

lenovo

ThinkStation
User Guide



ThinkThink**ThinkStation**Think

Machine Types: 4105, 4157, and 4217

Note: Before using this information and the product it supports, be sure to read and understand the *ThinkStation Safety and Warranty Guide* that came with this product and Appendix C “Notices” on page 51.

Fifth Edition (December 2011)

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Introduction

This *ThinkStation User Guide* contains the following information:

- Chapter 1 “Important safety information” on page 1 provides information about where to find safety information for this product.
- Chapter 2 “Arranging your workspace” on page 3 provides information about setting up your computer for comfort and the impact of light sources, air circulation, and electrical outlets.
- Chapter 3 “Setting up your computer” on page 5 provides information about setting up your computer, and also installing the operating system and other software.
- Chapter 4 “Software overview” on page 15 provides information on the operating system and software applications that might be preloaded on your computer.
- Chapter 5 “Using the Setup Utility” on page 17 provides instructions on how to view and change the configuration settings of your computer.
- Chapter 7 “Updating system programs” on page 25 provides information about updating POST/BIOS and how to recover from a POST/BIOS update failure.
- Chapter 8 “Troubleshooting and diagnostics” on page 27 provides information about basic troubleshooting and diagnostic tools for your computer.
- Chapter 9 “Recovery information” on page 33 provides instructions on how to use the ThinkVantage® Rescue and Recovery® program to create product recovery discs, back up data, recover software, and restore the entire contents of your hard disk drive to a previously saved state.
- Chapter 10 “Getting information, help, and service” on page 39 provides information about the wide variety of helpful resources available from Lenovo®.
- Appendix A “Manual modem commands” on page 43 provides commands for manually programming your modem.
- Appendix B “System memory speed” on page 49 provides information on the supported system memory speed for your computer model.
- Appendix C “Notices” on page 51 provides notices and trademark information.

Chapter 1. Important safety information

CAUTION:

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

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

Chapter 2. Arranging your workspace

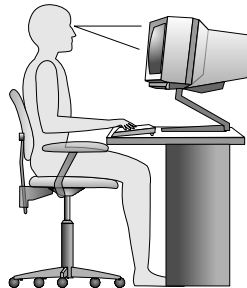
To get the most from your computer, arrange both the equipment you use and your work area to suit your needs and the kind of work you do. Your comfort is of foremost importance, but light sources, air circulation, and the location of electrical outlets can also affect the way you arrange your workspace.

Comfort

Although no single working position is ideal for everyone, here are a few guidelines to help you find a position that suits you best.

Sitting in the same position for a long time can cause fatigue. The backrest and seat of your chair should adjust independently and provide good support. The seat should have a curved front to relieve pressure on the thighs. Adjust the seat so that your thighs are parallel to the floor and your feet are either flat on the floor or on a footrest.

When using the keyboard, keep your forearms parallel to the floor and your wrists in a comfortable position. Use a light touch on the keyboard and your hands and fingers relaxed. Change the angle of the keyboard for maximum comfort by adjusting the position of the keyboard feet.



Adjust the monitor so the top of the screen is at, or slightly below, eye level. Place the monitor at a comfortable viewing distance, usually 51 to 61 cm (20 to 24 inches), and position it so you can view it without having to twist your body. Also, position other equipment you use regularly, such as the telephone or a mouse, within easy reach.

Glare and lighting

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

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

Dust buildup compounds problems associated with glare. Remember to clean your monitor screen periodically using a soft cloth as directed in your monitor documentation.

Air circulation

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

Electrical outlets and cable lengths

The location of electrical outlets, the length of power cords and cables that connect to the monitor, printer, and other devices might determine the final placement of your computer.

When arranging your workspace:

- Avoid the use of extension cords. When possible, plug the computer power cord directly into an electrical outlet.
- Keep power cords and cables neatly routed away from walkways and other areas where they might get kicked accidentally.

For more information about power cords, refer to the *ThinkStation Safety and Warranty Guide* that came with your computer.

Chapter 3. Setting up your computer

Be sure to read and understand the *ThinkStation Safety and Warranty Guide* before you set up your computer. Reading and understanding the safety information reduces the risk of personal injury and or damage to your product.

Set up your computer in the best possible work area that suits your needs and the kind of work you do. For more information, see Chapter 2 “Arranging your workspace” on page 3.

Connecting your computer

Use the following information when connecting your computer.

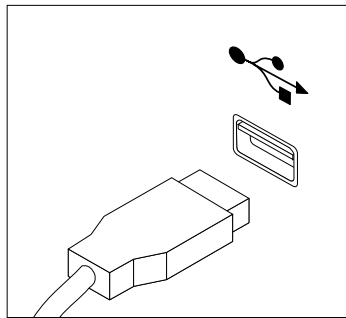
- Look for the small connector icons on the back of your computer. Match the connectors to the icons.
- If your computer cables and connector panel have color-coded connectors, match the color of the cable end with the color of the connector. For example, match a blue cable end with a blue connector or a red cable end with a red connector.

Notes:

1. Depending on your model type, your computer might not have all the connectors that are described in this section.
2. Your computer automatically detects the voltage and sets the power supply to the correct setting.

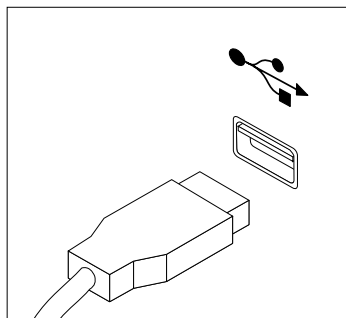
To connect your computer, do the following:

1. Connect the Universal Serial Bus (USB) keyboard cable to the USB connector.



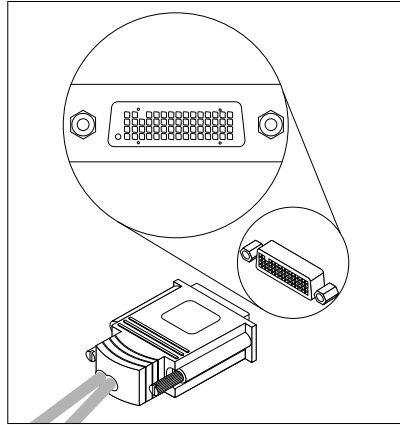
Note: Some models will have keyboards with a fingerprint reader.

2. Connect the USB mouse cable to the USB connector.

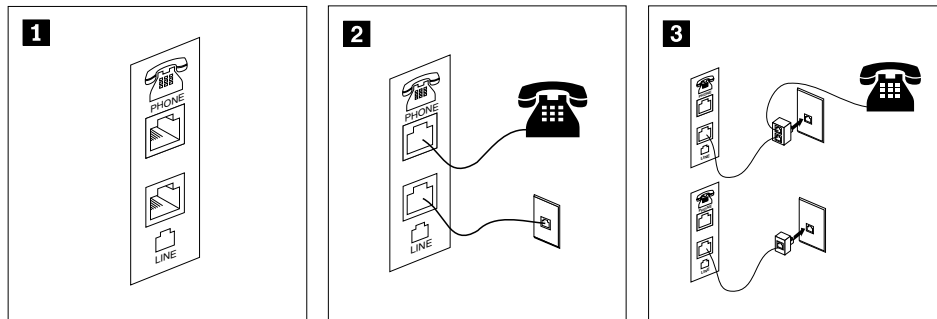


3. Connect the monitor cable to the monitor connector.

Note: Depending on your model type, your computer might come with a Low Force Helix (LFH) connector on the rear panel, which enables you to connect up to four monitors. The standard LFH connector has two breakout Video Graphics Array (VGA) cables or Digital Video Interface (DVI) cables. This solution provides you with flexibility for a variety of monitor configurations. To use the LFH connector, your computer must have a graphics card with multi-monitor capabilities. Connect the breakout cables to the LFH connector as shown, then connect the VGA or DVI cables to the breakout cables.

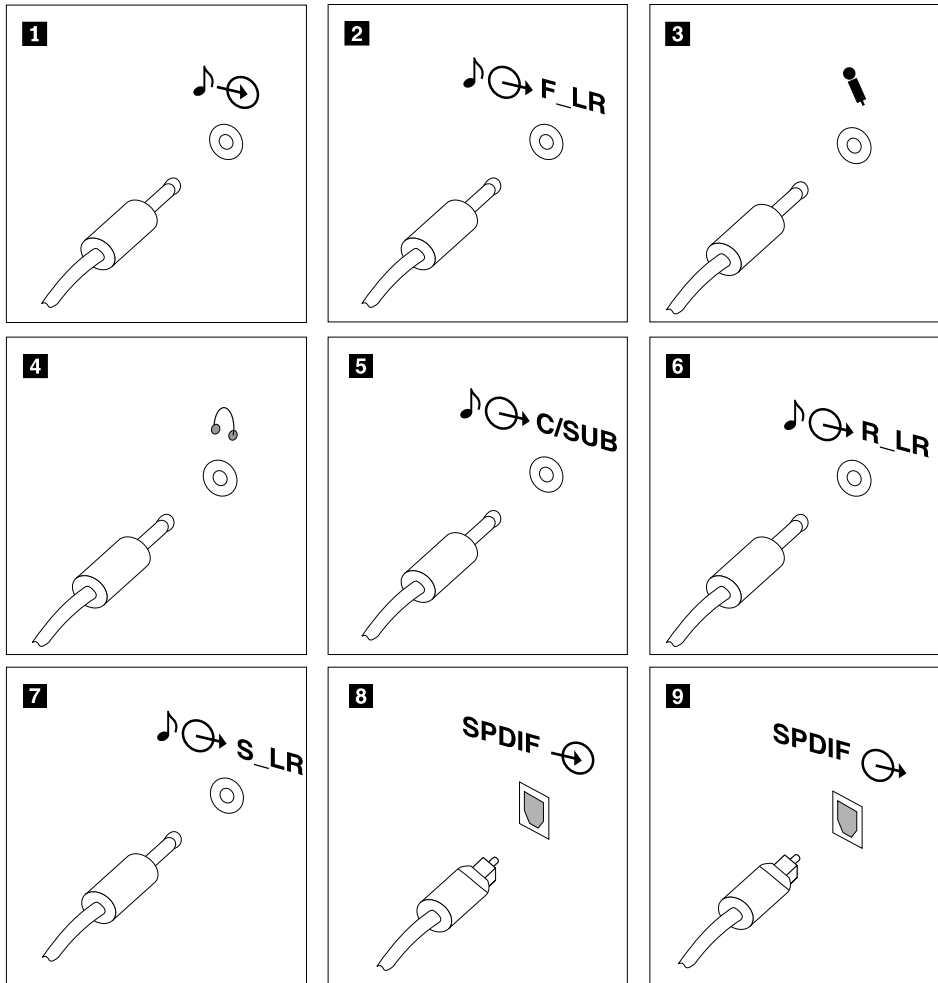


4. If you have a modem, connect the modem using the following information.



- 1** This illustration shows the two connectors on the back of the computer that are needed to set up your modem.
- 2** In the United States and other countries or regions that use the RJ-11 telephone outlet, attach one end of the telephone cable to the telephone and the other end to the telephone connector on the back of the computer. Attach one end of the modem cable to the modem connector on the back of the computer and the other end to the telephone outlet.
- 3** In countries or regions that do not use RJ-11 telephone outlets, a splitter or converter is required to attach the cables to the telephone outlet, as shown at the top of the illustration. You also can use the splitter or converter without the telephone, as shown at the bottom of the illustration.

