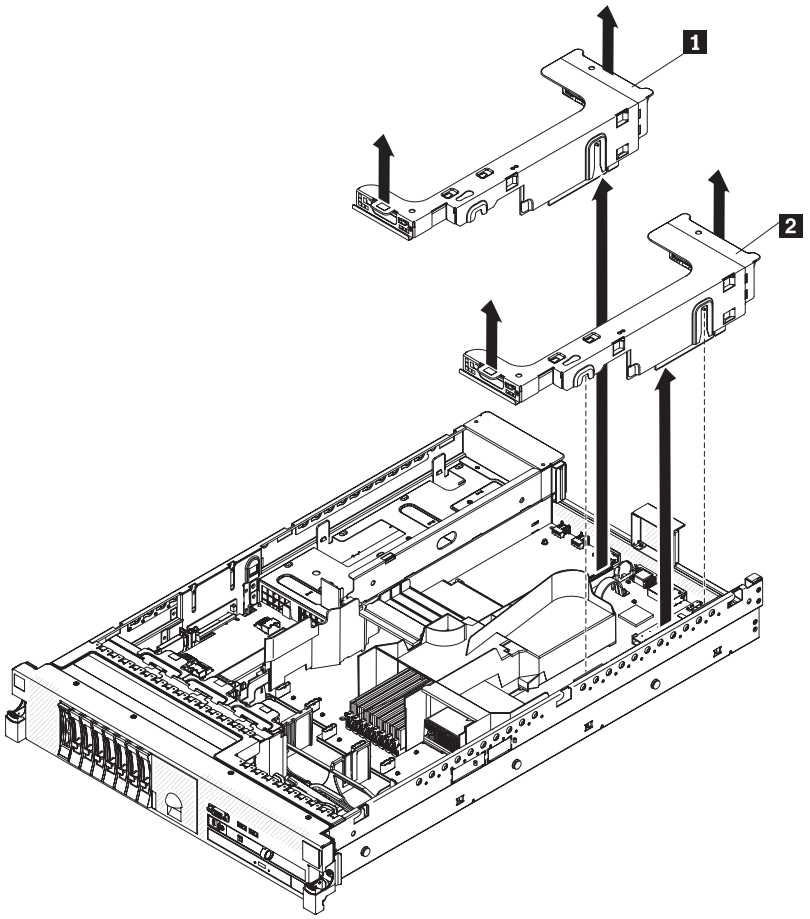
1 DIMM air baffle
2 SAS expander card
3 New backplane



1 Power cable
2 SAS signal cable
3 Configuration cable
4 Hard disk drive backplane

Removing a PCI riser-card assembly

The server comes with two riser-card assemblies that each contain two PCI Express x8 connectors. You can replace a PCI Express riser-card assembly with a riser-card assembly that contains one PCI Express Gen 2 x16 connector. See http://www.lenovo.com/thinkserver for a list of riser-card assemblies that you can use with the server.



1 PCI riser-card assembly 2
2 PCI riser-card assembly 1

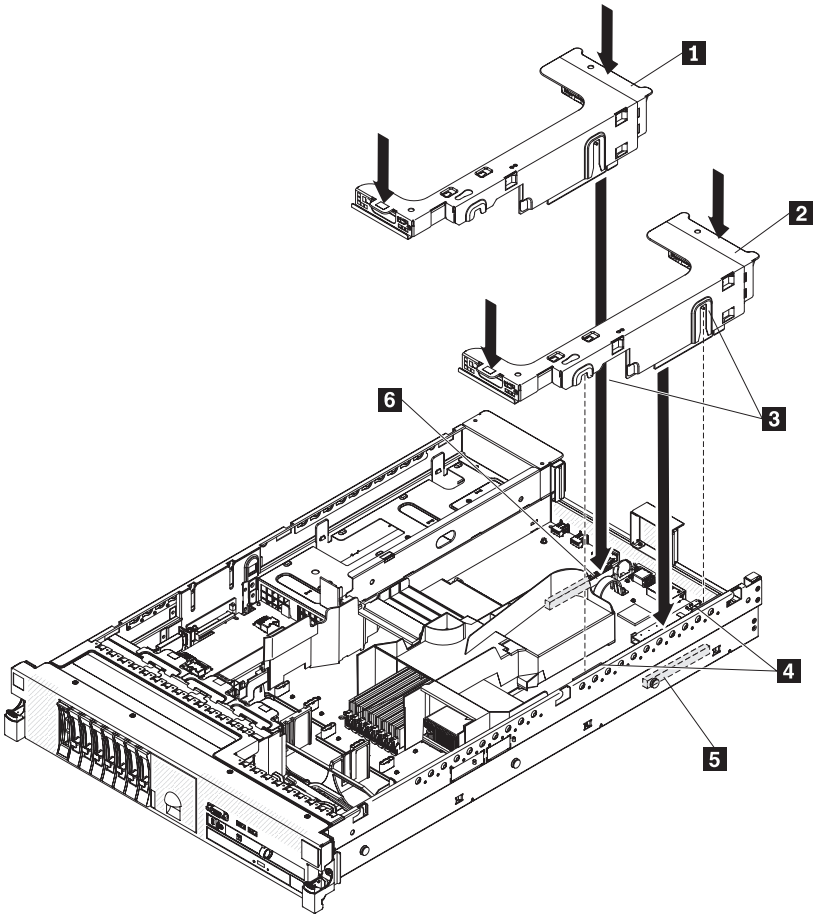
To remove the riser-card assembly, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices, and disconnect the power cord and all external cables.
3. Slide the server out of the rack.
4. Remove the cover (see “Removing the cover” on page 37).
5. Grasp the assembly at the front tab and rear edge and lift it to remove it from the server. Place the riser-card assembly on a flat, static-protective surface.

Installing a PCI riser-card assembly

To install a PCI riser-card assembly, complete the following steps.

Note: The illustrations in this document might differ slightly from your hardware.



1 PCI riser-card assembly 2
2 PCI riser-card assembly 1
3 Alignment slots
4 Alignment brackets
5 PCI riser connector 1
6 PCI riser connector 2

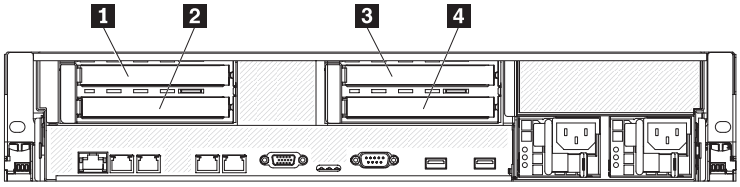
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Make sure that the server and all peripheral devices are turned off and that the power cords and all external cables are disconnected.
3. Reinstall any adapters and reconnect any internal cables that you removed in other procedures (see “Internal cable routing and connectors” on page 38).
4. Align the PCI riser-card assembly with the selected PCI riser connector on the system board:
   - PCI riser connector 1: Carefully fit the two alignment slots on the side of the assembly onto the two alignment brackets in the side of the chassis.
   - PCI riser connector 2: Carefully align the bottom edge (the contact edge) of the riser-card assembly with the PCI riser connector on the system board.
5. Press down on the assembly. Make sure that the riser-card assembly is fully seated in the riser-card connector on the system board.

If you have other optional devices to install, do so now. Otherwise, go to “Completing the installation” on page 100.

Removing a PCI adapter from a PCI riser-card assembly

This topic describes removing an adapter from a PCI expansion slot in a PCI riser-card assembly. These instructions apply to PCI adapters such as video graphic adapters and network adapters. To remove a SAS controller from the SAS riser card, go to “Removing a SAS controller from the SAS riser card” on page 79.

The following illustration shows the locations of the adapter expansion slots from the rear of the server.

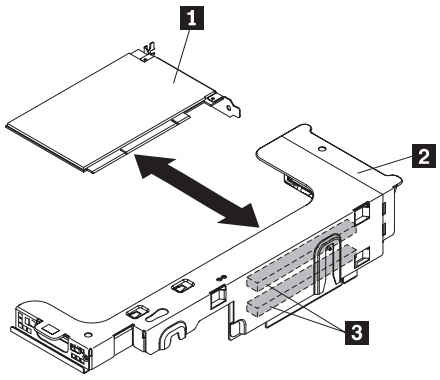


1 PCI slot 1
2 PCI slot 2
3 PCI slot 3
4 PCI slot 4

Notes:

1. If a PCI Express Gen 2x16 adapter is installed in a PCI riser-card assembly, the second expansion slot is not available.
2. If you are replacing a high power graphics adapter, you might need to disconnect the internal power cable from the system board before removing the adapter.

To remove an adapter from a PCI expansion slot, complete the following steps.



1 Adapter
2 PCI riser-card assembly
3 Adapter connectors

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables.

3. Press down on the left and right side latches and slide the server out of the rack enclosure until both slide rails lock; then, remove the cover (see “Removing the cover” on page 37).
4. Remove the PCI riser-card assembly that contains the adapter (see “Removing a PCI riser-card assembly” on page 42).
   - If you are removing an adapter from PCI expansion slot 1 or 2, remove PCI riser-card assembly 1.
   - If you are removing an adapter from PCI expansion slot 3 or 4, remove PCI riser-card assembly 2.
5. Disconnect any cables from the adapter (make note of the cable routing, in case you reinstall the adapter later).
6. Carefully grasp the adapter by its top edge or upper corners, and pull the adapter from the PCI expansion slot.
7. If the adapter is a full-length adapter in the upper expansion slot of the PCI riser-card assembly and you do not intend to replace it with another full-length adapter, remove the full-length-adapter bracket and store it on the underside of the top of the PCI riser-card assembly.
8. If you are instructed to return the adapter, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

Installing a PCI adapter in a PCI riser-card assembly

To ensure that a ServeRAID-10i, ServeRAID-10is, or ServeRAID-10M adapter works correctly in your server, make sure that the adapter firmware is at the latest level.

Important: Some cluster solutions require specific code levels or coordinated code updates. If the device is part of a cluster solution, verify that the latest level of code is supported for the cluster solution before you update the code.

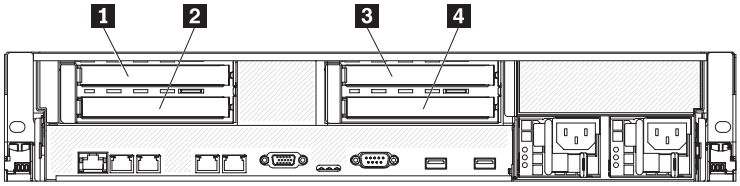
Some high end video adapters are supported by your server. See http://www.lenovo.com/thinkserver for more information.

Notes:

1. If you are installing a video adapter in your server, do not set the maximum digital video resolution above 1600 x 1200 at 60 Hz for an LCD monitor. This is the highest resolution supported for any video adapter in this server.
2. Any high-definition video-out connector or stereo connector on the video adapter is not supported.

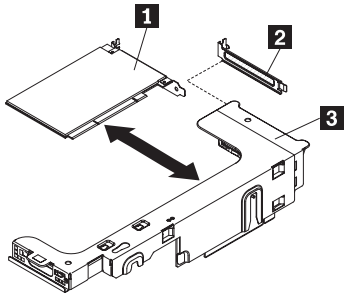
These instructions apply to PCI adapters such as video graphics adapters and network adapters. To install a SAS controller, go to “Installing a SAS controller on the SAS riser card” on page 81.

The following illustration shows the locations of the adapter expansion slots from the rear of the server.



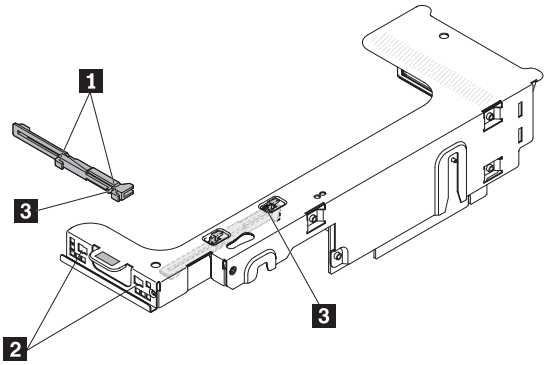
1 PCI slot 1
2 PCI slot 2
3 PCI slot 3
4 PCI slot 4

To install an adapter, complete the following steps.



1 Adapter
2 Expansion-slot cover
3 PCI riser-card assembly

1. Install the adapter in the expansion slot.
   a. If the adapter is a full-length adapter for the upper expansion slot (1 or 3) in the riser card, remove the full-length-adapter bracket 1 from underneath the top of the riser-card assembly and insert it in the two openings 2 in the end of the upper expansion slot of the riser-card assembly.



   b. Press the bracket tab 3 and slide the bracket to the right until it clicks into place.
   c. Align the adapter with the PCI connector on the riser card and the guide on the external end of the riser-card assembly.
   d. Press the adapter firmly into the PCI connector on the riser card.

2. Connect any required cables to the adapter (see “Internal cable routing and connectors” on page 38.)

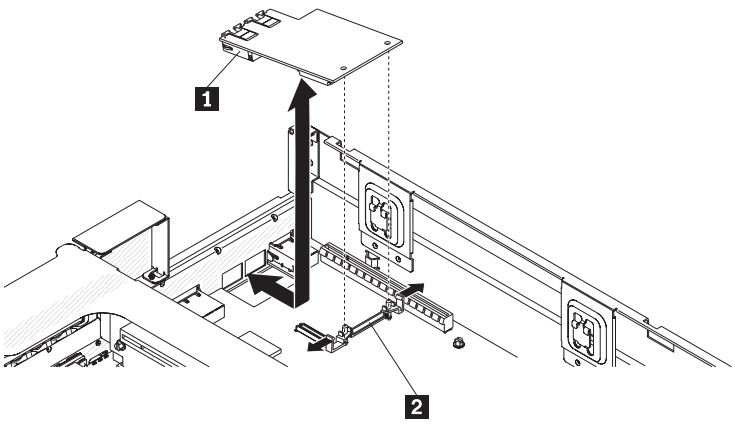
   Attention:

   - When you route cables, do not block any connectors or the ventilated space around any of the fans.
   - Make sure that cables are not routed on top of components under the PCI riser-card assembly.
   - Make sure that cables are not pinched by the server components.
3. Align the PCI riser-card assembly with the selected PCI connector on the system board:
   - PCI-riser connector 1: Carefully fit the two alignment slots on the side of the assembly onto the two alignment brackets on the side of the chassis; align the rear of the assembly with the guides on the rear of the server.
   - PCI-riser connector 2: Carefully align the bottom edge (the contact edge) of the riser-card assembly with the riser-card connector on the system board; align the rear of the assembly with the guides on the rear of the server.
4. Press down on the assembly. Make sure that the riser-card assembly is fully seated in the riser-card connector on the system board.
5. Perform any configuration tasks that are required for the adapter.
6. Install the server cover (see “Completing the installation” on page 100).
7. Slide the server into the rack.
8. Reconnect the external cables; then, reconnect the power cords and turn on the peripheral devices and the server.

Removing an Ethernet adapter

To remove an Ethernet adapter, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables.
3. Remove the cover (see “Removing the cover” on page 37).
4. Remove the PCI riser card 1.
5. Push the tabs on the adapter bracket **2** outwards, then lift the front end of the adapter **1** to disconnect it from the system board. Then lift it out of the server.



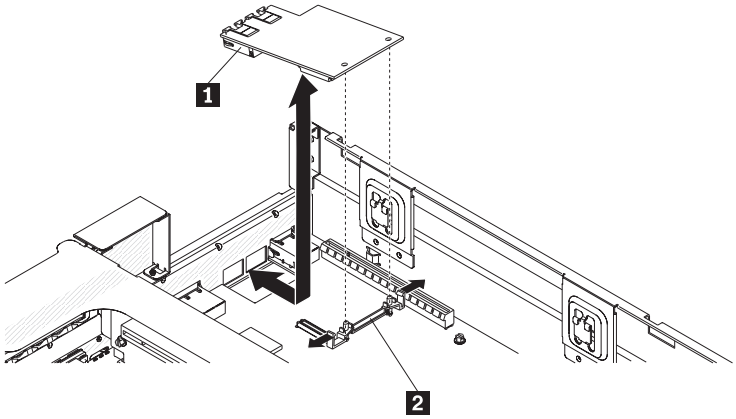
6. Install the cover.

7. Turn on the server and reconnect the peripheral devices, power cords, and external cables.

Installing an Ethernet adapter

To install an Ethernet adapter, complete the following steps:

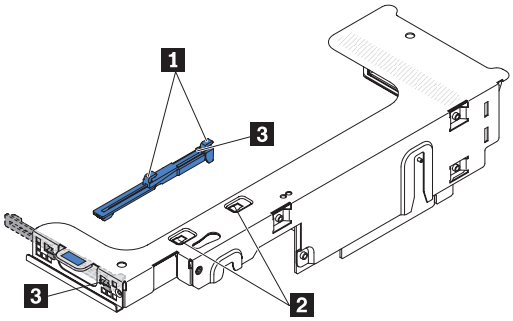
1. Remove the adapter bracket **2** from the new Ethernet adapter **1**.
2. Extend the Ethernet ports through the openings in the rear of the chassis.



3. Press down on the adapter above the connector and adapter bracket.
4. Install PCI riser 1.
5. Install the cover.
6. Turn on the server and reconnect the peripheral devices, power cords, and external cables.

Storing the full-length-adapter bracket

If you are removing a full-length adapter in the upper riser-card PCI slot and will replace it with a shorter adapter or no adapter, you must remove the full-length-adapter bracket from the end of the riser-card assembly and return the bracket to its storage location.



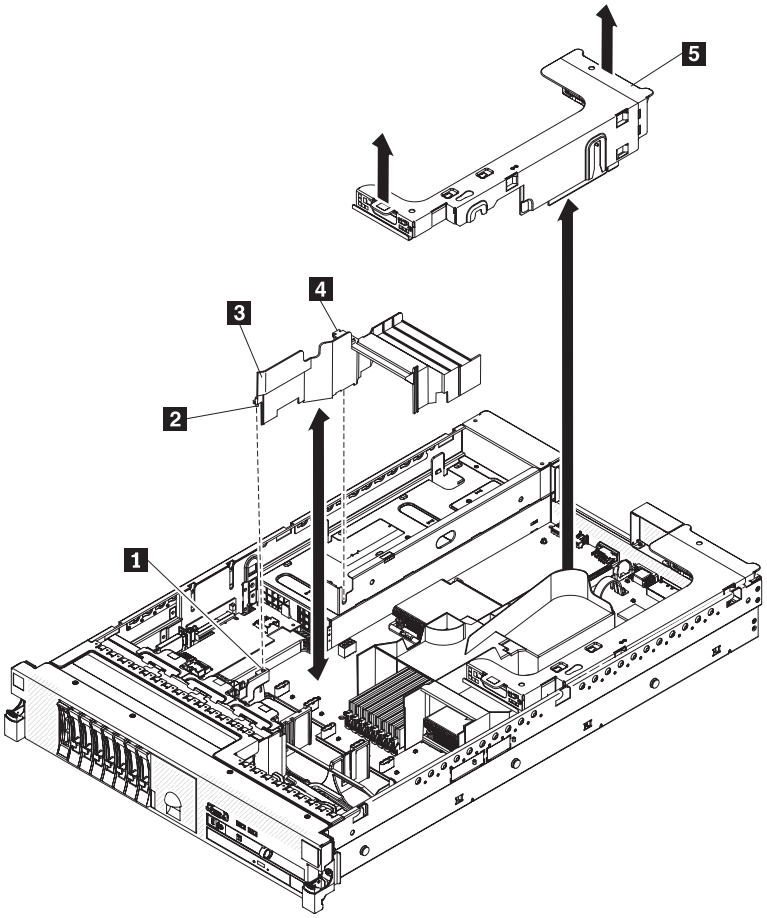
To remove and store the full-length-adapter bracket, complete the following steps:

1. Press the bracket tab **3** and slide the bracket to the left until the bracket falls free of the riser-card assembly.
2. Align the bracket with the storage location on the riser-card assembly as shown.
3. Place the two hooks **1** in the two openings **2** in the storage location on the riser-card assembly.

4. Press the bracket tab **3** and slide the bracket toward the expansion-lot-opening end of the assembly until the bracket clicks into place.

Removing the microprocessor 2 air baffle

When you work with some optional devices, you must first remove the microprocessor 2 air baffle to access certain components. The following illustration shows how to remove the microprocessor 2 air baffle.



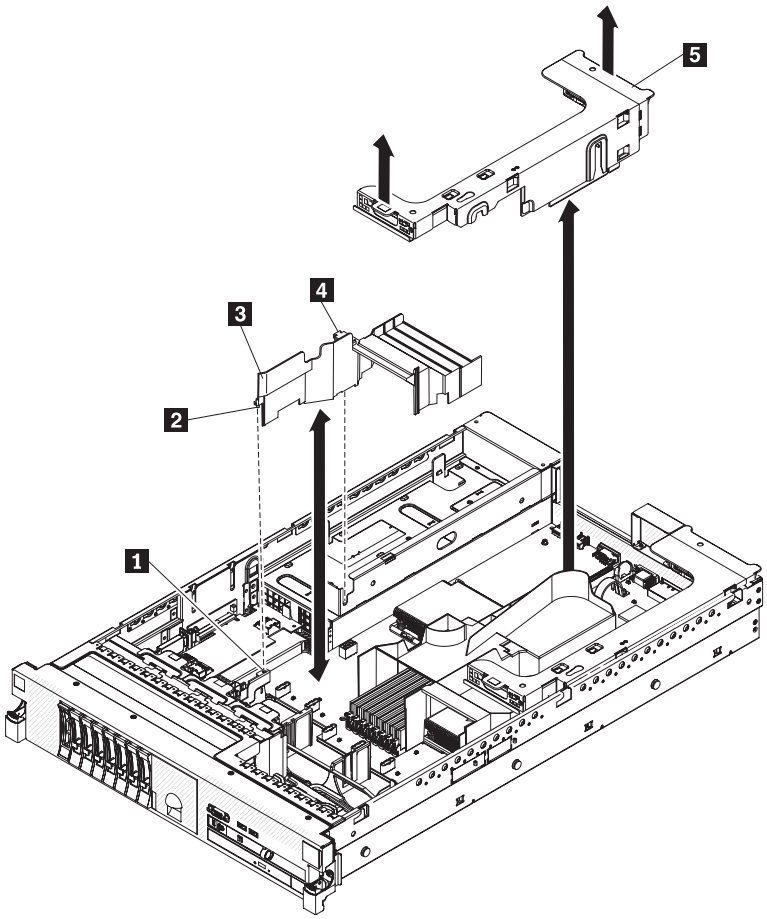
1	Hole
2	Pin
3	Microprocessor 2 air baffle
4	Tab
5	PCI riser-card assembly 2

To remove the microprocessor 2 air baffle, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables (see “Turning off the server” on page 31).
3. Remove the cover (see “Removing the cover” on page 37).
4. Remove PCI riser-card assembly 2 (see “Removing a PCI riser-card assembly” on page 42).
5. Grasp the top of the air baffle and lift the air baffle out of the server.

Attention: For proper cooling and airflow, replace all air baffles before you turn on the server. Operating the server with any air baffle removed might damage server components.

Installing the microprocessor 2 air baffle



1 Hole
2 Pin
3 Microprocessor 2 air baffle
4 Tab
5 PCI riser-card assembly 2

To install the microprocessor 2 air baffle, complete the following steps:

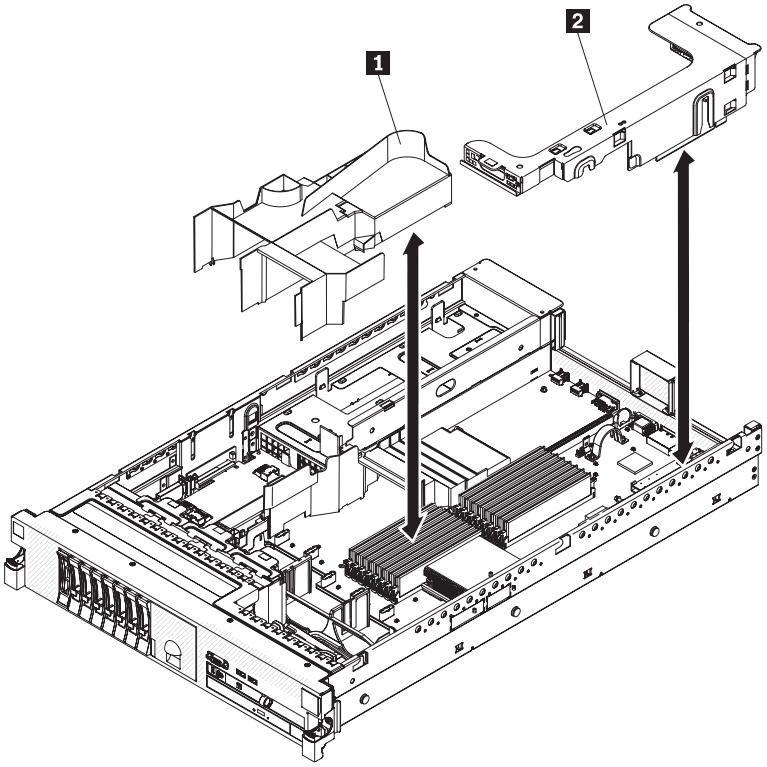
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Make sure that the server and peripheral devices are turned off (see “Turning off the server” on page 31) and that all power cords and external cables are disconnected.
3. Remove the cover (see “Removing the cover” on page 37).
4. Align the tab on the left side of the microprocessor 2 air baffle with the slot in the right side of the power-supply cage.
5. Align the pin on the bottom of the microprocessor air baffle with the hole on the system board retention bracket.

6. Lower the microprocessor 2 air baffle into the server, making sure all cables are out of the way.

   Attention: For proper cooling and airflow, replace all air baffles before you turn on the server. Operating the server with any air baffle removed might damage server components.
7. Install PCI riser-card assembly 2.
8. Install the cover (see “Completing the installation” on page 100).
9. Slide the server into the rack.
10. Reconnect the external cables; then, reconnect the power cords and turn on the peripheral devices and the server.

Removing the DIMM air baffle

When you work with some optional devices, you must first remove the DIMM air baffle to access certain components or connectors on the system board. The following illustration shows how to remove the DIMM air baffle.



