

IBM IntelliStation Z Pro Type 9228 and 9232



# Problem Determination and Service Guide



IBM IntelliStation Z Pro Type 9228 and 9232



# Problem Determination and Service Guide

**Note:**

Before using this information and the product it supports, read the general information in Appendix B, "Notices," on page 151 and the *Warranty and Support Information* documentation on the IBM *IntelliStation Documentation* CD.

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## Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

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

在安裝本產品之前，請仔細閱讀 **Safety Information**  
(安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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

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

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

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

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

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

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по  
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

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

Läs säkerhetsinformationen innan du installerar den här produkten.

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## Guidelines for trained service technicians

This section contains information for trained service technicians.

### Inspecting for unsafe conditions

Use the information in this section to help you identify potential unsafe conditions in an IBM product that you are working on. Each IBM product, as it was designed and manufactured, has required safety items to protect users and service technicians from injury. The information in this section addresses only those items. Use good judgment to identify potential unsafe conditions that might be caused by non-IBM alterations or attachment of non-IBM features or options that are not addressed in this section. If you identify an unsafe condition, you must determine how serious the hazard is and whether you must correct the problem before you work on the product.

Consider the following conditions and the safety hazards that they present:

- Electrical hazards, especially primary power. Primary voltage on the frame can cause serious or fatal electrical shock.
- Explosive hazards, such as a damaged CRT face or a bulging capacitor.
- Mechanical hazards, such as loose or missing hardware.

To inspect the product for potential unsafe conditions, complete the following steps:

1. Make sure that the power is off and the power cord is disconnected.
2. Make sure that the exterior cover is not damaged, loose, or broken, and observe any sharp edges.
3. Check the power cord:
  - Make sure that the third-wire ground connector is in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
  - Make sure that the power cord is the correct type, as specified in "Power cords" on page 26.
  - Make sure that the insulation is not frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the computer for any obvious unsafe conditions, such as metal filings, contamination, water or other liquid, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Make sure that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

### Guidelines for servicing electrical equipment

Observe the following guidelines when servicing electrical equipment:

- Check the area for electrical hazards such as moist floors, nongrounded power extension cords, and missing safety grounds.
- Use only approved tools and test equipment. Some hand tools have handles that are covered with a soft material that does not provide insulation from live electrical current.
- Regularly inspect and maintain your electrical hand tools for safe operational condition. Do not use worn or broken tools or testers.

- Do not touch the reflective surface of a dental mirror to a live electrical circuit. The surface is conductive and can cause personal injury or equipment damage if it touches a live electrical circuit.
- Some rubber floor mats contain small conductive fibers to decrease electrostatic discharge. Do not use this type of mat to protect yourself from electrical shock.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Locate the emergency power-off (EPO) switch, disconnecting switch, or electrical outlet so that you can turn off the power quickly in the event of an electrical accident.
- Disconnect all power before you perform a mechanical inspection, work near power supplies, or remove or install main units.
- Before you work on the equipment, disconnect the power cord. If you cannot disconnect the power cord, have the customer power-off the wall box that supplies power to the equipment and lock the wall box in the off position.
- Never assume that power has been disconnected from a circuit. Check it to make sure that it has been disconnected.
- If you have to work on equipment that has exposed electrical circuits, observe the following precautions:
  - Make sure that another person who is familiar with the power-off controls is near you and is available to turn off the power if necessary.
  - When you are working with powered-on electrical equipment, use only one hand. Keep the other hand in your pocket or behind your back to avoid creating a complete circuit that could cause an electrical shock.
  - When using a tester, set the controls correctly and use the approved probe leads and accessories for that tester.
  - Stand on a suitable rubber mat to insulate you from grounds such as metal floor strips and equipment frames.
- Use extreme care when measuring high voltages.
- To ensure proper grounding of components such as power supplies, pumps, blowers, fans, and motor generators, do not service these components outside of their normal operating locations.
- If an electrical accident occurs, use caution, turn off the power, and send another person to get medical aid.

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## Safety statements

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

For example, if a caution statement begins with a number 1, translations for that caution statement appear in the *IBM Safety Information* document under statement 1.

Be sure to read all caution and danger statements in this documentation before performing the instructions. Read any additional safety information that comes with your computer or optional device before you install the device.



**Statement 1:**



**DANGER**

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

**To avoid a shock hazard:**

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

**To Connect:**

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

**To Disconnect:**

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

**Statement 2:**



**CAUTION:**

When replacing the lithium battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

*Do not:*

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

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

**Statement 3:**



**CAUTION:**

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

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

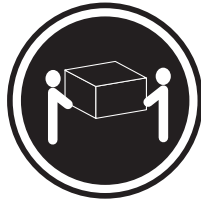


**DANGER**

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

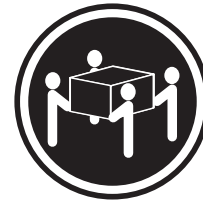
**Statement 4:**



≥ 18 kg (39.7 lb)



≥ 32 kg (70.5 lb)



≥ 55 kg (121.2 lb)

**CAUTION:**

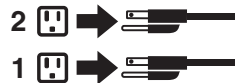
Use safe practices when lifting.

**Statement 5:**



**CAUTION:**

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



**Statement 8:**



**CAUTION:**

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



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

**Statement 26:**



**CAUTION:**

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



**Statement 27:**



**CAUTION:**

Hazardous moving parts are nearby.



**Statement 28:**



**CAUTION:**

The battery is a lithium ion battery. To avoid possible explosion, do not burn the battery. Exchange it only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call.

**Important:**

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



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## Chapter 1. Introduction

This *Problem Determination and Service Guide* contains information to help you solve problems that might occur in your IBM® IntelliStation® Z Pro Type 9228 and 9232 computers. It describes the diagnostic tools that come with the computer, error codes and suggested actions, and instructions for replacing failing components.

Replaceable components are of four types:

- **Consumable parts:** Purchase and replacement of consumable parts (components, such as batteries and printer cartridges, that have depletable life) is your responsibility. If IBM acquires or installs a consumable part at your request, you will be charged for the service.
- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.
- **Tier 2 customer replaceable unit:** You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.

For information about the terms of the warranty and getting service and assistance, see the *Warranty and Support Information* document on the IBM *IntelliStation Documentation CD*.

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## Related documentation

In addition to this document, the following documentation also comes with the computer:

- *Installation Guide*

This printed document contains instructions for setting up the computer. This document is also in Portable Document Format (PDF) on the IBM *IntelliStation Documentation CD*.

- *User's Guide*

This document is in PDF on the IBM *IntelliStation Documentation CD*. It contains general information about the computer, including information about features, and how to configure the computer. It also contains detailed instructions for installing, removing, and connecting optional devices that the computer supports.

- *Safety Information*

This document is in PDF on the IBM *IntelliStation Documentation CD*. It contains translated caution and danger statements. Each caution and danger statement that appears in the documentation has a number that you can use to locate the corresponding statement in your language in the *Safety Information* document.

- *Warranty and Support Information*

This document is in PDF on the IBM *IntelliStation Documentation CD*. It contains information about the terms of the warranty and getting service and assistance.

- Readme files on the *Device Drivers* CD  
Several readme files on this CD contain information about the preinstalled device drivers. Other readme files on this CD contain information about the various adapters and devices that might be installed in or attached to the computer.
- IBM *IntelliStation Documentation* CD  
This CD contains all of the IBM IntelliStation Z Pro Type 9228 and 9232 documents in Portable Document Format (PDF).

Depending on the computer model, additional documentation might be included on the IBM *IntelliStation Documentation* CD.

The computer might have features that are not described in the documentation that comes with the computer. The documentation might be updated occasionally to include information about those features, or technical updates might be available to provide additional information that is not included in the server documentation. These updates are available from the IBM Web site. To check for updated documentation and technical updates, complete the following steps.

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

1. Go to <http://www.ibm.com/support/>.
2. Under the **Search technical support** section, type 9228 or 9232, and click **Search**.