5. If you have audio devices, attach them using the following instructions. For more information about speakers, see step 6 and step 7.



1 Audio line-in connector

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

2 Audio line-out connector (front speaker connector)

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

When used with 5.1 or 7.1 surround speakers, this connector should be attached to the front left and right speakers.

3 Microphone connector

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

4 Headphone connector

Used to attach headphones to your computer when you want to listen to music or other sounds without disturbing anyone. This connector might be located on the front of the computer.

5 Audio line-out connector (subwoofer/center speaker connector)

When used with 5.1 or 7.1 surround speakers, this connector should be attached to the center speaker and subwoofer.

6 Audio line-out connector (rear speaker connector)

When used with 5.1 or 7.1 surround speakers, this connector should be attached to the rear left and right speakers.

7 Audio line-out connector (side speaker connector)

When used with 7.1 surround speakers, this connector should be attached to the side left and right speakers.

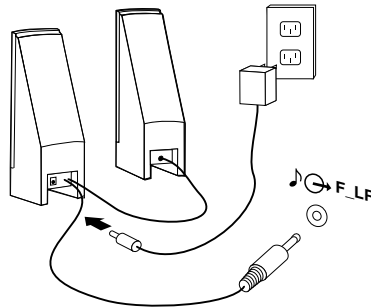
8 Optical SPDIF (Sony Philips Digital Interconnect Format) in connector

Used to receive 5.1 digital audio signals from an external device, such as a receiver or other multimedia devices, through a TOSLINK (ToshibaLink) optical cable.

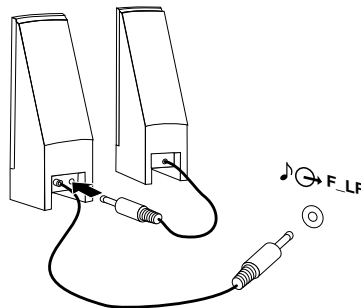
9 Optical SPDIF out connector

Used to send 5.1 digital audio signals from a computer to an external device, such as an amplifier or a receiver, through a TOSLINK optical cable.

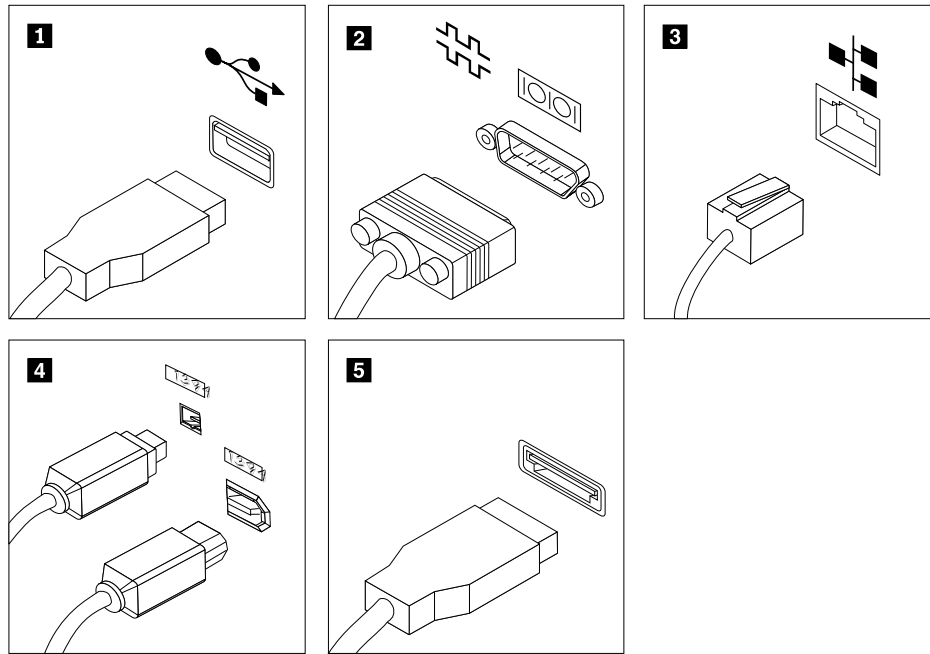
6. If you have powered speakers with an ac power adapter:



- Connect the cable that runs between the speakers, if necessary. On some speakers, this cable is permanently attached.
 - Connect the ac power adapter cable to the speaker.
 - Connect the speakers to the computer.
 - Connect the ac power adapter to the ac power source.
7. If you have unpowered speakers with no ac power adapter:

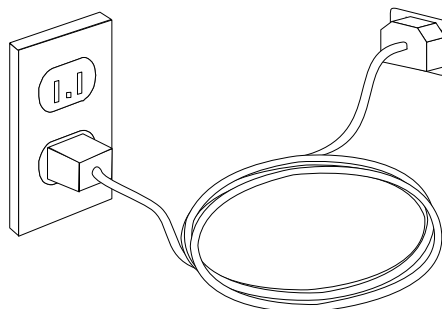


- Connect the cable that runs between the speakers, if necessary. On some speakers, this cable is permanently attached.
 - Connect the speakers to the computer.
8. Connect any additional devices that you have. Your computer might not have all the connectors that are shown.



- 1** USB connector Used to attach a device that requires a USB connector, such as a USB keyboard, a USB mouse, a USB scanner, or a USB printer. If you have more than 10 USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.
- 2** Serial port Used to attach an external modem, a serial printer, or other devices that use a 9-pin serial port.
- 3** Ethernet connector Used to attach an Ethernet cable for a local area network (LAN).
Note: To operate the computer within FCC Class B limits, use a Category 5 Ethernet cable.
- 4** IEEE 1394 connector (optional) Used to send and receive IEEE 1394 signals between the computer and other compliant devices, such as a video camera or an external storage drive. This connector is sometimes called Firewire.
- 5** eSATA connector Use this External Serial Advanced Technology Attachment (eSATA) connector to attach an external hard disk drive.

9. Connect the power cords to properly grounded electrical outlets.



Turning on computer power

Turn on the monitor and other external devices first, and then turn on the computer. When the power-on self-test (POST) is finished, the logo window closes. If your computer has preinstalled software, the software installation program starts.

If you experience any problems during startup, refer to Chapter 10 “Getting information, help, and service” on page 39. You can get additional help and information by telephone through the Customer Support Center. For the latest Service and Support worldwide telephone list, go to:
<http://support.lenovo.com>

Finishing the software installation

Important: Be sure to read and understand the license agreements carefully before using the programs on this computer. These agreements detail your rights, obligations, and warranties for the software programs on this computer. By using these programs, you accept the terms of the agreements. If you do not accept the agreements, do not use the programs. Instead, promptly return the entire computer for a full refund.

The first time you start your computer, follow the instructions on the screen to complete the software installation. If you do not complete the software installation the first time the computer is turned on, unpredictable results might occur.

Note: Some models might have a multilingual version of Microsoft® Windows® operating system preinstalled. If your computer has the multilingual version, you will be prompted to choose a language during the installation process. After installation, the language version can be changed through the Windows Control Panel.

Completing important tasks

After you have set up your computer, perform the following tasks, which could save you time and trouble in the future:

- Create a diagnostic CD/DVD image or rescue medium. Diagnostic programs are used to test hardware components of your computer and report operating-system-controlled settings that can cause hardware failures. Making a diagnostic CD/DVD image or rescue medium beforehand assures that you will be able to run diagnostics if the Rescue and Recovery workspace becomes inaccessible. See “PC-Doctor for DOS” on page 30 and “Creating and using rescue media” on page 36 for more information.
 - Record your computer machine type, model, and serial number. If you need service or technical support, you will probably be asked for this information. For further information, refer to the safety and warranty information that is provided with your computer.
-

Updating your operating system

Microsoft makes updates available for various operating systems through the Microsoft Windows Update Web site. The Web site automatically determines what Windows updates are available for your specific computer and lists those updates only. Updates could include security fixes, new versions of Windows components (such as media player), fixes to other portions of the Windows operating system, or enhancements.

Installing other operating systems

If you want to install your own operating system rather than the operating system preinstalled, follow the instructions that come with your operating system discs or diskettes. Remember to install all device drivers after you have installed the operating system. You can find the device drivers together with the installation instructions for ThinkStation™ at:
<http://support.lenovo.com>

Updating your antivirus software

Your computer comes with antivirus software that you can use to detect and eliminate viruses. Lenovo provides a full version of antivirus software on your hard disk drive with a free 30-day subscription. After 30 days, you must renew the license to continue receiving the antivirus program updates.

Shutting down the computer

When you turn off your computer, always follow the shutdown procedure for your operating system. This prevents the loss of unsaved data or damage to your software programs.

- To shut down the Microsoft Windows 7 operating system, open the **Start** menu from the Windows desktop and click **Shut down**.
- To shut down the Microsoft Windows Vista® operating system, open the **Start** menu from the Windows desktop, move the cursor to the arrow next to the lock workstation button, and select **Shut Down**.
- To shut down the Microsoft Windows XP operating system, open the **Start** menu from the Windows desktop and click **Shut Down**. Then, select **Shut down** from the drop-down list box and click **OK**.

Installing external options

For information about installing external options for your computer, refer to “Installing external options” in the *ThinkStation Hardware Installation and Replacement Guide*.

Installing the computer on a rack shelf

Your ThinkStation computer can be used on a rack shelf. When installing the computer on a rack shelf, make sure to leave at least a 12.70 cm (5 inches) space between the front edge of the rack shelf and your computer for fire protection.

Features

This section provides an overview of the computer features.

System information

The following information covers a variety of models. For information for your specific model, use the Setup Utility. See Chapter 5 “Using the Setup Utility” on page 17.

Microprocessor

- Intel® Xeon® dual-core processor
- Intel Xeon Quad Core processor
- Intel Xeon six-core processor
- Internal cache (size varies by model type)

Memory

Your computer supports up to six DDR3 ECC UDIMMs (double data rate 3 error correction code unbuffered dual inline memory modules).