1 DIMM air baffle
2 PCI riser-card assembly 1

To remove the DIMM air baffle, complete the following steps:

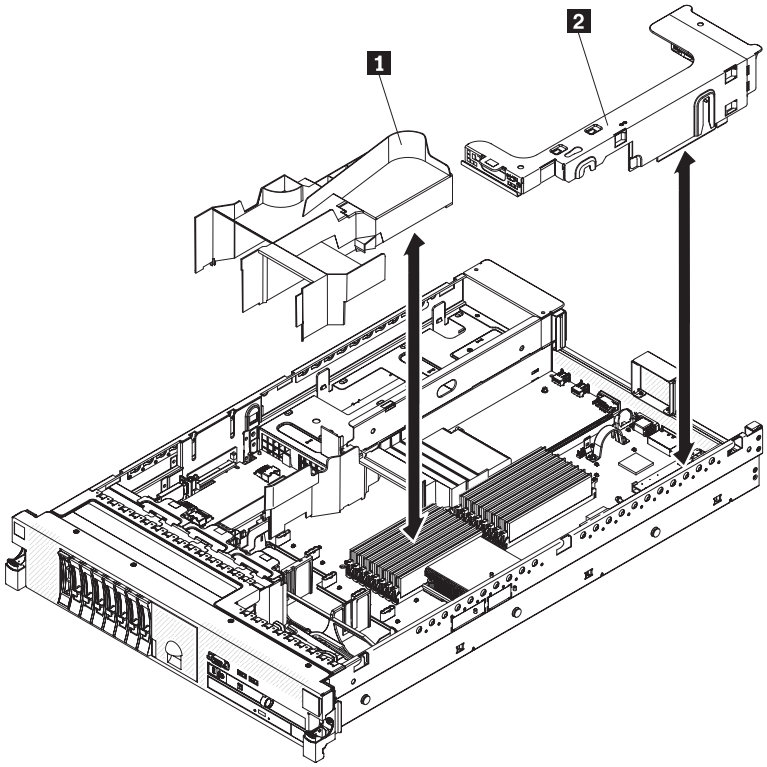
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables (see “Turning off the server” on page 31).
3. Remove the cover (see “Removing the cover” on page 37).
4. Remove PCI riser-card assembly 1 (see “Removing a PCI riser-card assembly” on page 42).

5. Place your fingers under the front and back of the top of the air baffle; then, lift the air baffle out of the server.

   Attention: For proper cooling and airflow, replace all air baffles before you turn on the server. Operating the server with any air baffle removed might damage server components.

Installing the DIMM air baffle

The following illustration shows how to install the DIMM air baffle.



1 DIMM air baffle
2 PCI riser-card assembly 1

To install the DIMM air baffle, complete the following steps:

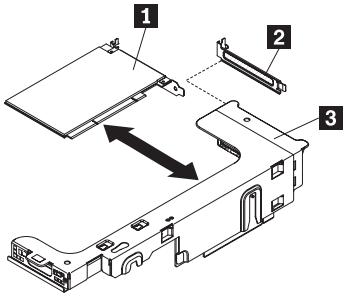
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Make sure that the server and peripheral devices are turned off (see “Turning off the server” on page 31) and that all power cords and external cables are disconnected.
3. Remove the cover (see “Removing the cover” on page 37).
4. Make sure that PCI riser-card assembly 1 is removed (see “Removing a PCI riser-card assembly” on page 42).
5. Align the DIMM air baffle with the DIMMs and the back of the fans.
6. Lower the air baffle into place, making sure all cables are out of the way.
7. Install PCI riser-card assembly 1.

   Attention: For proper cooling and airflow, replace all air baffles before you turn on the server. Operating the server with any air baffle removed might damage server components.

8. Install the cover (see “Completing the installation” on page 100).

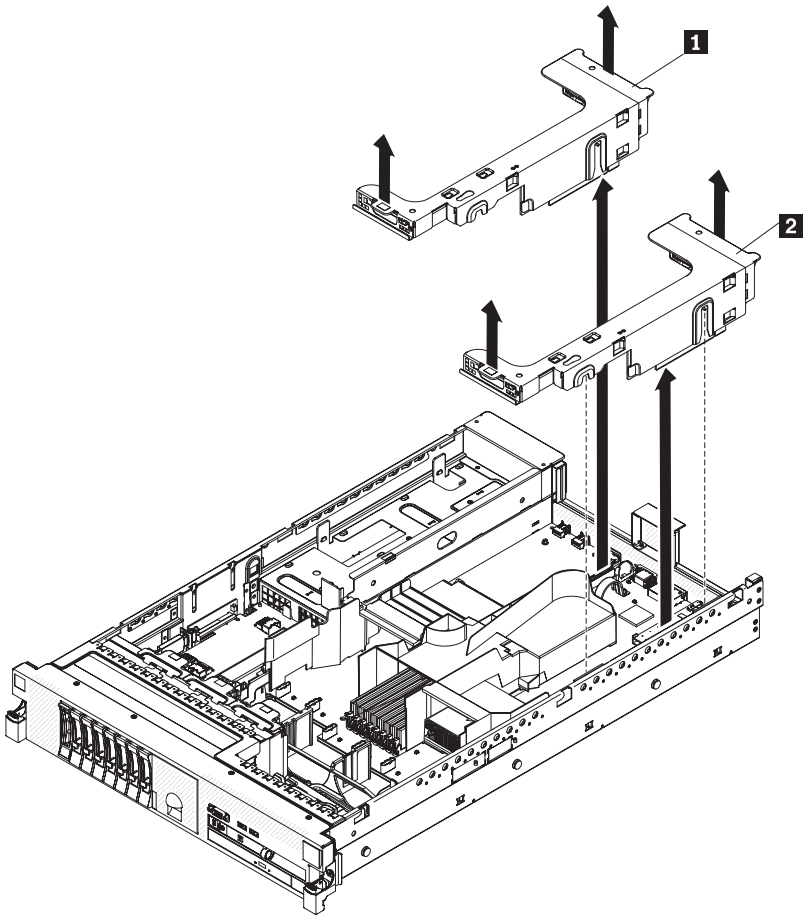
Removing a PCI adapter

To remove an adapter from a PCI riser-card assembly, complete the following steps.



1	Adapter
2	Expansion slot cover
3	PCI riser-card assembly

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables (see “Turning off the server” on page 31).
3. Press down on the left and right side rack latches and slide the server out of the rack enclosure until both slide rails lock; then, remove the cover (see “Removing the cover” on page 37).



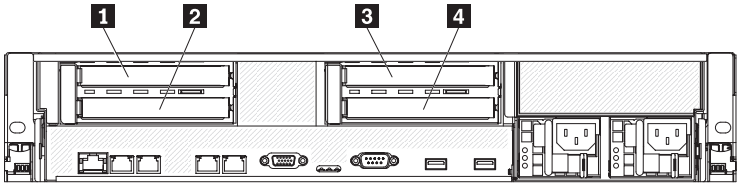
1 PCI riser-card assembly 2
2 PCI riser-card assembly 1

4. Remove the PCI riser-card assembly that contains the adapter (see “Removing a PCI riser-card assembly” on page 42).
5. Disconnect any cables from the adapter (make note of the cable routing, in case you reinstall the adapter later).
6. Carefully grasp the adapter by its top edge or upper corners, and pull the adapter from the PCI expansion slot.

If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Installing a PCI adapter

The following illustration shows the PCI adapter expansion slots.



1 PCI slot 1
2 PCI slot 2
3 PCI slot 3
4 PCI slot 4

The following notes describe the types of adapters that the server supports and other information that you must consider when installing an adapter:

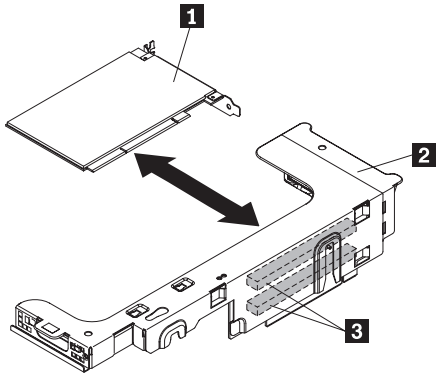
- Locate the documentation that comes with the adapter and follow those instruction in addition to the instructions in this section. If you have to change switch settings or jumper settings on the adapter, follow the instructions that come with the adapter.
- To ensure that a ServeRAID-10i, ServeRAID-10is, or ServeRAID-10M adapter works correctly in your UEFI-based server, make sure that the adapter firmware is at the latest level.

  Important: Some cluster solutions require specific code levels or coordinated code updates. If the device is part of a cluster solution, verify that the latest level of code is supported for the cluster solution before you update the code.
- Some high performance video adapters are supported by your server. See http://www.lenovo.com/thinkserver/ for more information.
- The following notes describe important information about the NVIDIA video adapter that comes preinstalled in some server models:
  - Do not set the maximum digital video resolution above 1600 x 1200 at 60 Hz for an LCD monitor. This is the highest resolution that is supported for an optional video adapter in the server.
  - Any high-definition video-out connector or stereo connector on an optional video adapter is not supported.
- A PCI Express Gen 2 x16 riser card can support only one adapter.
- The expansion slots in the PCI riser cards accommodate the various form factors of the non-hot-plug adapters as follows:
  - Expansion slot 1: Full-height, full-length
  - Expansion slot 2: Low-profile with standard bracket
  - Expansion slot 3: Full-height, full-length
  - Expansion slot 4: Full-height, half-length

  If you install a different supported riser-card assembly, the supported adapter types might be different. For a list of supported riser-card assemblies, see http://www.lenovo.com/thinkserver.
- The system scans devices in the following order, if you have not changed the default boot precedence:
  - Video unified extensible firmware interface (UEFI) (fixed)
  - System board Ethernet 1 PXE (fixed)

– System board Ethernet 2 PXE (fixed)
– System board SAS (or RAID)

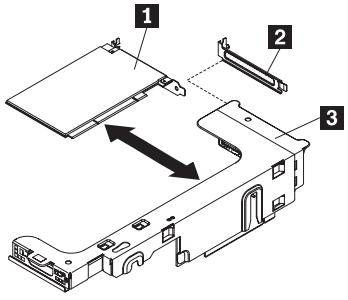
The following illustration shows the adapter connectors on the PCI riser-card assembly.



1 Adapter
2 PCI riser-card assembly
3 Adapter connectors

To install a PCI adapter, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables (see “Turning off the server” on page 31).
3. Remove the cover (see “Removing the cover” on page 37).
4. Determine which expansion slot you will use for the adapter.
5. If you are installing an adapter in PCI expansion slot 1 or 2, remove PCI riser-card assembly 1; if you are installing an adapter in PCI expansion slot 3 or 4, remove PCI riser-card assembly 2. See “Removing a PCI riser-card assembly” on page 42.
6. Slide the expansion-slot cover out of the PCI riser-card assembly expansion slot.



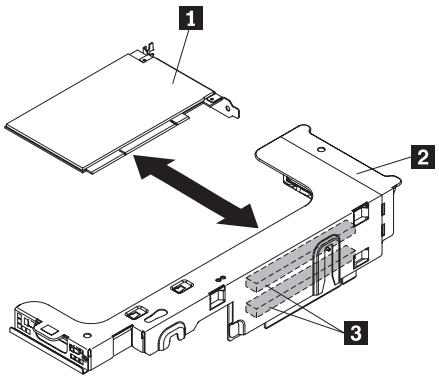
1 Adapter
2 Expansion slot cover
3 PCI riser-card assembly

7. Install the adapter:
   a. If the adapter is a full-length adapter for the upper expansion slot in the riser card, remove the full-length-adapter bracket from underneath the top

of the riser-card assembly and insert it in the end of the upper expansion slot of the riser-card assembly. See “Installing the full-length-adapter bracket” on page 60 for instructions.

b. Align the adapter with the adapter connector on the riser-card, and the guide on the external end of the PCI riser-card assembly.

c. Press the adapter firmly into the adapter connector on the riser card.



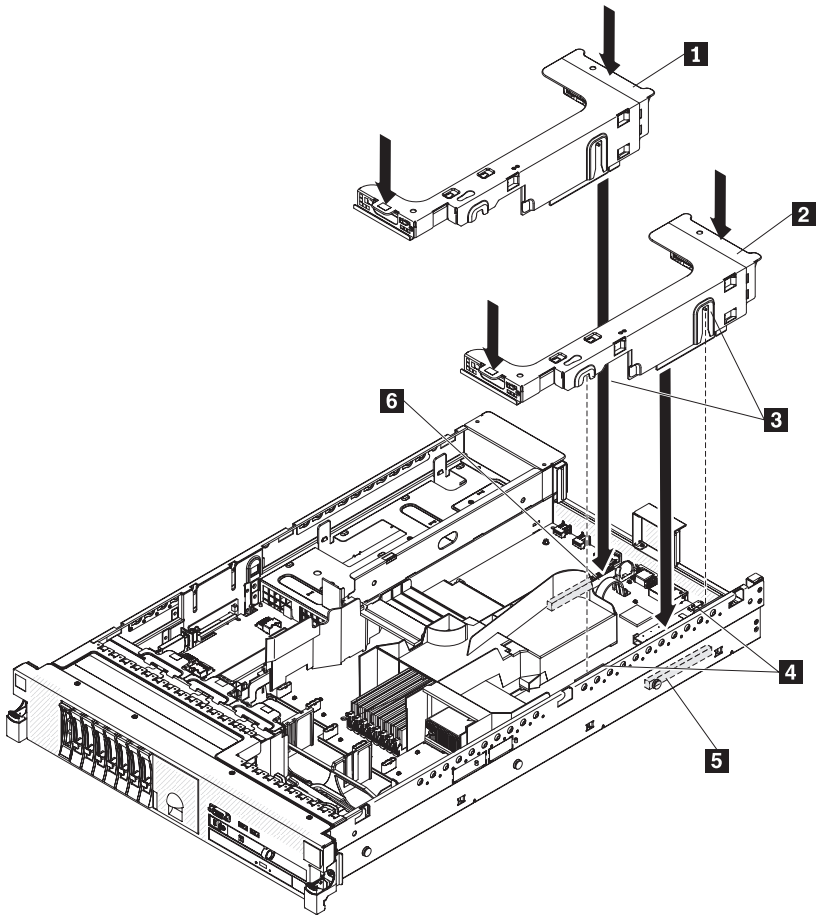
1 Adapter
2 PCI riser-card assembly
3 Adapter connectors

8. Connect any required cables to the adapter.

   Attention:

   - When you route cables, do not block any connectors or the ventilated space around any of the fans.
   - Make sure that cables are not routed on top of components that are under the PCI riser-card assembly.
   - Make sure that cables are not pinched by the server components.

9. Align the PCI riser-card assembly with the selected PCI riser connector on the system board.



1 PCI riser-card assembly 2
2 PCI riser-card assembly 1
3 Alignment slots
4 Alignment brackets
5 PCI riser connector 1
6 PCI riser connector 2

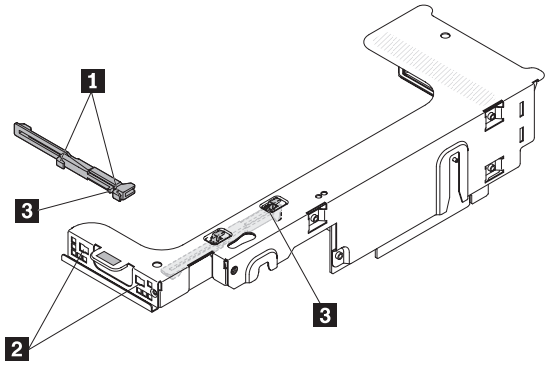
- PCI riser connector 1: Carefully fit the two alignment slots on the side of the assembly onto the two alignment brackets in the side of the chassis; align the rear of the assembly with the guides on the rear of the server
- PCI riser connector 2: Carefully align the bottom edge (the contact edge) of the riser-card assembly with the PCI riser-card connector on the system board; align the rear of the assembly with the guides on the rear of the server.

10. Press down on the assembly. Make sure that the riser-card assembly is fully seated in the PCI riser-card connector on the system board.
11. Perform any configuration tasks that are required for the adapter.

If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Installing the full-length-adapter bracket

If you are installing a full-length adapter in the upper riser-card PCI slot, you must first install the full-length-adapter bracket in the end of the riser-card assembly.

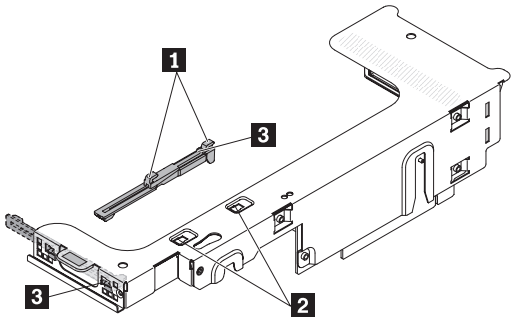


To install the full-length-adapter bracket, complete the following steps:

1. Orient the riser-card assembly as shown.
2. Remove the full-length-adapter bracket from the storage location.
   a. Press the bracket tab **3** and slide the bracket toward the end of the riser-card assembly.
   b. Push the bracket out of the storage location on the riser-card assembly.
3. Align the bracket with the end of the riser-card assembly as shown.
4. Place the two hooks **1** in the two openings **2** in the end of the riser-card assembly.
5. Press the bracket tab **3** and slide the bracket to the right until it clicks into place.
6. Return to the adapter-installation instructions.

Storing the full-length-adapter bracket

If you are removing a full-length adapter in the upper riser-card PCI slot and will replace it with a shorter adapter or no adapter, you must remove the full-length-adapter bracket from the end of the riser-card assembly and return the bracket to its storage location.

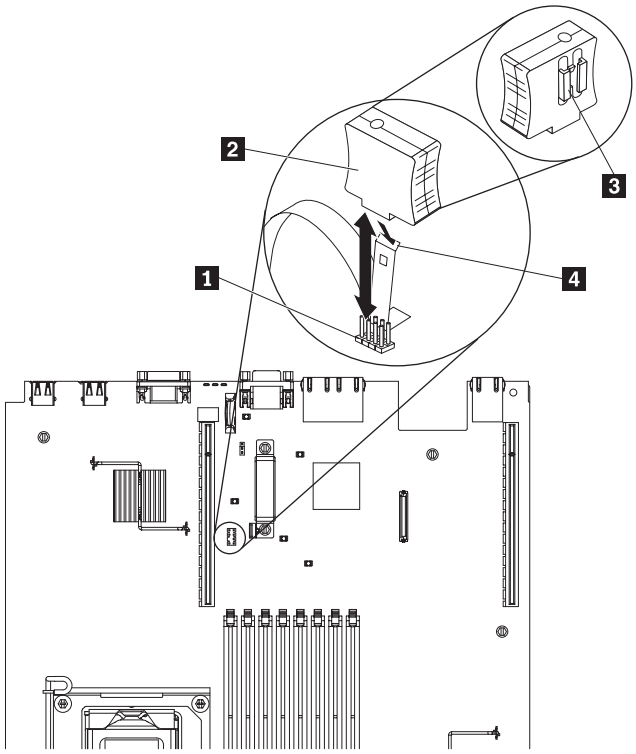


To remove and store the full-length-adapter bracket, complete the following steps:

1. Press the bracket tab **3** and slide the bracket to the left until the bracket falls free of the riser-card assembly.
2. Align the bracket with the storage location on the riser-card assembly as shown.
3. Place the two hooks **1** in the two openings **2** in the storage location on the riser-card assembly.

4. Press the bracket tab **3** and slide the bracket toward the expansion-slot-opening end of the assembly until the bracket clicks into place.
5. Return to “Installing a PCI adapter” on page 56 or “Installing a PCI riser-card assembly” on page 43, as applicable.

Removing a virtual media key



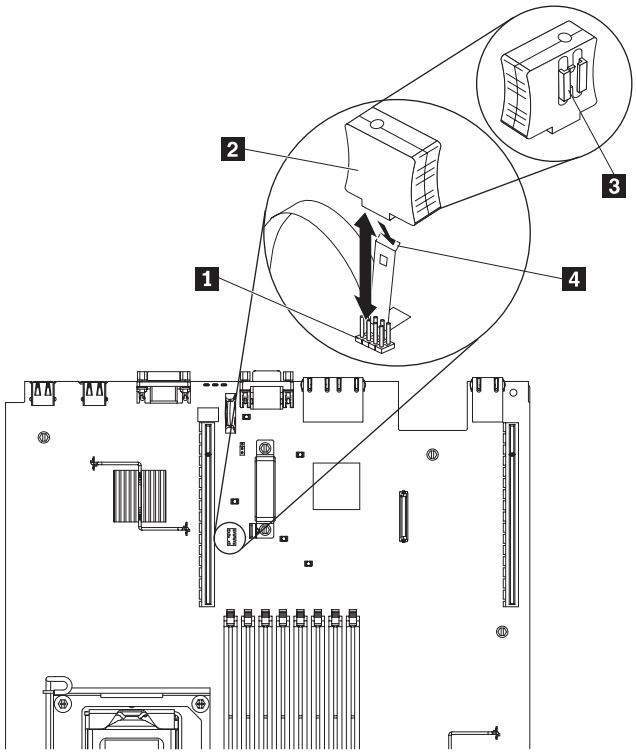
1 Virtual media key connector
2 Virtual media key (front)
3 Mounting bracket (rear)
4 Mounting tab

To remove a virtual media key, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables.
3. Slide the server out of the rack.
4. Remove the cover (see “Removing the cover” on page 37).
5. Locate the virtual media key on the system board. Grasp it and carefully pull it off the virtual media key connector pins.

Installing a virtual media key

IMM Premium enables the IMM remote presence and blue-screen capture capability. This feature provides graphical console redirection with remote keyboard and mouse interaction, plus remote diskette and CD/DVD drive support.



1 Virtual media key connector
2 Virtual media key (front)
3 Mounting bracket (rear)
4 Mounting tab

To install a virtual media key, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables (see “Turning off the server” on page 31).
3. Remove the cover (see “Removing the cover” on page 37).
4. Align the mounting bracket on the rear of the virtual media key with the mounting tab and slide it down the tab onto the virtual medial key connector on the system board. Press the virtual media key down into the connector until it is firmly seated on the system board.

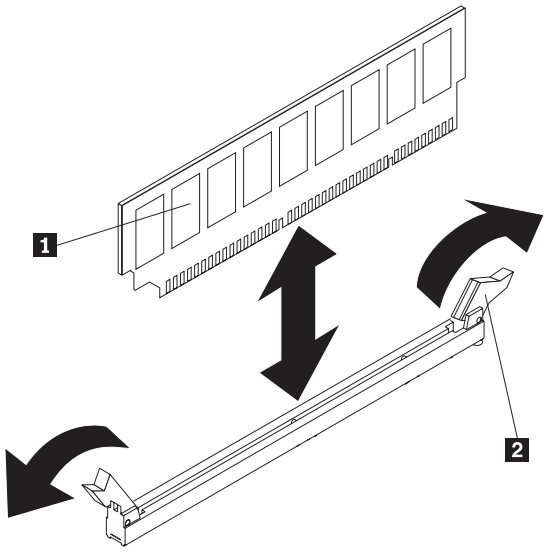
If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Removing a memory module (DIMM)

To remove a DIMM, complete the following steps.

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables.
3. Slide the server out of the rack.
4. Remove the cover (see “Removing the cover” on page 37).
5. If riser-card assembly 1 contains one or more adapters, remove it (see “Removing a PCI riser-card assembly” on page 42).
6. Remove the air baffle over the DIMMs (see “Removing the DIMM air baffle” on page 52).

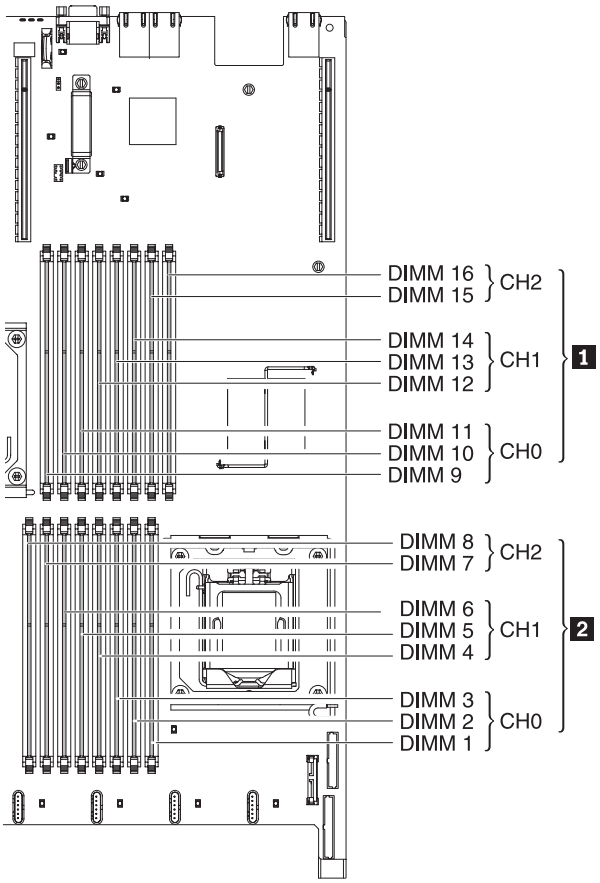
   Attention: To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.



7. Open the retaining clip **2** on each end of the DIMM connector and lift the DIMM **1** from the connector.
8. If you are instructed to return the DIMM, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

Installing a memory module

The following notes describe the types of dual inline memory modules (DIMMs) that the server supports and other information that you must consider when installing DIMMs:



1 Microprocessor 2
2 Microprocessor 1

- The server supports only industry-standard double-data-rate 3 (DDR3), 800, 1066, or 1333 MHz, PC3-10600R-999 (single-rank or dual-rank), registered, synchronous dynamic random-access memory (SDRAM) dual inline memory modules (DIMMs) with error correcting code (ECC). See http://www.lenovo.com/thinkserver/ for a list of supported memory modules for the server.
- The server supports a maximum of 16 single-rank or dual-rank DIMMs.
- The server supports three single-rank or dual-rank DIMMs per channel. The following table shows an example of the maximum amount of memory that you can install, using ranked DIMMs.

Table 7. Maximum memory installation using ranked DIMMs

Number of DIMMs	Number of ranks	DIMM size	Total memory
16	Single rank	4 GB	64 GB
16	Dual rank	4 GB	64 GB
16	Dual rank	8 GB (if available)	128 GB

- The specifications of a DDR3 DIMM are on a label on the DIMM, in the following format.

  *ggg e*Rx*ff*-PC3-*wwwwwm-aa-bb-cc*

  where:

  ggg is the total capacity of the DIMM (for example, 1GB, 2GB, or 4GB)

  e is the number of ranks

  1 = single-rank

  2 = dual-rank

  4 = quad-rank

  ff is the device organization (bit width)

  4 = x4 organization (4 DQ lines per SDRAM)

  8 = x8 organization

  16 = x16 organization

  wwwww is the DIMM bandwidth, in MBps

  6400 = 6.40 GBps (PC3-800 SDRAMs, 8-byte primary data bus)

  8500 = 8.53 GBps (PC3-1066 SDRAMs, 8-byte primary data bus)

  10600 = 10.66 GBps (PC3-1333 SDRAMs, 8-byte primary data bus)

  12800 = 12.80 GBps PC3-1600 SDRAMs, 8-byte primary data bus)

  m is the DIMM type

  E = Unbuffered DIMM (UDIMM) with ECC (x72-bit module data bus)

  R = Registered DIMM (RDIMM)

  U = Unbuffered DIMM with no ECC (x64-bit primary data bus)

  aa is the CAS latency, in clocks at maximum operating frequency

  bb is the JEDEC SPD Revision Encoding and Additions level

  cc is the reference design file for the design of the DIMM

  d is the revision number of the reference design of the DIMM

- The following rules apply to single-rank and dual-rank DDR3 DIMM speed as it relates to the number of DIMMs in a channel:
  - When you install 1 DIMM per channel, the memory runs at 1333 MHz
  - When you install 2 DIMMs per channel, the memory runs at 1066 MHz
  - When you install 3 DIMMs per channel, the memory runs at 800 MHz
  - All channels in a server run at the fastest common frequency.
  - Mixing registered and unbuffered DIMMs is not supported.
- The DIMM options that are available for the server are 1 GB, 2 GB, 4 GB, and 8 GB (when available). The server supports a minimum of 1 GB and a maximum of 128 GB of system memory.