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## Notices and statements in this document

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

The following notices and statements are used in this document:

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



## Features and specifications

The following table provides a summary of the features and specifications of the computer. Depending on the model, some features might not be available, or some specifications might not apply.

Use the Configuration/Setup Utility program to determine the type and speed of the microprocessor.

*Table 1. Features and specifications*

<p><b>Microprocessor:</b></p> <ul style="list-style-type: none"> <li>• Supports up to two Intel® Xeon dual-core microprocessors</li> <li>• One 4 MB Level-2 cache</li> <li>• 1333 MHz front-side bus (FSB)</li> </ul> <p><b>Memory:</b></p> <ul style="list-style-type: none"> <li>• Minimum: 1 GB</li> <li>• Maximum: 32 GB (mirroring mode 16 GB)</li> <li>• Type: PC2-5300, 667 MHz, dual-data-rate 2 (DDR2) fully-buffered error correcting code (ECC)</li> <li>• Connectors: eight dual inline memory module (DIMM) connectors</li> </ul> <p><b>Internal drives:</b></p> <ul style="list-style-type: none"> <li>• Hard disk drive: SATA or SAS</li> <li>• One of the following drives: <ul style="list-style-type: none"> <li>– DVD/CD-RW combo: IDE</li> <li>– CD-RW: IDE</li> <li>– CD-ROM: IDE</li> <li>– DVD ROM: IDE</li> <li>– Multi-burner Plus: IDE</li> </ul> </li> </ul> <p><b>Expansion bays:</b></p> <ul style="list-style-type: none"> <li>• Two half-high 5.25-inch bays (optical drive installed in one bay)</li> <li>• Four slim-high 3.5-inch internal drive bays (one hard disk drive installed)</li> <li>• One slim-high 3.5-inch drive bay (optional diskette drive)</li> </ul> <p><b>PCI expansion slots:</b></p> <ul style="list-style-type: none"> <li>• One PCI Express x16 (x16) slot</li> <li>• One PCI Express x16 (x4) slot</li> <li>• One PCI Express x8 (x4) slot</li> <li>• One PCI 32-bit/33 MHz slot</li> <li>• Two PCI-X 64-bit 133 MHz slots</li> </ul> <p><b>Power supply:</b></p> <ul style="list-style-type: none"> <li>• One 815-watt power supply</li> </ul> <p><b>Cooling:</b></p> <ul style="list-style-type: none"> <li>• Six to eight speed-controlled fans and one power-supply fan</li> </ul>	<p><b>Integrated functions:</b></p> <ul style="list-style-type: none"> <li>• Broadcom BC5752KFB 10/100/1000 Ethernet controller with RJ-45 Ethernet connector</li> <li>• One serial connector</li> <li>• Four-port Serial ATA controller</li> <li>• Two IEEE 1394A (FireWire) ports (one on rear, one on front)</li> <li>• Seven Universal Serial Bus (USB) connectors (two on front, four on rear, and one internal)</li> <li>• Keyboard connector</li> <li>• Mouse connector</li> <li>• Audio connectors <ul style="list-style-type: none"> <li>– Line out (rear)</li> <li>– Mic (front and rear)</li> <li>– Line in (rear)</li> <li>– Headphone (front)</li> </ul> </li> <li>• Single-channel IDE controller</li> </ul> <p><b>Video adapter</b> (depending on the model):</p> <ul style="list-style-type: none"> <li>• NVIDIA Quadro NVS 285 (DMS-59), PCI Express x16, with 128 MB DDR2 SDRAM and dual analog connectors, (or dual digital monitor capability with the purchase of an additional pigtail cable)</li> <li>• NVIDIA Quadro FX 550 (DVI-I), PCI Express x16, with 128 MB GDDR3 synchronous dynamic random access memory (SDRAM) and dual DVI-I connectors</li> <li>• NVIDIA Quadro FX 1500 (dual-link DVI-I), PCI Express x16, with 256 MB GDDR3 SDRAM and two dual DVI-I connectors</li> <li>• NVIDIA Quadro FX 3500 (DVI-I), PCI Express x16, with 256 MB GDDR3 SDRAM and two dual DVI-I connectors</li> <li>• NVIDIA Quadro FX 4500 (DVI-I), PCI Express x16, with 512 MB GDDR3 SDRAM and two dual DVI-I connectors</li> </ul>	<p><b>Electrical input:</b></p> <ul style="list-style-type: none"> <li>• Sine-wave input (50 or 60 Hz) required</li> <li>• Input voltage and frequency ranges automatically selected</li> <li>• Input voltage low range: <ul style="list-style-type: none"> <li>– Minimum: 100 V ac</li> <li>– Maximum: 124 V ac</li> </ul> </li> <li>• Input voltage high range: <ul style="list-style-type: none"> <li>– Minimum: 200 V ac</li> <li>– Maximum: 240 V ac</li> </ul> </li> <li>• Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> <li>– Minimum: 0.03 kVA</li> <li>– Maximum: 1.24 kVA</li> </ul> </li> </ul> <p><b>Heat output:</b></p> <p>Approximate heat output in British thermal units (Btu) per hour:</p> <ul style="list-style-type: none"> <li>• Minimum configuration: 870 Btu per hour (255 watts)</li> <li>• Maximum configuration: 3495 Btu per hour (1025 watts)</li> </ul> <p><b>Environment:</b></p> <ul style="list-style-type: none"> <li>• Air temperature: <ul style="list-style-type: none"> <li>– Computer on: 10° to 35°C (50° to 95°F)</li> <li>Altitude: 0 to 2134 m (7000 ft)</li> <li>– Computer off: -40° to +60°C (-40° to +140°F)</li> <li>Maximum altitude: 2133 m (7000 ft)</li> </ul> </li> <li>• Humidity (operating and storage): 8% to 80%</li> </ul> <p><b>Acoustical noise emissions:</b></p> <ul style="list-style-type: none"> <li>• Sound power, idle: 4.3 bel (with SATA hard disk drive)</li> <li>• Sound power, operating: 5.3 bel</li> </ul> <p><b>Size:</b></p> <ul style="list-style-type: none"> <li>• Height: 467.3 mm (18.4 in.)</li> <li>• Depth: 492.7 mm (19.4 in.)</li> <li>• Width: 215.9 mm (8.5 in.)</li> <li>• Weight: 18.1 kg (40 lb) to 21.8 kg (48 lb) depending upon configuration</li> </ul>
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## Controls, LEDs, and connectors

This section describes the computer controls, light-emitting diodes (LEDs), and connectors.

### Front view

Figure 1 shows the controls, LEDs, and front connectors on the IntelliStation Z Pro Type 9228 and 9232 computers. See the *User's Guide* for an illustration and description of the input/output connectors on the rear of the computer.

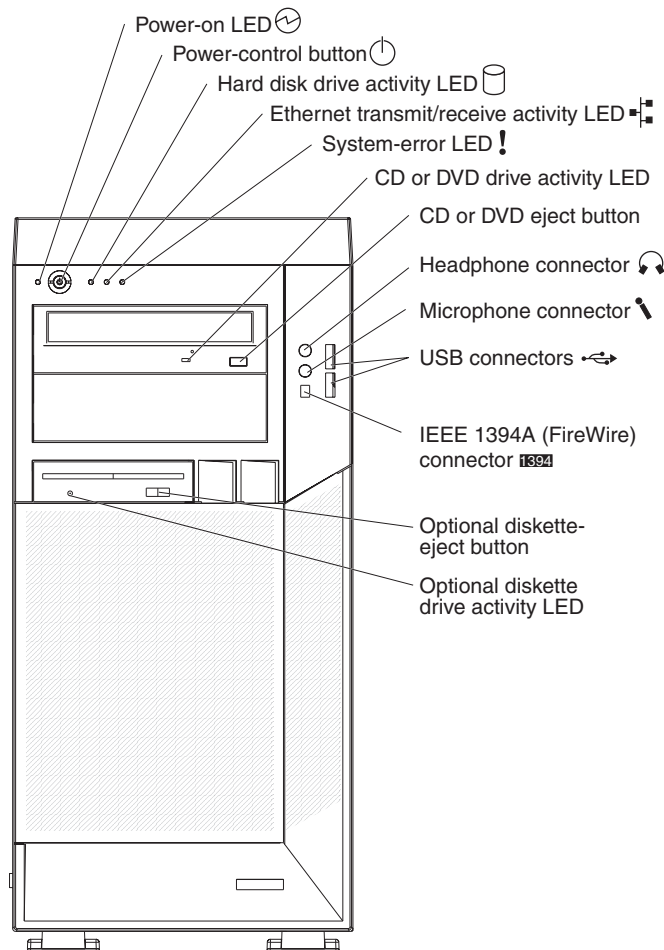


Figure 1. Controls, LEDs, and indicators

#### Power-on LED

When this LED is lit, it indicates that the computer is turned on.