Note: The Intel Xeon microprocessor families compatible with this ThinkStation computer feature an integrated memory controller, which provides the microprocessor with direct access to the system memory. Because of this design, the system memory speed will be determined by a number of factors, including

the microprocessor model and the type, speed, size (capacity), and number of DIMMs installed. Refer to Appendix B “System memory speed” on page 49 for the information on the supported system memory speed for your own computer model.

Internal drives

- 3.5-inch standard half-high diskette drive (optional)
- Card reader (optional)
- Serial Advanced Technology Attachment (SATA) internal hard disk drive or Serial attached SCSI (SAS) internal hard disk drive
- Optical drive

Video subsystem

- Graphics card (varies by model type)

Audio subsystem

- Integrated high-definition (HD) audio
- Headphone connector and microphone connector on the front panel
- Eight audio connectors on the rear panel (audio line-in connector, audio line-out front speaker connector, microphone connector, audio line-out subwoofer/center speaker connector, audio line-out rear speaker connector, audio line-out side speaker connector, optical SPDIF in connector, and optical SPDIF out connector)
- Internal speaker

Connectivity

- Two 10/100/1000 Mbps integrated Ethernet connectors
- Peripheral Component Interconnect (PCI) V.90 Data/Fax modem (some models)

System management features

- Ability to store POST hardware test results
- Alert Standard Format (ASF) 2.0
- Automatic power-on startup
- Preboot Execution Environment (PXE)
- Remote Administration
- System Management (SM) Basic Input/Output System (BIOS) and SM software
- Wake on LAN
- Wake on Ring (in the Setup Utility program, this feature is called Serial Port Ring Detect for an external modem)

Input/Output (I/O) features

- 9-pin serial port
- Eight audio connectors on the rear panel (audio line-in connector, audio line-out front speaker connector, microphone connector, audio line-out subwoofer/center speaker connector, audio line-out rear speaker connector, audio line-out side speaker connector, optical SPDIF in connector, and optical SPDIF out connector)
- Eight rear and two front USB connectors
- eSATA connector

- One Ethernet connector
- Two rear IEEE 1394 connectors (optional)
- Two audio connectors on the front panel (microphone connector and headphone connector)
- VGA or DVI monitor connector (requires video card)

Expansion

- Two optical drive bays
- One drive bay for either a 3.5-inch diskette drive or a card reader
- One 32-bit PCI card slot
- One PCI Express x1 card slot
- One PCI Express x4 card slot (mechanical x16)
- Two PCI Express 2.0 x16 card slots
- Three hard disk drive bays

Power

- 625-watt auto-sensing power supply
- Automatic 50/60 Hz input frequency switching
- Advanced Configuration and Power Interface (ACPI) support

Security features

- Cover presence switch (also called intrusion switch, some models)
- Keyboard with fingerprint reader (some models)
- Support for the addition of an integrated cable lock (Kensington lock)
- Serial port and parallel port I/O control
- Startup sequence control
- Startup without diskette drive, keyboard, or mouse
- Support to enable or disable a device
- Trusted Platform Module (TPM)
- User and administrator passwords for BIOS access

Software programs, preinstalled

Your computer might come with preinstalled software programs. If it does, an operating system, device drivers to support built-in features, and other support programs are included. For more information, see Chapter 4 “Software overview” on page 15.

Operating system, preinstalled

- Microsoft Windows 7
- Microsoft Windows Vista
- Microsoft Windows XP Professional (preinstalled through downgrade rights in Windows 7 Professional, Windows 7 Ultimate, Windows Vista Business, or Windows Vista Ultimate)

Operating systems, certified or tested for compatibility¹ (varies by model type)

- Linux®

Specifications

This section lists the physical specifications for your ThinkStation computer.

Dimensions

- Width: 175 mm (6.9 inches)
- Height: 478 mm (18.8 inches) floor to top of handle
- Depth: 460 mm (18.1 inches)

Weight

- Maximum configuration: 16.33 kg (36 lb)

Dimensions rack mounted:

- Width: 427 mm (16.8 inches)
- Height: 210 mm (8.0 inches)
- Depth: 579 mm (22.8 inches)

Environment

- Air temperature:
 - Operating at 0 to 3 000 ft (914.4 m): 10°C to 35°C (50°F to 95°F)
 - Storage: -10°C to 60°C (14°F to 140°F)
- Humidity:
 - Operating: 10% to 80%
 - Storage: 10% to 90%
 - Transit: 10% to 90%
- Maximum altitude: 7 000 ft (2 133.6 m)

Electrical input

- Input voltage:
 - Range 100 V - 240 V
 - Input kilovolt-amperes (kVA) (approximate)
 - Minimum configuration as shipped: 0.17 kVA
 - Maximum configuration: 0.8 kVA

1. The operating systems listed here are being certified or tested for compatibility at the time this publication goes to press. Additional operating systems might be identified by Lenovo as compatible with your computer following the publication of this booklet. Corrections and additions to this list are subject to change. To determine if an operating system has been certified or tested for compatibility, check the Web site of the operating system vendor.

Chapter 4. Software overview

The ThinkStation computer comes with a preinstalled operating system and several preloaded applications. The applications can be specified by the customer.

Software provided with your Windows operating system

This section describes the Windows applications provided with your product.

Software provided by Lenovo

The following software programs are provided by Lenovo to help you improve productivity and reduce the cost associated with maintaining your computer. Software programs provided with your computer might vary depending on your model type and preinstalled operating system.

Notes: The following software programs are supported on your ThinkStation computer. You can find detailed information and download the software programs from the Lenovo Support Web site at: <http://support.lenovo.com>

- ThinkVantage Productivity Center
- ThinkVantage Client Security Solution
- ThinkVantage System Update

Lenovo ThinkVantage Tools

The Lenovo ThinkVantage Tools program guides you to a host of information sources and provides easy access to various tools to help you work more easily and securely. For more information, see “Lenovo ThinkVantage Tools” on page 39.

Note: The Lenovo ThinkVantage Tools program is only available on computers preinstalled with Windows 7 from Lenovo.

Product Recovery

The Product Recovery program enables you to restore the contents of the hard disk drive to the factory default settings.

ThinkVantage Rescue and Recovery

The ThinkVantage Rescue and Recovery program is a one button recovery and restore solution that includes a set of self-recovery tools to help you diagnose computer problems, get help, and recover from system crashes quickly, even if the primary operating system does not start.

Fingerprint software

The integrated fingerprint reader provided on some keyboards enables you to enroll your fingerprint and associate it with your power-on password, hard disk drive password, and Windows password. As a result, fingerprint authentication can replace passwords and enable simple and secure user access. A fingerprint reader keyboard is available with select computers or can be purchased for computers that support this option.

Lenovo Solution Center

Note: Depending on the date when your computer was manufactured, your computer is preinstalled with either the Lenovo Solution Center program or the Lenovo ThinkVantage Toolbox program for diagnostic

purposes. For additional information about the Lenovo ThinkVantage Toolbox program, see “Lenovo ThinkVantage Toolbox” on page 29.

The Lenovo Solution Center program enables you to troubleshoot and resolve computer problems. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for maximum system performance. See “Lenovo Solution Center” on page 29 for detailed information.

Lenovo ThinkVantage Toolbox

Note: Depending on the date when your computer was manufactured, your computer is preinstalled with either the Lenovo Solution Center program or the Lenovo ThinkVantage Toolbox program for diagnostic purposes. For additional information about the Lenovo Solution Center program, see “Lenovo Solution Center” on page 29.

The Lenovo ThinkVantage Toolbox program helps you maintain your computer, improve computing security, diagnose computer problems, get familiar with the innovative technologies provided by Lenovo, and get more information about your computer. See “Lenovo ThinkVantage Toolbox” on page 29 for detailed information.

PC-Doctor for Rescue and Recovery

The PC-Doctor for Rescue and Recovery diagnostic program is preinstalled on your hard disk drive. It is part of the Rescue and Recovery workspace on each Lenovo computer to diagnose hardware problems and report operating-system-controlled settings that can cause hardware failures. Use the PC-Doctor for Rescue and Recovery if you are unable to start the Windows operating system. See “PC-Doctor for Rescue and Recovery” on page 29 for more information.

Adobe Reader

The Adobe Reader is a tool used to view, print, and search PDF documents.

Chapter 5. Using the Setup Utility

The Setup Utility program is used to view and change the configuration settings of your computer, regardless of which operating system you are using. However, the operating-system settings might override any similar settings in the Setup Utility program.

Starting the Setup Utility program

To start the Setup Utility program, do the following:

1. Make sure your computer is turned off.
2. Repeatedly press and release the F1 key when turning on the computer. When you hear multiple beeps or see a logo screen, release the F1 key.

Note: If a user password or an administrator password has been set, the Setup Utility program menu is not displayed until you type the correct password. For more information, see “Using passwords” on page 17.

The Setup Utility program might start automatically when POST detects that hardware has been removed or new hardware has been installed in your computer.

Viewing and changing settings

The Setup Utility program menu lists items that identify system configuration topics. To view or change settings, see “Starting the Setup Utility program” on page 17.

When working with the Setup Utility program menu, you must use the keyboard. The keys used to perform various tasks are displayed at the bottom of each screen.

Using passwords

By using the Setup Utility program, you can set passwords to prevent unauthorized access to your computer and data. See “Starting the Setup Utility program” on page 17. The following types of passwords are available:

- User Password
- Administrator Password

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

Password considerations

A password can be any combination of up to 12 alphabetic and numeric characters (a-z and 0-9). For security reasons, it is recommended to use a strong password that cannot be easily compromised. To set a strong password, use the following guidelines:

- Have at least eight characters in length
- Contain at least one alphabetic character and one numeric character
- Setup Utility program and hard disk drive passwords are not case sensitive
- Not be your name or your user name

- Not be a common word or a common name
- Be significantly different from your previous passwords

User Password

When a User Password is set, the computer cannot be used until a valid password is typed from the keyboard.

Administrator Password

Setting an Administrator Password deters unauthorized users from changing configuration settings. If you are responsible for maintaining the settings of several computers, you might want to set an Administrator Password.

After you set an Administrator Password, a password prompt is displayed each time you try to access the Setup Utility program.

If both the user and administrator passwords are set, you can type either password. However, to change any configuration settings, you must use your administrator password.

Setting, changing, and deleting a password

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

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 17.
2. From the Setup Utility program main menu, select **Security → Set Passwords**.
3. Follow the instructions displayed on the right side of the screen to set, change, or delete the password you want.

Note: A password can be any combination of up to 12 (1 to 12) alphabetic and numeric characters. For more information, see “Password considerations” on page 17.

Enabling or disabling a device

You can enable or disable user access to a device.