  For 32-bit operating systems only: Some memory is reserved for various system resources and is unavailable to the operating system. The amount of memory that is reserved for system resources depends on the operating system, the configuration of the server, and the configured PCI devices.
- A minimum of one DIMM must be installed for each microprocessor. For example, you must install a minimum of two DIMMs if the server has two microprocessors. However, to improve system performance, install a minimum of three DIMMs for each microprocessor.
- The maximum operating speed of the server is determined by the slowest DIMM in the server.

DIMM installation sequence

The server requires at least one DIMM per microprocessor. The server comes with a minimum of two 1 GB DIMMs, installed in connectors 3 and 6. (Connectors 3 and 6 are the farthest connectors for channels 0 and 1 of microprocessor 1.) When you install additional DIMMs, install them in the order shown in Table 8, to maintain performance.

Important: If you have configured the server to use memory mirroring, do not use the order in Table 8; go to “Memory mirroring” and use the installation order shown there.

Table 8. DIMM installation sequence for non-mirroring (normal) mode

Installed microprocessors	DIMM connector population sequence
Microprocessor socket 1	Install the DIMMs in the following sequence: 3, 6, 8, 2, 5, 7, 1, 4
Microprocessor socket 2	Install the DIMMs in the following sequence: 11, 14, 16, 10, 13, 15, 9, 12

Memory mirroring

Memory-mirroring mode replicates and stores data on two pairs of DIMMs within two channels simultaneously. If a failure occurs, the memory controller switches from the primary pair of memory DIMMs to the backup pair of DIMMs. You must enable memory mirroring through the Setup utility. For details about enabling memory mirroring, see “Using the Setup Utility program” on page 104. When you use the memory mirroring feature, consider the following information:

- When you use memory mirroring, you must install a pair of DIMMs at a time. One DIMM must be in channel 0, and the mirroring DIMM must be in the same connector in channel 1. The two DIMMs in each pair must be identical in size, type, rank (single, dual, or quad), and organization. They do not have to be identical in speed. The channels run at the speed of the slowest DIMM in any of the channels. See Table 10 on page 68 for the DIMM connectors that are in each pair.
- Channel 2, DIMM connectors 8 ,7, 15, and 16 are not used in memory-mirroring mode.
- The maximum available memory is reduced to half of the installed memory when memory mirroring is enabled. For example, if you install 64 GB of memory, only 32 GB of addressable memory is available when you use memory mirroring.

The following illustration shows the memory channel interface layout with the DIMM installation sequence for mirroring mode. The numbers within the boxes indicate the DIMM population sequence in pairs within the channels, and the numbers next to the boxes indicate the DIMM connectors within the channels. For example, the following illustration shows that the first pair of DIMMs (indicated by ones (1) inside the boxes) should be installed in DIMM connector 3 on channel 0 and DIMM connector 6 on channel 1. DIMM connectors 7, 8, 15, and 16 on channel 2 are not used in memory-mirroring mode.

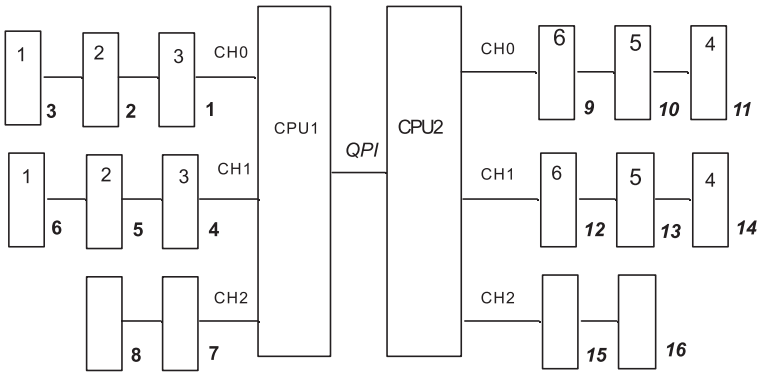


Figure 1. Memory channel interface layout

The following table lists the DIMM connectors on each memory channel.

Table 9. Connectors on each memory channel

Memory channel	DIMM connectors
Channel 0	1, 2, 3, 9, 10, 11
Channel 1	4, 5, 6, 12, 13, 14
Channel 2	7, 8, 15, 16

The following illustration shows the memory connector layout that is associated with each microprocessor. For example, DIMM connectors 9, 10, 11, 12, 13, 14, 15, and 16 (DIMM connectors are shown underneath the boxes) are associated with microprocessor 2 socket (CPU2) and DIMM connectors 1, 2, 3, 4, 5, 6, 7, and 8 are associated with microprocessor 1 socket (CPU1). The numbers within the boxes indicate the installation sequence of the DIMM pairs. For example, the first DIMM pair (indicated within the boxes by ones (1)) should be installed in DIMM connectors 3 and 6, which are associated with microprocessor 1 (CPU1).

Note: You can install DIMMs for microprocessor 2 as soon as you install microprocessor 2; you do not have to wait until all of the DIMM connectors for microprocessor 1 are filled.

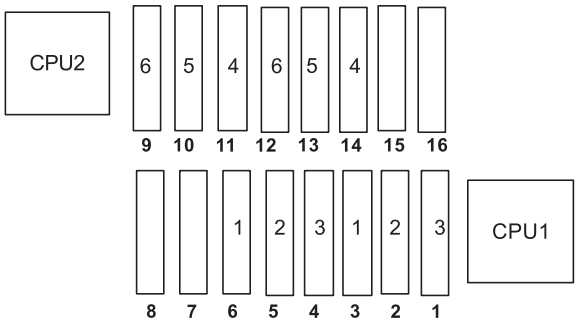


Figure 2. Memory connectors associated with each microprocessor

The following table lists the installation sequence for installing DIMMs in memory-mirroring mode.

Table 10. Memory-mirroring mode DIMM population sequence

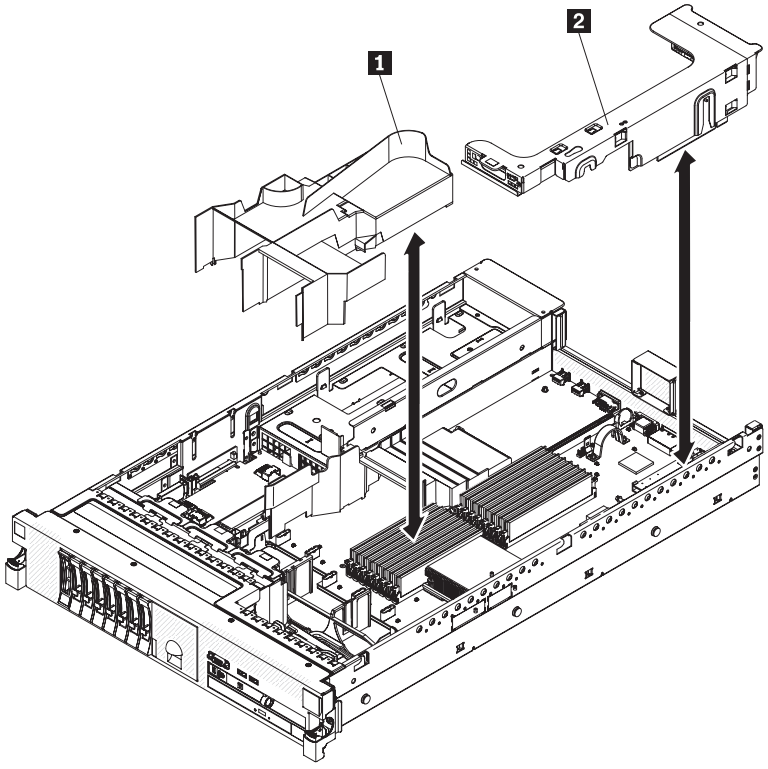
DIMMs	Number of installed microprocessors	DIMM connector
First pair of DIMMs	1	3, 6
Second pair of DIMMs	1	2, 5
Third pair of DIMMs	1	1, 4
Fourth pair of DIMMs	2	14, 11
Fifth pair of DIMMs	2	13, 10
Sixth pair of DIMMs	2	12, 9
Note: DIMM connectors 7, 8, 15, and 16 are not used in memory-mirroring mode.		

When you install or remove DIMMs, the server configuration information changes. When you restart the server, the system displays a message that indicates that the memory configuration has changed.

Installing a DIMM

To install a DIMM, complete the following steps.

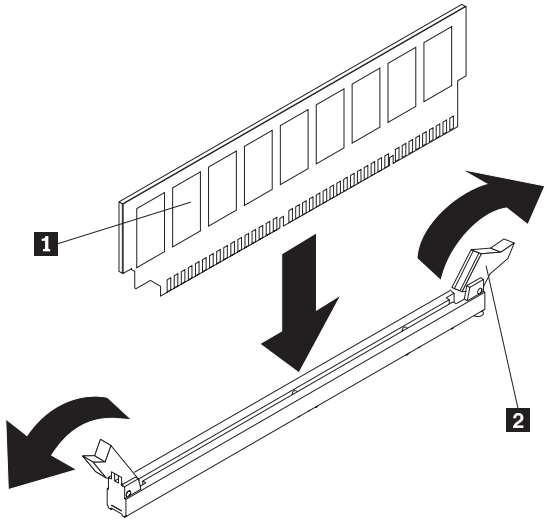
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices, and disconnect the power cord and all external cables (see “Turning off the server” on page 31).
3. Remove the server cover (see “Removing the cover” on page 37).



1 DIMM air baffle
2 PCI riser-card assembly 1

4. If PCI riser-card assembly 1 contains one or more adapters, remove riser-card assembly 1 (see “Removing a PCI riser-card assembly” on page 42).
5. Remove the DIMM air baffle (see “Removing the DIMM air baffle” on page 52).

   Attention: To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.
6. Open the retaining clip **2** on each end of the DIMM connector.



7. Touch the static-protective package that contains the DIMM to any unpainted metal surface on the server. Then, remove the DIMM from the package.
8. Turn the DIMM so that the DIMM keys align correctly with the connector.
9. Insert the DIMM into the connector **1** by aligning the edges of the DIMM with the slots at the ends of the DIMM connector. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector.

   Important: If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.
10. Install the DIMM air baffle (see “Installing the DIMM air baffle” on page 53).
11. Install PCI riser-card assembly 2, if you removed it (see “Installing a PCI riser-card assembly” on page 43).

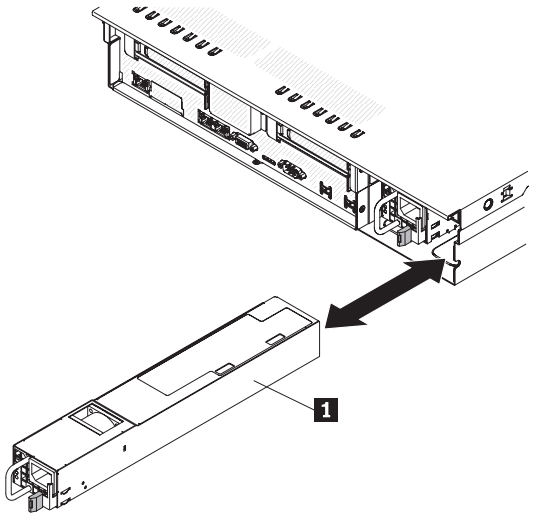
If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Removing a hot-swap power supply

Important: If the server has two power supplies, and if you remove either of them, the server will not have redundant power; if the server power load then exceeds 675 W, the server might not start or might not function correctly.

To remove a power supply, complete the following steps.



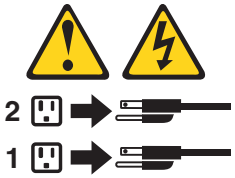
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. If only one power supply is installed, turn off the server and peripheral devices.
3. Disconnect the power cord from the power supply that you are removing.
4. Grasp the power-supply handle.
5. Press the orange release latch to the left and hold it in place.
6. Pull the power supply **1** part of the way out of the bay, then release the latch and support the power supply as you pull it the rest of the way out of the bay.
7. If you are instructed to return the power supply, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

Installing a hot-swap power supply

The server supports a maximum of two hot-swap ac power supplies.

Statement 5:

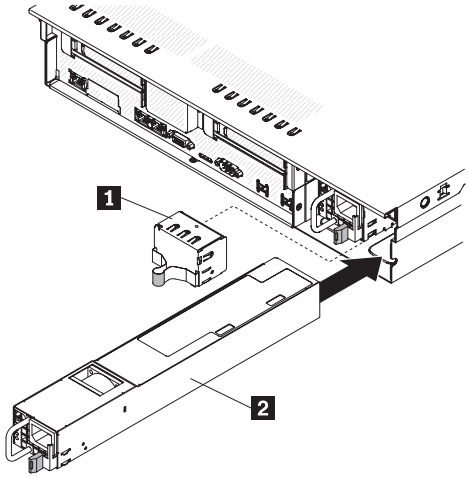
CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from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



Statement 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.



1 Power supply filler panel
2 Hot-swap power supply 2

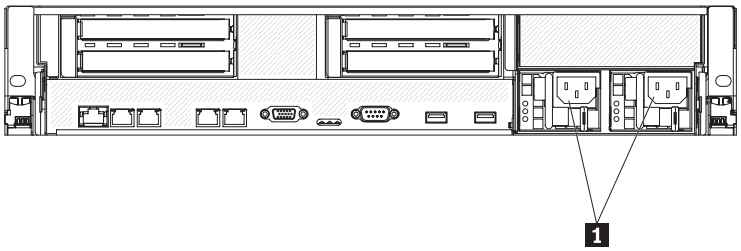
Attention: During normal operation, each power-supply bay must contain either a power supply or power-supply filler 1 for proper cooling.

To install a power supply, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Remove the power-supply blank from the empty power-supply bay by pinching the side clip and pulling the power-supply blank from the bay. Save the power-supply blank in case you remove the power supply at a later time.
3. Slide the ac power supply into the bay until the retention latch clicks into place.

4. Connect the power cord for the new ac power supply to the power-cord connector on the power supply.

   The following illustration shows the ac power-supply connectors **1** on the rear of the server.



5. Route the power cord through the power-supply handle and through any cable clamps on the rear of the server, to prevent the power cord from being accidentally pulled out when you slide the server in and out of the rack.
6. Connect the power cord to a properly grounded electrical outlet.
7. Make sure that the error LED on the power supply is not lit, and that the dc power LED and ac power LED on the power supply are lit, indicating that the power supply is operating correctly.

If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Removing a hot-swap fan

The server comes with three replaceable fans.

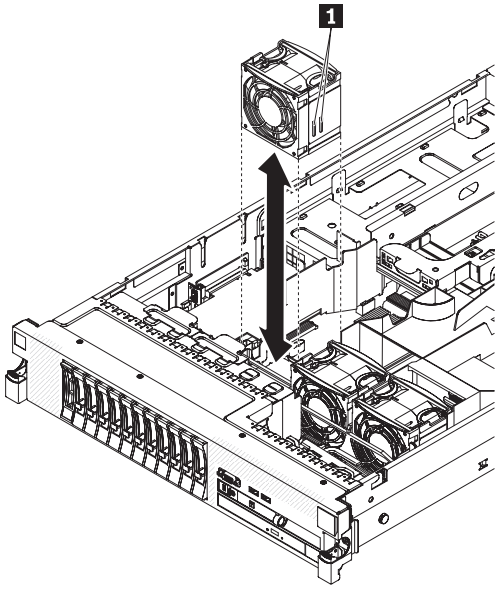
Attention: To ensure proper server operation, if a fan fails, replace it immediately. Have a replacement fan ready to install as soon as you remove the failed fan.

To remove a replaceable fan, complete the following steps.

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Leave the server connected to power.
3. Slide the server out of the rack and remove the cover (see “Removing the cover” on page 37). The LED near the failing fan will be lit.

   Attention: To ensure proper system cooling, do not remove the top cover for more than two minutes during this procedure.

4. Lift the fan out of the server, holding the vertical tabs 1 .



5. Replace the fan within 30 seconds (see “Installing a hot-swap fan”).

If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Installing a hot-swap fan

The server comes with three replaceable double-fans. For proper cooling, the server requires that all three fans be installed at all times.

Attention: To ensure proper server operation, if a fan fails, replace it immediately. Have a replacement fan ready to install as soon as you remove the failed fan.

The fans use system-board fan connectors 2, 4, and 6 only. Table 11 lists the fan connector on the system board for each double-fan. See “System-board internal connectors” on page 24 for the locations of the fan connectors.

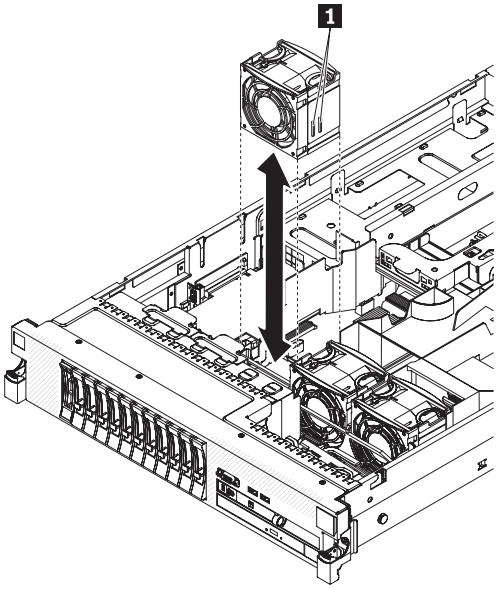
Table 11. Fan connectors on the system board

Fan number	System board fan connector
1	2
2	4
3	6

To install any of the three replaceable fans, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. If you have not done so already, slide the server out of the rack and remove the cover (see “Removing the cover” on page 37).

   Attention: To ensure proper system cooling, do not remove the top cover for more than two minutes during this procedure.
3. Orient the new fan over its position in the fan bracket 1 so that the connector on the bottom aligns with the fan connector on the system board.



4. Align the vertical tabs on the fan with the slots on the fan cage bracket.
5. Push the new fan into the fan connector on the system board. Press down on the top surface of the fan to seat the fan fully.

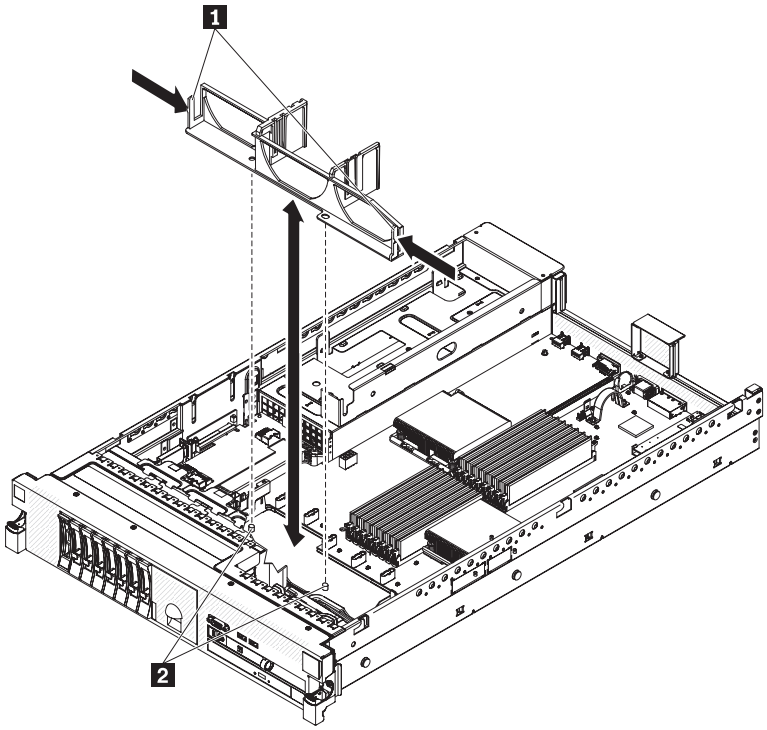
If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Removing the fan bracket

To replace some components or to create working room, you might have to remove the fan-bracket assembly.

Note: To remove or install a fan, it is not necessary to remove the fan bracket. See “Removing a hot-swap fan” on page 72 and “Installing a hot-swap fan” on page 73.

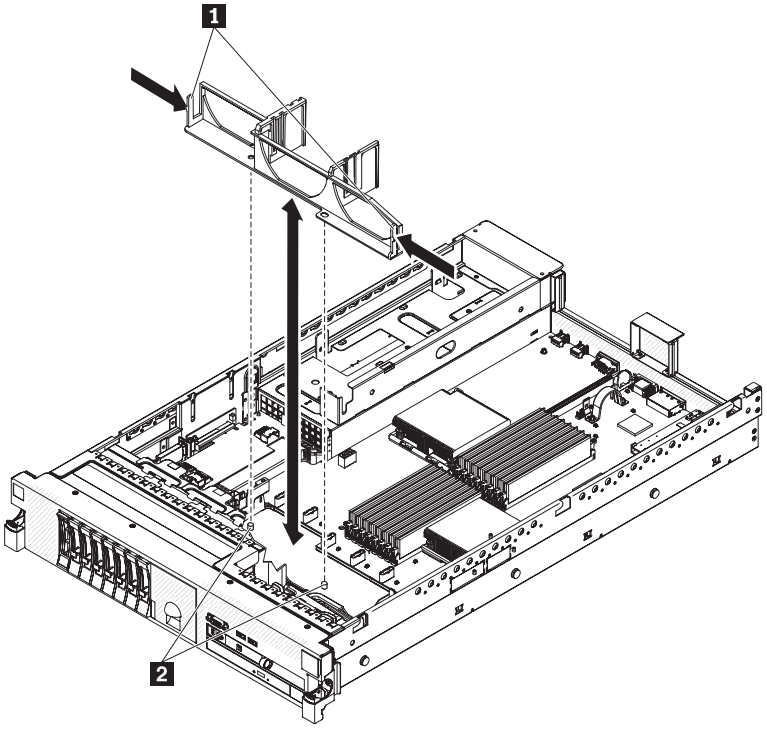
To remove the fan bracket, complete the following steps.



1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables.
3. Remove the cover (see “Removing the cover” on page 37).
4. Remove the fans (see “Removing a hot-swap fan” on page 72).
5. Remove the PCI riser-card assemblies and the DIMM air baffle (see “Removing a PCI riser-card assembly” on page 42 and “Removing the DIMM air baffle” on page 52).
6. Press the fan-bracket release latches **1** toward each other to release the pins **2** and lift the fan bracket out of the server.

Installing the fan bracket

To install the fan bracket, complete the following steps.

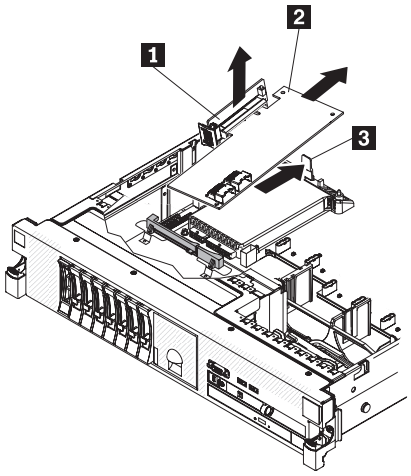


1. Lower the fan bracket into the chassis.
2. Align the holes in the bottom of the bracket with the pins **2** in the bottom of the chassis.
3. Press the bracket into position until the fan-bracket release levers **1** click into place.
4. Replace the fans (see “Installing a hot-swap fan” on page 73).
5. Replace the PCI riser-card assemblies and the DIMM air baffle (see “Installing a PCI riser-card assembly” on page 43 and “Installing the DIMM air baffle” on page 53).
6. Install the cover (see “Completing the installation” on page 100).
7. Slide the server into the rack.
8. Reconnect the external cables; then, reconnect the power cords and turn on the peripheral devices and the server.

Removing the SAS riser card and controller assembly

To remove the SAS riser-card and controller assembly from the server, complete the steps for the applicable server model.

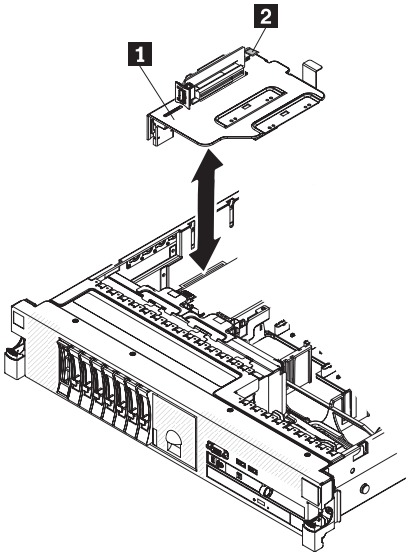
- **12-drive-capable server model**:



1 SAS riser card
2 SAS controller
3 Release tab

1. Press the assembly release latch toward the rear of the server and lift that end of the SAS controller assembly a little. Place your fingers underneath the upper portion of the SAS riser card and lift the assembly from the system board.
2. Lift the assembly out of the server.

- **Tape-enabled server model**:

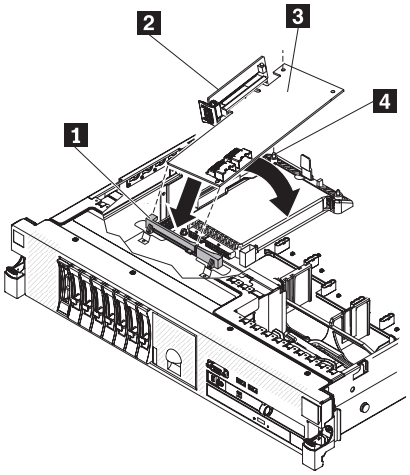


1. Press down on the assembly release latch **2** and lift up on the tab to release the SAS controller assembly, which includes the SAS riser card **1**, from the system board.
2. Lift the front and back edges of the assembly to remove the assembly from the server.

Installing the SAS riser card and controller assembly

To install the SAS riser-card and controller assembly in the server, complete the steps for the applicable server model.

- **12-drive-capable server model:**

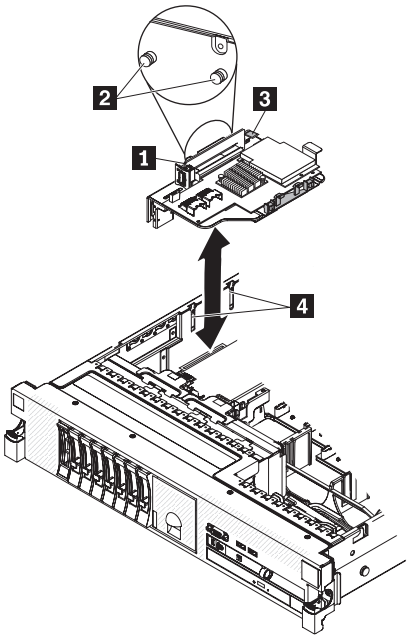


1 SAS controller front retention bracket
2 SAS riser card
3 SAS controller
4 Alignment post

1. Place the front end of the SAS controller in the front retention bracket and align the SAS riser card with the SAS riser-card connector on the system board.