#### Power-control button

Press this button to turn the computer on or off.

#### Hard disk drive activity LED

When this LED is lit, it indicates that the hard disk drive is in use.

#### Ethernet transmit/receive activity LED

When this LED is lit, it indicates that there is activity between the computer and the network. There are two of these LEDs, one on the front and one on the rear of the computer.

**System-error LED**

When this LED is lit, it indicates that a system error has occurred. An LED on the system board might also be lit to help isolate the error. If the LED on the system board is not lit, check the error log.

**CD or DVD drive activity LED**

When this LED is lit, it indicates that the CD or DVD drive is in use.

**CD or DVD eject button**

Press this button to insert a CD or DVD into or remove a CD or DVD from the CD or DVD drive.

**Headphone connector (green)**

Use this connector to send audio signals from the computer to external devices, such as speakers with built-in amplifiers, headphones, multimedia keyboards, or the audio line-in jack on a stereo system.

**Microphone connector (pink)**

Use this connector to connect a microphone to the computer when you want to record voices or other sounds on the hard disk. You can also use this connector (and a microphone) with speech-recognition software.

**USB connectors**

Use these connectors to connect USB devices to the computer, using redundant Plug and Play technology.

**IEEE 1394A (FireWire) connectors**

Use these connectors (four-pin on the front and six-pin on the rear) to connect FireWire devices, such as digital video cameras and external hard disk drives.

**Optional diskette-eject button**

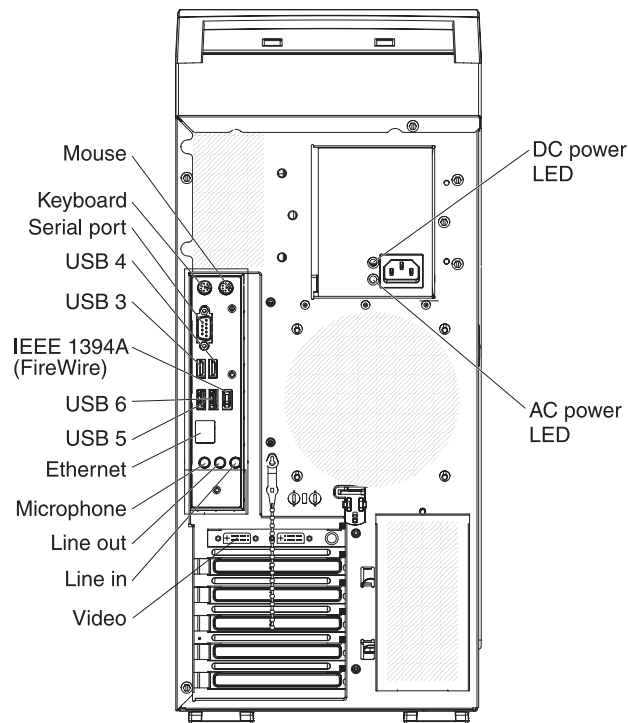
Press this button to release a diskette from the diskette drive.

**Optional diskette drive activity LED**

When this LED is lit, it indicates that the diskette drive is in use.

## Rear view

The following illustration shows the connectors and indicators on the rear of the computer.



#### **Mouse connector**

Connect a mouse device to this connector.

#### **Keyboard connector**

Connect a keyboard to this connector.

#### **Serial connector**

Connect a 9-pin serial device to this connector.

#### **USB 3 and 4 connectors**

Connect USB devices to these connectors.

#### **IEEE 1394A (FireWire) connector**

Use this connector (six-pin on the rear) to connect FireWire devices, such as digital video cameras and external hard disk drives.

#### **USB 5 and 6 connectors**

Connect USB devices to these connectors.

#### **Ethernet connector**

Use this connector to connect the computer to a network.

#### **Microphone connector (pink)**

Use this connector to connect a microphone to the computer when you want to record voices or other sounds on the hard disk drive. You can also use this connector (and a microphone) with speech-recognition software.

#### **Line out connector (green)**

Connect an audio output device, such as speakers, to this connector.

#### **Line in connector (blue)**

Connect an audio input device, such as stereo, to this connector.

#### **Video connector**

Connect a monitor to this connector.

**DC power LED**

On some computer models, each power supply has a dc power LED and an ac power LED. During typical operation, both the ac and dc power LEDs are lit.

**AC power LED**

On some computer models, each power supply has an ac power LED and a dc power LED. During typical operation, both the ac and dc power LEDs are lit.

**Power-cord connector**

Connect the power cord to this connector.

## Internal LEDs, connectors, and jumpers

The illustrations in this section show the LEDs, connectors, and jumpers on the system board. The illustrations might differ slightly from your hardware.