ICH SATA Controller	When this feature is set to Disabled , any optical drives or eSATA devices are disabled and will not be displayed in the system configuration.
Marvell SATA/SAS Controller	When this feature is set to Disabled , all internal hard disk drives are disabled and will not be displayed in the system configuration. When disabling this feature, make sure your system has an alternate boot method, such as LAN PXE boot, or a bootable floppy diskette, memory key, or optical disc.
Legacy diskette A	When this feature is set to Disabled , the diskette drive cannot be accessed.

To set the ICH SATA Controller or Marvell SATA/SAS Controller, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 17.
2. Depending on which device you want to set, select either **Devices → SAS/SATA Drive Setup → ICH SATA Controller** or **Devices → SAS/SATA Drive Setup → Marvell SATA/SAS Controller** from the Setup Utility program menu.
3. Select the desired settings and press Enter.
4. Return to the Setup Utility program menu and select **Exit → Save and exit the Setup Utility**.

Note: If you do not want to save the settings, select **Exit the Setup Utility without saving**.

To set the Legacy diskette A, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 17.
2. From the Setup Utility program menu, select **Devices → Legacy diskette A**.
3. Select the desired settings and press Enter.
4. Return to the Setup Utility program menu and select **Exit → Save and exit the Setup Utility**.

Note: If you do not want to save the settings, select **Exit the Setup Utility without saving**.

Selecting a startup device

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

Selecting a temporary startup device

Use this procedure to start up from any startup device.

Note: Not all discs, hard disk drives, and diskettes are bootable.

1. Turn off your computer.
2. Repeatedly press and release the F12 key when turning on the computer. When the **Startup Device Menu** displays, release the F12 key.
3. Select the desired startup device from the **Startup Device Menu** and press Enter to begin.

Note: Selecting a startup device from the **Startup Device Menu** does not permanently change the startup sequence.

Selecting or changing the startup device sequence

To view or permanently change the configured startup device sequence, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 17.
2. Select **Startup → Startup Sequence**. See the information displayed on the right side of the screen.
3. Select the devices for the Primary Startup Sequence, the Automatic Startup Sequence, and the Error Startup Sequence.
4. Select **Exit** from the **Setup Utility** menu and then **Save Settings** or **Save and exit the Setup Utility**.

If you have changed these settings and want to return to the default settings, select **Load Default Settings** on the **Exit** menu.

Advanced settings

On some computer models, the **Advanced settings** menu includes a setting to enable or disable HyperThreading. This feature works only with HyperThreading-aware operating systems, such as Windows 7 and Windows Vista. The default setting for HyperThreading is enabled. However, if you are not using a HyperThreading-aware operating system and you select **Set Defaults** for HyperThreading, your computer performance might be degraded. Therefore, you should always set HyperThreading to **Disabled** unless you are sure your operating system supports HyperThreading.

Exiting from the Setup Utility program

After you finish viewing or changing settings, press Esc to return to the Setup Utility program menu (you might have to press Esc several times). If you want to save the new settings, select **Save Settings** or **Save and exit the Setup Utility**. Otherwise, your changes will not be saved.

Chapter 6. Installing hard disk drives and configuring RAID

This chapter contains information about installing hard disk drives and configuring Redundant Array of Independent Disks (RAID) for this product.

Notes:

- The information about configuring RAID in this chapter is applicable only for a Windows environment. For information about configuring RAID in a Linux environment, contact your Linux software provider.
- You can install a combination of SATA and SAS hard disk drives within the same computer. However, SATA and SAS hard disk drives cannot be installed within the same RAID array. All drives should be connected to the SAS controller card.

Installing SATA hard disk drives and configuring RAID

This section contains information about the required number of SATA hard disk drives for the supported level of RAID and SATA RAID configuration.

Installing SATA hard disk drives

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

- RAID Level 0 – Striped disk array
 - Two hard disk drives minimum
 - Better performance without fault tolerance
- RAID Level 1 – Mirrored disk array
 - Two hard disk drives minimum
 - Improved read performance and 100% redundancy
- RAID Level 5 – Block-level striped disk array with distributed parity
 - Three hard disk drives minimum
 - Data striped at the byte level
 - Stripe error correction information
 - Better performance and fault tolerance

To install a new SATA hard disk drive, refer to the installation procedure in “Replacing a hard disk drive” in the *ThinkStation Hardware Installation and Replacement Guide*.

Configuring the system BIOS to enable SATA RAID functionality

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

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

1. Press F1 to enter the system BIOS setup. See “Starting the Setup Utility program” on page 17.
2. Select **Devices** → **IDE Drives Setup** and press Enter.
3. Select **SATA RAID Enable** and press Enter.
4. Select **Enabled** and press Enter.
5. Press F10 to save the new settings and exit.

Creating RAID volumes

This section describes how to use the Intel Matrix Storage Manager option ROM configuration utility to create RAID volumes.

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility.

Note: To make enough physical hard disk drives available to create a RAID volume.

2. Use the up and down arrow keys to select **Create RAID Volume** and press Enter.
3. Type a proper RAID Volume name in the **Name** field and press Tab.
4. Use the arrow keys to select a RAID level in the **RAID Level** field and press Tab.
5. If appropriate, use the arrow keys to select a Stripe Size in the **Stripe Size** field and press Tab.
6. Type a volume size in the **Capacity** field and press Tab.
7. Press Enter to initiate volume creation.
8. When prompted, press Y to accept the warning message and create the volume.
9. Return to step 2 to create additional RAID volumes, or select **Exit** and press Enter.
10. Press Y when prompted to confirm the exit.

Deleting RAID volumes

This section describes how to use the Intel Matrix Storage Manager option ROM configuration utility to delete RAID volumes.

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility.
2. Use the up and down arrow keys to select **Delete RAID Volume** and press Enter.
3. Use the arrow keys to select the RAID volume to be deleted and press Delete.
4. When prompted, press Y to confirm the deletion of the selected RAID volume. Deleting a RAID volume will reset the hard disk drives to non-RAID.
5. After deleting a RAID volume, you can:
 - Return to step 2 to delete additional RAID volumes.
 - See “Creating RAID volumes” on page 22 for RAID volume creation.
 - Use the up and down arrow keys to select **Exit** and press Enter.
 - Use the up and down arrow keys to select **Reset Disks to Non-RAID** and press Enter.
 - a. Use the arrow keys and the space key to mark individual physical hard disk drives to be reset, and then press Enter to complete the selection.
 - b. When prompted, press Y to confirm the reset action.
 - c. After completing the Reset Disks to Non-RAID function, you can:
 - Return to step 2 to delete additional RAID volumes.
 - See “Creating RAID volumes” on page 22 for RAID volume creation.
 - Use the up and down arrow keys to select **Exit** and press Enter.

Installing SAS hard disk drives and configuring RAID

This section contains information about the required number of SAS hard disk drives for the supported level of RAID and SAS RAID configuration.

Installing SAS hard disk drives

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

- RAID Level 0 – Striped disk array
 - Two hard disk drives minimum
 - Better performance without fault tolerance
- RAID Level 1 – Mirrored disk array
 - Two hard disk drives minimum
 - Improved read performance and 100% redundancy
- RAID Level 5 – Block-level striped disk array with distributed parity
 - Three hard disk drives minimum
 - Data striped at the byte level
 - Stripe error correction information
 - Better performance and fault tolerance

To install a new SAS hard disk drive, refer to the installation procedure in “Replacing a hard disk drive” in the *ThinkStation Hardware Installation and Replacement Guide*.

Entering the Marvell BIOS Setup to configure SAS RAID

This section describes how to enter the Marvell BIOS Setup to configure SAS RAID.

1. Your computer must have a Marvell SAS adapter card (Marvell SAS controller) installed to configure SAS RAID. For installing or replacing a Marvell SAS adapter card, refer to “Replacing an adapter card” in the *ThinkStation Hardware Installation and Replacement Guide*.
2. Turn on the computer after you have installed the required number of SAS hard disk drives and the Marvell SAS adapter card.
3. Press Ctrl+M when prompted to enter the Marvell BIOS Setup to configure SAS RAID.

Configuring the Marvell BIOS Setup to enable SAS RAID 0, 1, or 5 functionality

To enable SAS RAID 0, 1, or 5 functionality, use the Marvell BIOS Setup configuration utility as the SAS configuration utility. This utility assumes that the system has the required number of hard disk drives.

1. Turn on your computer and press Ctrl+M when prompted to enter the Marvell BIOS Setup.
2. On the Marvell BIOS Setup screen, use the arrow keys to select **RAID Config** and press Enter. The **RAID Config** menu opens.
3. From the **RAID Config** menu, select **Create array**.
4. Use the arrow keys and the Enter key to select each free hard disk drive that you want to include in the array.
5. Select **Next** and press Enter.
6. From the **Create array** menu, select **RAID level** and press Enter.

Note: Only the valid RAID levels will be active.
7. Select the SAS RAID level you want (**RAID 0**, **RAID 1**, or **RAID 5**) and press Enter.
8. From the **Stripe size** menu, you can change the stripe size or keep it as default.
9. Type a proper array name in the **Array name** field.
10. Select **Next** and press Enter. When prompted, press Y to complete the array creation and RAID configuration.

Configuring the Marvell BIOS Setup to set an optional hot spare hard disk drive

To configure the Marvell BIOS Setup to set an optional hot spare hard disk drive:

1. Turn on your computer and press Ctrl+M when prompted to enter the Marvell BIOS Setup.
2. On the Marvell BIOS Setup screen, use the arrow keys to select **RAID Config** and press Enter. The **RAID Config** menu opens.
3. From the **RAID Config** menu, select **Spare Management**.
4. Use the arrow keys to select the hard disk drive you want to set as an optional hot spare hard disk drive.
5. Use the arrow keys to select **Next** and press Enter.
6. Press Y when prompted to set the optional hot spare hard disk drive.

Configuring the Marvell BIOS Setup to delete an optional hot spare hard disk drive

To configure the Marvell BIOS Setup to delete an optional hot spare hard disk drive:

1. Turn on your computer and press Ctrl+M when prompted to enter the Marvell BIOS Setup.
2. On the Marvell BIOS Setup screen, use the arrow keys to select **RAID Config** and press Enter. The **RAID Config** menu opens.
3. From the **RAID Config** menu, select **Spare Management**.
4. Use the arrow keys to select the optional hot spare hard disk drive you want to delete.
5. Use the arrow keys to select **Next** and press Enter.
6. Press Y when prompted to delete the optional hot spare hard disk drive.

Configuring the Marvell BIOS Setup to delete an array

To configure the Marvell BIOS Setup to delete an array:

1. Turn on your computer and press Ctrl+M when prompted to enter the Marvell BIOS Setup.
2. On the Marvell BIOS Setup screen, use the arrow keys to select **RAID Config** and press Enter. The **RAID Config** menu opens.
3. From the **RAID Config** menu, select **Delete array**.
4. Use the arrow keys and the Enter key to select the array you want to delete from the list.
5. Use the arrow keys to select **Next** and press Enter.
6. Press Y when prompted to complete the deletion.