2. Press down on the SAS riser card and the rear edge of the SAS controller until the SAS riser card is firmly seated and the SAS controller card retention latch clicks into place.

- **Tape-enabled server model:**



1. Align the pins on the back side of the SAS riser card **2** with the slots on the server chassis **4** .
2. Make sure that any tape drive cables are routed correctly underneath the SAS riser card. For information about the cable routing, see “Installing a tape drive” on page 91.
3. Press the SAS controller assembly into place. Make sure that the SAS riser card is firmly seated and that the release latch **3** and retention latch **1** hold the assembly securely.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Removing a SAS controller from the SAS riser card

A SAS controller is installed in a dedicated slot on the SAS riser card.

Important: If you have installed a 4-disk-drive optional expansion device in a 12-drive-capable server, the SAS controller is installed in a PCI riser-card assembly and is installed and removed the same way as any other PCI adapter. Do not use the instructions in this topic; use the instructions in “Installing a PCI adapter” on page 56 and “Removing a PCI adapter” on page 54.

Depending on the server model, the server comes with a ServeRAID-BR10i SAS/SATA controller or a ServeRAID-MR10i SAS/SATA controller installed.

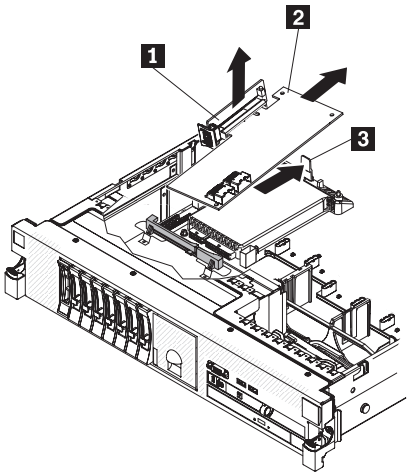
You can replace the SAS controller with another supported SAS controller. For a list of supported RAID controllers, see http://www.lenovo.com/thinkserver

Note: For brevity, in this documentation the ServeRAID SAS controller is often referred to as *SAS controller*.

To remove the SAS controller from a SAS riser card, complete the following steps:

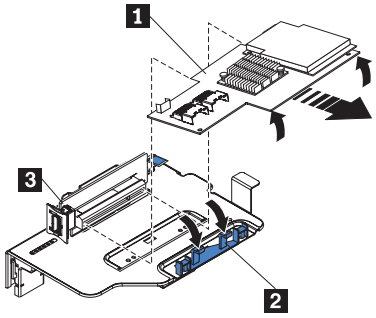
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables (see “Turning off the server” on page 31).
3. Remove the cover (see “Removing the cover” on page 37).
4. Locate the SAS riser-card and controller assembly near the left front corner of the server.
5. Disconnect the SAS signal cables from the connectors on the SAS controller.
6. Remove the SAS controller assembly, which includes the SAS riser card, from the server (see “Removing the SAS riser card and controller assembly” on page 77).

   12-drive-capable server model:



1 SAS riser card
2 SAS controller
3 Release tab

   Tape-enabled server model:



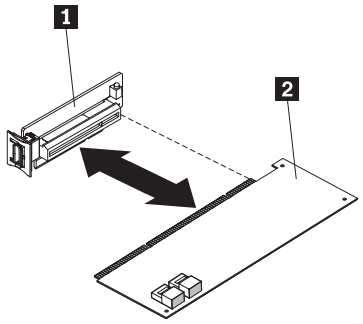
7. Press down the retention bracket 2 and pull the SAS controller horizontally 1 out of the connector on the SAS riser card 3 .
8. If you are replacing the SAS controller with another supported SAS controller, continue with “Installing a SAS controller on the SAS riser card” on page 81.

Installing a SAS controller on the SAS riser card

Important: If you have installed a 4-disk-drive optional expansion device in a 12-drive-capable server, the SAS controller is installed in a PCI riser-card assembly and is installed and removed the same way as any other PCI adapter. Do not use the instructions in this topic; use the instructions in “Installing a PCI adapter” on page 56 and “Removing a PCI adapter” on page 54.

To install a SAS controller on the SAS riser card, complete the following steps:

1. Make sure that the server is turned off, all external cables and power cords are disconnected, and the cover has been removed.
2. If you are installing a new or replacement SAS controller, touch the static-protective package that contains the new SAS controller to any unpainted metal surface on the server. Then, remove the SAS controller from the package.



1 SAS riser card
2 RAID adapter

3. If you are installing a new or replacement SAS controller that uses a battery, complete the following steps:
   a. Remove the battery from the SAS controller package or the battery package.
   b. Install the battery and connect the battery to the SAS controller as instructed in the documentation that comes with the SAS controller or the battery.
4. If the new SAS controller is a different physical size than the SAS controller you removed, you might have to move the controller retention bracket (tape-enabled model servers only) to the correct location for the new SAS controller. See “Moving the SAS-controller retention bracket” on page 82; then, continue with the next step in this procedure.
5. Turn the SAS controller so that the keys on the bottom edge align correctly with the connector on the SAS riser card in the SAS controller assembly.
6. Firmly press the SAS controller horizontally into the connector on the SAS riser card.
7. (Tape-enabled model server only) Gently press the opposite edge of the SAS controller into the controller retention bracket.
8. Install the SAS riser card and controller assembly (see “Installing the SAS riser card and controller assembly” on page 78).

If you have other optional devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 100.

Notes:

1. When you restart the server for the first time after you install a SAS controller with a battery, the monitor screen remains blank while the controller initializes the battery. This might take a few minutes, after which the startup process continues. This is a one-time occurrence.

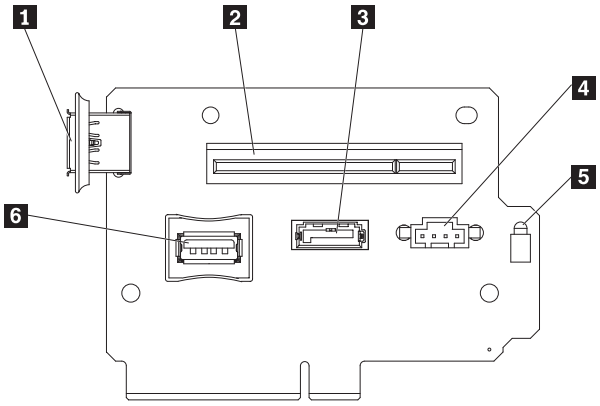
   Important: You must allow the initialization process to be completed. If you do not, the battery pack will not work, and the server might not start.

   The battery comes partially charged, at 30% or less of capacity. Run the server for 4 to 6 hours to fully charge the controller battery. The LED just above the battery on the controller remains lit until the battery is fully charged.

   Until the battery is fully charged, the controller firmware sets the controller cache to write-through mode; after the battery is fully charged, the controller firmware re-enables write-back mode.
2. When you restart the server, you will be given the opportunity to import the existing RAID configuration to the new SAS controller.

Moving the SAS-controller retention bracket

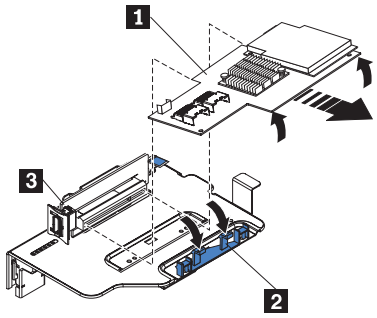
Note: This procedure applies only to servers that have the following SAS riser card installed.



1 USB connector
2 PCI Express RAID adapter
3 SATA tape signal
4 Tape drive power
5 SAS controller error LED
6 USB tape

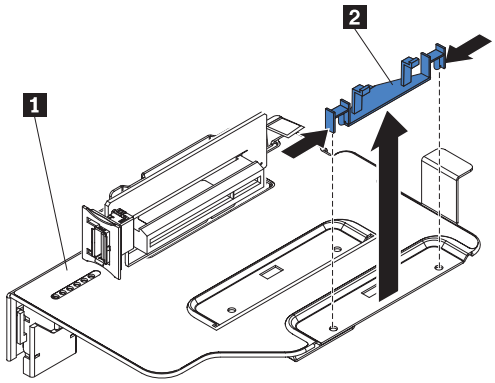
To move the SAS-controller retention bracket to a different position to accommodate the dimensions of the current SAS controller, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Make sure that the server and all peripheral devices are turned off and that the power cords and all external cables are disconnected.
3. Remove the SAS riser-card assembly from the server (see “Removing the SAS riser card and controller assembly” on page 77).
4. Remove the RAID controller from the SAS riser card.

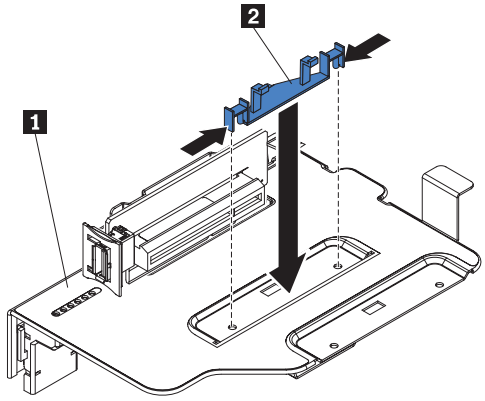


1 RAID controller
2 Retention bracket
3 SAS riser card

5. Remove the retention bracket from the current location:
   a. Pinch the bottoms of both bracket posts and push the posts up out of the SAS riser-card assembly.



   b. Rotate the bracket 2 to free the bracket tab from the slot on the SAS riser-card assembly 1.
6. Install the retention bracket in the new location on the SAS riser-card assembly:



   a. Insert the bracket tab 2 into the slot on the SAS riser-card assembly 1.
   b. Rotate the bracket so that the bracket posts align with the holes in the SAS riser-card assembly.
   c. Press the posts through the holes in the SAS riser-card assembly until they click into place.

d. Install the SAS controller on the SAS riser card (see “Installing a SAS controller on the SAS riser card” on page 81).

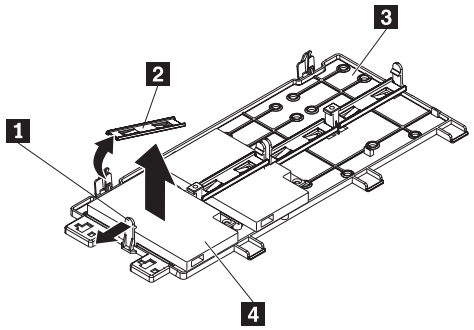
e. Install the riser-card assembly in the server (see “Installing the SAS riser card and controller assembly” on page 78).

f. Connect the power cords and all external cables, and turn on the server and peripheral devices.

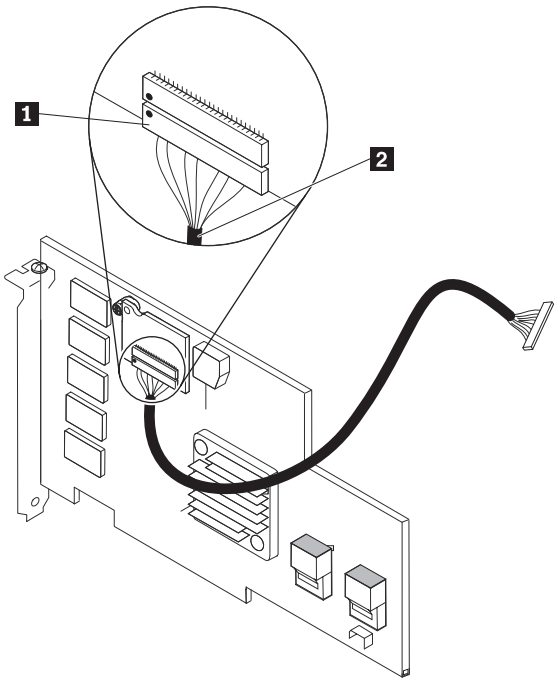
Removing a SAS controller battery from the remote battery tray

To remove a SAS controller battery from the remote battery tray, complete the following steps:

1. Read the safety information that begins on page “Safety” on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables.
3. Remove the cover (see “Removing the cover” on page 37).
4. Locate the remote battery tray in the server and remove the battery that you want to replace:
   a. Remove the battery retention clip **2** from the tabs **1** that secure the battery **4** to the remote battery tray **3**.



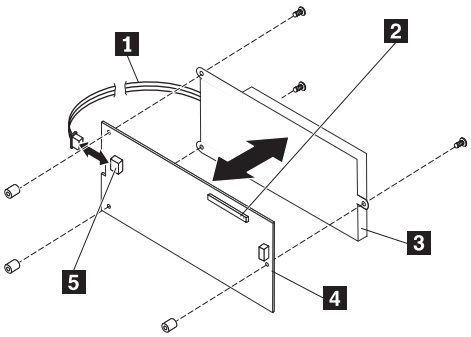
   b. Lift the battery and battery carrier from the tray and carefully disconnect the remote battery cable from the interposer card on the SAS controller.



1 Remote battery cable connector
2 Remote battery cable

c. Disconnect the battery carrier cable from the battery.
d. Squeeze the clip on the side of the battery and battery carrier to remove the battery from the battery carrier.

Note: If your battery and battery carrier are attached with screws instead of a locking-clip mechanism, remove the three screws to remove the battery from the battery carrier.



1 Battery cable
2 Remote battery cable connector
3 Battery
4 Battery carrier
5 Battery connector

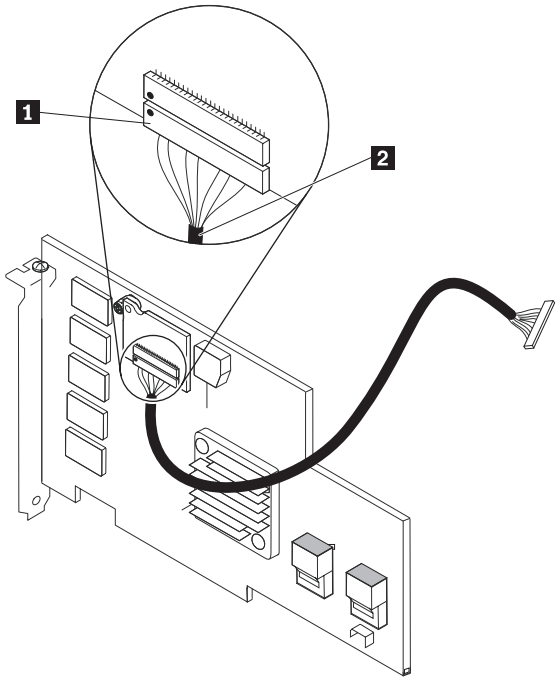
e. If you are instructed to return the SAS controller battery, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

Installing a SAS controller battery on the remote battery tray

To install a SAS controller battery on the remote battery tray, complete the following steps:

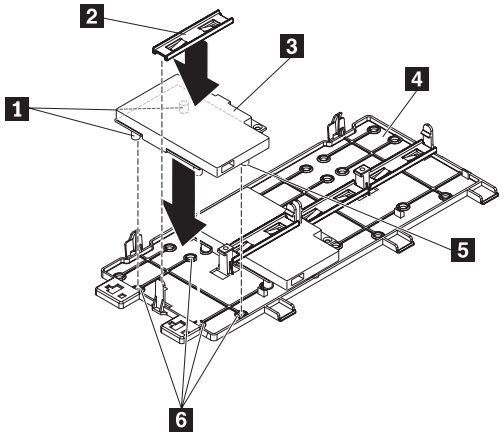
1. Install the replacement battery on the remote battery tray:
   a. Place the replacement battery on the battery carrier from which the former battery had been removed, and connect the battery carrier cable to the replacement battery.
   b. Connect the remote battery cable to the interposer card.

      Attention: To avoid damage to the hardware, make sure that you align the black dot on the cable connector with the black dot on the connector on the interposer card. *Do not force the remote battery cable into the connector.*



1 Remote battery cable connector
2 Remote battery cable

   c. On the remote battery tray, find the pattern of recessed rings that matches the posts on the battery and battery carrier.

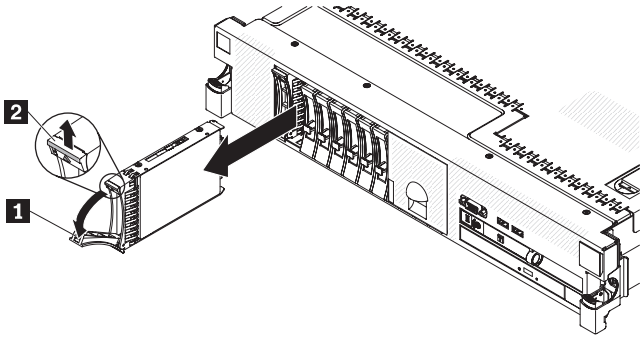


1 Posts
2 Battery retention clip
3 Battery
4 Battery tray
5 Post
6 Rings

d. Press the posts into the rings and underneath the tabs on the remote battery tray.
e. Secure the battery to the tray with the battery retention clip.

2. Install the cover “Completing the installation” on page 100.

Removing a hot-swap hard disk drive



Attention: To maintain proper system cooling, do not operate the server for more than 10 minutes without either a drive or a filler panel installed in each bay.

To remove a hard disk drive from a hot-swap bay, complete the following steps.

1. Read the safety information that begins on page vii, “Handling static-sensitive devices” on page 35, and “Installation guidelines” on page 33.
2. Press up on the release latch 2 at the top of the drive front.
3. Rotate the handle 1 on the drive downward to the open position.
4. Pull the hot-swap drive assembly out of the bay approximately 25 mm (1 inch). Wait approximately 45 seconds while the drive spins down before you remove the drive assembly completely from the bay.
5. If you are instructed to return the hot-swap drive, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

Installing a hot-swap hard disk drive

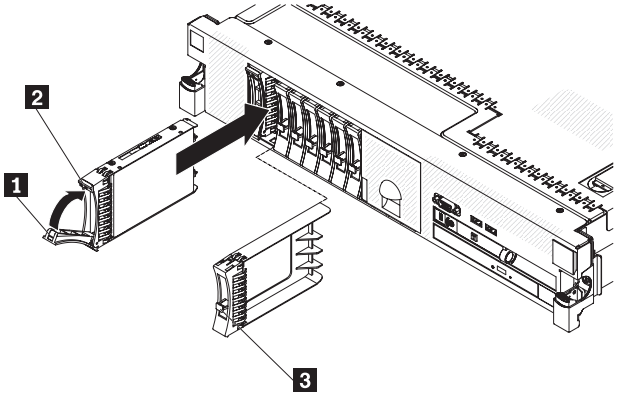
Locate the documentation that comes with the hard disk drive and follow those instructions in addition to the instructions in this section.

The following notes describe the type of hard disk drive that the server supports and other information that you must consider when installing a hard disk drive:

- The server supports eight 2.5-inch hot-swap hard disk drives installed on Ultra-Slim hard disk drive trays for 2.5-inch drives. An optional 4–drive-bay kit is available for 12–drive-capable server models. For a list of supported 2.5-inch hard disk drives, see http://www.lenovo.com/thinkserver.

- All hot-swap drives in the server should have the same throughput speed rating. Mixing hard disk drives with different speed ratings will cause all drives to operate at the lower throughput speed.
- The ID that is assigned to each bay is printed on the front of the server above the drive bay.

Important: Do not install a SCSI hard disk drive in this server.



1	Handle
2	Latch
3	Filler panel handle

To install a drive in a hot-swap bay, complete the following steps.

Attention: To maintain proper system cooling, do not operate the server for more than 10 minutes without either a drive or a filler panel installed in each bay.

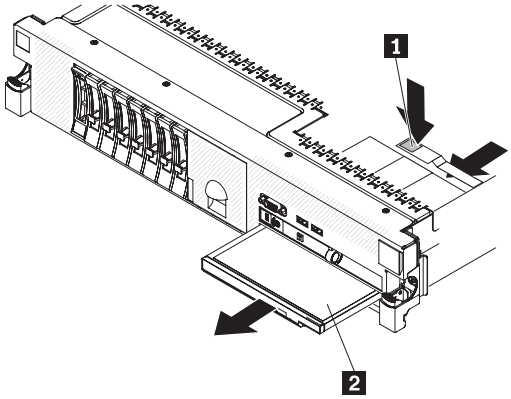
1. Orient the drive as shown in the illustration.
2. Make sure that the tray handle is open.
3. Align the drive assembly with the guide rails in the bay.
4. Gently push the drive assembly into the bay until the drive stops.
5. Push the tray handle to the closed (locked) position.
6. If the system is turned on, check the hard disk drive status LED to verify that the hard disk drive is operating correctly.

After you replace a failed hard disk drive, the green activity LED flashes as the disk spins up. The amber LED turns off after approximately 1 minute. If the new drive starts to rebuild, the amber LED flashes slowly, and the green activity LED remains lit during the rebuild process. If the amber LED remains lit, see “Hard disk drive problems” on page 131.

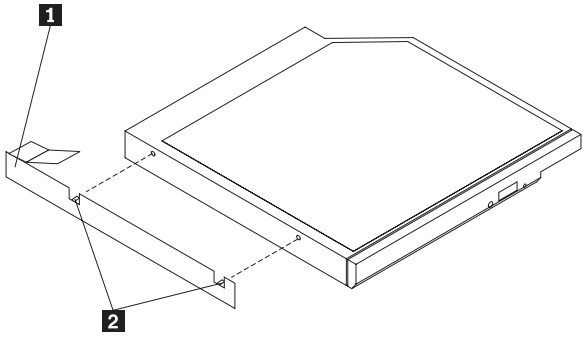
Note: You might have to reconfigure the disk arrays after you install hard disk drives.

Removing a CD-RW/DVD drive

To remove the CD-RW/DVD drive, complete the following steps.



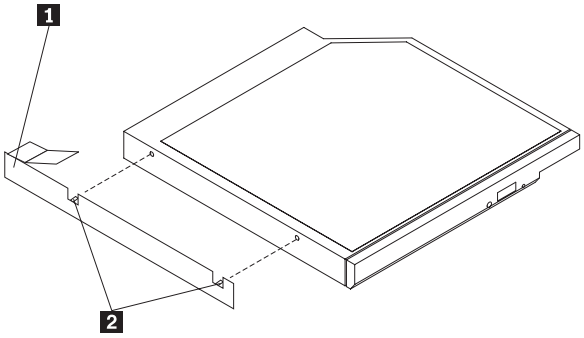
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect all power cords and external cables.
3. Slide the server out of the rack; then, remove the cover (see “Removing the cover” on page 37).
4. Press the release tab down **1** to release the drive; then, while you press the tab, push the drive toward the front of the server.
5. From the front of the server, pull the drive out of the bay **2** .



6. Remove the drive retention clip **1** from the drive (held with alignment pins **2**).
7. If you are instructed to return the CD-RW/DVD drive, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

Installing a CD-RW/DVD drive

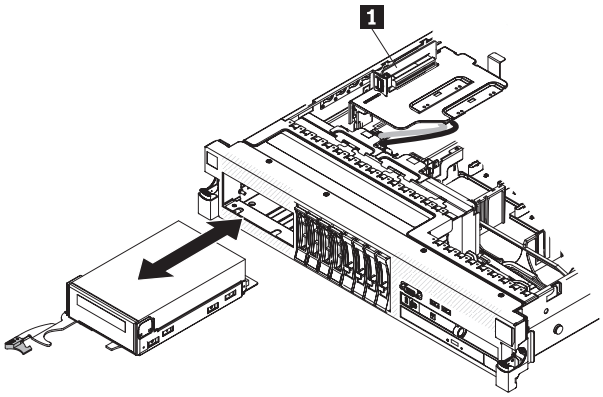
To install the replacement CD-RW/DVD drive, complete the following steps.



1. Attach the drive-retention clip **1** to the side of the drive.
2. Slide the drive into the CD/DVD drive bay (using the alignment pins **2**) until the drive clicks into place.
3. Install the cover (see “Completing the installation” on page 100).
4. Slide the server into the rack.
5. Reconnect the external cables; then, reconnect the power cords and turn on the peripheral devices and the server.

Removing a tape drive

The following illustration shows how to remove an optional tape drive from the server.

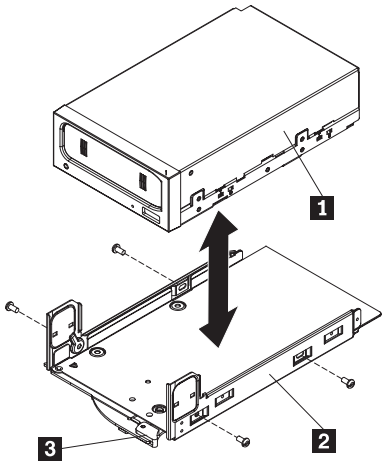


1 SAS riser card

To remove a tape drive from the server, complete the following steps:

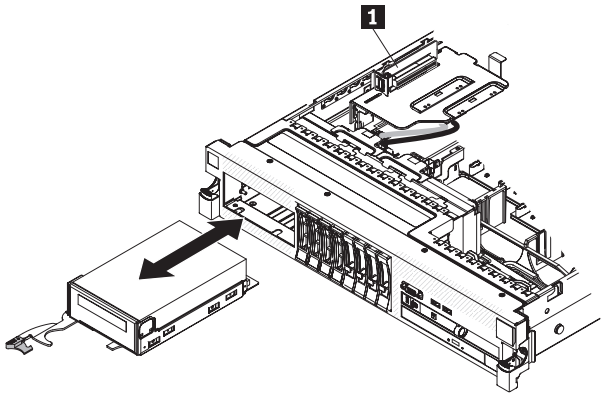
1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Slide the server out of the rack; then, remove the cover (see “Removing the cover” on page 37).
4. Open the tape drive tray release latch **3** and slide the drive tray out of the bay approximately 25 mm (1 inch).
5. Disconnect the power and signal cables from the rear of the tape drive.

6. Pull the drive completely out of the bay.
7. Remove the tape drive 1 from the drive tray 2 by removing the four screws on the sides of the tray.



8. If you are not installing another drive in the bay, insert the tape drive filler panel into the empty tape drive bay.
9. If you are instructed to return the drive, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

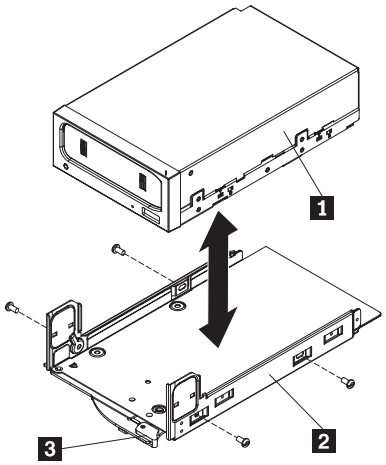
Installing a tape drive



1 SAS riser card

To install a tape drive, complete the following steps:

1. If the tape drive came with metal spacers on the installed on the sides, remove the spacers.
2. Install the drive tray on the new tape drive as shown, using the four screws that you removed from the former drive.