### System board option connectors

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

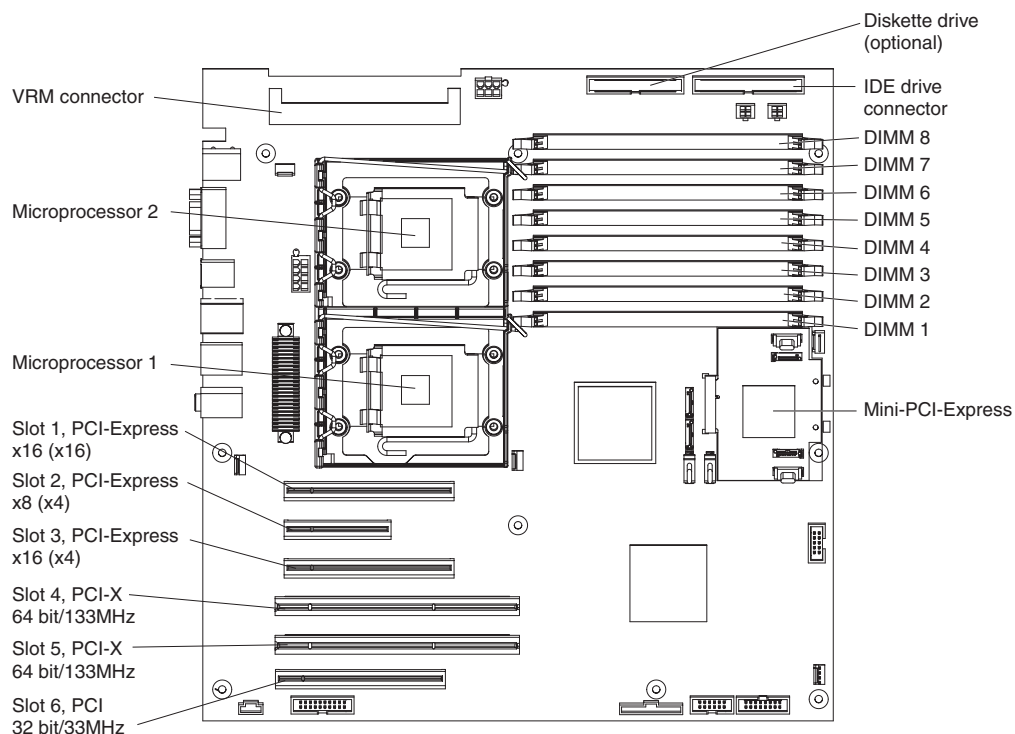


Figure 2. System board option connectors

## System board internal connectors

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

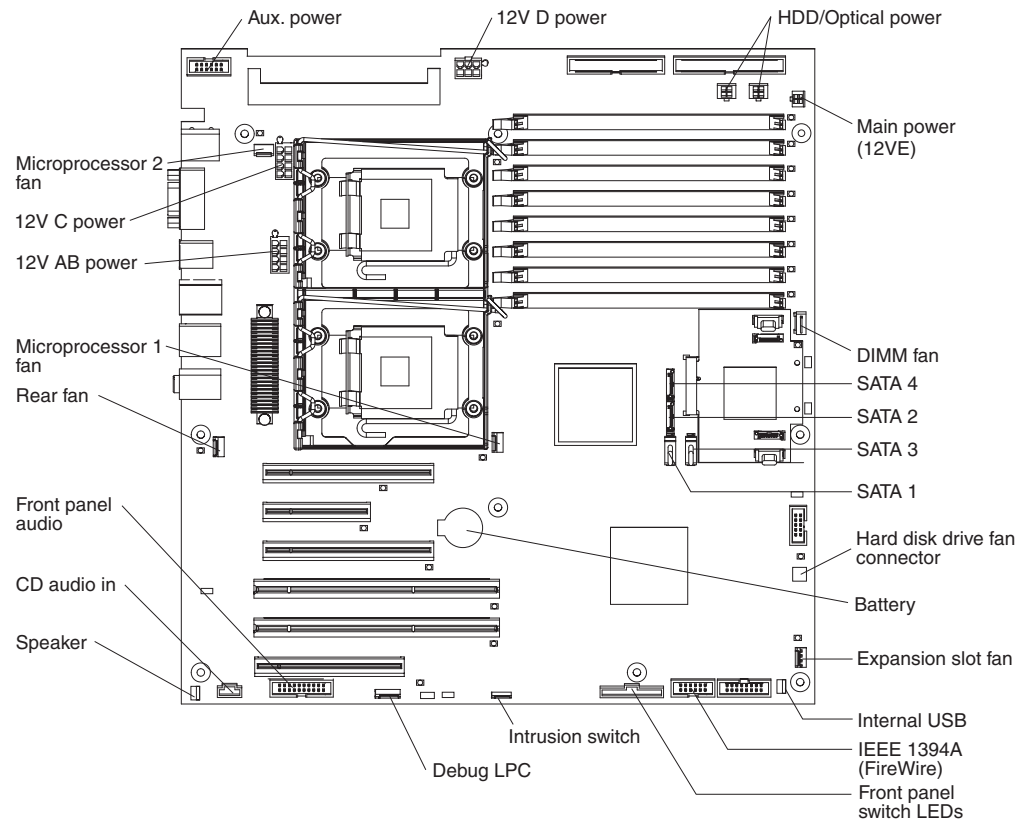


Figure 3. System board internal connectors

## System board external connectors

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

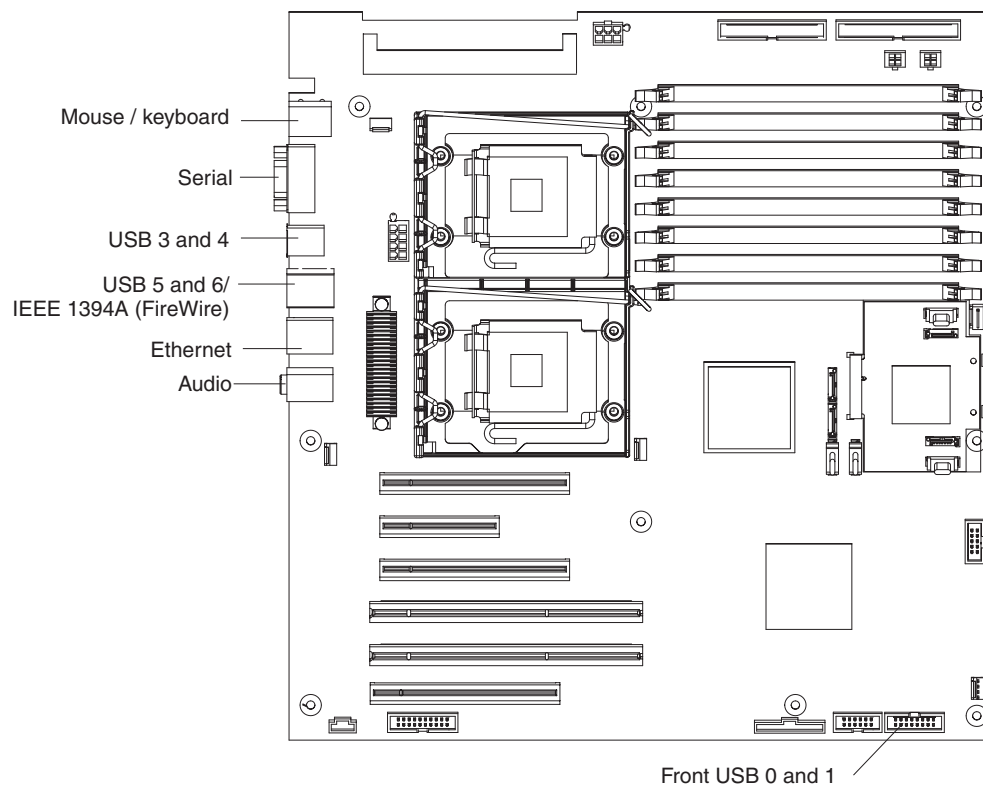
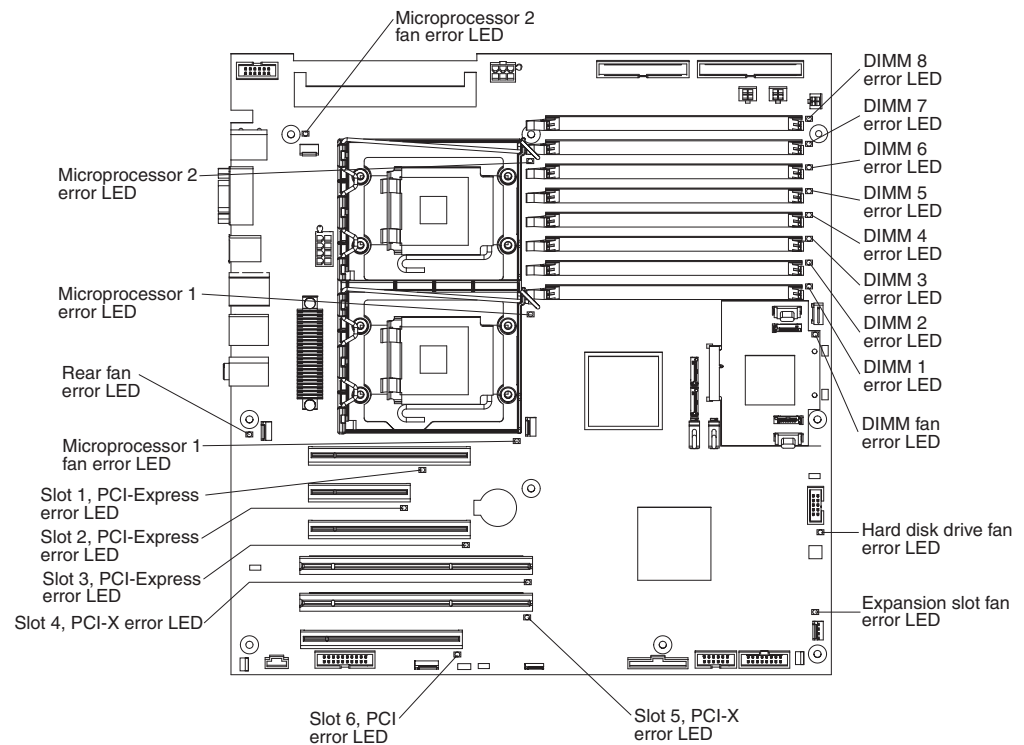


Figure 4. System board external connectors



## System board LEDs

The following illustration shows the system-board LEDs.



*Figure 5. System board LEDs*

Each error LED is lit to indicate a problem with a specific component. The error LEDs remain lit until the error log is cleared, this prevents false errors from going undetected. For information about how to correct the problems that are indicated by the error LEDs, see “System board error LEDs” on page 134.