Chapter 7. Updating system programs

This chapter contains information about updating POST/BIOS and how to recover from a POST/BIOS update failure.

Using system programs

System programs are the basic layer of software built into your computer. System programs include the POST, the BIOS, and the Setup Utility program. The POST is a set of tests and procedures that are performed each time you turn on your computer. The BIOS is a layer of software that translates instructions from other layers of software into electrical signals that the computer hardware can execute. You can use the Setup Utility program to view or change the configuration settings of your computer. See Chapter 5 “Using the Setup Utility” on page 17 for detailed information.

Your computer system board has a module called electrically erasable programmable read-only memory (EEPROM, also referred to as flash memory). You can easily update the POST, the BIOS, and the Setup Utility program by starting your computer with a system-program-update disc or running a special update program from your operating system.

Lenovo might make changes and enhancements to the POST and BIOS. When updates are released, they are available as downloadable files on the Lenovo Web site at <http://www.lenovo.com>. Instructions for using the POST/BIOS updates are available in a TXT file that is included with the update files. For most models, you can download either an update program to create a system-program-update (flash) disc or an update program that can be run from the operating system.

Note: You can download a self-starting bootable CD/DVD image (known as an ISO image) of the diagnostics program to support computers without a diskette drive. Go to:
<http://www.lenovo.com>

Updating (flashing) the BIOS from a disc

This section provides instructions on how to update (flash) the BIOS from a disc. System program updates are available at:

<http://support.lenovo.com>

To update (flash) the BIOS from a disc:

1. Make sure the optical drive you want to use is set as the first boot device in the startup device sequence. See “Selecting or changing the startup device sequence” on page 19.
2. Make sure the computer is turned on. Insert the disc into the optical drive.
3. Turn off the computer and back on again. The update begins.
4. When prompted to change the serial number, press N.

Note: If you want to change the serial number, press Y when prompted. Type in the serial number and then press Enter.

5. When prompted to change the machine type/model, press N.

Note: If you want to change the machine type/model, press Y when prompted. Type in the machine type/model and then press Enter.

6. Follow the instructions on the screen to complete the update.

Updating (flashing) the BIOS from your operating system

Note: Because Lenovo makes constant improvements to the Web site, the Web page content is subject to change without notice, including the links referenced in the following procedure.

1. Go to <http://support.lenovo.com>.
2. Do the following to locate the downloadable files for your machine type:
 - a. In the **Enter a product number** field, type your machine type and click **Go**.
 - b. Click **Downloads and drivers**.
 - c. Select **BIOS** in the **Refine results** field to easily locate all the BIOS related links.
 - d. Click the BIOS update link.
 - e. Click the TXT file that contains the instructions for updating (flashing) BIOS from your operating system.
3. Print these instructions. This is very important because they are not on the screen after the download begins.
4. Follow the printed instructions to download, extract, and install the update.

Recovering from a POST/BIOS update failure

If power to your computer is interrupted while the POST/BIOS is being updated (flash update), your computer might not restart correctly. If this happens, perform the following procedure commonly called Boot-block Recovery.

1. Turn off the computer and any attached devices, such as printers, monitors, and external drives.
2. Unplug all power cords from electrical outlets, and remove the computer cover. Refer to “Removing the cover” in the *ThinkStation Hardware Installation and Replacement Guide*.
3. Access the system board. Refer to “Accessing system board components” in the *ThinkStation Hardware Installation and Replacement Guide*.
4. Locate the Clear CMOS/Recovery jumper on the system board. Refer to “Identifying parts on the system board” in the *ThinkStation Hardware Installation and Replacement Guide*.
5. Remove any cables that impede access to the Clear CMOS/Recovery jumper.
6. Move the jumper from the standard position (pin 1 and pin 2) to pin 2 and pin 3.
7. Reconnect any cables that were disconnected. Refer to “Completing the parts replacement” in the *ThinkStation Hardware Installation and Replacement Guide*.
8. Close the computer cover and reconnect the power cords for the computer and monitor to electrical outlets.
9. Turn on the computer and the monitor. Insert the POST/BIOS update (flash) disc into the optical drive.
10. Turn the computer off and back on again.
11. The recovery session will take two to three minutes. During this time you will hear a series of beeps. After the update session is completed, there will be no video, the series of beeps will end, and the system will automatically turn off. Remove the disc from the optical drive.
12. Repeat steps 2 through 5.
13. Replace the Clear CMOS/Recovery jumper to the standard position (pin 1 and pin 2).
14. Reconnect any cables that were disconnected. Refer to “Completing the parts replacement” in the *ThinkStation Hardware Installation and Replacement Guide*.
15. Close the computer cover and reconnect the power cords for the computer and monitor to electrical outlets.
16. Turn on the computer to restart the operating system.

Chapter 8. Troubleshooting and diagnostics

This chapter describes some basic troubleshooting and diagnostic programs. If your computer problem is not described here, see Chapter 10 “Getting information, help, and service” on page 39 for additional troubleshooting resources.

Basic troubleshooting

The following table provides information to help you troubleshoot your computer problem.

Symptom	Action
The computer does not start when you press the power button.	Verify that: <ul style="list-style-type: none">• The power cord is plugged into the rear of the computer and into a working electrical outlet.• If your computer has a secondary power switch on the back of the computer, make sure that it is switched on.• The power indicator on the front of the computer is on. If you cannot correct the problem, have the computer serviced. Refer to the safety and warranty information that is provided with your computer for a list of service and support telephone numbers.
The monitor screen is blank.	Verify that: <ul style="list-style-type: none">• The monitor cable is securely attached to the rear of the monitor and to the rear of the computer.• The monitor power cord is plugged into the monitor and into a working electrical outlet.• The monitor is turned on and the brightness and contrast controls are set correctly.• The monitor signal cable is securely connected to the monitor and to the monitor connector on the computer. If you cannot correct the problem, have the computer serviced. Refer to the safety and warranty information that is provided with your computer for a list of service and support telephone numbers.
The keyboard does not work. The computer does not respond to the keyboard.	Verify that: <ul style="list-style-type: none">• The computer is turned on.• The monitor is turned on and the brightness and contrast controls are set correctly.• The keyboard is securely connected to the keyboard connector on the computer.• No keys are stuck. If you cannot correct the problem, have the computer serviced. Refer to the safety and warranty information that is provided with your computer for a list of service and support telephone numbers.

Symptom	Action
The USB Keyboard does not work.	<p>Verify that:</p> <ul style="list-style-type: none"> • The computer is turned on. • The keyboard is securely connected to a USB connector on the front or rear of the computer. • No keys are stuck. <p>If you cannot correct the problem, have the computer serviced. Refer to the safety and warranty information that is provided with your computer for a list of service and support telephone numbers.</p>
The mouse does not work. The computer does not respond to the mouse.	<p>Verify that:</p> <ul style="list-style-type: none"> • The computer is turned on. • The mouse is securely connected to the mouse connector on the computer. • The mouse is clean. Refer to “Cleaning an optical mouse” on page 30 for further information. <p>If you cannot correct the problem, have the computer serviced. Refer to the safety and warranty information that is provided with your computer for a list of service and support telephone numbers.</p>
The operating system will not start.	<p>Verify that:</p> <ul style="list-style-type: none"> • There is no diskette in the diskette drive. • The startup sequence includes the device where the operating system resides. Usually, the operating system is on the hard disk drive. For more information, see “Selecting a startup device” on page 19. <p>If you cannot correct the problem, have the computer serviced. Refer to the safety and warranty information that is provided with your computer for a list of service and support telephone numbers.</p>
The computer beeps multiple times before the operating system starts.	<p>Verify that no keys are stuck down.</p> <p>If you cannot correct the problem, have the computer serviced. Refer to the safety and warranty information that is provided with your computer for a list of service and support telephone numbers.</p>

Diagnostic programs

Diagnostic programs are used to test hardware components of your computer. Diagnostic programs can also report operating-system-controlled settings that interfere with the correct operation of your system.

Depending on the preinstalled operating system and the date when your computer was manufactured, Lenovo provides one of the following diagnostic solutions:

- Lenovo Solution Center (used when the Windows operating system is running normally)
- Lenovo ThinkVantage Toolbox (used when you are running the Windows operating system)
- PC-Doctor for Rescue and Recovery (used when your Windows operating system does not start)

Notes:

1. You can also download the PC-Doctor for DOS diagnostic program from <http://www.lenovo.com/support>. See “PC-Doctor for DOS” on page 30 for detailed information.

2. If you are unable to isolate and repair the problem yourself after running the diagnostic programs, save and print the log files created by the diagnostic programs. You will need the log files when you speak to a Lenovo technical support representative.

Lenovo Solution Center

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

Notes:

- The Lenovo Solution Center program is available only on models preinstalled with the Windows 7 operating system. If your Windows 7 model is not preinstalled with the program, you can download it from <http://www.lenovo.com/diagnose>.
- If you are using the Windows Vista or Windows XP operating system, go to <http://www.lenovo.com/diagnose> for the latest information on diagnostics for your computer.

To run the Lenovo Solution Center program on the Windows 7 operating system, click **Start → All Programs → Lenovo ThinkVantage Tools → System Health and Diagnostics**. Follow the instructions on the screen.

For additional information, refer to the Lenovo Solution Center help system.

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

Lenovo ThinkVantage Toolbox

The Lenovo ThinkVantage Toolbox program helps you maintain your computer, improve computing security, diagnose computer problems, get familiar with the innovative technologies provided by Lenovo, and get more information about your computer. You can use the diagnostics feature of the Lenovo ThinkVantage Toolbox program to test devices, diagnose computer problems, create bootable diagnostic media, update system drivers, and view system information.

- To run the Lenovo ThinkVantage Toolbox program on the Windows 7 operating system, click **Start → All Programs → Lenovo ThinkVantage Tools → System Health and Diagnostics**. Follow the instructions on the screen.
- To run the Lenovo ThinkVantage Toolbox program on the Windows Vista operating system or the Windows XP operating system, click **Start → All Programs → ThinkVantage → Lenovo ThinkVantage Toolbox**. Follow the instructions on the screen.

For additional information about running the Lenovo ThinkVantage Toolbox program, refer to the Lenovo ThinkVantage Toolbox help system.

PC-Doctor for Rescue and Recovery

The PC-Doctor for Rescue and Recovery diagnostic program is part of the Rescue and Recovery workspace on each Lenovo computer. Use the PC-Doctor for Rescue and Recovery if you are unable to start the Windows operating system.