1 Tape drive
2 Tray
3 Latch

3. Prepare the drive according to the instructions that come with the drive, setting any switches or jumpers.
4. Slide the tape-drive assembly most of the way into the tape-drive bay.
5. Using the cables from the former tape drive, connect the signal and power cables to the back of the tape drive.
6. Make sure all the cables are out of the way, and slide the tape-drive assembly the rest of the way into the tape-drive bay.
7. Push the tray handle to the closed (locked) position.
8. Install the cover (see “Completing the installation” on page 100).
9. Slide the server into the rack.
10. Reconnect the external cables; then, reconnect the power cords and turn on the peripheral devices and the server.

Removing a microprocessor and heat sink

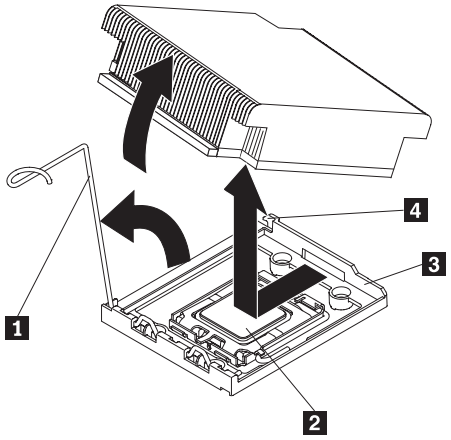
Attention:

- Do not allow the thermal grease on the microprocessor and heat sink to come in contact with anything. Contact with any surface can compromise the thermal grease and the microprocessor socket.
- Dropping the microprocessor during installation or removal can damage the contacts.
- Do not touch the microprocessor contacts; handle the microprocessor by the edges only. Contaminants on the microprocessor contacts, such as oil from your skin, can cause connection failures between the contacts and the socket.

To remove a microprocessor and heat sink, complete the following steps:

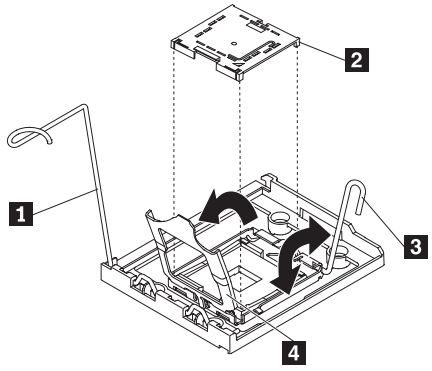
1. Read the safety information that begins on page vii, “Handling static-sensitive devices” on page 35, and “Installation guidelines” on page 33.
2. Turn off the server and peripheral devices and disconnect the power cord and all external cables.
3. Remove the cover (see “Removing the cover” on page 37).

4. Depending on which microprocessor you are removing, remove the following components, if necessary:
   - Microprocessor 1: PCI riser-card assembly 1 and DIMM air baffle (see “Removing a PCI riser-card assembly” on page 42 and “Removing the DIMM air baffle” on page 52)
   - Microprocessor 2: PCI riser-card assembly 2 and microprocessor 2 air baffle (see “Removing a PCI riser-card assembly” on page 42 and “Removing the microprocessor 2 air baffle” on page 50).
5. Open the heat-sink release lever to the fully open position.



1 Heat-sink release lever
2 Microprocessor
3 Retainer bracket
4 Lock tab

6. Lift the heat sink out of the server. If the heat sink sticks to the microprocessor, slightly twist the heat sink back and forth to break the seal. After removal, place the heat sink on its side on a clean, flat surface.
7. Release the microprocessor retention latch 1 by pressing down on the end, moving it to the side, and releasing it to the open (up) position.



8. Open the microprocessor bracket frame 4 by lifting up the tab on the top edge. Keep the bracket frame in the open position.
9. Carefully lift the microprocessor 2 straight up and out of the socket, and place it on a static-protective surface.
10. If you are instructed to return the microprocessor, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

Installing a microprocessor and heat sink

Read the documentation that comes with the microprocessor to determine whether you must update the firmware.

Important: Some cluster solutions require specific code levels or coordinated code updates. If the device is part of a cluster solution, verify that the latest level of code is supported for the cluster solution before you update the code.
To download the most current level of server firmware, complete the following steps:

1. Go to: http://www.lenovo.com/support.
2. Enter your product number (machine type and model number) or select **Servers and Storage** from the **Select your product** list.
3. From **Family** list, select **ThinkServer RD220**, and click **Continue**.
4. Click **Downloads and drivers** to download firmware updates.

Important:

- A startup (boot) microprocessor must always be installed in microprocessor connector 1 on the system board.
- To ensure correct server operation, make sure that you use microprocessors that are compatible and you have installed an additional DIMM for microprocessor 2. Compatible microprocessors must have the same QuickPath Interconnect (QPI) link speed, integrated memory controller frequency, core frequency, power segment, cache size, and type.
- Microprocessors with different stepping levels are supported in this server. If you install microprocessors with different stepping levels, it does not matter which microprocessor is installed in microprocessor connector 1 or connector 2.
- If you are installing a microprocessor that has been removed, make sure that it is paired with its original heat sink or a new replacement heat sink. Do not reuse a heat sink from another microprocessor; the thermal grease distribution might be different and might affect conductivity.
- If you are installing a new heat sink, remove the protective backing from the thermal material that is on the underside of the new heat sink.
- If you are installing a new heat-sink assembly that did not come with thermal grease, see “Thermal grease” on page 96 for instructions for applying thermal grease; then, continue with step 1 of this procedure.
- If you are installing a heat sink that has contaminated thermal grease, see “Thermal grease” on page 96 for instructions for replacing the thermal grease; then, continue with step 1 of this procedure.

To install a new or replacement microprocessor, complete the following steps. The following illustration shows how to install a microprocessor on the system board.

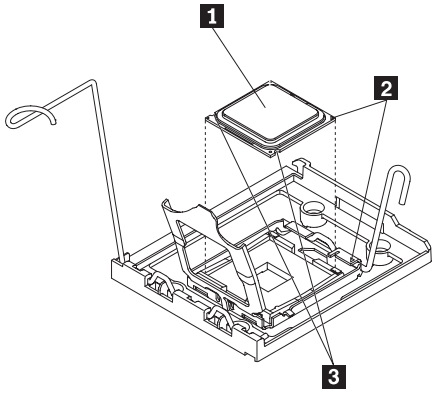
1. Touch the static-protective package that contains the microprocessor to any unpainted metal surface on the server. Then, remove the microprocessor from the package.
2. Rotate the microprocessor release lever on the socket from its closed and locked position until it stops in the fully open position.

Attention:

- Do not touch the microprocessor contact; handle the microprocessor by the edges only. Contaminants on the microprocessor contacts, such as oil from your skin, can cause connection failures between the contacts and the socket.
- Handle the microprocessor carefully. Dropping the microprocessor during installation or removal can damage the contacts.
- Do not use excessive force when you press the microprocessor into the socket.
- Make sure that the microprocessor is oriented and aligned and positioned in the socket before you try to close the lever.

3. Align the microprocessor with the socket (note the alignment mark and the position of the notches); then, carefully place the microprocessor on the socket. Close the microprocessor bracket frame.

   Note: The microprocessor fits only one way on the socket.

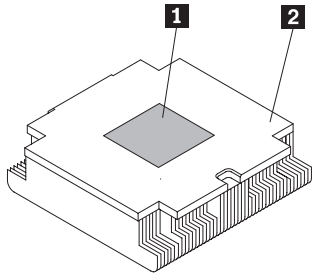


1 Microprocessor
2 Alignment marks
3 Notches

4. Carefully close the microprocessor release lever to secure the microprocessor in the socket.
5. Install a heat sink on the microprocessor.

   Attention: Do not touch the thermal grease 1 on the bottom of the heat sink 2 or set down the heat sink after you remove the plastic cover. Touching the thermal grease will contaminate it.

   The following illustration shows the bottom surface of the heat sink.



   a. Make sure that the heat-sink release lever is in the open position.
   b. Remove the plastic protective cover from the bottom of the heat sink.

c. If the new heat sink did not come with thermal grease, apply thermal grease on the microprocessor before you install the heat sink (see “Thermal grease”).

d. Align the heat sink above the microprocessor with the thermal grease side down.

e. Slide the flange of the heat sink into the opening in the retainer bracket.

f. Press down firmly on the heat sink until it is seated securely.

g. Rotate the heat-sink release lever to the closed position and hook it underneath the lock tab.

6. Replace the components that you removed in “Removing a microprocessor and heat sink” on page 92:
   - Microprocessor 1: DIMM air baffle and PCI riser-card assembly 1 (see “Installing the DIMM air baffle” on page 53 and “Installing a PCI riser-card assembly” on page 43)
   - Microprocessor 2: Microprocessor 2 air baffle and PCI riser-card assembly 2 (see “Installing the microprocessor 2 air baffle” on page 51 and “Installing a PCI riser-card assembly” on page 43).
7. Install the cover (see “Completing the installation” on page 100).
8. Slide the server into the rack.
9. Reconnect the external cables; then, reconnect the power cords and turn on the peripheral devices and the server.

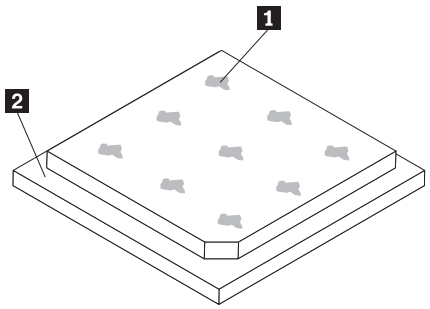
Thermal grease

The thermal grease must be replaced whenever the heat sink has been removed from the top of the microprocessor and is going to be reused or when debris is found in the grease.

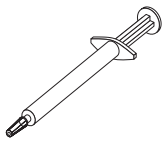
To replace damaged or contaminated thermal grease on the microprocessor and heat exchanger, complete the following steps:

1. Place the heat-sink assembly on a clean work surface.
2. Remove the cleaning pad from its package and unfold it completely.
3. Use the cleaning pad to wipe the thermal grease from the bottom of the heat exchanger.

   Note: Make sure that all of the thermal grease is removed.
4. Use a clean area of the cleaning pad to wipe the thermal grease from the microprocessor; then, dispose of the cleaning pad after all of the thermal grease is removed.



5. Use the thermal-grease syringe to place nine uniformly spaced dots of 0.02 mL 1 each on the top of the microprocessor 2 .



Note: 0.01mL is one tick mark on the syringe. If the grease is properly applied, approximately half (0.22 mL) of the grease will remain in the syringe.

6. Continue with step 5d on page 96 of the “Installing a microprocessor and heat sink” on page 94 procedure.

Removing the battery

Statement 2:

CAUTION:
When replacing the lithium battery, use only battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

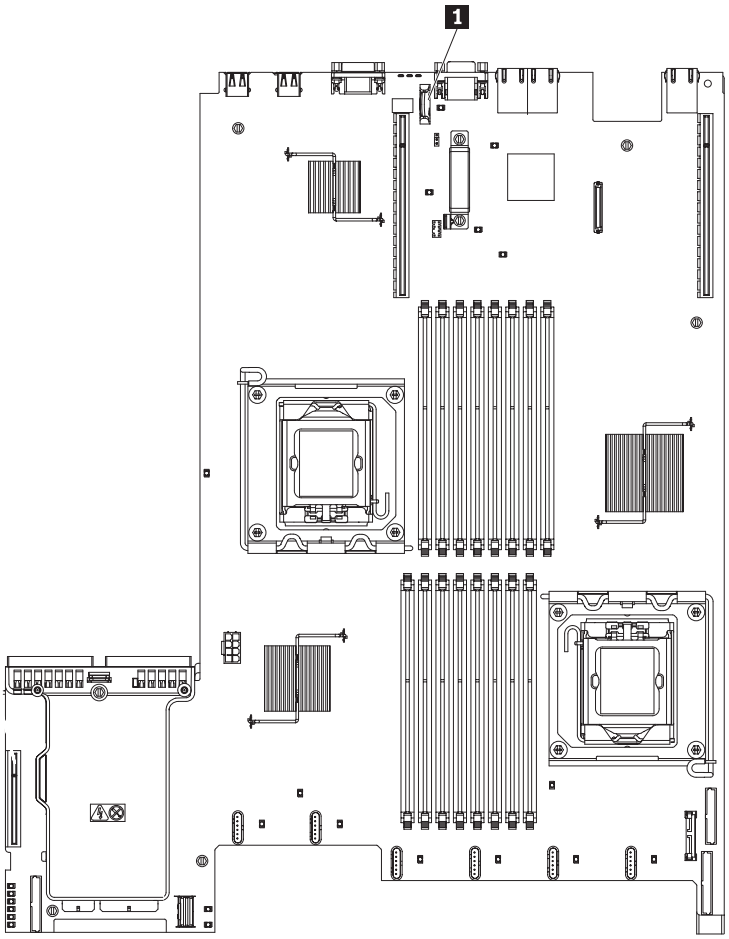
- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

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

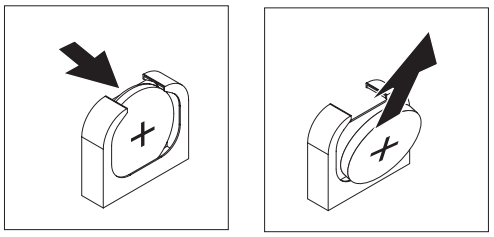
To remove the battery, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 33.
2. Follow any special handling and installation instructions that come with the battery.
3. Turn off the server and peripheral devices, and disconnect the power cord and all external cables.
4. Slide the server out of the rack.
5. Remove the cover (see “Removing the cover” on page 37).
6. Disconnect any internal cables, as necessary (see “Internal cable routing and connectors” on page 38).

7. Locate the battery on the system board **1** .



8. Remove the battery:
   a. Use one finger to push the battery horizontally out of its housing, pushing it away from the PCI riser 2.
   b. Lift the battery from the socket.



9. Dispose of the battery as required by local ordinances or regulations. See the *Important Notices* and *Safety Information* on the *ThinkServer Documentation* DVD for more information.

Installing the battery

The following notes describe information that you must consider when you replace the battery in the server.

- You must replace the battery with a lithium battery of the same type from the same manufacturer.

- After you replace the battery, you must reconfigure the server and reset the system date and time.
- To avoid possible danger, read and follow the following safety statement.

Statement 2:

CAUTION:
When replacing the lithium battery, use only battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

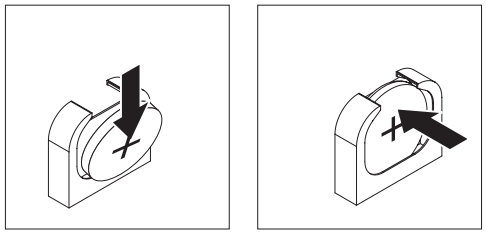
- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

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

See the *Important Notices* and *Safety Information* document on the *ThinkServer Documentation* DVD for more information.

To install the replacement battery, complete the following steps:

1. Follow any special handling and installation instructions that come with the replacement battery.
2. Insert the new battery:
   a. Hold the battery in a vertical orientation so that the smaller side is facing the housing.
   b. Place the battery into its socket, and press the battery toward the housing and the PCI riser 2 until it snaps into place.



3. Reinstall any adapters that you removed.
4. Reconnect the internal cables that you disconnected (see “Internal cable routing and connectors” on page 38).
5. Install the cover (see “Completing the installation” on page 100).
6. Slide the server into the rack.

7. Reconnect the external cables; then, reconnect the power cords and turn on the peripheral devices and the server.

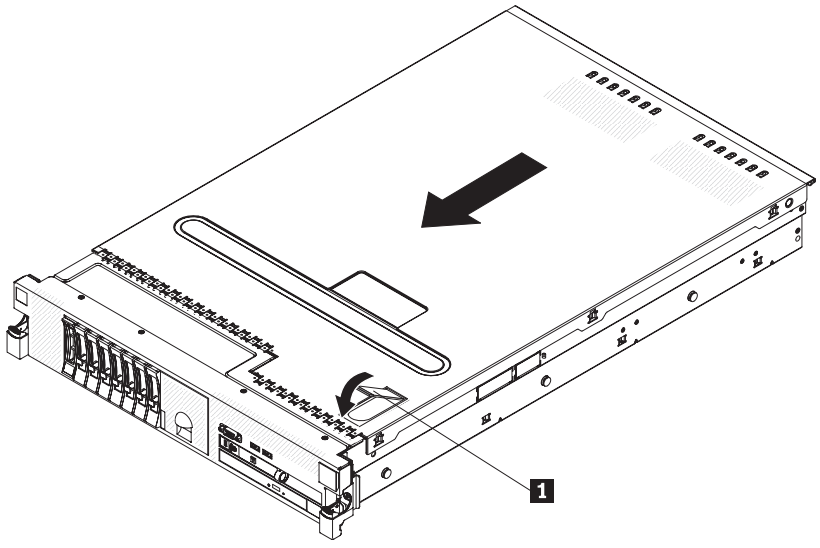
   Note: You must wait approximately 20 seconds after you connect the power cord of the server to an electrical outlet before the power-control button becomes active.
8. Start the Setup utility and reset the configuration.
   - Set the system date and time.
   - Set the power-on password.
   - Reconfigure the server.

   See Chapter 6, “Configuring the server,” on page 103 for details.

Completing the installation

To complete the installation, complete the following steps:

1. If you removed the microprocessor 2 air baffle, replace the microprocessor 2 air baffle (see “Installing the microprocessor 2 air baffle” on page 51).
2. If you removed the DIMM air baffle, install it now (see “Installing the DIMM air baffle” on page 53).
3. If you removed either of the PCI riser-card assemblies, replace the riser-card assemblies now (see “Installing a PCI riser-card assembly” on page 43).
4. If you removed the server cover, replace it:
   a. Make sure that all internal cables are correctly routed.
   b. Place the cover-release latch **1** in the open (up) position.

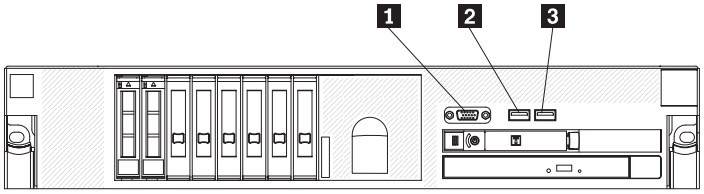


   c. Insert the bottom tabs of the top cover into the matching slots in the server chassis.
   d. Press down on the cover-release latch to slide the cover forward and lock the cover in place.
   e. Slide the server into the rack.
5. Install the server in a rack. See the *Rack Installation Instructions* that come with the server for complete rack installation and removal instructions.
6. To attach peripheral devices and connect the power cords, see “Connecting the cables” on page 101.

Connecting the cables

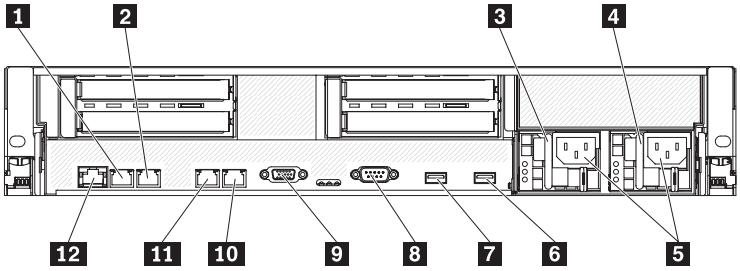
The following illustrations show the locations of the input and output connectors on the front and rear of the server.

Front view



1 Video connector
2 USB 1 connector
3 USB 2 connector

Rear view



1 Ethernet 3 (optional)
2 Ethernet 4 (optional)
3 Power supply 1
4 Power supply 2
5 Power cord connectors
6 USB 4
7 USB 3
8 Serial
9 Video
10 Ethernet 2
11 Ethernet 1
12 Systems-management (Ethernet)

You must turn off the server before you connect or disconnect cables from the server. **Exception:** in order to view the error LEDs inside the server, you must leave the power cables connected to the power supplies.

See the documentation that comes with any external devices for additional cabling instructions. It might be easier for you to route cables before you connect the devices to the server.

Cable identifiers are printed on the cables that come with the server and optional devices. Use these identifiers to connect the cables to the correct connectors.

If the server comes with an installed operating system, see the documentation that comes with the operating system for additional cabling instructions.

Updating the server configuration

When you start the server for the first time after you add or remove an internal device, external SAS device, or USB keyboard or mouse, you might receive a message that the configuration has changed. The Server Configuration and Boot

Management program starts automatically so that you can save the new configuration settings. For more information, see Chapter 6, “Configuring the server,” on page 103.

Some optional devices have device drivers that you must install. See the documentation that comes with each optional device for information about installing device drivers.

If you have installed or removed a hard disk drive, see “Using the LSI Configuration Utility program” on page 110.

For information about the integrated Gigabit Ethernet controller, see “Configuring the Gigabit Ethernet controller” on page 118.

Chapter 6. Configuring the server

Lenovo provides a number of programs to assist you with getting your server up and running quickly.

- **Setup Utility program**

  The Unified Extensible Firmware Interface (UEFI, formerly called BIOS) Setup Utility program is part of the system firmware. Use it to change interrupt request (IRQ) settings, change the startup-device sequence, set the date and time, and set passwords. For information about using this program, see “Using the Setup Utility program” on page 104.

- **Boot Manager program**

  The Boot Menu program is part of the UEFI firmware. Use it to override the startup sequence that is set in the UEFI Setup Utility program and temporarily assign a device to be first in the startup sequence. For additional information, see “Using the Boot Manager program” on page 109.

- **LSI Configuration Utility program**

  Use the LSI Configuration Utility program to configure the integrated SAS/SATA controller with RAID capabilities and the devices that are attached to it. For information about using this program, see “Using the LSI Configuration Utility program” on page 110.

- **ThinkServer EasyStartup program**

  This program simplifies the process of your RAID controller and installing supported operating systems and device drivers. It is on the *ThinkServer EasyStartup* DVD provided with your server. For details, see “Using the *ThinkServer EasyStartup* DVD” on page 114.

- **Broadcom Gigabit Ethernet Utility program**

  Use this program to specify where the network startup option is displayed in the startup sequence. For additional information, see “Enabling the Broadcom Gigabit Ethernet Utility program” on page 118.

- **ThinkServer EasyManage products**

  ThinkServer EasyManage Core Server and ThinkServer EasyManage Agent work together to provide centralized hardware and software inventory management and secure automated system management through a single console. See “Installing ThinkServer EasyManage software” on page 121.

- **Integrated Management Module**

  Use the Integrated Management Module (IMM) for configuration, to update the firmware and sensor data record/field replaceable unit (SDR/FRU) data, and to remotely manage a network. For information about using IMM, see “Using the Integrated Management Module” on page 119.

- **Remote presence capability and blue-screen capture**

  The remote presence and blue-screen capture feature are integrated into the Integrated Management Module (IMM). The virtual media key is required to enable the full system-management functions and the remote desktop protocol support. When IMM Premium is installed in the server, it activates the remote presence functions and remote desktop protocol support. Without the virtual media key, you will not be able to access the network remotely to mount or unmount drives or images on the client system. However, you still will be able to access the host graphical user interface through the Web interface without IMM Premium. For more information about how to enable the remote presence function, see “Using the remote presence capability and blue-screen capture” on page 124.

- **Ethernet controller configuration**

  For information about the Ethernet controller, see “Configuring the Gigabit Ethernet controller” on page 118.

Using the Setup Utility program

The Unified Extensible Firmware Interface (UEFI) provides the interface between the operating system and platform firmware and controls platform initialization. These functions are analogous to those provided in the BIOS on non-UEFI compliant computers. Use the UEFI Setup Utility program to

- View configuration information
- View and change assignments for devices and I/O ports
- Set the date and time
- Set the startup characteristics of the server and the order of startup devices
- Set and change settings for advanced hardware features
- View, set, and change settings for power-management features
- View and clear error logs
- Change interrupt request (IRQ) settings
- Resolve configuration conflicts

Starting the Setup Utility program

Complete the following steps to start the UEFI Setup Utility program:

1. Turn on the server.

   Note: Approximately 1 to 2 minutes after the server is connected to ac power, the power-control button becomes active.
2. When the prompt `Press F1 for Setup` appears, press F1. If you have set both a power-on password and an administrator password, you must type the administrator password to access the full UEFI Setup Utility menu. If you do not type the administrator password, a limited UEFI Setup Utility menu is available.
3. Select settings to view or change.

Setup Utility menu choices

The following choices are on the UEFI Setup Utility main menu (UEFI was formerly called BIOS). Depending on the version of the firmware, some menu choices might differ slightly from these descriptions.

- **System Information**

  Select this choice to view information about the server. When you make changes through other options in the UEFI Setup Utility program, some of those changes are reflected in the system information; you cannot change settings directly in the system information. This choice is on the full UEFI Setup utility menu only.

  – **System Summary**

    Select this choice to view configuration information, including the ID, speed, and cache size of the microprocessors, machine type and model of the server, the serial number, the system UUID, and the amount of installed memory. When you make configuration changes through other options in the UEFI Setup Utility program, the changes are reflected in the system summary; you cannot change settings directly in the system summary.

  – **Product Data**

Select this choice to view the system board identifier, the revision level or issue date of the firmware, the integrated baseboard management controller and diagnostics code, and the version and date.

This choice is on the full UEFI Setup Utility menu only.

- **System Settings**

  Select this choice to view or change the server component settings.

  – **Processors**

    Select this choice to view or change the processor settings.

  – **Memory**

    Select this choice to view or change the memory settings.

  – **Devices and I/O Ports**

    Select this choice to view or change assignments for devices and input/output (I/O) ports. You can configure the serial ports, configure remote console redirection, enable or disable integrated Ethernet controllers, the SAS/SATA controller, SATA optical drive channels, PCI slots, and view the system Ethernet MAC addresses. If you disable a device, it cannot be configured, and the operating system will not be able to detect it (this is equivalent to disconnecting the device).

  – **Power**

    Select this choice to view or change power capping to control consumption, processors, and performance states.

  – **Integrated Management Module**

    Select this choice to view or change the settings for the Integrated Management Module.

    - **OS Loader Watchdog Timer**

      Select this choice to view or enable the OS Loader Watchdog Timer.

    - **POST Watchdog Timer**

      Select this choice to view or enable the POST Watchdog Timer.

    - **POST Watchdog Timer Value**

      Select this choice to view or set the POST Loader Watchdog Timer Value.

    - **Reboot System on NMI**

      Enable or disable restarting the system whenever a nonmaskable interrupt (NMI) occurs. **Disabled** is the default.

    - **Network Configuration**

      Select this choice to view the System Management Network Interface port, IMM MAC address, the current IMM IP address, and host name. Define the static IMM IP address, subnet mask, and gateway address, and specify whether to use the static IP address or have DHCP assign the IMM IP address, save the network changes, and reset IMM.