## System board jumpers

The following illustration shows the jumper blocks on the system board.

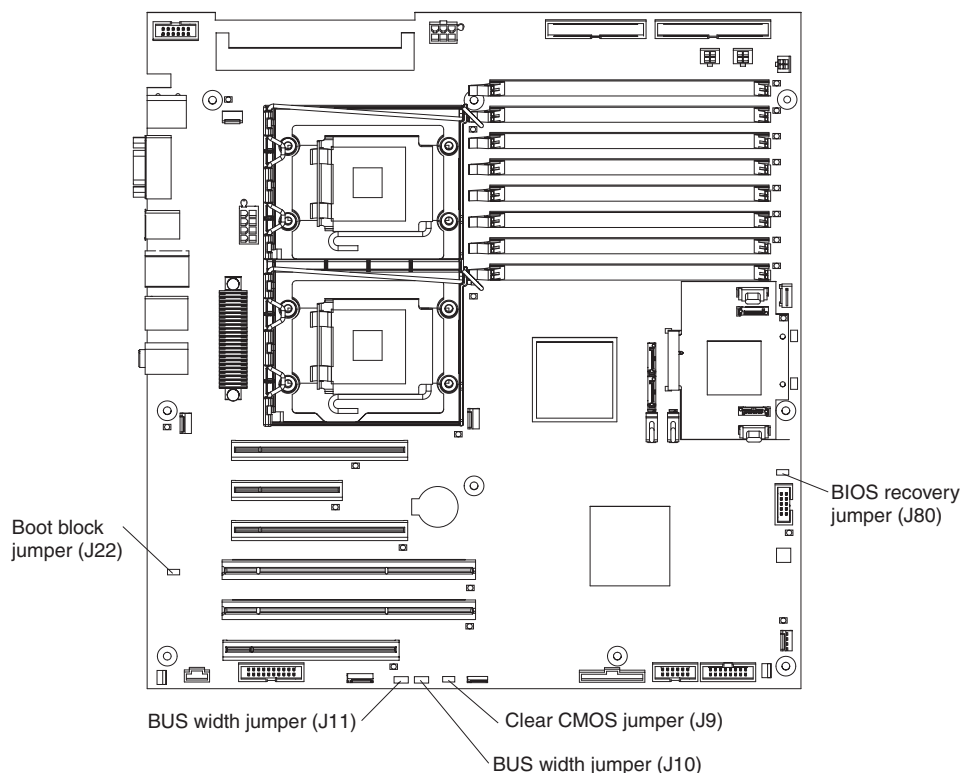


Figure 6. System board jumpers

Any jumper blocks on the system board that are not shown in the illustration are reserved.

Jumper	Settings
BIOS recovery (J80)	<ul style="list-style-type: none"> <li>Normal (default): jumper on pins 1 and 2.</li> <li>Boot block recovery: no jumper; see “Recovering from a BIOS update failure” on page 139 for more information.</li> </ul>
Boot block (J22)	<ul style="list-style-type: none"> <li>Normal (default): jumper on pins 1 and 2.</li> <li>Boot block recovery: no jumper; see “Recovering from a BIOS update failure” on page 139 for more information.</li> </ul>
Bus Width (J10)	<ul style="list-style-type: none"> <li>Normal default: jumper on pins 1 and 2.</li> <li>Set jumper on pins 2 and 3 to reroute the signals of slot 2 down to slot 3, therefore converting slot 3 to a PCI Express x8 slot.</li> </ul>
Bus Width (J11)	<ul style="list-style-type: none"> <li>Normal default: jumper on pins 2 and 3.</li> <li>Set jumper on pins 1 and 2 to reroute the signals of slot 2 down to slot 3, therefore converting slot 3 to a PCI Express x8 slot.</li> </ul>
Clear CMOS (J9)	<ul style="list-style-type: none"> <li>Keep CMOS data (default): jumper on pins 1 and 2.</li> <li>Clear CMOS data: jumper on pins 2 and 3 with power cords removed from the computer; see “Erasing a lost or forgotten password (clearing CMOS)” on page 145 for more information.</li> </ul>

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## Chapter 2. Configuration information and instructions

This chapter provides information about updating the firmware and using the configuration utilities.

Detailed information about configuring the computer is in the *User's Guide* on the IBM *IntelliStation Documentation* CD.

The latest information on these programs and the most recent device-driver files are available at <http://www.ibm.com/support/>.

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### Updating the firmware

The firmware for the computer is periodically updated and is available for download on the Web. Go to <http://www.ibm.com/support/> to get the latest level of firmware, such as BIOS code, vital product data (VPD) code, and device drivers.

When replacing devices in the computer, you might have to either update the computer with the latest version of the firmware stored on the system board or restore the pre-existing firmware from a diskette or CD image. The firmware code is stored as follows:

- BIOS code is stored in ROM on the system board.
- Ethernet firmware is stored in ROM on the Ethernet controller on the system board.
- Major components contain VPD code. You can select to update the VPD code when you update the BIOS code.

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### Configuring the computer

The following configuration programs are available to configure the computer:

- **Configuration/Setup Utility program**

The Configuration/Setup Utility program is part of the basic input/output system (BIOS) code in the computer. You can use this program to configure serial port assignments, change interrupt request (IRQ) settings, change the drive startup sequence, set the date and time, set passwords, and set the chassis-intrusion detector. For more information about using this utility program, see "Starting the Configuration/Setup Utility program" on page 14.

- **Boot Menu program**

The Boot Menu program is part of the BIOS code in the computer. Use it to temporarily assign a device to be first in the startup sequence, overriding the startup sequence that is set in the Configuration/Setup Utility program. For information about how to start the Boot Menu, see "Using the Boot Menu program" on page 14.

- **Broadcom NetXtreme Gigabit Ethernet Boot Agent**

The Broadcom NetXtreme Gigabit Ethernet Boot Agent is part of the BIOS code in the computer. You can use it to configure the network as a startable device, and you can customize where the network startup option appears in the startup sequence. You enable and disable the Broadcom NetXtreme Gigabit Ethernet Boot Agent from the Configuration/Setup Utility program. For information, see "Enabling the Broadcom NetXtreme Gigabit Ethernet Boot Agent" on page 15.

- **Broadcom NetXtreme Gigabit Ethernet controller configuration**

To configure the integrated Gigabit Ethernet controller, see “Configuring the Broadcom NetXtreme Gigabit Ethernet controller” on page 15.

- **LSI Logic Configuration Utility program**

Use the LSI Logic Configuration Utility program to configure the integrated SAS controller with RAID capabilities and the devices that are attached to it. For information about using this program, see “LSI Logic Configuration Utility program” on page 15.

See the *User's Guide* on the IBM *IntelliStation Documentation* CD for detailed instructions for using the configuration programs.

The following sections provide the instructions for starting the utility programs.

## Starting the Configuration/Setup Utility program

Configuration/Setup is a menu-driven utility that is part of the BIOS code in the computer. You can use it to:

- Configure serial connector assignments
- Change the startup sequence
- Enable USB keyboard and mouse support
- Resolve configuration conflicts
- Set the date and time
- Set an administrator password

To start the Configuration/Setup Utility program, complete the following steps:

1. Turn on the computer and watch the monitor screen. If the computer is already on when you start this procedure, you must shut down the operating system, turn off the computer, wait a few seconds until all in-use LEDs are turned off, and restart the computer.
2. When the message Press F1 for Configuration/Setup, Press F12 for Boot Menu appears on the screen during startup, press F1. (This prompt appears on the screen for only a few seconds. You must press F1 quickly.) If you have set both a user password and an administrator password, you must type the administrator password to access the full Configuration/Setup Utility menu.
3. Follow the instructions on the screen.

## Using the Boot Menu program

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

To use the Boot Menu program to change the startup sequence of the computer, complete the following steps:

1. Turn off the computer.
2. Restart the computer.
3. Press F12.
4. Select the startup device.

The next time the computer is started, it returns to the startup sequence that is set in the Configuration/Setup Utility program.