To run the PC-Doctor for Rescue and Recovery from the Rescue and Recovery workspace, do the following:

1. Turn off the computer.
2. Repeatedly press and release the F11 key when turning on the computer. When you hear beeps or see a logo screen, stop pressing the F11 key. The Rescue and Recovery workspace opens after a short delay.

3. From the Rescue and Recovery workspace, select **Launch advanced Rescue and Recovery → Diagnose hardware**. The PC-Doctor for Rescue and Recovery diagnostic program opens.
4. Select the diagnostic test you want to run. Then, follow the instructions on the screen.

For additional information about running the PC-Doctor for Rescue and Recovery, refer to the PC-Doctor for Rescue and Recovery help system.

Note: If you encounter failures that prevent you from gaining access to the Rescue and Recovery workspace, you can run the PC-Doctor for Rescue and Recovery diagnostic program after using a rescue medium to recover the computer from failures and gaining access to the Rescue and Recovery workspace. See “Creating and using rescue media” on page 36.

PC-Doctor for DOS

You can also download the latest version of the PC-Doctor for DOS diagnostic program from <http://support.lenovo.com>. The PC-Doctor for DOS diagnostic program runs independently of the Windows operating system. Use the PC-Doctor for DOS if you are unable to start the Windows operating system or if the two diagnostic programs preinstalled on your computer have not been successful in isolating a possible problem. You can run the PC-Doctor for DOS from a diagnostic disc that you created.

Creating a diagnostic disc

This section provides instructions on how to create a diagnostic disc.

To create a diagnostic disc, do the following:

1. Download a self-starting bootable CD/DVD image (known as an ISO image) of the diagnostic program from:
<http://support.lenovo.com>
2. Use any CD/DVD burning software to create a diagnostic disc with the ISO image.

Running the diagnostic program from a diagnostic disc

This section provides instructions on how to run the diagnostic program from a diagnostic disc that you created.

To run the diagnostic program from a diagnostic disc that you created, do the following:

1. Make sure the optical drive you want to use is set as the first boot device in the startup device sequence. See “Selecting a startup device” on page 19.
2. Make sure the computer is turned on and then insert the disc into the optical drive. The diagnostic program opens.

Note: You can insert the disc into the optical drive when you are setting the startup device sequence. However, if you insert the disc into the optical drive when you have already entered the operating system, you need to restart the computer to access the diagnostic program.

3. Follow the instructions on the screen to select the diagnostic test you want to run.

Note: For additional help, press the F1 key.

4. Remove the diagnostic disc from the optical drive when you complete the diagnostic process.

Cleaning an optical mouse

This section provides instructions on how to clean an optical mouse.

An optical mouse uses a LED and an optical sensor to navigate the pointer. If the pointer on the screen does not move smoothly with the optical mouse, you might need to clean the mouse.

To clean an optical mouse, do the following:

1. Turn off your computer.
2. Disconnect the mouse cable from the computer.
3. Turn the mouse upside down to check the lens.
 - a. If there is a smudge on the lens, gently clean the area with a plain cotton-tipped swab.
 - b. If there is debris in the lens, gently blow the debris away from the area.
4. Check the surface on which you are using the mouse. If you have a very intricate picture or pattern beneath the mouse, it may be difficult for the digital signal processor (DSP) to determine changes in the mouse position.
5. Reconnect the mouse cable to the computer.
6. Turn your computer back on.

Chapter 9. Recovery information

This chapter will help you get familiar with recovery solutions provided by Lenovo. This chapter explains when and how to use the following recovery methods:

- Creating and using recovery media
- Performing backup and recovery operations
- Using the Rescue and Recovery workspace
- Creating and using rescue media
- Installing or reinstalling device drivers
- Setting a rescue device in the startup sequence
- Solving recovery problems

Notes:

1. There are a variety of methods to choose from when considering how to recover in the event of a software- or hardware-related problem. Some methods vary depending on the type of your operating system.
2. The product on the recovery media may be used only for the following purposes:
 - Restore the product preinstalled on your computer
 - Reinstall the product
 - Modify the product using the Additional Files

Creating and using recovery media

Recovery media enable you to restore the hard disk drive to the factory default settings. Recovery media are useful if you transfer the computer to another area, sell the computer, recycle the computer, or put the computer in an operational state after all other methods of recovery have failed. As a precautionary measure, it is important to create recovery media as soon as possible.

Note: The recovery operations you can perform using recovery media vary depending on the operating system from which they are created. Your Microsoft Windows license permits you to create only one data medium, so it is important that you store the created recovery medium in a safe place.

Creating recovery media

This section provides instructions on how to create recovery media on different operating systems.

Note: On Windows 7, you can create recovery media using discs or external USB storage devices. On Windows Vista and Windows XP, you can create recovery media using discs only.

- To create recovery media on Windows 7, click **Start → All Programs → Lenovo ThinkVantage Tools → Factory Recovery Disks**. Then, follow the instructions on the screen.
- To create Product Recovery discs on Windows Vista, click **Start → All Programs → ThinkVantage → Create Product Recovery Media**. Then, follow the instructions on the screen.
- To create Product Recovery discs on Windows XP, click **Start → All Programs → ThinkVantage → Create Recovery Media**. Then, follow the instructions on the screen.

Using recovery media

This section provides instructions on how to use recovery media on different operating systems.

- To use recovery media on Windows 7 or Windows Vista, do the following:

Attention: When you use recovery media to restore the computer to the factory default settings on Windows 7 or Windows Vista, all the files currently on the system drive or the hard disk drive will be deleted and replaced by the factory default settings.

1. Depending on the type of your recovery media, connect your boot medium (memory key or USB hard disk drive) to your computer, or insert the boot disc into your CD or DVD drive.
2. Restart your computer.
3. Repeatedly press and release the F12 key when turning on the computer. When the Startup Device Menu window opens, release the F12 key.
4. Depending on the type of your recovery media, select the proper startup device and press Enter. After a short delay, the Product Recovery program opens.
5. Follow the instructions on the screen. After restoring the computer to the factory default settings, you might have to reinstall some software programs or device drivers. See “Installing or reinstalling device drivers” on page 37 for details.

- To use Product Recovery discs on Windows XP, do the following:

Attention: When you use Product Recovery discs to restore the computer to the factory default settings on Windows XP, all the files currently on the hard disk drive will be deleted and replaced by the factory default settings. During the restore process, you will be given the option to save one or more files currently on the hard disk drive to other media before the data is deleted.

1. Insert the boot disc into your CD or DVD drive.
2. Restart your computer.
3. Repeatedly press and release the F12 key when turning on the computer. When the Startup Device Menu window opens, release the F12 key.
4. Select the CD or DVD drive as the startup device and press Enter. After a short delay, the Rescue and Recovery workspace opens.
5. From the **Rescue and Recovery** menu, click **Restore your system**.
6. Follow the instructions on the screen.

Performing backup and recovery operations

The Rescue and Recovery program enables you to back up all your hard disk drive contents including the operating system, data files, software programs, and personal settings. You can designate where the Rescue and Recovery program stores the backup:

- On a protected area of your hard disk drive
- On a secondary hard disk drive installed in your computer
- On an attached external USB hard disk drive
- On a network drive
- On recordable CDs or DVDs (a recordable CD or DVD drive is required for this option)

After you have backed up the contents on the hard disk drive, you can restore the complete contents of the hard disk drive, restore only the selected files, or restore only the Windows operating system and applications.

Performing a backup operation

This section provides instructions on how to perform a backup operation using the Rescue and Recovery program on different operating systems.

- To perform a backup operation using the Rescue and Recovery program on Windows 7, do the following:
 1. From the Windows desktop, click **Start → All Programs → Lenovo ThinkVantage Tools → Enhanced Backup and Restore**. The Rescue and Recovery program opens.
 2. From the Rescue and Recovery main window, click the **Launch advanced Rescue and Recovery** arrow.
 3. Click **Back up your hard drive** and select backup operation options. Follow the instructions on the screen.
- To perform a backup operation using the Rescue and Recovery program on Windows Vista or Windows XP, do the following:
 1. From the Windows desktop, click **Start → All Programs → ThinkVantage → Rescue and Recovery**. The Rescue and Recovery program opens.
 2. From the Rescue and Recovery main window, click **Launch advanced Rescue and Recovery → Back up your hard drive**, and select backup operation options.
 3. Follow the instructions on the screen.

Performing a recovery operation

This section provides instructions on how to perform a recovery operation using the Rescue and Recovery program on different operating systems.

- To perform a recovery operation using the Rescue and Recovery program on Windows 7, do the following:
 1. From the Windows desktop, click **Start → All Programs → Lenovo ThinkVantage Tools → Enhanced Backup and Restore**. The Rescue and Recovery program opens.
 2. From the Rescue and Recovery main window, click the **Launch advanced Rescue and Recovery** arrow.
 3. Click the **Restore your system from a backup** icon.
 4. Follow the instructions on the screen.
- To perform a recovery operation using the Rescue and Recovery program on Windows Vista or Windows XP, do the following:
 1. From the Windows desktop, click **Start → All Programs → ThinkVantage → Rescue and Recovery**. The Rescue and Recovery program opens.
 2. From the Rescue and Recovery main window, click **Launch advanced Rescue and Recovery**.
 3. Click the **Restore your system from a backup** icon.
 4. Follow the instructions on the screen.

For more information about performing a recovery operation from the Rescue and Recovery workspace, see “Using the Rescue and Recovery workspace” on page 35.

Using the Rescue and Recovery workspace

The Rescue and Recovery workspace resides in a protected, hidden area of your hard disk drive that operates independently from the Windows operating system. This enables you to perform recovery operations even if the Windows operating system cannot be started. You can perform the following recovery operations from the Rescue and Recovery workspace:

- Rescue files from your hard disk drive or from a backup The Rescue and Recovery workspace enables you to locate files on your hard disk drive and transfer them to a network drive or other recordable media, such as a USB device, a disc, or a diskette. This solution is available, even if you did not back up your files or if changes were made to the files since your last backup operation. You can also rescue individual files from a Rescue and Recovery backup located on your local hard disk drive, a USB device, or a network drive.

- Restore your hard disk drive from a Rescue and Recovery backup If you have backed up your hard disk drive using the Rescue and Recovery program, you can restore the hard disk drive from a Rescue and Recovery backup, even if you cannot start the Windows operating system.
- Restore your hard disk drive to the factory default settings The Rescue and Recovery workspace enables you to restore the complete contents of your hard disk drive to the factory default settings. If you have multiple partitions on your hard disk drive, you have the option to restore the factory default settings to the C: partition and leave the other partitions intact. Because the Rescue and Recovery workspace operates independently from the Windows operating system, you can restore the factory default settings even if you cannot start the Windows operating system.