    - **Reset IMM to Defaults**

      Select this choice to view or reset IMM to the default settings.

  – **Legacy Support**

    Select this choice to view or set legacy support.

    - **Force Legacy Video on Boot**

      Select this choice to force INT video support, if the operating system does not support UEFI Video Output Standards.

    - **Rehook INT**

Select this choice to Enable or Disable devices from taking control of the boot process. The default is **Disable**.

- **Legacy Thunk Support**

  Select this choice to Enable or Disable Legacy Thunk Support.

- **Legacy PXE Enable**

  Select this choice to Enable or Disable the Legacy PXE Boot option. The default is **Disable**.

– **Adapters and UEFI Drivers**

  Select this choice to view information about the adapters and UEFI drivers installed in the server.

– **iSCSI Configuration**

  Select this choice to view the unique name for the iSCSI initiator.

- **Date and Time**

  Select this choice to set the date and time in the server, in 24-hour format (*hour*:*minute*:*second*).

  This choice is on the full UEFI Setup Utility menu only.

- **Start Options**

  Select this choice to view or change the start options, including the startup sequence, keyboard NumLock state, PXE boot option, and PCI device boot priority. Changes in the startup options take effect when you start the server.

  This choice is on the full UEFI Setup Utility menu only.

- **Boot Manager**

  Select this choice to view, add, or change the device boot order, boot from a file, select a one-time boot, or to reset the boot order to the default setting.

- **System Event Logs**

  Select this choice to enter the System Event Manager where you can view the error messages in the system event logs. You can use the arrow keys to move between pages in the error log.

  The system event logs contain all event and error messages that have been generated during POST, by the system management interface handler, and by the system service processor. Run the diagnostic programs to get more information about error codes that occur. See the *Hardware Maintenance Manual* for instructions for running the diagnostic programs.

  Important: If the system-error LED on the front of the server is lit but there are no other error indications, clear the IMM system event log. Also, after you complete a repair or correct an error, clear the IMM system event lot to turn off the system error LED on the front of the server.

  – **POST Event Viewer**

    Select this choice to enter the POST Event Viewer to view the error messages in the POST Event Log.

  – **IMM System Event Log**

    Select this choice to view the error messages in the IMM System Event Log.

  – **Clear IMM System Event Log**

    Select this choice to clear the IMM System Event Log.

- **User Security**

  Select this choice to set, change, or clear passwords. See “Passwords” on page 107 for more information.

  This choice is on the full and limited UEFI Setup Utility menu.

  - **Power-on Password**

    Select this choice to set or change a power-on password. See “Power-on password” for more information.
  - **Administrator Password**

    Select this choice to set or change an administrator password. An administrator password is intended to be used by a system administrator; it limits access to the full UEFI Setup Utility menu. If an administrator password is set, the full UEFI Setup Utility menu is available only if you type the administrator password at the password prompt. For more information, see “Administrator password” on page 109.
- **Save Settings**

  Select this choice to save the changes that you have made in the settings.
- **Restore Settings**

  Select this choice to cancel the changes that you have made in the settings and restore the previous settings.
- **Load Default Settings**

  Select this choice to cancel the changes that you have made in the settings and restore the factory settings.
- **Exit Setup**

  Select this choice to exit from the UEFI Setup Utility program. If you have not saved the changes that you have made in the settings, you are asked whether you want to save the changes or exit without saving them.

Passwords

From the **User Security** menu choice, you can set, change, and delete a power-on password and an administrator password. The **User Security** choice is on the full UEFI Setup menu only.

If you set only a power-on password, you must type the power-on password to complete the system startup and to have access to the full UEFI Setup Utility menu.

An administrator password is intended to be used by a system administrator; it limits access to the full UEFI Setup Utility menu. If you set only an administrator password, you do not have to type a password to complete the system startup, but you must type the administrator password to access the UEFI Setup Utility menu.

If you set a power-on password for a user and an administrator password for a system administrator, you can type either password to complete the system startup. A system administrator who types the administrator password has access to the full UEFI Setup Utility menu; the system administrator can give the user authority to set, change, and delete the power-on password. A user who types the power-on password has access to only the limited UEFI Setup Utility menu; the user can set, change, and delete the power-on password, if the system administrator has given the user that authority.

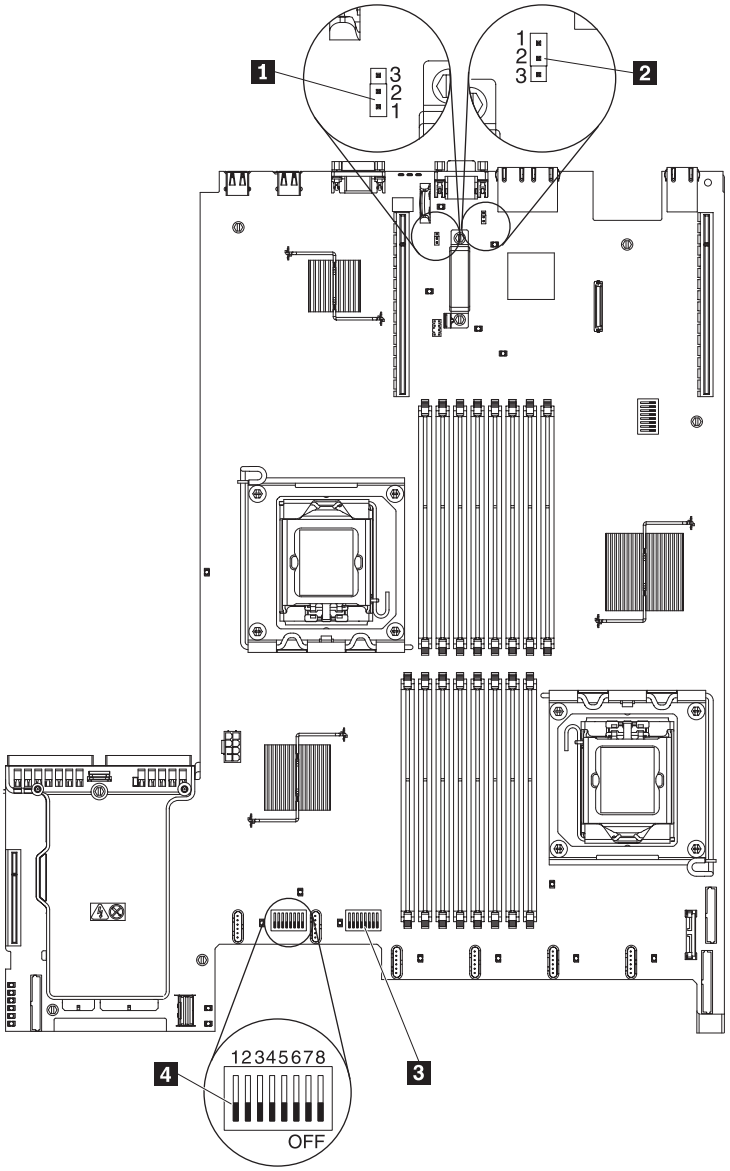
Power-on password

If a power-on password is set, when you turn on the server, the system startup will not be completed until you type the power-on password. You can use any combination of up to seven characters (A–Z, a–z, and 0–9) for the password.

When a power-on password is set, you can enable the Unattended Start mode, in which the keyboard and mouse remain locked but the operating system can start. You can unlock the keyboard and mouse by typing the power-on password.

If you forget the power-on password, you can regain access to the server in any of the following ways:

- If an administrator password is set, type the administrator password at the password prompt. Start the UEFI Setup Utility program and reset the power-on password.
- Remove the battery from the server and then reinstall it. See “Removing the battery” on page 97 for instructions on removing the battery.
- Change the position of the power-on password switch (enable switch 5 of the system board switch block (SW3) **4**) to bypass the power-on password check (see the following illustration).



1 UEFI boot recovery jumper (J29)
2 IMM recovery jumper (J147)
3 SW4 switch block (reserved)
4 SW3 switch block

Attention: Before changing any switch settings or moving any jumpers, turn off the server; then, disconnect all power cords and external cables. See the safety information that begins on page vii. Do not change settings or move jumpers on any system-board switch or jumper blocks that are not shown in this document.

While the server is turned off, move switch 5 of the switch block (SW3) **4** to the On position to enable the power-on password override. You can then start the UEFI Setup Utility program and reset the power-on password. You do not have to return the switch to the previous position.

The power-on password override jumper does not affect the administrator password.

Administrator password

If an administrator password is set, you must type the administrator password for access to the full UEFI Setup Utility menu. You can use any combination of up to seven characters (A–Z, a–z, and 0–9) for the password.

Attention: If you set an administrator password and then forget it, there is no way to change, override, or remove it. You must replace the system board.

Using the Boot Manager program

The Boot Manager program is a built-in, menu-driven configuration utility program that you can use to temporarily redefine the first startup device without changing settings in the Setup utility.

To use the Boot Manager program, complete the following steps:

1. Turn off the server.
2. Restart the server.
3. When the prompt `<F12> Select Boot Device` is displayed, press F12. If a bootable USB mass storage device is installed, a submenu item (**USB Key/Disk**) is displayed.
4. Use the Up arrow and Down arrow keys to select an item from the **Boot Selection Menu** and press **Enter**.

The next time the server starts, it returns to the startup sequence that is set in the Setup utility.

RAID controllers

The following table lists the various utilities available to configure RAID controllers before an operating system is installed.

Table 12. RAID utilities

RAID configuration utility	Description	Location	Where to find more information
EasyStartup RAID configuration utility	• For use with all factory-supported RAID controllers • Automatically detects hardware and lists all supported RAID configurations • Configures one disk array per controller using all drives currently attached to the controller • Created a RAID response file that can be used to configure RAID controllers on similarly configured Lenovo servers.	EasyStartup DVD	"Using the *ThinkServer EasyStartup* DVD" on page 114
MegaRAID BIOS Configuration Utility (WebBIOS)	For: • ServeRAID-MR10i controller • ServeRAID-MR10is controller • ServeRAID-MR10m controller	In system firmware. To access: • Use UEFI Setup Utility. • Press Ctrl + H at the WebBIOS prompt during startup.	"Using the WebBIOS utility" on page 112
LSI Logic MPT Setup Utility	For: • ServeRAID-BR10i controller • ServeRAID-BR10ie controller	In system firmware. To access: • Use UEFI Setup Utility. • Press Ctrl + C at the LSI prompt during startup.	"Using the LSI Configuration Utility program"

Using the LSI Configuration Utility program

Use the LSI Configuration Utility program to configure and manage redundant array of independent disks (RAID) arrays. Be sure to use this program as described in this document.

- Use the LSI Configuration Utility program to:
  - Perform™ a low-level format on a hard disk drive
  - Create an array of hard disk drives with or without a hot-spare drive

– Set protocol parameters on hard disk drives

The integrated SAS/SATA controller with RAID capabilities supports RAID arrays. You can use the LSI Configuration Utility program to configure RAID 1 (IM), RAID 1E (IME), and RAID 0 (IS) for a single pair of attached devices. If you install a different type of RAID adapter, follow the instructions in the documentation that comes with the adapter to view or change settings for attached devices.

When you are using the LSI Configuration Utility program to configure and manage arrays, consider the following information:

- The integrated SAS/SATA controller with RAID capabilities supports the following features:
  - Integrated Mirroring (IM) with hot-spare support (also known as RAID 1)

    Use this option to create an integrated array of two disks plus up to two optional hot spares. All data on the primary disk can be migrated.
  - Integrated Mirroring Enhanced (IME) with hot-spare support (also known as RAID 1E)

    Use this option to create an integrated mirror enhanced array of three to eight disks, including up to two optional hot spares. All data on the array disks will be deleted.
  - Integrated Striping (IS) (also known as RAID 0)

    Use this option to create an integrated striping array of two to eight disks. All data on the array disks will be deleted.
- Hard disk drive capacities affect how you create arrays. The drives in an array can have different capacities, but the RAID controller treats them as if they all have the capacity of the smallest hard disk drive.
- If you use an integrated SAS/SATA controller with RAID capabilities to configure a RAID 1 (mirrored) array after you have installed the operating system, you will lose access to any data or applications that were previously stored on the secondary drive of the mirrored pair.
- If you install a different type of RAID controller, see the documentation that comes with the controller for information about viewing and changing settings for attached devices.

Starting the LSI Configuration Utility program

To start the LSI Configuration Utility program, complete the following steps:

1. Turn on the server.

   Note: Approximately 3 minutes after the server is connected to ac power, the power-control button becomes active.
2. When the prompt `<F1> Setup` is displayed, press F1. If you have set an administrator password, you must type the administrator password to access the full Setup utility menu. If you do not type the administrator password, a limited Setup utility menu is available.
3. Select **System Settings → Adapters and UEFI drivers**.
4. Select **Please refresh this page first** and press Enter.
5. Select the device driver that is applicable for the SAS controller in the server. For example, **LSI Logic Fusion MPT SAS Driver**.
6. To perform storage-management tasks, see the SAS controller documentation.

When you have finished changing settings, press Esc to exit from the program; select **Save** to save the settings that you have changed.

Formatting a hard disk drive

Low-level formatting removes all data from the hard disk. If there is data on the disk that you want to save, back up the hard disk before you perform this procedure.

Note: Before you format a hard disk, make sure that the disk is not part of a mirrored pair.

To format a drive, complete the following steps:

1. From the list of adapters, select the controller (channel) for the drive that you want to format and press Enter.
2. Select **SAS Topology** and press Enter.
3. Select **Direct Attach Devices** and press Enter.
4. To highlight the drive that you want to format, use the Up Arrow and Down Arrow keys. To scroll left and right, use the Left Arrow and Right Arrow keys or the End key. Press Alt+D.
5. To start the low-level formatting operation, select **Format** and press Enter.

Creating a RAID array of hard disk drives

To create a RAID array of hard disk drives, complete the following steps:

1. From the list of adapters, select the controller (channel) for which you want to create an array.
2. Select **RAID Properties**.
3. Select the type of array that you want to create.
4. In the RAID Disk column, use the Spacebar or Minus (-) key to select **[Yes]** (select) or **[No]** (deselect) to select or deselect a drive from a RAID disk.
5. Continue to select drives, using the Spacebar or Minus (-) key, until you have selected all the drives for your array.
6. Press C to create the disk array.
7. Select **Save changes then exit this menu** to create the array.
8. Exit the Setup utility.

Using the WebBIOS utility

The WebBIOS configuration utility enables you to create and manage RAID configurations on LSI SAS controllers. The WebBIOS utility resides in the SAS controller BIOS and operates independently of the operating system. The WebBIOS utility provides a configuration wizard to guide you through the configuration of virtual disks and physical arrays.

Starting the WebBIOS utility

Perform the following steps to start the WebBIOS utility and access the main menu:

1. After you turn on the power and when the computer is starting, you are prompted to press Ctrl + H when the following message is displayed:

   ```
   Copyright© LSI Logic Corporation
   Press <Ctrl><H> for WebBIOS
   ```

2. Select an adapter from the list.
3. Click **Start**. The main WebBIOS utility interface is displayed. You can toggle between the physical view and logical view of the storage devices that are connected to the controller. Click **Physical View** or **Logical View** on the menu in the left pane to change the view.

Main menu of the WebBIOS utility

The main menu includes the following options:

Adapter Properties
From this view, you can display and modify the properties of the SAS adapter that is currently selected.

Scan Devices
From this view, you can re-scan the physical and virtual disks for any changes in the drive status or physical configuration.

Virtual Disks
From this view, you can display and modify the virtual disk properties, delete virtual disks, initialize disks, and perform other tasks.

Physical Drives
From this view, you can view the physical drive properties, create hot spare disks, and perform other tasks.

Configuration Wizard
Select this to start the Configuration Wizard and create a new storage configuration, clear a configuration, or add a new configuration.

Adapter Selection
From this view, you can select a different SAS adapter. Then, you can view information about the adapter and the drives connected to it, or create a new configuration for the adapter.

Physical View or Logical View
Select this to toggle between the Physical View and Logical View.

Events
From this view, you can display the system events in the Event Information page.

Exit Select this to exit the WebBIOS utility and continue with the system boot.

Creating a storage configuration using the Configuration Wizard

Follow these steps to start create a storage configuration:

1. Click **Configuration Wizard** to start the wizard.
2. Select a configuration option:

   Attention: If you select **Clear Configuration** or **New Configuration**, all existing data in the configuration is deleted. Make a backup copy of any data that you want to keep before selecting these options.

   Clear Configuration
   Clears the existing configuration.

   New Configuration
   Clears the existing configuration and lets you create a new configuration.

   Add Configuration
   Retains the existing storage configuration and adds new drives to it (this does not cause any data loss).
3. Click **Next**.
4. Select a configuration mode from the following options:

   Custom Configuration
   In this mode, you can control all attributes of the new storage configuration.

Auto Configuration and Redundancy
This mode automatically creates an optimal RAID 1 or RAID 5 configuration, providing data redundancy.

Auto Configuration without Redundancy
This mode automatically created a non-redundant RAID 0 configuration.

5. Click **Next** to continue.

Viewing and changing adapter properties

You can view information for one LSI SAS adapter at a time. If your system has multiple LSI SAS adapters, you can view information for a different adapter, click **Adapter Selection** on the main view. To view the properties for the currently selected adapter, click **Adapter Properties** on the main WebBIOS screen.

Viewing and changing virtual disk properties

On the WebBIOS main screen, select a virtual disk from the list and click **Virtual Disk**.

The Properties panel displays the RAID level, state, size, and stripe size.

The Policies panel lists the virtual disk policies that were defined when the storage configuration was created. To change any of these policies, select a policy from the menu and click **Change**. The Operations panel lists operations that can be performed on the virtual disk. Select the operation and click **Go**. Then choose from the following operations:

- Select **Del** to delete this virtual disk.
- Select **Locate** and the LEDs flash on the physical drives used by this virtual disk.
- Select **Fast** or **Slow** to initialize this virtual disk.

  Attention: Before you run an initialization, back up any data on the virtual disk that you want to save. All data on the virtual disk is lost when you initialize it.

Using the *ThinkServer EasyStartup* DVD

The *ThinkServer EasyStartup* DVD simplifies the process of your RAID controller and installing an operating system. The program works in conjunction with your Windows or Linux operating-system installation disc to automate the process of installing the operating system and associated device drivers.

If you did not receive an *ThinkServer EasyStartup* DVD with your server, you can download an image from the Lenovo Support Web site at http://www.lenovo.com/support.

The EasyStartup program has the following features:

- Self-booting DVD
- Easy-to-use, language-selectable interface
- Integrated help system
- Automatic hardware detection
- RAID configuration utility
- Device drivers (based on the server model and detected devices)
- Selectable partition size and file system type
- Support for Windows, Red Hat, and SUSE server operating systems
- Installs the operating system and device drivers in an unattended mode to save time

- Creates a reuseable response file that can be used with similarly configured Lenovo servers to make future installations even faster.

Before you use the *ThinkServer EasyStartup* DVD

Functionality and supported operating systems can vary with different versions of the EasyStartup program. To learn more about the version you have, do the following:

1. Insert the *ThinkServer EasyStartup* DVD and restart the server.
2. Advance to the Home screen.
3. Click **Compatability notes**. The compatability notes provide detailed information about the operating systems and server configurations supported by that version of the EasyStartup program.
4. Click **User Guide**. The User Guide provides an overview of the various functions provided by that version of the EasyStartup program.

Before using the EasyStartup program to install an operating system, make sure any external storage devices and fiber channels are configured correctly.

Configuring RAID

The RAID configuration feature that is part of the EasyStartup program enables you to view and change RAID settings for supported RAID controllers. Through this feature, you have the ability to select one RAID level for each installed controller, and the program automatically will use the discs currently attached to the controller to support that RAID level. This method satisfies most users' needs.

If you have a need to assign a primary and secondary RAID on the same controller and assign some of your discs to the primary RAID and some to the secondary RAID, you can use either of the following methods:

- **Manually remove the drives that you do not want included in your array before you configure your RAID controller through the EasyStartup program.**

  This method enables you to use the EasyStartup program to configure your RAID controller and install the operating system. After the operating system is installed, reinstall the drives and use the RAID configuration utility provided in the firmware to configure the secondary RAID.
- **Configure the controller using the RAID configuration utility provided in the firmware before you use the EasyStartup program.**

  For details, see “Starting the LSI Configuration Utility program” on page 111. After your RAID controller is configured, start the EasyStartup program and install your operating system.

EasyStartup overview

The EasyStartup program requires a supported Lenovo server with an enabled, startable (bootable) DVD drive. In addition to the *ThinkServer EasyStartup* DVD, you also must have the operating-system installation CD or DVD and the product key or installation number for the operating system (if provided).

The EasyStartup program performs the following tasks:

- Detects installed hardware devices
- Guides you through the process of one or more RAID controllers and optionally saves the settings in a RAID response file

- Guides you through the process of creating a response file for the unattended installation of the operating system
- Enables you to create scripts or commands that run at the end of the operating system installation process
- Facilitates the installation of the ThinkServer EasyManage products and DVD-burning software (Windows installations only)
- Prepares the hard disk for installation
- Prompts you to insert the operating-system installation disc
- Initiates an unattended installation of the operating system and device drivers

Setup and configuration

When you start the *ThinkServer EasyStartup* DVD, you will be prompted for the following:

- Select the language in which you want to view the program.
- Select the language of the keyboard you will be using with the program.

Note: The following language keyboards are supported: English, French, German, Spanish, Japanese, Korean, Turkish, Italian, and Dutch.

You will then see one or more reminders about storage devices, and then you will be presented with the Lenovo License Agreement. Read the license agreement carefully. You must agree with terms in order to continue.

After agreeing to the license agreement, you will be given the following choices:

- Continue to the main program interface
- Use a shortcut to install an operating system based a response file that you previously created using the EasyStartup program
- Use a short cut to configure RAID controllers based on a RAID response file that you previously created using the EasyStartup program

If you continue to the main program interface, you will have the following selectable options:

- **Compatibility notes:** This selection provides information about the operating systems and server configurations supported by that version of the EasyStartup program.
- **User Guide:** This selection provides information about the features provided by that version of the EasyStartup program.
- **Hardware list:** This selection displays a list of hardware devices detected by the EasyStartup program.
- **Configure RAID:** This selection enables you to view the current RAID configuration for each installed RAID controller and make changes if needed.
- **Install operating system:** This selection displays a series of choices and prompts to collect information required for installation, prepares the hard disk for installation, and then initiates the installation process using the user-provided operating-system installation CD or DVD.
- **About:** This selection displays version information and legal notices.

Typical operating system installation

When you select **Install operating system**, you will be prompted for information required for the installation. The prompts vary depending on the operating system

selected. This section describes the tasks associated with a typical Windows Server operating system installation. Each task must be completed before moving to the next task.

Note: Ensure that your RAID controller is correctly configured before you select an operating system to install.

- **Select operating system:** This task enables you to select the operating system that you will be installing.
- **Select disk:** This task enables you to select the disk where you want to install the operating system.

  Note: The disk that you select must be set as the boot disk in UEFI.
- **Partitions options:** This task enables you to choose whether you want to repartition the selected drive or use an existing partition.
- **Partition settings:** This task enables you to choose the file system type and define the partition size.
- **Installation settings:** This task prompts you for user and system settings, the operating system product key, and the administrator password.
- **Network settings:** This task prompts you for domain and workgroup settings, Ethernet controller type, IP address settings, DNS settings, and WINS address settings.
- **Install applications:** This task enables you to run custom commands or scripts at the end of the installation process. It also facilitates the installation of DVD-burning software and install ThinkServer EasyManage software products.
- **Install Windows components:** This task enables you to install optional Windows components such as IIS, ASP.NET, and SNMP.
- **Confirm settings:** This task enables you to review all of the information you provided.
- **Save response file:** This task gives you the option of saving the information on a diskette or USB device as a response file for future installations on similarly configured Lenovo servers.
- **Start installation:** This task starts the actual installation process. First, the disk is prepared using the disk and partition information you specified. Then you are prompted to insert the operating system disk, and the operating system is installed using the information that you specified.

Installing your operating system without using EasyStartup

If you have already configured the server hardware and you are not using the EasyStartup program to install your operating system, complete the following steps to download the latest operating-system installation instructions from the Lenovo Support Web site:

Note: Changes are made periodically to the Lenovo Web site. The actual procedure might vary slightly from what is described in this document.

1. Go to: http://www.lenovo.com/support.
2. Enter your product number (machine type and model number) or select **Servers and Storage** from the **Select your product** list.
3. From **Family** list, select **ThinkServer RD220**, and click **Continue**.
4. Select the operating system that you want from the **Operating system** list, and click **Continue**.

5. Click **Operating system installation** to download instructions to install the operating system.

Enabling the Broadcom Gigabit Ethernet Utility program

The Broadcom Gigabit Ethernet Utility program is part of the UEFI firmware. You can use it to configure the network as a startable device, and you can customize where the network startup option appears in the startup sequence. Enable and disable the Broadcom Gigabit Ethernet Utility program from the UEFI Setup Utility program.

Configuring the Gigabit Ethernet controller

The Ethernet controllers are integrated on the system board. They provide an interface for connecting to a 10-Mbps, 100-Mbps, or 1-Gbps network and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the network. If the Ethernet ports in the server support auto-negotiation, the controllers detect the data-transfer rate (10BASE-T, 100BASE-TX, or 1000BASE-T) and duplex mode (full-duplex or half-duplex) of the network and automatically operate at that rate and mode.

You do not have to set any jumpers or configure the controllers. However, you must install a device driver to enable the operating system to address the controllers. To find updated information about the controllers, complete the following steps.

Note: Changes are made periodically to the . The actual procedure might vary slightly from what is described in this document.

1. Go to: http://www.lenovo.com/support.
2. Enter your product number (machine type and model number) or select **Servers and Storage** from the **Select your product** list.
3. From **Family** list, select **ThinkServer RD220**, and click **Continue**.
4. Click **Downloads and drivers** to download firmware updates.

Updating the firmware

The firmware in the server is periodically updated and is available for download on the Lenovo Support Web site. Go to http://www.lenovo.com/support to check for the latest level of firmware, such as unified extensible firmware interface (UEFI) code, vital product data (VPD) code, device drivers, and service processor firmware.

When you replace a device in the server, you might have to either update the server with the latest version of the firmware that is stored in memory on the device or restore the pre-existing firmware from a diskette or CD image.

- UEFI code is stored in ROM on the system board.
- IMM firmware is stored in ROM on the baseboard management controller on the system board.
- Ethernet firmware is stored in ROM on the Ethernet controller.
- ServeRAID firmware is stored in ROM on the SAS controller.
- SAS firmware is stored in ROM on the integrated RAID controller on the system board.
- Major components contain vital product data (VPD) code. You can select to update the VPD code during theUEFI code update procedure.

The following items are downloadable at http://www.lenovo.com/support:

- Diagnostics programs
- IMM firmware
- Ethernet firmware

Using the EasyUpdate Firmware Updater tool

ThinkServer EasyUpdate Firmware Updater is a software application that enables you to maintain your system firmware up to date and helps you avoid unnecessary outages. Firmware Updater updates the server firmware in two steps, by updating system and adapter firmware and updating hard disk drive (HDD) firmware.