## Enabling the Broadcom NetXtreme Gigabit Ethernet Boot Agent

The Broadcom NetXtreme Gigabit Ethernet Boot Agent is part of the BIOS code in the computer. You can use it to configure the network as a startable device, and you can customize where the network startup option appears in the startup sequence. You enable and disable the Broadcom NetXtreme Gigabit Ethernet Boot Agent from the Configuration/Setup Utility program.

To enable the Broadcom NetXtreme Gigabit Ethernet boot agent, complete the following steps:

1. From the Configuration/Setup Utility main menu, select **Devices and I/O Ports** and press Enter.
2. Select **Planar Ethernet** and use the Right Arrow (→) key to set it to **Enabled**.
3. Set the network-planar device as the first startup device under the **Startup Option → Startup Sequence Options** menu choice in the Configuration/Setup Utility program.
4. Select **Save Settings** and press Enter.

## Configuring the Broadcom NetXtreme Gigabit Ethernet controller

The Ethernet controller is integrated on the system board. It provides an interface for connecting to a 10-Mbps, 100-Mbps, or 1-Gbps network and provides full duplex (FDX) capability, which enables simultaneous transmission and reception of data on the network. If the Ethernet port in the computer supports auto-negotiation, the controller detects the data-transfer rate (10BASE-T, 100BASE-TX, or 1000BASE-T) and duplex mode (full-duplex or half-duplex) of the network and automatically operates at that rate and mode.

You do not have to set any jumpers or configure the controller. However, you must install a device driver to enable the operating system to address the controller. For device drivers and information about configuring the Gigabit Ethernet controller, see <http://www.ibm.com/support/>.

## LSI Logic Configuration Utility program

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

- Use the LSI Logic Configuration Utility program to perform the following tasks:
  - Perform a low-level format on a SAS hard disk drive
  - Set SAS protocol parameters

In addition, you can download an LSI command-line configuration program from <http://www.ibm.com/support/>.

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

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

Use this option to create an integrated mirror enhanced array of three to eight disks, including an optional hot spare.

- Integrated Striping (IS) (also known as RAID 0)

Use this option to create an integrated striping array of two to eight disks. All data on the array disk will be deleted.

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

## Using the LSI Logic Configuration Utility program

Use the LSI Logic Configuration Utility program to perform the following tasks:

- Perform a low-level format of a SAS hard disk drive
- Create an array of SAS hard disk drives with or without a hot-spare drive
- Set SAS protocol parameters on SAS hard disk drives

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

The following sections provide instructions for starting the LSI Logic Configuration Utility program and performing selected functions.

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

1. Turn on the computer.
2. When the prompt <<< Press <CTRL><C> to start LSI Logic Configuration Utility >>> appears, press Ctrl+C. If you have set an administrator password, you are prompted to type the password.
3. To select a controller (channel) from the list of adapters, use the arrow keys and press Enter.
4. To change the settings of the selected items, follow the instructions on the screen. If you select **Raid Properties**, **SAS Topology**, or **Advanced Adapter Properties** additional screens are displayed.

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

**Formatting a SAS hard disk drive:** Low-level formatting removes all data from the hard disk. If there is data on the disk that you want to save, back up the hard disk before performing this procedure.

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

To format a drive, complete the following steps:

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

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

1. From the list of adapters, select the controller (channel) for the drives that you want to mirror.
2. Select **RAID Properties**.
3. Select the type of array you want to create from the list.
4. Use the arrow keys to highlight the first drive in the pair; then, press the Minus (-) or Plus (+) key to change the mirror value to **Primary**.
5. Continue to select the next drive using the Minus (-) or Plus (+) key until you have all the drives for your array.
6. Press C to create the disk array.
7. Select **Apply changes and exit menu** to create the array.





## Chapter 3. Parts listing, Type 9228 and 9232

The following replaceable components are available for the IntelliStation Z Pro Type 9228 and 9232 computers, except as specified otherwise in Table 2 on page 20. To check for an updated parts listing on the Web, complete the following steps:

1. Go to <http://www.ibm.com/support/>.
2. Under **Search technical support**, type 9228 or 9232 and click **Search**.
3. Under **Document type**, select **Parts information** and click **Go**.

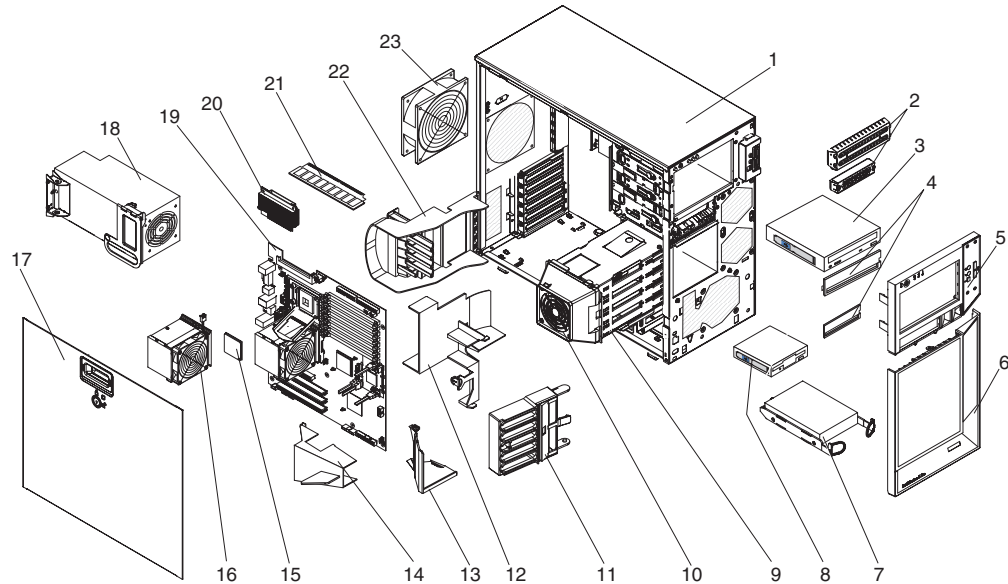


Figure 7. Type 9228 and 9232 parts

## Replaceable computer components

Replaceable components are of four types:

- **Consumable parts:** Purchase and replacement of consumable parts (components, such as batteries and printer cartridges, that have depletable life) is your responsibility. If IBM acquires or installs a consumable part at your request, you will be charged for the service.
- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.
- **Tier 2 customer replaceable unit:** You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.

For information about the terms of the warranty and getting service and assistance, see the *Warranty and Support Information* document.

Table 2. Part listing, Type 9228 and 9232

Index	Description	CRU part number (Tier 1)	CRU part number (Tier 2)	FRU part number
1	Chassis assembly (all models)			39R9394
2	Shield kit, 3.5 inches and 5.25 inches (all models)	13N2997		
3	CD-ROM drive, 48X (optional)	39M3511		
3	CD-RW/DVD-ROM combo drive, 48X (models 84x, 86x, 92x, 94x, 96x, 98x)	39M0135		
3	DVD ROM drive, (16/48X) (models 62x, 72x, 74x, 76x, 82x)	39M3569		
3	CD-ROM drive, Rambo (optional)	42C0951		
3	CD-ROM drive, Rambo (optional)	42C0953		
4	Bezel blanks (all models)	13N2450		
5	Upper bezel (all models)	39R9395		
6	Lower bezel (all models)	39R9337		
7	Hard disk drive, (160 GB) (models 62x, 72x, 74x, 76x, 84x, 86x, 92x)		39M4507	
7	Hard disk drive, (73 GB) (models 82x, 94x, 96x, 98x)		39R7360	
7	Hard disk drive, SATA, 80 GB (optional)		39M4503	
7	Hard disk drive, SATA, 250 GB, (optional)		39M4511	
7	Hard disk drive, SATA, 500 GB, (optional)		39M4517	
7	Hard disk drive, SAS, 73 GB, 10 K, (optional)		39R7352	
7	Hard disk drive, SAS, 146 GB, 10 K, (optional)		39R7354	
7	Hard disk drive, SAS, 300 GB 10 K, (optional)		39R7356	
7	Hard disk drive, SAS, 36 GB, 15 K, (optional)		39R7358	
7	Hard disk drive, SAS, 146 GB, 15 K, (optional)		39R7362	
8	Diskette drive (optional) (all models)	33P3343		
9	Hard disk drive cage (all models)			39Y9858