Attention: If you restore the hard disk drive from a Rescue and Recovery backup or restore the hard disk drive to the factory default settings, all files on the primary hard disk drive partition (usually drive C:) will be deleted in the recovery process. If possible, make copies of important files. If you are unable to start the Windows operating system, you can use the Rescue files feature in the Rescue and Recovery workspace to copy files from your hard disk drive to other media.

To start the Rescue and Recovery workspace, do the following:

1. Make sure the computer is turned off.
2. Repeatedly press and release the F11 key when turning on the computer.
3. When you hear beeps or see a logo screen, release the F11 key.
4. If you have set a Rescue and Recovery password, type your password when prompted. The Rescue and Recovery workspace opens after a short delay.

Note: If the Rescue and Recovery workspace fails to open, see “Solving recovery problems” on page 38.

5. Do one of the following:
 - To rescue files from your hard disk drive or from a backup, click **Rescue files** and follow the instructions on the screen.
 - To restore your hard disk drive from a Rescue and Recovery backup or to restore your hard disk drive to the factory default settings, click **Restore your system** and follow the instructions on the screen.

For more information about the features of the Rescue and Recovery workspace, click **Help**.

Notes:

1. After restoring a hard disk drive to the factory default settings, you might have to reinstall device drivers for some devices. See “Installing or reinstalling device drivers” on page 37.
2. Some computers come with Microsoft Office or Microsoft Works preinstalled. If you need to recover or reinstall your Microsoft Office or Microsoft Works applications, you must use the *Microsoft Office CD* or *Microsoft Works CD*. These CDs are provided only with computers preinstalled with Microsoft Office or Microsoft Works.

Creating and using rescue media

With rescue media, such as a disc or a USB hard disk drive, you can recover the computer from failures that prevent you from gaining access to the Rescue and Recovery workspace on your hard disk drive.

Notes:

1. The recovery operations you can perform using rescue media vary depending on the operating system.
2. The rescue discs can be started in any type of CD or DVD drive.
3. You can also run the PC-Doctor for Rescue and Recovery diagnostic program, after using a rescue medium to recover the computer from failures and gaining access to the Rescue and Recovery workspace.

Creating rescue media

This section provides instructions on how to create rescue media on different operating systems.

- To create a rescue medium on Windows 7, do the following:
 1. From the Windows desktop, click **Start → All Programs → Lenovo ThinkVantage Tools → Enhanced Backup and Restore**. The Rescue and Recovery program opens.
 2. From the Rescue and Recovery main window, click the **Launch advanced Rescue and Recovery** arrow.
 3. Click the **Create Rescue Media** icon. The Create Rescue and Recovery Media window opens.
 4. In the **Rescue Media** area, select the type of rescue media you want to create. You can create a rescue medium using a disc, a USB hard disk drive, or a secondary internal hard disk drive.
 5. Click **OK** and follow the instructions on the screen.
- To create a rescue medium on Windows Vista or Windows XP, do the following:
 1. From the Windows desktop, click **Start → All Programs → ThinkVantage → Create Recovery Media**. The Create Rescue and Recovery Media window opens.
 2. In the **Rescue Media** area, select the type of rescue media you want to create. You can create a rescue medium using a disc, a USB hard disk drive, or a secondary internal hard disk drive.
 3. Click **OK** and follow the instructions on the screen.

Using rescue media

This section provides instructions on how to use the rescue media you have created.

Note: Make sure your rescue device (optical drive, USB device, or the secondary internal hard disk drive) is set as the first boot device in the startup device sequence before doing this procedure. See “Selecting a startup device” on page 19.

To use the rescue medium you have created, do one of the following:

- If you have created the rescue medium using a disc, make sure that your computer is turned on and insert the rescue disc. Then, restart the computer. The rescue medium starts.
- If you have created the rescue medium using a USB hard disk drive, attach the USB hard disk drive to one of the USB connectors on your computer. Then, turn on the computer. The rescue medium starts.
- If you have created the rescue medium using a secondary internal hard disk drive, set the secondary internal hard disk drive as the first boot device in the startup device sequence. Then, the rescue medium starts.

When the rescue medium starts, the Rescue and Recovery workspace opens. The help information for each feature is available from the Rescue and Recovery workspace. Follow the instructions to complete the recovery process.

Installing or reinstalling device drivers

Before installing or reinstalling device drivers, make sure that you have a preinstalled operating system and the documentation and software media for the device.

Device drivers for factory-installed devices are located on the computer hard disk drive (usually drive C:) in the SWTOOLS\DRIVERS folder. The latest device drivers for factory-installed devices are also available at <http://support.lenovo.com>. Other device drivers are on the software media that come with individual devices.

To install or reinstall a device driver for a factory-installed device, do the following:

1. Turn on the computer.
2. Use Windows Explorer or My Computer to display the directory structure of your hard disk drive.
3. Go to the C:\SWTOOLS directory.
4. Open the DRIVERS folder. Within the DRIVERS folder, there are several subfolders named for various devices installed in your computer, such as AUDIO or VIDEO.
5. Open the appropriate device subfolder.
6. Do one of the following:
 - In the device subfolder, look for a README.txt file or a file with the .txt extension. This file might be named after the operating system, such as WIN98.txt. The TXT file contains information about how to install the device driver. Follow the instructions to complete the installation.
 - If the device subfolder contains a file with the .inf extension and you want to install the device driver using the INF file, click **Start → Help and Support** to enter the Windows Help and Support information system for the detailed information about how to install the device driver.
 - In the device subfolder, look for a SETUP.EXE file. Double-click the file and follow the instructions on the screen.

Setting a rescue device in the startup sequence

Before you start the Rescue and Recovery program from an internal hard disk drive, a disc, a USB hard disk drive, or other external devices, you must first make sure that your rescue device is set as the first boot device in the startup device sequence in the Setup Utility program. Refer to “Selecting a startup device” on page 19 for detailed information about temporarily or permanently changing the startup sequence.

Note: If you use an external device, you must first turn off your computer before connecting the external device.

For more information on the Setup Utility program, see Chapter 5 “Using the Setup Utility” on page 17.

Solving recovery problems

If you are unable to access the Rescue and Recovery workspace or the Windows environment, do one of the following:

- Use a rescue medium to start the Rescue and Recovery workspace. See “Creating and using rescue media” on page 36.
- Use a recovery medium if you want to restore the system drive or the hard disk drive to the factory default settings. See “Creating and using recovery media” on page 33.

Note: If you are unable to access the Rescue and Recovery workspace or the Windows environment from a rescue medium, a recovery repair diskette, or a recovery medium, you might not have the rescue device, diskette drive, or recovery device set as the first boot device in the startup device sequence. For more information, see “Setting a rescue device in the startup sequence” on page 38.

It is important to create a rescue medium, a recovery repair diskette, and a recovery medium as early as possible and store them in a safe place.

Chapter 10. Getting information, help, and service

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

Information resources

This section describes how to access useful resources relating to your computing needs.

Online Books folder

The Online Books folder preinstalled on your computer contains the *ThinkStation User Guide*, which provides information about your computer to help you set up, use, and maintain your computer. It requires no Internet access to view the publication.

To view the publications, click **Start → All Programs → Online Books → Online Books**, then double-click the appropriate publication for your computer. The publications are also available on the Lenovo Support Web site at:

<http://support.lenovo.com>

Notes:

1. The publications are in Portable Document Format (PDF). To view the publications, you need to have the Adobe Reader preinstalled on your computer. If the Adobe Reader has not been installed on your computer, a message will appear when you attempt to view the PDF file and you will be guided through the Adobe Reader installation.
2. The publications are available in other languages on the Lenovo Support Web site at:
<http://support.lenovo.com>
3. If you want to install a different language version of the Adobe Reader rather than the version preinstalled on your computer, download the language version you want from the Adobe Web site at:
<http://www.adobe.com>

Lenovo ThinkVantage Tools

The Lenovo ThinkVantage Tools program guides you to a host of information sources and provides easy access to various tools to help you work more easily and securely.

Note: The Lenovo ThinkVantage Tools program is only available on computers preinstalled with Windows 7 from Lenovo.

To access the Lenovo ThinkVantage Tools program, click **Start → All Programs → Lenovo ThinkVantage Tools**.

Lenovo Welcome

The Lenovo Welcome program introduces some innovative built-in features of Lenovo to you and guides you through some important setup tasks to help you make the most of your computer.

Note: The Lenovo Welcome program is only available on computers preinstalled with Windows 7 or Windows Vista from Lenovo.

Safety and Warranty

The *ThinkStation Safety and Warranty Guide* that is provided with your computer contains information on safety, warranty, and notices. Read and understand all safety information before using this product.

Lenovo Web site (<http://www.lenovo.com>)

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

- Shop for desktop and notebook computers, monitors, projectors, upgrades and accessories for your computer, and special offers.
- Purchase additional services, such as support for hardware, operating systems, application programs, network setup and configuration, and custom installations.
- Purchase upgrades and extended hardware repair services.
- Download the latest device drivers and software updates for your computer model.
- Access the online manuals for your products.
- Access the Lenovo Statement of Limited Warranty.
- Access troubleshooting and support information for your computer model and other supported products.
- Find the service and support phone numbers for your country or region.
- Find a Service Provider located near you.

Lenovo Support Web site

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

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

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

Help and service

This section contains information about obtaining help and service.

Using the documentation and diagnostic programs

If you experience a problem with your computer, see Chapter 8 “Troubleshooting and diagnostics” on page 27. For information on additional resources to help you troubleshoot your computer problem, see “Information resources” on page 39.

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

Most computers come with a set of diagnostic programs that you can use to help you identify hardware problems. For instructions on using the diagnostic programs, see “Diagnostic programs” on page 28.

You can get the latest technical information and download device drivers and updates from the Lenovo Support Web site at:
<http://support.lenovo.com>

Calling for service

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

The following services are available during the warranty period:

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

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 the Lenovo Support phone numbers for your country or region, go to <http://support.lenovo.com> and click **Support phone list** or refer to the *ThinkStation Safety and Warranty Guide* that is 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 your hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

Using other services

If you travel with your computer or relocate it to a country where your desktop or notebook computer 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://support.lenovo.com>, click **Product & Service 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://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:
<http://www.lenovo.com>

Appendix A. Manual modem commands

The following section lists commands for manually programming your modem.

Commands are accepted by the modem while it is in Command Mode. Your modem is automatically in Command Mode until you dial a number and establish a connection. Commands can be sent to your modem from a PC running communication software or any other terminal devices.

All commands sent to the modem must begin with **AT** and end with **ENTER**. All commands can be typed in either upper or lower case, but not mixed. To make the command line more readable, spaces can be inserted between commands. If you omit a parameter from a command that requires one, it is just like specifying a parameter of **0**.

Example:

ATH [ENTER]

Basic AT commands

In the following listings, all default settings are printed in **bold text**.