To update your system, first go the Lenovo Support Web site and obtain the ISO file.

1. Go to: http://www.lenovo.com/support.
2. Enter your product number (machine type and model number) or select **Servers and Storage** from the **Select your product** list.
3. From **Family** list, select **ThinkServer RD220**, and click **Continue**.
4. Click **Downloads and drivers** to download firmware updates.
5. Download the ThinkServer fimrware update media ISO file.
6. Burn the ISO image to CD or DVD.
7. Insert the media in the server CD/DVD drive, and boot the server to that drive.
8. After DOS starts, the master application starts automatically. Hardware detection runs, and a list of applicable firmware updates is displayed.
9. Select the firmware updates that you want to install.

Before distributing the firmware update to other servers, ensure that your server can restart successfully without encountering hardware problems.

Starting the backup UEFI firmware

The system board contains a backup copy area for the UEFI (formerly called BIOS) firmware. This is a secondary copy of UEFI firmware that you update only during the process of updating UEFI firmware. If the primary copy of the UEFI firmware becomes damaged, use this backup copy.

To force the server to start from the backup copy, turn off the server; then, place the J29 jumper in the backup position (pins 2 and 3).

Use the backup copy of the UEFI firmware until the primary copy is restored. After the primary copy is restored, turn off the server; then, move the J29 jumper back to the primary position (pins 1 and 2).

Using the Integrated Management Module

The Integrated Management Module (IMM) is a second generation of the functions that were formerly provided by the baseboard management controller hardware. It combines service processor functions, video controller, and (when IMM Premium is installed) remote presence function in a single chip.

The IMM supports the following basic system management features:

- Environmental monitor with fan speed control for temperature, voltages, fan failure, power supply failure, and power backplane failure.

- LED indicators to report errors that occur with fans, power supplies, microprocessor, hard disk drives, and system errors (EasyLED Diagnostics)
- DIMM error assistance. The Unified Extensible Firmware Interface (UEFI) will disable a failing DIMM that is detected during POST IMM will light the associated system error LED and the failing DIMM error LED.
- System event log (SEL)
- ROM-based IMM firmware flash (IMM firmware updates)
- Auto Boot Failure Recovery (ABR)
- A virtual media key which enables full system management support (remote video, remote keyboard/mouse, and remote storage)
- Automatic microprocessor disable on failure restart in a two-microprocessor configuration when one microprocessor signals an internal error
- NMI detection and reporting
- SMI handling
- Automatic Server Restart (ASR) when (1) POST is not complete or (2) the OS hangs and the OS Watchdog Timer times-out. The IMM might be configured to watch for OS Watchdog Timer and reboot the system after time-out, if the ASR feature is enabled. Otherwise, IMM allows the administrator to generate an NMI by pressing an NMI button on the system board for OS memory dump. ASR is supported by IPMI.
- Intelligent Platform Management Interface (IPMI) Specification V2.0 and Intelligent Platform Management Bus (IPMB) support
- Invalid system configuration (CNFG) LED support
- Serial redirect
- Serial Over LAN (SOL)
- Active Energy Manager
- Query power supply input power
- PECI 2 support
- Power/Reset control (power-on, hard and soft shut down, hard and soft reset, schedule power control)
- Alerts (in-band and out-of-band alerting, PET traps - IPMI style, SNMP, e-mail)
- Operating system failure blue screen capture
- Command line interface
- Configuration save and restore
- PCI configuration data
- Boot sequence manipulation

The IMM also provides the following remote server management capabilities:

- **Command-line interface (IPMI Shell)**

  The command-line interface provides direct access to server management functions through the IPMI 2.0 protocol. Use the command-line interface to issue commands to control the server power, view system information, and identify the server. You can also save one or more commands as a text file and run the file as a script.

- **Serial over LAN**

  Establish a Serial over LAN (SOL) connection to manage servers from a remote location. You can remotely view and change the UEFI settings, restart the server, identify the server, and perform other management functions. Any standard Telnet client application can access the SOL connection.

IBM Advanced Settings Utility program

The IBM Advanced Settings Utility (ASU) program is an alternative to the Setup utility for modifying UEFI settings. Use the ASU program online or out-of-band to modify UEFI settings from the command line without the need to restart the server to access the Setup utility.

You can also use the ASU program to configure the optional remote presence features or other IMM settings. The remote presence features provide enhanced systems-management capabilities.

In addition, the ASU program provides limited settings for the IPMI function in the IMM through the command-line interface.

Use the command-line interface to issue setup commands. You can save any of the settings as a file and run the file as a script. The ASU program supports scripting environments through a batch-processing mode.

For more information and to download the ASU program, go to http://www.lenovo.com/support.

Installing ThinkServer EasyManage software

You can install the ThinkServer® EasyManage Core Server program from the ThinkServer EasyManage CD or you can download and install the program from http://www.lenovo.com/support. After one instance of the ThinkServer EasyManage Core Server has been installed, you can use the ThinkServer EasyManage Agent installer to install the agent on other servers and clients on the network.

Also, the ThinkServer EasyStartup™ program provides an option to either install the ThinkServer EasyManage Agent as part of the operating system installation process or install a desktop icon to assist with the installation of the ThinkServer EasyManage Core Server after the operating system has been installed.

Installation requirements

Before installing ThinkServer EasyManage software on your server, your environment must meet the following requirements:

- Microsoft® Windows Server 2003 or Windows Server 2008 is installed on the server where you intend to install the Core Server.
- The original Windows Server operating system installation CDs are available in case files are needed while installing the prerequisites.
- The server has Internet access to obtain prerequisites and to activate the software after the installation is complete.
- The server has a static IP address.
- The server is not a domain controller. However, it is recommended to have the server join a domain.
- The account that you use to log in and to install the Core Server has Administrator privileges on the server with full read/write access. Ideally, this account is also a Domain Administrator account. This account will be used to create the initial administrator-level account used to log in to the ThinkServer EasyManage console.
- Any previous agent from EasyManage or LANDesk must be removed prior to installing the Core Server and Management Console.

Installation order

The order in which you install the operating system and Windows Components is critical to install ThinkServer EasyManage software successfully. To ensure a clean, working installation of ThinkServer EasyManage software, use the following installation order:

1. Install Microsoft Windows Server 2003 or Microsoft Windows Server 2008 32-bit with the latest Service Pack.
2. Install the following Windows Components: See “Installing Windows 2003 components on the Core Server” or “Installing Windows 2008 32-bit components” on page 123.
3. Use Windows Update to install all available critical updates.
4. (For Windows Server 2003 only) Download Microsoft .NET Framework 2.0 Service Pack 1 or newer from the following Web site: http://www.microsoft.com/downloads/details.aspx?FamilyID=0856eacb-4362-4b0d-8edd-aab15c5e04f5&DisplayLang=en. Install the software using the default settings.
5. (For both Windows Server 2003 and 2008) Download Microsoft Web Services Enhancement 2.0 Service Pack 3 (LANDesk Process Manager only) from the following Web site: http://www.microsoft.com/downloads/details.aspx?FamilyID=1ba1f631-c3e7-420a-bc1e-ef18bab66122&DisplayLang=en. Install the software using the default settings.

   Note: This specific version is required.
6. Use Windows Update to install all available critical updates.
7. Launch the EasyManage installation.
8. After ThinkServer EasyManage is installed, enable Security and Patch Manager to obtain the LANDesk 8.8 Software Updates. In the console application, click **Help -> LANDesk -> Security Updates** for a guide to configuring Security and Patch Manager.
9. Install Adobe Flash Player 9 if you plan to use the Management Console functions from the same server on which the Core Server is installed. You can obtain Adobe Flash Player 9 from the Adobe Web site: http://www.adobe.com/products/flashplayer/

Installing Windows 2003 components on the Core Server

To install IIS, ASP.Net, and SNMP on the Core Server, do the following procedure for each component:

1. In the Windows Control Panel, double-click **Add or Remove Programs**.
2. In the toolbar on the left, click **Add/Remove Windows Components** to launch the Windows Components Wizard.
3. Select from the Components list:
   - When installing IIS and ASP.NET, click **Application Server**; then, click **Details**.
   - When installing SNMP, click **Management and Monitoring Tools**; then, click **Details**.
4. Select the component that you want to install:
   - When installing IIS, select **Internet Information Services (IIS)**; then, click **OK**.
   - When installing ASP.NET, select **ASP.NET**; then, click **OK**.
   - When installing SNMP, select **Simple Network Management Protocol**; then, click **OK**.

5. Click **Next** to continue the wizard.
6. If prompted, insert the original Windows operating system CD. If the autorun launches when you insert the CD, close it. The Windows Components Wizard will automatically detect and install the necessary files.
7. Click **Finish**.

Installing Windows 2008 32-bit components

To install the Windows Server 2008 32-bit components necessary for a ThinkServer EasyManage core server installation, complete the steps in this section.

Installing Web Server Role (IIS)

To install the Web Server Role (IIS), complete the following steps:

1. Click **Start** -> **Server Manager**.
2. Under Roles Summary, click **Add Roles**. The **Add Roles** wizard appears.
3. Click **Next**.
4. Select the checkbox next to **Web Server (IIS)**. A dialog box displays the additional features that are required.
5. Click **Add Required Features**, then click **Next**. In the list of additional role services that can be installed, ensure that the follow are checked:
   - HTTP Redirection
   - Static Content
   - ASP.NET
   - ASP
   - CGI
   - Server Side Includes
   - Windows Authentication
   - IIS 6 Metabase Compatibility

   Note: When you select **ASP.Net** or **ASP**, a dialog box displays the additional role services required. Click **Add Required Role Services**.
6. Click **Install**.

   Note: If IIS is already installed and certain Role Services are still required, expand **Roles** in the tree view on the left in Server Manager and click on **Web Server (IIS)**, then click on **Add Role Services**. Select the necessary role services and click **Install**.

Installing Microsoft SNMP services

To install Microsoft SNMP services, complete the following steps:

1. Click **Add Features** in the **Features Summary** section on the main page of Server Manager.
2. Select the **SNMP Services** checkbox.
3. Click **Next**, then **Install**.

Uninstalling the LANDesk Software Agent

If the Core Server has LANDesk agents on it from a previous Management Suite release, it will fail the autorun prerequisite check. You must remove the old agents by running uninstallwinclient.exe from the \Program Files\LANDesk\ ManagementSuite folder.

Using the remote presence capability and blue-screen capture

The remote presence and blue-screen capture features are integrated functions of the Integrated Management Module (IMM). When IMM Premium (the virtual media key) is installed in the server, it activates full system-management functions. IMM Premium is required to enable the integrated remote presence and blue-screen capture features (via the NMI button). Without the virtual media key, you will not be able to access the remote network to remotely mount or unmount drives or images on the client system. However, you will still be able to access the Web interface without the key.

After IMM Premium is installed in the server, the Active Energy Manager controller determines the presence of the virtual media key and authenticates the key to determine if it is valid. If the key is not valid, you will receive a message from the Web interface indicating that the hardware key is required to use the remote presence feature.

The virtual media key provides an LED to indicate a problem. When this LED is lit and green, it indicates that the key is installed and functioning correctly.

The remote presence feature provides the following functions:

- Remotely viewing video with graphics resolutions up to 1280 x 1024 at 75 Hz, regardless of the system state
- Remotely accessing the server, using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating-system hang condition. A system administrator can use the blue-screen capture to assist in determining the cause of the hang condition.

Enabling the remote presence feature

To enable the remote presence feature, complete the following steps:

1. Install the virtual media key (IMM Premium) into the dedicated slot on the system board (see “System-board internal connectors” on page 24).
2. Turn on the server.

   Note: Approximately 1 to 2 minutes after the server is connected to ac power, the power-control button becomes active.

Obtaining the IP address for the Web-based interface access

To access the Web interface and use the remote presence feature, you will need the IP address for IMM. The IMM IP address can be obtained through the UEFI Setup Utility. To locate the IP address, complete the following steps:

1. Turn on the server.

   Note: Approximately 1 to 2 minutes after the server is connected to ac power, the power-control button becomes active.

2. When the prompt `Press F1 for UEFI Setup` displays, press `F1`. (This prompt is displayed on the screen for only a few seconds. You must press F1 quickly.) If you have set both a power-on password and an administrator password, you must type the administrator password to access the full UEFI Setup Utility menu.
3. From the UEFI Setup Utility main menu, select **System Settings**.
4. On the next screen, select **Integrated Management Module**.
5. On the next screen, select **Network Configuration**.
6. Find the IP address and write it down.
7. Exit the UEFI Setup Utility.

Logging on to the Web interface

To log on to the Web interface to use the remote presence functions, complete the following steps:

1. Open a Web browser and in the **Address** or **URL** field, type the IP address or host name of the IMM to which you want to connect.

   Notes:

   a. If you are logging in to the IMM for the first time after installation, the IMM defaults to DHCP. If a DHCP host is not available, the IMM uses the default static IP address 192.168.70.125.

   b. You can obtain the DHCP-assigned IP address or the static IP address from the server UEFI or from your network administrator.

   The Login page is displayed.
2. Type the user name and password. If you are using the IMM for the first time, you can obtain the user name and password from your system administrator. All login attempts are documented in the event log. A welcome page opens in the browser.

   Note: The IMM is set initially with a user name of USERID and password of PASSW0RD (passw0rd with a zero, not the letter O). You have read/write access. For enhanced security, change this default password during the initial configuration.
3. On the Welcome page, type a timeout value (in minutes) in the field that is provided. The IMM will log you off the Web interface if your browser is inactive for the number of minutes that you entered for the timeout value.
4. Click **Continue** to start the session. The browser opens the System Status page, which displays the server status and the server health summary.

Chapter 7. Solving problems

This chapter provides basic troubleshooting information to help you solve some common problems that might occur while you are setting up the server.

If you cannot locate and correct the problem using the information in this chapter, see Appendix A, “Getting help and technical assistance,” on page 151, the *Hardware Maintenance Manual* on the *ThinkServer Documentation* DVD.

Diagnostic tools overview

The following tools are available to help you diagnose and solve hardware-related problems:

- **POST beep codes**

  The power-on self-test beep codes indicate the detection of a problem.

  – One beep indicates successful completion of POST, with no errors.

  – More than one beep indicates that POST detected a problem. Error messages also appear during startup if POST detects a hardware-configuration problem.

    See “POST beep codes” and the *Hardware Maintenance Manual* for more information.

- *Diagnostics* **DVD**

  The *Diagnostics* DVD provided with your server contains the diagnostic programs for testing the major components of the server. For additional information about the *Diagnostics* DVD, see the *Hardware Maintenance Manual*.

- **Troubleshooting tables**

  These tables list problem symptoms and steps to correct the problems. See “Troubleshooting tables” on page 129 for more information.

- **Diagnostic programs and error messages**

  The system diagnostic programs are provided in ROM. These programs test the major components of the server. See the *Hardware Maintenance Manual*.

- **EasyLED Diagnostics**

  Use EasyLED Diagnostics to diagnose system errors quickly. See “EasyLED Diagnostics” on page 142 for more information.

POST beep codes

POST emits one beep to signal successful completion. If POST detects a problem during startup, other beep codes might occur. Use the following beep code descriptions to help diagnose and solve problems that are detected during startup.

Note: See the *Hardware Maintenance Manual* on the *ThinkServer Documentation* DVD for more information about the POST beep codes.

One beep

POST was completed successfully without finding any errors.

One long beep and two short beeps

A video error has occurred, and the BIOS cannot initialize the monitor screen to display additional information.

Other beep codes

See the *Hardware Maintenance Manual*.

POST error codes

The following table provides an abbreviated list of the error codes that might appear during POST. See the *Hardware Maintenance Manual* for more information about the POST error codes. To check for updated technical information, complete the following steps.

Note: Changes are made periodically to the Lenovo Web site. The actual procedure might vary slightly from what is described in this document.

1. Go to: http://www.lenovo.com/support.
2. Enter your product number (machine type and model number) or select **Servers and Storage** from the **Select your product** list.
3. From **Family** list, select **ThinkServer RD220**, and click **Continue**.
4. Click **User's guides and manuals** for documentation.

Table 13. Abbreviated list of POST error messages

POST message	Failing device or problem found	Suggested action
161	The real-time clock battery has failed.	1. Reseat the battery. 2. Replace the battery or call for service.
162	A device configuration has changed.	• Run the Configuration/Setup Utility program, select **Load Default Settings**, and save the settings. • Make sure that optional devices are turned on and installed correctly.
163	The time of day has not been set.	Run the Configuration/Setup Utility program and set the date and time.
289	A failing DIMM was disabled.	Make sure that the DIMMs are supported by the server and that they are installed correctly.
301, 303	Keyboard and keyboard controller	Make sure that the keyboard cable is connected and that nothing is resting on the keyboard keys.
1810	PCI device error	Make sure that all PCI adapters are installed correctly. In the Configuration/Setup Utility program, make sure that all PCI devices are enabled. Disable option ROMs and integrated devices that are not needed and set the PCI device boot priority to ensure that the boot device option ROM is able to load.
1962	POST could not find an operating system.	Install an operating system.
00019*xxx*	Microprocessor *x* is not functioning or failed the built-in self-test.	Make sure that microprocessor *x* is installed correctly. (Trained service technician only) If the problem remains, replace microprocessor *x*.
012980*xx* 012981*xx*	Data for microprocessor *x*	Download and install the latest level of BIOS code.

Troubleshooting tables

Use the troubleshooting tables to find solutions to problems that have identifiable symptoms. See the *Hardware Maintenance Manual* for more detailed troubleshooting information. If you cannot find the problem in these tables, run the diagnostic programs (see “Running the diagnostic programs” in the *Hardware Maintenance Manual*).

If you have just added new software or a new optional device and the server is not working, complete the following steps before using the troubleshooting tables:

1. Check the diagnostics LEDs on the operator information panel (see “EasyLED Diagnostics” on page 142).
2. Remove the software or device that you just added.
3. Run the diagnostic tests to determine whether the server is running correctly.
4. Reinstall the new software or new device.

EasyStartup problems

Table 14. ThinkServer EasyStartup DVD

- **Follow the suggested actions in the order in which they are listed in the Action Column until the problem is resolved.**
- **See the** *Hardware Maintenance Manual* **to determine which components are customer replaceable units (CRU’s) and which fields are field replaceable units (FRUs).**
- **If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.**

Symptom	Action
The *ThinkServer EasyStartup* DVD will not start.	• Make sure that the server supports the EasyStartup program and has a startable (bootable) CD or DVD drive. • If the startup (boot) sequence settings have been changed, make sure that the CD or DVD drive is first in the startup sequence. • If more than one CD or DVD drive is installed, make sure that only one drive is set as the primary drive. Start the CD from the primary drive.
The operating-system installation program continuously loops.	Make more space available on the hard disk.
The EasyStartup program will not start the operating-system media.	Make sure that the operating-system media is supported by the EasyStartup program. See the EasyStartup User Guide for a list of supported operating-system versions.

CD-RW/DVD drive problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The CD-RW/DVD drive is not recognized.	1. Make sure that: • The IDE channel to which the CD-RW/DVD drive is attached (primary) is enabled in the Configuration/Setup Utility program. • All cables and jumpers are installed correctly. • The signal cable and connector are not damaged and the connector pins are not bent. • All damaged parts are repaired or replaced. • The correct device driver is installed for the CD-RW/DVD drive. 2. Run the CD-RW/DVD drive diagnostic programs. 3. Reseat the following components: a. CD-RW/DVD drive b. IDE/Ultrabay Enhanced (UBE) interposer card cable 4. Replace the components listed in step 3 one at a time, in the order shown, restarting the server each time.
The CD-RW/DVD drive is not working correctly.	1. Clean the CD or DVD. 2. Run the CD-RW/DVD drive diagnostic programs. 3. Check the connector and signal cable for bent pins or damage. 4. Replace any damaged parts. 5. Reseat the CD-RW/DVD drive. 6. Replace the CD-RW/DVD drive.
The CD-RW/DVD drive tray is not working.	1. Make sure that the server is turned on. 2. Insert the end of a straightened paper clip into the manual tray-release opening. 3. Reseat the CD-RW/DVD drive. 4. Replace the CD-RW/DVD drive.

General problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
A cover lock is broken, an LED is not working, or a similar problem has occurred.	If the part is a CRU, replace it. If the part is a FRU, the part must be replaced by a trained service technician.

Hard disk drive problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the** *Hardware Maintenance Manual* **to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
Not all drives are recognized by the hard disk drive diagnostic test (the Fixed Disk test).	Remove the drive that is indicated by the diagnostic tests; then, run the hard disk drive diagnostic test again. If the remaining drives are recognized, replace the drive that you removed with a new one.
The server stops responding during the hard disk drive diagnostic test.	Remove the hard disk drive that was being tested when the server stopped responding, and run the diagnostic test again. If the hard disk drive diagnostic test runs successfully, replace the drive that you removed with a new one.
A hard disk drive was not detected while the operating system was being started.	Reseat all hard disk drives and cables; then, run the hard disk drive diagnostic tests again.
A hard disk drive passes the diagnostic Fixed Disk Test, but the problem remains.	Run the diagnostic SCSI Attached Disk Test.

Intermittent problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the** *Hardware Maintenance Manual* **to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
A problem occurs only occasionally and is difficult to diagnose.	1. Make sure that: • All cables and cords are connected securely to the rear of the server and attached devices. **Attention:** In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply. See the documentation that comes with each dc power supply. • When the server is turned on, air is flowing from the fan grille. If there is no airflow, the fans are not working. This can cause the server to overheat and shut down. 2. Check the system event/error log (see "Error Logs" in the *Hardware Maintenance Manual*).

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The server resets (restarts) occasionally	1. If the reset occurs during POST and the POST watchdog timer is enabled (click **Advanced Setup --> Baseboard Management Controller (BMC) Setting --> BMC Post Watchdog** in the Configuration/Setup Utility program to see the POST watchdog setting), make sure that sufficient time is allowed in the watchdog timeout value (**BMC POST Watchdog Timeout**). See the *User Guide* for information about the settings in the Configuration/Setup Utility program. If the server continues to reset during POST, see the "POST" and "Diagnostic programs" sections in the *Hardware Maintenance Manual*. 2. If the reset occurs after the operating system starts, disable any automatic server restart (ASR) utilities, such as the IBM Automatic Server Restart IPMI Application for Windows, or ASR devices that may be installed. **Note:** ASR utilities operate as operating-system utilities and are related to the IPMI device driver. If the reset continues to occur after the operating system starts, the operating system might have a problem; see "Software problems" on page 141. 3. If neither condition applies, check the system event/error log or BMC system event log (see "Error Logs" in the *Hardware Maintenance Manual*).

USB keyboard, mouse, or pointing-device problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
All or some keys on the keyboard do not work.	1. If you have installed a USB keyboard, run the Configuration/Setup Utility program and enable keyboardless operation to prevent the POST error message 301 from being displayed during startup. 2. See http://www.lenovo.com/thinkserver for keyboard compatibility. 3. Make sure that: • The keyboard cable is securely connected. • The server and the monitor are turned on. 4. Move the keyboard cable to a different USB connector. 5. Replace the following components one at a time, in the order shown, restarting the server each time: a. Keyboard b. (Only if the problem occurred with a front USB connector) Internal USB cable c. (Trained service technician only) System board

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the** *Hardware Maintenance Manual* **to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The USB mouse or USB pointing device does not work.	1. Make sure that: • The mouse is compatible with the server. See http://www.lenovo.com/thinkserver. • The mouse or pointing-device USB cable is securely connected to the server, and the device drivers are installed correctly. • The server and the monitor are turned on. 2. If a USB hub is in use, disconnect the USB device from the hub and connect it directly to the server. 3. Move the mouse or pointing device cable to another USB connector. 4. Replace the following components one at a time, in the order shown, restarting the server each time: a. Mouse or pointing device b. (Only if the problem occurred with a front USB connector) Internal USB cable c. (Trained service technician only) System board

Memory problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The amount of system memory that is displayed is less than the amount of installed physical memory.	1. Make sure that: • No error LEDs are lit on the operator information panel. • Memory mirroring or memory sparing does not account for the discrepancy. • The memory modules are seated correctly. • You have installed the correct type of memory . See the *User Guide* on the Lenovo *ThinkServer Documentation* DVD, which comes with the server. • If you changed the memory, you updated the memory configuration in the Configuration/Setup Utility program. • All banks of memory are enabled. The server might have automatically disabled a memory bank when it detected a problem, or a memory bank might have been manually disabled. 2. Check the POST error log for error message 289: • If a DIMM was disabled by a system-management interrupt (SMI), replace the DIMM. • If a DIMM was disabled by the user or by POST, run the Configuration/Setup Utility program and enable the DIMM. 3. Run memory diagnostics (see "Running the diagnostic programs" in the *Hardware Maintenance Manual*). 4. Make sure that there is no memory mismatch when the server is at the minimum memory configuration (two 512 MB DIMMs). 5. Add one pair of DIMMs at a time, making sure that the DIMMs in each pair are matching. Install the DIMMs in the sequence that is described in the *User Guide* on the Lenovo *ThinkServer Documentation* DVD, which comes with the server. 6. Reseat the DIMMs. 7. Replace the following components one at a time, in the order shown, restarting the server each time: a. DIMMs b. (Trained service technician only) System board
Multiple rows of DIMMs in a branch are identified as failing.	1. Reseat the DIMMs; then, restart the server. 2. Replace the lowest-numbered DIMM pair of those that are identified; then, restart the server. Repeat as necessary. 3. (Trained service technician only) Replace the system board.

Microprocessor problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The server emits a continuous beep during POST, indicating that the microprocessor is not working correctly.	1. Correct any errors that are indicated by the LEDs (see "EasyLED Diagnostics" in the *Hardware Maintenance Manual*). 2. Make sure that the server supports all the microprocessors and that the microprocessors match in speed and cache size. 3. (Trained service technician only) Make sure that microprocessor 1 is seated correctly. 4. Reseat the following components: a. (Trained service technician only) Microprocessors b. VRM, if microprocessor 2 is installed 5. (Trained service technician only) Replace the microprocessors.