Table 2. Part listing, Type 9228 and 9232 (continued)

Index	Description	CRU part number (Tier 1)	CRU part number (Tier 2)	FRU part number
10	Fan assembly, DASD cage, 80 x 38 (all models)		42C7484	
11	Front adapter-retention bracket (all models)		39R9382	
12	DIMM airflow guide (all models)			39Y9860
13	DIMM air baffle (all models)		39Y9731	
14	Core-chip air baffle (all models)		42C7500	
15	Microprocessor, dual core, 3.0 GHz (models 92x, 94x, 96x, 98x)			42D1372
15	Microprocessor, dual core, 2.66 GHz (models 82x, 84, 86x)			42D1382
15	Microprocessor, dual core, 2.33 GHz (models 72x, 74x, 76x)			42D1384
15	Microprocessor, dual core, 2.0 GHz (model 62x)			42D1386
15	Microprocessor, dual core, 3.0 GHz (optional)			42C4226
16	Fan-sink retention module (all models)			39M6783
17	Cover, side (all models)	25R8859		
18	Power supply 815 (models 62x, 72x, 74x, 76x, 82x, 84x, 86x, 92x, 94x, 96x, 98x)			39Y7272
19	System board (all models)			43W9213
20	Voltage regulator module (all models)	24R2694		
21	Memory, 512 MB, 667 MHz, PC2-5300 ECC (models 64x, 68x, 84x, 86x, 92x, 96x, 98x, 62x, 72x, 74x, 76x)	39M5781		
22	Rear adapter retention bracket (all models)			13N2994
23	System fan, rear 120 x 38 (all models)		42C7482	
	C2 security cable (all models)		39Y9783	
	Cable, ATA, 2-drop (all models)		13N2466	
	Cable, audio (all models)		13N2999	
	Cable, CD-ROM audio (all models)	39Y9718		
	Cable, dongle (models 72x, 86x)	25R9043		
	Cable, dual VGA (models 62x, 74x, 76x, 82x, 84x, 92x, 94x, 96x, 98x)	25R9045		
	Cable, DVI pigtail (optional)	25R9048		
	Cable, IEEE 1394A (FireWire) (all models)		26K7302	
	Cable, power 2 x 2 diskette drive (all models)			42C8934
	Cable, SATA 4-drop (models 62x, 72x, 74x, 76x, 82x, 84x, 86x, 92x, 94x, 96x, 98x)			39R9405
	Cable, USB 2.0 (all models)		26K6096	
	Card, IEEE 1394A (FireWire) (all models)		39Y9700	
	Control panel (all models)		39Y9722	
	Device retainers (all models)	39R9369		
	Cover, top and side (all models)		13N2447	
	EMC shield (system board) (all models)			39R9392
	Expansion slot fan, 92 x 38 mm (all models)		13N2967	
	Fan assembly, DIMM, 80 x 38 (all models)		42C7484	

Table 2. Part listing, Type 9228 and 9232 (continued)

Index	Description	CRU part number (Tier 1)	CRU part number (Tier 2)	FRU part number
	Fan-sink fan, 80 mm (all models)			39Y9832
	Front-panel assembly (all models)		39Y7157	
	Handle cap assembly (all models)	13N2996		
	Hard disk drive backplate (all models)	25R8842		
	Hard disk drive carrier (all models)			42C7495
	Hard disk drive tray assembly (optional)	43X0817		
	Hardware kit, miscellaneous items (all models)		39Y9773	
	3U SCSI adapter (optional)	43W4325		
	Line cord (type 9232, model 96x)	39M5179		
	Keyboard (all models)	40K9430		
	Keylock, key-alike (optional)		26K7363	
	Keylock, key-random (all models)		26K7364	
	Memory, 1 GB, 667 MHz, PC2-5300 ECC (optional)	39M5784		
	Memory, 2 GB, 667 MHz, PC2-5300 ECC (optional)	39M5790		
	Memory, 4 GB, 667 MHz, PC2-5300 ECC (optional)	41Y2845		
	Mini-PCI Express adapter (models 82x, 94x, 96x, 98x)		43W8269	
	Mouse (type 9228, all models)	39Y9876		
	Mouse (type 9232, model 96x)	40K9203		
	Panel mount (all models)		39R9403	
	Speaker assembly (all models)			39Y9720
	System feet (all models)	13N2985		
	System service label (all models)	39R9331		
	Video card, NVIDIA Quadro NVS 285 (models 72x, 86x)	13M8493		
	Video card, NVIDIA Quadro FX 550 (models 44x, 62x, 74x)	13M8461		
	Video card, NVIDIA Quadro FX 1500 (models 76x, 84x, 92x)	13M8479		
	Video card, NVIDIA Quadro FX 3500 (models 82x, 94x, 96x)	13M8457		
	Video card, NVIDIA Quadro FX 4500 (models 68x, 98x)	13M8429		
	Video card, NVIDIA Quadro FX 4600 (optional)	43V5756		

Consumable parts are not covered by the IBM Statement of Limited Warranty. The following consumable part is available for purchase from the retail store.

Table 3. Consumable parts

Description	Part number
Battery, 3.0 volt (all models)	33F8354

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## Keyboards (USB)

Table 4. Keyboards

Keyboard	CRU part number
Arabic (253)	42C0061
Arabic/French (462)	42C0062
Belgium/French (120)	42C0063
Belgium/UK (120)	42C0064
Brazil/Portuguese (275)	42C0065
Bulgarian (442)	42C0066
Chinese/US (467)	42C0067
Czech ABB	42C0068
Danish (159)	42C0069
Dutch (143)	42C0070
English, US (103P)	42C0060
English, UK (166)	42C0098
English, US-EMEA (103P)	42C0099
French (189)	42C0071
French Canadian (445)	42C0072
French Canadian (058)	42C0073
German (129)	42C0074
Greek (319)	42C0075
Hebrew (212)	42C0076
Hungarian (208)	42C0077
Icelandic (197)	42C0078
Italian (141)	42C0079
Italian (142)	42C0080
Japanese (194)	42C0081
Korean (413)	42C0082
Norwegian (155)	42C0084
Polish (214)	42C0085
Portuguese (163)	42C0086
Romanian (96)	42C0087
Russian (443)	42C0088
Russian/Cyrillic (441)	42C0089
Serbian/Cyrillic (118)	42C0090
Slovic (245)	42C0091
Spanish (172)	42C0092
Spanish, Latin American (171)	42C0083
Swedish/Finnish (153)	42C0093
Swiss, F/G (150)	42C0094
Thailand (191)	42C0095

Table 4. Keyboards (continued)

Keyboard	CRU part number
Turkish (440)	42C0096
Turkish (179)	42C0097
Yugoslavian/Latin (234)	42C0100

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## Product recovery CDs

Table 5. Recovery CDs

Operating system, Language, Language code	CRU part number
Windows XP, English (EN)	42D2546
Windows XP, French (FR)	42D2547
Windows XP, German (GR)	42D2548
Windows XP, Italian (IT)	42D2549
Windows XP, Spanish (SP)	42D2550
Windows XP, Danish (DK)	42D2551
Windows XP, Dutch (NL)	42D2552
Windows XP, Norwegian (NO)	42D2553
Windows XP, Finnish (FI)	42D2554
Windows XP, Swedish (SV)	42D2555
Windows XP, Japanese (JP)	42D2556
Windows XP, Korean (KR)	42D2557
Windows XP, Chinese - Simplified (CS)	42D2558
Windows XP, Hong Kong (HK)	42D2559
Windows XP, Chinese - Traditional (CT)	42D2560
Windows XP 64-bit, English (EN)	42D2537
Windows XP 64-bit, Japanese (JP)	42D2538

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## Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

IBM power cords for a specific country or region are usually available only in that country or region.