Command		Function
A		Manually answer incoming call.
A/		Repeat last command executed. Do not precede A/ with AT or follow with ENTER.
D_		0 - 9, A-D, # and *
	L	last number redial
	P	pulse dialing
		Note: Pulse dialing is not supported for Australia, New Zealand, Norway, and South Africa.
	T	touch-tone dialing
	W	wait for second dial tone
	,	pause
	@	wait for five seconds of silence
	!	flash
	;	return to Command Mode after dialing
DS=n		Dial one of the four telephone numbers (n=0-3) stored in the modem non-volatile memory.
E_	E0	Commands are not echoed
	E1	Commands are echoed
+++		Escape Characters - Switch from Data Mode to Command Mode (T.I.E.S. Command)
H_	H0	Force modem on-hook (hang up)
	H1	Force modem off-hook (make busy) Note: H1 command is not supported for Italy

Command		Function
I_	I0	Display product-identification code
	I1	Factory ROM checksum test
	I2	Internal memory test
	I3	Firmware ID
	I4	Reserved ID
L_	L0	Low speaker volume
	L1	Low speaker volume
	L2	Medium speaker volume
	L3	High speaker volume
M_	M0	Internal speaker off
	M1	Internal speaker on until carrier detected
	M2	Internal speaker always on
	M3	Internal speaker on until carrier detected and off while dialing
N_		Included for compatibility only, provides no effect
O_	O0	Return to Data Mode
	O1	Return to Data Mode and initiate an equalizer retrain
P		Set Pulse dial as default
Q_	Q0	Modem sends responses
Sr?		Read and display value in register r.
Sr=n		Set register r to value n (n = 0-255).
T		Set Tone Dial as default
V_	V0	Numeric responses
	V1	Word responses
W_	W0	Report DTE speed only
	W1	Report line speed, error correction protocol, and DTE speed.
	W2	Report DCE speed only
X_	X0	Hayes Smartmodem 300 compatible responses/blind dialing.
	X1	Same as X0 plus all CONNECT responses/blind dialing
	X2	Same as X1 plus dial tone detection
	X3	Same as X1 plus busy detection/blind dialing
	X4	All responses and dial tone and busy signal detection
Z_	Z0	Reset and retrieve active profile 0
	Z1	Reset and retrieve active profile 1

Extended AT commands

Command		Function
&C_	&C0	Force Carrier Detect Signal High (ON)
	&C1	Turn on CD when remote carrier is present

Command		Function
&D_	&D0	Modem ignores the DTR signal
	&D1	Modem returns to Command Mode after DTR toggle
	&D2	Modem hangs up, returns to the Command Mode after DTR toggle
	&D3	Resets modem after DTR toggle
&F_	&F	Recall factory default configuration
&G_	&G0	Guard tone disabled
	&G1	Guard tone disabled
	&G2	1800 Hz guard tone
&K_	&K0	Disable flow control
	&K3	Enable RTS/CTS hardware flow control
	&K4	Enable XON/XOFF software flow control
	&K5	Enable transparent XON/XOFF flow control
	&K6	Enable both RTS/CTS and XON/XOFF flow control
&M_	&M0	Asynchronous operation
&P_	&P0	US setting for off-hook-to-on-hook ratio
	&P1	UK and Hong Kong off-hook-to-on-hook ratio
	&P2	Same as &P0 setting but at 20 pulses per minute
	&P3	Same as &P1 setting but at 20 pulses per minute
&R_	&R0	Reserved
	&R1	CTS operates per flow control requirements
&S_	&S0	Force DSR Signal High (ON)
	&S1	DSR off in command mode, on in online mode
&T_	&T0	Ends test in progress
	&T1	Perform Local Analog Loopback Test
	&T3	Perform Local Digital Loopback Test
	&T4	Grant Remote Digital Loopback Test request by remote modem
	&T5	Deny Remote Digital Loopback Test request
	&T6	Perform a Remote Digital Loopback Test
	&T7	Perform a Remote Digital Loopback Test and Self-Test
	&T8	Perform Local Analog Loopback Test and Self-Test
&V	&V0	Displays Active and Stored Profiles
	&V1	Display Last Connection Statistics
&W_	&W0	Stores the active profile as Profile 0
	&W1	Stores the active profile as Profile 1
%E_	%E0	Disable auto-retrain
	%E1	Enable auto-retrain
+MS?		Displays the current Select Modulation settings

Command		Function
+MS=?		Displays a list of supported Select Modulation options
+MS=a,b,c,e,f		Select modulation where: a =0, 1, 2, 3, 9, 10, 11, 12, 56, 64, 69; b =0-1; c =300-56000; d =300- 56000; e =0-1; and f =0-1. A, b, c,d, e, f default= 12, 1, 300, 56000, 0, 0 . Parameter " a " specifies the modulation protocol desired where: 0=V.21, 1=V.22, 2=V.22bis, 3=V.23, 9=V.32, 10=V.32bis, 11=V.34, 12=V.90,K56Flex,V.34.....,56=K 56Flex, V.90,V.34....., 64=Bell 103, and 69=Bell 212. Parameter " b " specifies automode operations where: 0=automode disabled, 1= automode enabled with V.8/V.32 Annex A. Parameter " c " specifies the minimum connection data rate (300- 56000). Parameter " d " specifies the maximum connection rate (300-56000); Parameter " e " specifies the codec type (0= Law, and 1=A-Law). Parameter " f " specifies "robbed bit" signaling detection (0=detection disabled 1=detection enabled)

MNP/V.42/V.42bis/V.44 commands

Command		Function
%C_	%C0	Disable MNP Class 5 and V.42bis data compression
	%C1	Enable MNP Class 5 data compression only
	%C2	Enable V.42bis data compression only
	%C3	Enable MNP Class 5 and V.42bis data compression
&Q_	&Q0	Direct data link only (same as \N1)
	&Q5	V.42 data link with fallback options
	&Q6	Normal data link only (same as \N0)
+DS44=0, 0		Disable V.44
+DS44=3, 0		Enable V.44
+DS44?		Current values
+DS44=?		List of support values

Fax Class 1 commands

+FAE=n	Data/Fax Auto Answer
+FCLASS=n	Service Class
+FRH=n	Receive data with HDLC framing
+FRM=n	Receive data
+FRS=n	Receive silence
+FTH=n	Transmit data with HDLC framing
+FTM=n	Transmit data
+FTS=n	Stop transmission and wait

Fax Class 2 commands

+FCLASS=n	Services class.
+FAA=n	Adaptive answer.
+FAXERR	Fax error value.
+FBOR	Phase C data bit order.
+FBUF?	Buffer size (read only).
+FCFR	Indicate confirmation to receive.
+FCLASS=	Service class.
+FCON	Facsimile connection response.
+FCIG	Set the polled station identification.
+FCIG:	Report the polled station identification.
+FCR	Capability to receive.
+FCR=	Capability to receive.
+FCSI:	Report the called station ID.
+FDCC=	DCE capabilities parameters.
+FDCS:	Report current session.
+FDCS=	Current session results.
+FDIS:	Report remote capabilities.
+FDIS=	Current sessions parameters.
+FDR	Begin or continue phase C receive data.
+FDT=	Data transmission.
+FDTC:	Report the polled station capabilities.
+FET:	Post page message response.
+FET=N	Transmit page punctuation.
+FHNG	Call termination with status.
+FK	Session termination.
+FLID=	Local ID string.
+FLPL	Document for polling.
+FMDL?	Identify model.
+FMFR?	Identify manufacturer.
+FPHCTO	Phase C time out.
+FPOLL	Indicates polling request.
+FPTS:	Page transfer status.
+FPTS=	Page transfer status.
+FREV?	Identify revision.
+FSPT	Enable polling.
+FTSI:	Report the transmit station ID.

Voice commands

#BDR	Select Baud Rate
#CID	Enable Caller ID detection and reporting format
#CLS	Select Data, Fax or Voice/Audio
#MDL?	Identify Model
#MFR?	Identify Manufacturer
#REV?	Identify Revision Level
#TL	Audio output transmit level
#VBQ?	Query Buffer Size
#VBS	Bits per sample (ADPCM or PCM)
#VBT	Beep Tone Timer
#VCI?	Identify Compression Method
#VLS	Voice line select
#VRA	Ringback goes away timer
#VRN	Ringback never came timer
#VRX	Voice Receive Mode
#VSDB	Silence deletion tuner
#VSK	Buffer skid setting
#VSP	Silence detection period
#VSR	Sampling rate selection
#VSS	Silence deletion tuner
#VTD	DTMF tone reporting capability
#VTM	Enable timing mark placement
#VTS	Generate tone signals
#VTX	Voice transmit mode

Attention Switzerland User:

If your Swisscom phone line does not have Taxsignal switched OFF, modem function may be impaired. The impairment may be resolved by a filter with the following specifications:

Telekom PTT SCR-BE
Taximpulssperrfilter-12kHz
PTT Art. 444.112.7
Bakom 93.0291.Z.N

Appendix B. System memory speed

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

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

DIMM size (capacity)	Number of DIMMs installed per CPU bank	Microprocessor model	Memory frequency
1 GB, 2 GB, 4 GB	1 to 3	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5520, E5530, E5540, E5620, E5603, E5606, E5607, E5630, E5640, E5647, W3503, W3505, W3520, W3530, W3540, W3550, W3565, W3670	1066 MHz
		Intel Xeon E5645, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W3570, W3580, W3680, W3690, W5580, W5590	1333 MHz
	4 to 6	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5520, E5530, E5540, E5620, E5603, E5606, E5607, E5630, E5640, E5647, X5550, X5560, X5570, W3503, W3505, W3520, W3530, W3540, W3550, W3565, W3570, W3580, W3670, W5580, W5590	1066 MHz
		Intel Xeon E5645, E5649, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W3680, W3690	1333 MHz

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

DIMM size (capacity)	Number of DIMMs installed per CPU bank	Microprocessor model	Memory frequency
1 GB, 2 GB, 4 GB	1 to 6	Intel Xeon E5502, E5503, E5504, E5506, E5507	800 MHz
		Intel Xeon E5520, E5530, E5540, E5620, E5603, E5606, E5607, E5630, E5640, E5645, E5647, E5649, X5550, X5560, X5570, X5650, X5660, X5667, X5670, X5672, X5675, X5677, X5680, X5687, X5690, W3503, W3505, W3520, W3530, W3540, W3550, W3565, W3570, W3580, W3670, W3680, W3690, W5580, W5590	1066 MHz

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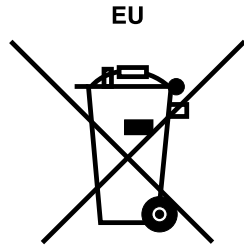
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