Monitor problems

Some Lenovo monitors have their own self-tests. If you suspect a problem with your monitor, see the documentation that comes with the monitor for instructions for testing and adjusting the monitor. If you cannot diagnose the problem, call for service.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
Testing the monitor	1. Make sure that the monitor cables are firmly connected. 2. Try using the other video port. 3. Try using a different monitor on the server, or try testing the monitor on a different server. 4. Run the diagnostic programs (see the *Hardware Maintenance Manual*). If the monitor passes the diagnostic programs, the problem might be a video device driver. 5. Replace the system board (trained service technician only) and then restart the server.
The screen is blank.	1. If the server is attached to a KVM switch, bypass the KVM switch to eliminate it as a possible cause of the problem: connect the monitor cable directly to the correct connector on the rear of the server. 2. Make sure that: • The server is turned on. If there is no power to the server, see "Power problems" on page 138. • The monitor cables are connected correctly. • The monitor is turned on and the brightness and contrast controls are adjusted correctly. • No beep codes sound when the server is turned on. **Important:** In some memory configurations, the 3-3-3 beep code might sound during POST, followed by a blank monitor screen. If this occurs and the **Boot Fail Count** option in the **Start Options** of the Configuration/Setup Utility program is enabled, you must restart the server three times to reset the configuration settings to the default configuration (the memory connector or bank of connectors enabled). 3. Make sure that the correct server is controlling the monitor, if applicable. 4. Make sure that damaged BIOS code is not affecting the video; see the *Hardware Maintenance Manual* for information about recovering from a BIOS failure. 5. See the *Hardware Maintenance Manual* for information about solving undetermined problems.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the** *Hardware Maintenance Manual* **to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The monitor works when you turn on the server, but the screen goes blank when you start some application programs.	1. Make sure that: • The application program is not setting a display mode that is higher than the capability of the monitor. • You installed the necessary device drivers for the application. 2. Run video diagnostics (see the *Hardware Maintenance Manual* for information about running the diagnostic programs). • If the server passes the video diagnostics, the video is good; see the *Hardware Maintenance Manual* for information about solving undetermined problems.
The monitor has screen jitter, or the screen image is wavy, unreadable, rolling, or distorted.	1. If the monitor self-tests show that the monitor is working correctly, consider the location of the monitor. Magnetic fields around other devices (such as transformers, appliances, fluorescent lights, and other monitors) can cause screen jitter or wavy, unreadable, rolling, or distorted screen images. If this happens, turn off the monitor. **Attention:** Moving a color monitor while it is turned on might cause screen discoloration. Move the device and the monitor at least 305 mm (12 in.) apart, and turn on the monitor. **Notes®:** a. To prevent diskette drive read/write errors, make sure that the distance between the monitor and any external diskette drive is at least 76 mm (3 in.). b. Non-Lenovo monitor cables might cause unpredictable problems. 2. Reseat the monitor cable. 3. Replace the following components one at a time, in the order shown, restarting the server each time: a. Monitor cable b. Monitor c. (Trained service technician only) System board
Wrong characters appear on the screen.	1. If the wrong language is displayed, update the BIOS code with the correct language. 2. Reseat the monitor cable. 3. Replace the following components one at a time, in the order shown, restarting the server each time: a. Monitor b. (Trained service technician only) System board

Optional-device problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
An optional device that was just installed does not work.	1. Make sure that: • The device is designed for the server (see http://www.lenovo.com/support/). • You followed the installation instructions that came with the device and the device is installed correctly. • You have not loosened any other installed devices or cables. **Attention:** In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply. See the documentation that comes with each dc power supply. • You updated the configuration information in the Configuration/Setup Utility program. Whenever memory or any other device is changed, you must update the configuration. 2. Reseat the device that you just installed. 3. Replace the device that you just installed.
An optional device that used to work does not work now.	1. Make sure that all of the hardware and cable connections for the device are secure. **Attention:** In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply. See the documentation that comes with each dc power supply. 2. If the device comes with test instructions, use those instructions to test the device. 3. Reseat the failing device. 4. Follow the instructions for device maintenance, such as keeping the heads clean, and troubleshooting in the documentation that comes with the device. 5. Replace the failing device.

Power problems

Attention: In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply. See the documentation that comes with each dc power supply.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The power-control button does not work, and the reset button does work (the server does not start). **Note:** The power-control button will not function until 20 seconds after the server has been connected to power.	1. Make sure that: • The power cords are correctly connected to the server and to a working power source. **Attention:** In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply. See the documentation that comes with each dc power supply. • The type of memory that is installed is correct. • The LEDs on the power supply do not indicate a problem. • The microprocessors are installed in the correct sequence. 2. Make sure that the power-control button and the reset button are working correctly: **Attention:** In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply. See the documentation that comes with each dc power supply. a. Disconnect the server power cords. b. Reseat the operator information panel assembly cable. c. Reconnect the power cords. d. Press the power-control button to restart the server. If the button does not work, replace the operator information panel assembly. e. Press the reset button (on the diagnostics panel) to restart the server. If the button does not work, replace the operator information panel assembly. 3. If you just installed an optional device, remove it, and restart the server. If the server now starts, you might have installed more devices than the power supply supports. 4. Reseat the power backplane and restart the server. 5. Replace the power backplane and restart the server. 6. Replace the following components one at a time, in the order shown, restarting the server each time: a. Power supplies **Attention:** In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply and to remove and install the dc power supply. See the documentation that comes with each dc power supply. b. (Trained service technician only) System board 7. See "Solving power problems" and "Solving undetermined problems" in the *Hardware Maintenance Manual*.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The server does not turn off.	1. Turn off the server by pressing the power-control button for 5 seconds. 2. Restart the server. 3. If the server fails POST and the power-control button does not work, disconnect the power cord for 20 seconds; then, reconnect the power cord and restart the server. **Attention:** In a dc power environment, only trained service personnel other than Lenovo service technicians are authorized to connect or disconnect power to the dc power supply. See the documentation that comes with each dc power supply. 4. If the problem remains, suspect the system board.
The OVER SPEC LED on the diagnostics panel is lit, and the one of the power channel LEDs on the system board is lit.	See the power troubleshooting table in the *Hardware Maintenance Manual* or call for service.
The server unexpectedly shuts down, and the LEDs on the operator information panel are not lit.	See "Solving undetermined problems" in the *Hardware Maintenance Manual*.

Serial port problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
The number of serial ports that are identified by the operating system is less than the number of installed serial ports.	1. Make sure that: • Each port is assigned a unique address in the Configuration/Setup Utility program and none of the serial ports is disabled. • The serial-port adapter (if one is present) is seated correctly. 2. Reseat the serial port adapter, if one is present. 3. Replace the serial port adapter, if one is present.

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
A serial device does not work.	1. Make sure that: • The device is compatible with the server. • The serial port is enabled and is assigned a unique address. • The device is connected to the correct connector (see "Rear view" on page 22). 2. Reseat the following components: a. Failing serial device b. Serial cable 3. Replace the following components one at a time, in the order shown, restarting the server each time: a. Failing serial device b. Serial cable c. (Trained service technician only) System board

Software problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
You suspect a software problem.	1. To determine whether the problem is caused by the software, make sure that: • The server has the minimum memory that is needed to use the software. For memory requirements, see the information that comes with the software. If you have just installed an adapter or memory, the server might have a memory-address conflict. • The software is designed to operate on the server. • Other software works on the server. • The software works on another server. 2. If you received any error messages when using the software, see the information that comes with the software for a description of the messages and suggested solutions to the problem. 3. Contact your place of purchase of the software.

Universal Serial Bus (USB) port problems

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **See the parts listing in the *Hardware Maintenance Manual* to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).**
- **If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.**

Symptom	Action
A USB device does not work.	1. Make sure that: • The correct USB device driver is installed. • The operating system supports USB devices. 2. Make sure that the USB configuration options are set correctly in the Configuration/Setup Utility program menu (see the *User Guide* for more information). 3. If you are using a USB hub, disconnect the USB device from the hub and connect it directly to the server. 4. Move the device cable to a different USB connector.

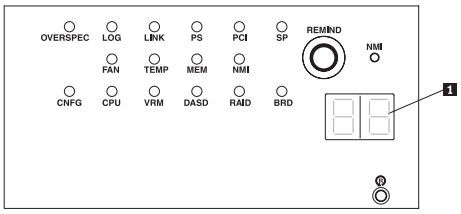
Video problems

See "Monitor problems" on page 136.

EasyLED Diagnostics

Use EasyLED Diagnostics to diagnose system errors. The diagnostics panel is behind the operator information panel, on the left front of the server. To access the diagnostics panel, slide the release latch on the front of the operator information panel to the left.

The following illustration shows the controls and LEDs on the diagnostics panel.



To acknowledge a system error but not take immediate action, press the remind button to place the server in Remind mode. When the server is in Remind mode, the system-error LED on the front of the server flashes. If a new failure occurs, the system-error LED is lit again.

Press the reset button to reset the server and run the power-on self-test (POST). You might have to use a pen or the end of a straightened paper clip to press the button.

The server is designed so that LEDs remain lit when the server is connected to a power source but is not turned on, provided that the power supply is operating correctly. This feature helps you to isolate the problem when the operating system is shut down.

Diagnosing problems using EasyLED Diagnostics

LEDs in two locations on the server are available to help you diagnose problems that might occur during installation. Use them in the following order:

1. **Diagnostics panel** - Look at this panel first. If a system error has occurred, the system-error LED on the front of the diagnostics drawer is lit. Slide the latch to the left on the front of the operator information panel to access the diagnostics panel. Note any LEDs that are lit, and then close the drawer.
2. **LEDs on the system board** - To identify the component that is causing the error, note the lit LED on or beside the component.

EasyLED LEDs

The following table describes the LEDs on the EasyLED panel and suggested actions to correct the detected problems.

Note: Check the system-error log or IMM system event log for additional information before replacing a FRU.

Table 15. EasyLED panel LEDs

LED	Description	Action
None, but the system error LED is lit.	An error has occurred and cannot be isolated. The error is not represented by a path.	Use the UEFI Setup Utility program to check the system error log for information about the error.

Table 15. EasyLED panel LEDs (continued)

LED	Description	Action
OVER SPEC	The power supplies are using more power than their maximum rating.	If the OVER SPEC LED on the EasyLED panel is lit, or any of the six 12V rail error LEDs (A, B, C, D, E, or AUX) on the system board are lit, follow the instructions below. If the 12V channel A error LED is lit, complete the following steps: 1. Turn the server off and disconnect the power from the server. 2. Remove the optical drive, fans, hard disk drives, and hard disk drive backplane. 3. Restart the server to see if the problem remains. 4. Reinstall each device that was removed in step b one at a time, starting the server each time, to isolate the failing device. 5. Replace any failing device. 6. (Trained service technician only) Replace the system board, if the problem remains. If the 12V channel B error LED is lit, complete the following steps: 1. Turn the server off and disconnect the power from the server. 2. Remove the PCI riser card in connector 1, all DIMMs, and the microprocessor in socket 2. 3. Restart the server to see if the problem remains. 4. Reinstall each device that was removed in step b one at a time, starting the server each time, to isolate the failing device. 5. Replace any failing device. 6. (Trained service technician only) Replace the system board, if the problem remains. (Continued on the next page)

Table 15. EasyLED panel LEDs (continued)

LED	Description	Action
OVER SPEC (Continued)	The power supplies are using more power than their maximum rating.	If the 12V channel C error LED is lit, complete the following steps: 1. Turn the server off and disconnect the power from the server. 2. Remove the SAS/SATA RAID riser card, DIMMs in connectors 1 through 8, and the microprocessor in socket 1. **Note:** The server will not power-on when the microprocessor in socket 1 is not installed in the server. You will need to toggle the switch block (SW3) to pin 6 to power-on the server. 3. Restart the server to see if the problem remains. 4. Reinstall each device that was removed in step b one at a time, starting the server each time, to isolate the failing device. 5. Replace any failing device. 6. (Trained service technician only) Replace the system board, if the problem remains. If the 12V channel D error LED is lit, complete the following steps: 1. Turn the server off and disconnect the power from the server. 2. Remove the microprocessor in socket 1. **Note:** The server will not power-on when the microprocessor in socket 1 is not installed in the server. You will need to toggle the switch block (SW3) to pin 6 to power-on the server. 3. Restart the server to see if the problem remains. 4. Reinstall the microprocessor in socket 1 and restart the server. 5. Replace any failing device. 6. (Trained service technician only) Replace the system board, if the problem remains. (Continued on the next page.)

Table 15. EasyLED panel LEDs (continued)

LED	Description	Action
OVER SPEC (Continued)	The power supplies are using more power than their maximum rating.	If the 12V channel E error LED is lit, complete the following steps: 1. Turn the server off and disconnect the power from the server. 2. Remove the PCI riser card from PCI riser connector 2 and the microprocessor in socket 2. 3. Restart the server to see if the problem remains. 4. Reinstall each device that was removed in step b one at a time, starting the server each time, to isolate the failing device. 5. Replace any failing device. 6. (Trained service technician only) Replace the system board, if the problem remains. If the 12V AUX channel error LED is lit, complete the following steps: 1. Turn the server off and disconnect the power from the server. 2. Remove all PCI Express cards, all PCI riser cards, the operator information panel, and the Ethernet daughter card. 3. Restart the server to see if the problem remains. 4. Reinstall each device that was removed in step b one at a time, starting the server each time, to isolate the failing device. 5. Replace any failing device. 6. (Trained service technician only) Replace the system board, if the problem remains.
LOG	An error occurred.	Check the IMM system event log and the system-error log for information about the error. Replace any components identified in the error logs.
LINK	Reserved.	
PS	Power supply 1 or 2 has failed.	1. Make sure that the power supplies are seated correctly. 2. Remove one of the power supplies to isolate the failed power supply. 3. Replace the failed power supply.

Table 15. EasyLED panel LEDs (continued)

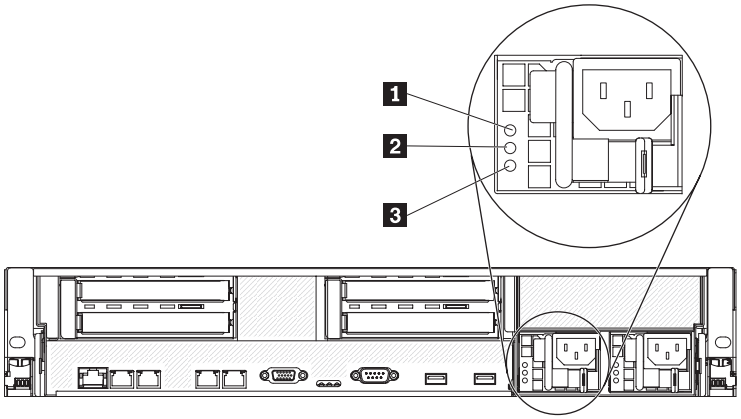
LED	Description	Action
PCI	An error has occurred on a PCI bus or on the system board. An additional LED will be lit next to a failing PCI slot.	1. Check the LEDs on the PCI slots to identify the component that caused the error. 2. Check the system-error log for information about the error. 3. If you cannot isolate the failing adapter using the LEDs and the information in the system-error log, remove one adapter at a time from the failing PCI bus; then, restart the server after each adapter is removed. 4. If the problem remains, replace the following components, in the order shown, restarting the server each time: • PCI riser card • (Trained service technician only) Replace the system board, if the problem remains.
SP	The service processor has failed.	1. Remove power from the server; then, reconnect the server to power and restart the server. 2. Update the IMM firmware. 3. (Trained service technician only) Replace the system board, if the problem remains.
FAN	A fan has failed, is operating too slowly, or has been removed. The TEMP LED might also be lit.	1. Reseat the fan. 2. Replace the failing fan, which is indicated by a lit LED next to the fan.
TEMP	The system temperature has exceeded a threshold level. A failing fan can cause the TEMP LED to be lit.	1. Determine whether a fan has failed. If it has, replace it. 2. Make sure that the room temperature is not too high. See “Specifications” on page 10 for the server temperature information. 3. Make sure that the air vents are not blocked.
MEM	A memory error has occurred.	Replace the failing DIMM, which is indicated by the lit DIMM latch on the system board (the DIMM LED is underneath the DIMM latch).
NMI	A machine check error has occurred or the NMI button was pressed.	Check the system-error log for information about the error.
CNFG	A hardware configuration error has occurred.	1. Check the microprocessors that were just installed to make sure that they are compatible with each other. 2. (Trained service technician only) Replace the incompatible microprocessor. 3. Check the system-error logs for information about the error. Replace any components identified in the error log.

Table 15. EasyLED panel LEDs (continued)

LED	Description	Action
CPU	A microprocessor has failed.	1. Make sure that the failing microprocessor, which is indicated by a lit LED on the system board, is install correctly. 2. (Trained service technician only) Replace the microprocessor.
DASD	A hard disk drive error has occurred.	1. Check the LEDs on the hard disk drives and replace the hard disk drive with the lit LED. 2. Replace the hard disk drive backplane.
RAID	A RAID controller error has occurred.	1. Make sure that a RAID controller is installed correctly. 2. Check the system-error log for information about the error.
BRD	An error has occurred on the system board.	1. Check the LEDs on the system board to identify the component that caused the error. 2. Check the system-error log for information about the error.

Power-supply diagnostics

The following illustration shows the power-supply LEDs on the rear of the server. For more information about solving power-supply problems, see the *Hardware Maintenance Manual*.



1 AC power LED (green)
2 DC power LED (green)
3 Power-supply error LED (amber)

The following table describes the problems that are indicated by various combinations of the power-supply LEDs and the power-on LED on the operator information panel and suggested actions to correct the detected problems.

Table 16. Power-supply LEDs

Power-supply LEDs			Description	Action	Notes
AC	**DC**	**Error**			
Off	Off	Off	No ac power to the server or a problem with the ac power source	1. Check the ac power to the server. 2. Make sure that the power cord is connected to a functioning power source. 3. Turn the server off and then turn the server back on. 4. If the problem remains, replace the power supply.	This is a normal condition when no ac power is present.
Off	Off	On	No ac power to the server or a problem with the ac power source and the power supply had detected an internal problem	1. Replace the power supply. 2. Make sure that the power cord is connected to a functioning power source.	This happens only when a second power supply is providing power to the server.
Off	On	Off	Faulty power supply	Replace the power supply.	
Off	On	On	Faulty power supply	Replace the power supply.	
On	Off	Off	Power supply not fully seated, faulty system board, or faulty power supply	1. Reseat the power supply. 2. If the 240V failure LED on the system board is lit, have the system board replaced (trained service technician only). 3. If the 240V failure LED on the system board is not lit, replace the power supply.	Typically indicates that a power supply is not fully seated.
On	Off or Flashing	On	Faulty power supply	Replace the power supply.	
On	On	Off	Normal operation		
On	On	On	Power supply is faulty but still operational	Replace the power supply.	

Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about Lenovo products, you will find a wide variety of sources available from Lenovo to assist you. This section contains information about where to go for additional information about Lenovo and Lenovo products, what to do if you experience a problem with your system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system. Information about diagnostic tools is in the *Hardware Maintenance Manual*.
- Go to the at http://www.lenovo.com/support to check for technical information, hints, tips, and new device drivers or to submit a request for information.

You can solve many problems without outside assistance by using the information available on the Lenovo support site or by following the troubleshooting procedures that Lenovo provides in the documentation that is provided with your Lenovo product. The documentation that comes with Lenovo systems also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with documentation that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

Using the documentation

Information about your Lenovo system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, readme files, and help files. Most of the documentation for your server is on the *ThinkServer Documentation* DVD provided with your server. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. Lenovo maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to http://www.lenovo.com/support and follow the instructions.

Getting help and information from the World Wide Web

On the World Wide Web, the Lenovo Web site has up-to-date information about Lenovo systems, optional devices, services, and support. For general information about Lenovo products or to purchase Lenovo products, go to http://www.lenovo.com. For support on Lenovo products, go to http://www.lenovo.com/support.

Calling for service

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

These services are available during the warranty period:

- **Problem determination -** Trained 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) available that apply to your hardware.

These items are not covered by the warranty:

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

Refer to the safety and warranty information that is provided with your computer for a complete explanation of warranty terms. You must retain your proof of purchase to obtain warranty service.

For a list of service and support phone numbers for your country or region, go to http://www.lenovo.com/support and click **Support phone list** or refer to the safety and warranty information provided with your computer.

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

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

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

Using other services

If you travel with a Lenovo notebook computer or relocate your computer to a country where your desktop, notebook, or 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 preinstalled Microsoft Windows product, refer to the Microsoft Product Support Services Web site at http://www.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; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region. For more information about these services, go to the Lenovo Web site at http://www.lenovo.com/.

Lenovo product service

台 灣 **Lenovo** 產 品 服 務 資 訊 如 下 :
荷蘭商思惟個人電腦產品股份有限公司台灣分公司
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服務電話: **0800-000-700**

Appendix B. Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area. Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service.

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Lenovo (United States), Inc.
1009 Think Place - Building One
Morrisville, NC 27560
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Attention: Lenovo Director of Licensing

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Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been

estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

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Important notes

Processor speed indicates the internal clock speed of the microprocessor; 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 1024 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.

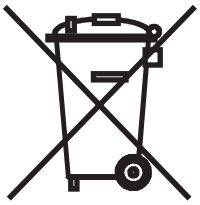
Lenovo makes no representation or warranties regarding non-Lenovo products and services, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. These products are offered and warranted solely by third parties.

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

Product recycling and disposal

This unit must be recycled or discarded according to applicable local and national regulations. 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. Information on Lenovo product recycling offerings can be found on Lenovo's Internet site at
http://www.lenovo.com/lenovo/environment/recycling.

Esta unidad debe reciclarse o desecharse de acuerdo con lo establecido en la normativa nacional o local aplicable. Lenovo recomienda a los propietarios de equipos de tecnología de la información (TI) que reciclen responsablemente sus equipos cuando éstos ya no les sean útiles. Lenovo dispone de una serie de programas y servicios de devolución de productos, a fin de ayudar a los propietarios de equipos a reciclar sus productos de TI. Se puede encontrar información sobre las ofertas de reciclado de productos de Lenovo en el sitio web de Lenovo
http://www.lenovo.com/lenovo/environment/recycling.



Notice: This mark applies only to countries within the European Union (EU) and Norway.

This appliance is labeled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

注意：このマークは EU 諸国およびノルウェーにおいてのみ適用されます。

この機器には、EU 諸国に対する廃電気電子機器指令 2002/96/EC(WEEE) のラベルが貼られています。この指令は、EU 諸国に適用する使用済み機器の回収とリサイクルの骨子を定めています。このラベルは、使用済みになった時に指令に従って適正な処理をする必要があることを知らせるために種々の製品に貼られています。

Remarque : Cette marque s'applique uniquement aux pays de l'Union Européenne et à la Norvège.

L'etiquette du système respecte la Directive européenne 2002/96/EC en matière de Déchets des Equipements Electriques et Electroniques (DEEE), qui détermine les dispositions de retour et de recyclage applicables aux systèmes utilisés à travers l'Union européenne. Conformément à la directive, ladite étiquette précise que le produit sur lequel elle est apposée ne doit pas être jeté mais être récupéré en fin de vie.

In accordance with the European WEEE Directive, electrical and electronic equipment (EEE) is to be collected separately and to be reused, recycled, or recovered at end of life. Users of EEE with the WEEE marking per Annex IV of the WEEE Directive, as shown above, must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to customers for the return, recycling, and recovery of WEEE. Customer participation is important to minimize any potential effects of EEE on the environment and human health due to the potential presence of hazardous substances in EEE. For proper collection and treatment, contact your local Lenovo representative.

Compliance with Republic of Turkey Directive on the Restriction of Hazardous Substances

Meets requirements of the Republic of Turkey Directive on the Restriction of the Use of Certain Hazardous Substances In Electrical and Electronic Equipment (EEE).

Lenovo ürünü Turkiye cumhuriyeti'nin Elektrikli ve elektronik eşyalardaki zararli madde kullaniminin sinirlandirilmasi hakkindaki direktif şartlarina uygundur (EEE).

EEE Yönetmeliğine Uygundur.

Recycling statements for Japan

日本のリサイクルに関して

本機器またはモニターの回収リサイクルについて

企業のお客様が、本機が使用済みとなり廃棄される場合は、廃棄物処理法の規定により、産業廃棄物として、地域を管轄する県知事あるいは、政令市長の許可を持った産業廃棄物処理業者に適正処理を委託する必要があります。また、弊社では資源有効利用促進法に基づき使用済みパソコンの回収および再利用・再資源化を行う「PC 回収リサイクル・サービス」を提供しています。詳細については、以下のURL にアクセスしてください。
http://www.ibm.com/jp/pc/service/recycle/pcrecycle

また、同法により、家庭で使用済みとなったパソコンのメーカー等による回収再資源化が2003 年10 月1 日よりスタートしました。詳細については、以下のURL にアクセスしてください。
http://www.ibm.com/jp/pc/service/recycle/personal

重金属を含む内部部品の廃棄処理について

本機器のプリント基板等には微量の重金属(鉛など) が使用されています。使用後は適切な処理を行うため、上記「本機器またはモニターの回収リサイクルについて」に従って廃棄してください。

リチウム電池交換後の廃棄処理について

本機器には、ボタン型のリチウム電池がシステム・ボード上に取り付けられています。この電池を交換する場合には、お買い上げいただいた販売店にお問い合わせいただくか、弊社の修理サービスをご利用ください。万一お客様が交換された場合の古い電池を廃棄する際は、ビニール・テープなどで絶縁処理をして、お買い上げいただいた販売店にお問い合わせいただくか、もしくは産業廃棄物処理業者に処理をご依頼ください。また一般家庭などから、一般廃棄物として自治体に廃棄を依頼するときは、地方自治体の条例・規則に従って廃棄してください。

Battery return program

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/lenovo/environment or contact your local waste disposal facility.

For Taiwan: Please recycle batteries.

For the European Union:

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.

Les batteries ou emballages pour batteries sont étiquetés conformément aux directives européennes 2006/66/EC, norme relative aux batteries et accumulateurs en usage et aux batteries et accumulateurs usés. Les directives déterminent la marche à suivre en vigueue dans l'Union Européenne pour le retour et le recyclage des batteries et accumulateurs usés. Cette étiquette est appliquée sur diverses

batteries pour indiquer que la batterie ne doit pas être mise au rebut mais plutôt récupérée en fin de cycle de vie selon cette norme.

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. For proper collection and treatment, go to http://www.lenovo.com/lenovo/environment.

For California:

Perchlorate material - special handling may apply. See http://www.dtsc.ca.gov/hazardouswaste/perchlorate/.

The foregoing notice is provided in accordance with California Code of Regulations Title 22, Division 4.5 Chapter 33. Best Management Practices for Perchlorate Materials. This product/part may include a lithium manganese dioxide battery which contains a perchlorate substance.

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.

Electronic emissions notices

This section includes electronic emissions notices and the FCC statement.

Federal Communications Commission (FCC) statement

Note: 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 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 Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

Attention: 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.

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 EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC 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 fitting of non-Lenovo option cards

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: 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 2004/108/EG (früher 89/336/EWG) zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

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 Betriebsmittein

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 EU-Richtlinie 2004/108/EG (früher 89/336/EWG) 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 EG Richtlinie 2004/108/EC (früher 89/336/EWG), 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, Gropiusplatz 10, D-70563 Stuttgart.

Informationen in Hinsicht EMVG Paragraf 4 Abs. (1) 4:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

Nach der EN 55022: “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.

Japanese Voluntary Control Council for Interference (VCCI) statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラス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。

Taiwanese Class A warning statement

警告使用者：
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

Chinese Class A warning statement

声　明

此为Ａ级产品，在生活环境中，
该产品可能会造成无线电干扰。
在这种情况下，可能需要用户对其
干扰采取切实可行的措施。

Korean Class A warning statement

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