IBM power cord part number	Used in these countries and regions
02K0546	China
13F9940	Australia, Fiji, Kiribati, Nauru, New Zealand, Papua New Guinea
13F9979	Afghanistan, Albania, Algeria, Andorra, Angola, Armenia, Austria, Azerbaijan, Belarus, Belgium, Benin, Bosnia and Herzegovina, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Democratic Republic of), Congo (Republic of), Cote D'Ivoire (Ivory Coast), Croatia (Republic of), Czech Republic, Dahomey, Djibouti, Egypt, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, French Guyana, French Polynesia, Germany, Greece, Guadeloupe, Guinea, Guinea Bissau, Hungary, Iceland, Indonesia, Iran, Kazakhstan, Kyrgyzstan, Laos (People's Democratic Republic of), Latvia, Lebanon, Lithuania, Luxembourg, Macedonia (former Yugoslav Republic of), Madagascar, Mali, Martinique, Mauritania, Mauritius, Mayotte, Moldova (Republic of), Monaco, Mongolia, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Reunion, Romania, Russian Federation, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Slovakia, Slovenia (Republic of), Somalia, Spain, Suriname, Sweden, Syrian Arab Republic, Tajikistan, Tahiti, Togo, Tunisia, Turkey, Turkmenistan, Ukraine, Upper Volta, Uzbekistan, Vanuatu, Vietnam, Wallis and Futuna, Yugoslavia (Federal Republic of), Zaire
13F9997	Denmark
14F0015	Bangladesh, Lesotho, Macao, Maldives, Namibia, Nepal, Pakistan, Samoa, South Africa, Sri Lanka, Swaziland, Uganda



<b>IBM power cord part number</b>	<b>Used in these countries and regions</b>
14F0033	Abu Dhabi, Bahrain, Botswana, Brunei Darussalam, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Dominica, Gambia, Ghana, Grenada, Iraq, Ireland, Jordan, Kenya, Kuwait, Liberia, Malawi, Malaysia, Malta, Myanmar (Burma), Nigeria, Oman, Polynesia, Qatar, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Seychelles, Sierra Leone, Singapore, Sudan, Tanzania (United Republic of), Trinidad and Tobago, United Arab Emirates (Dubai), United Kingdom, Yemen, Zambia, Zimbabwe
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Italy, Libyan Arab Jamahiriya
14F0087	Israel
1838574	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Caicos Islands, Canada, Cayman Islands, Costa Rica, Colombia, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Japan, Mexico, Micronesia (Federal States of), Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Taiwan, United States of America, Venezuela
24P6858	Korea (Democratic People's Republic of), Korea (Republic of)
34G0232	Japan
36L8880	Argentina, Paraguay, Uruguay
49P2078	India
49P2110	Brazil
6952300	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Caicos Islands, Canada, Cayman Islands, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Mexico, Micronesia (Federal States of), Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Thailand, Taiwan, United States of America, Venezuela



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## Chapter 4. Removing and replacing computer components

Replaceable components are of four types:

- **Consumable parts:** Purchase and replacement of consumable parts (components, such as batteries and printer cartridges, that have depletable life) is your responsibility. If IBM acquires or installs a consumable part at your request, you will be charged for the service.
- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.
- **Tier 2 customer replaceable unit:** You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.

See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine whether a component is a Tier 1 CRU, Tier 2 CRU, or FRU.

For information about the terms of the warranty and getting service and assistance, see the *Warranty and Support Information* document.

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### Installation guidelines

Before you remove or replace a component, read the following information:

- Read the safety information that begins on page vii and “Handling static-sensitive devices” on page 30. This information will help you work safely.
- Observe good housekeeping in the area where you are working. Place removed covers and other parts in a safe place.
- If you must start the computer while the cover is removed, make sure that no one is near the computer and that no tools or other objects have been left inside the computer.
- Do not attempt to lift an object that you think is too heavy for you. If you have to lift a heavy object, observe the following precautions:
  - Make sure that you stand safely without slipping.
  - Distribute the weight of the object equally between your feet.
  - Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
  - To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Make sure that you have an adequate number of properly grounded electrical outlets for the computer, monitor, and other devices.
- Back up all important data before you make changes to disk drives.
- Have a small flat-blade screwdriver available.
- When you have to access the inside of the computer, you might find it easier to lay the computer on its side.
- Blue on a component indicates touch points, where you can grip the component to remove it from or install it in the computer, open or close a latch, and so on.
- When you are finished working on the computer, reinstall all safety shields, guards, labels, and ground wires.

- For a list of supported options for the computer, see <http://www.ibm.com/pc/compat/>.

## System reliability guidelines

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

- Each of the drive bays has a drive or a filler panel and electromagnetic compatibility (EMC) shield installed in it.
- There is adequate space around the computer to allow the computer cooling system to work properly. Leave approximately 50 mm (2 in.) of open space around the front and rear of the computer. Do not place objects in front of the fans. For proper cooling and airflow, replace the computer cover before turning on the computer. Operating the computer for extended periods of time (more than 30 minutes) with the computer cover removed might damage computer components.
- You have followed the cabling instructions that come with optional adapters.
- You have replaced a failed fan as soon as possible.

## Handling static-sensitive devices

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

### Notes:

1. If you are instructed to return a device or component, follow all packaging instructions. Use any packaging materials for shipping that are supplied to you.
2. Use product-specific electrostatic-discharge procedures when they exceed the requirements that are specified in this document.
3. Make sure that the electrostatic-discharge-protective devices that you use have been certified (ISO-9000) as fully effective.

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

- Limit your movement. Movement can cause static electricity to build up around you.
- The use of a grounding system is recommended. For example, wear an electrostatic-discharge wrist strap, if one is available.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and damage it.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the computer for at least 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into the computer without setting down the device. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on the computer cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

## Returning a device or component

If you are instructed to return a device or component, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

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## Removing and replacing consumable parts and Tier 1 CRUs

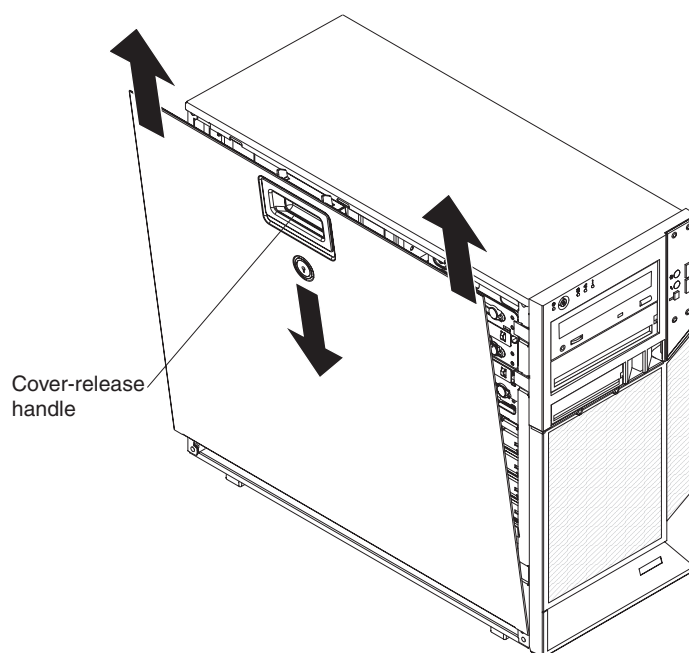
Replacement of consumable parts and Tier 1 CRUs is your responsibility. If IBM installs a consumable part or Tier 1 CRU at your request, you will be charged for the installation.

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

## Removing the side cover

To remove the side cover, you might find it easier to lay the computer on its side.

To remove the side cover, complete the following steps.



*Figure 8. Removing the side cover*

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices.
3. Disconnect all external cables and power cords.
4. Unlock the side cover.
5. Press down on the cover-release handle; then, pull the cover straight up (see Figure 8). Lift the side cover off the computer and set it aside.

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

## Installing the side cover

To install the side cover, complete the following steps.

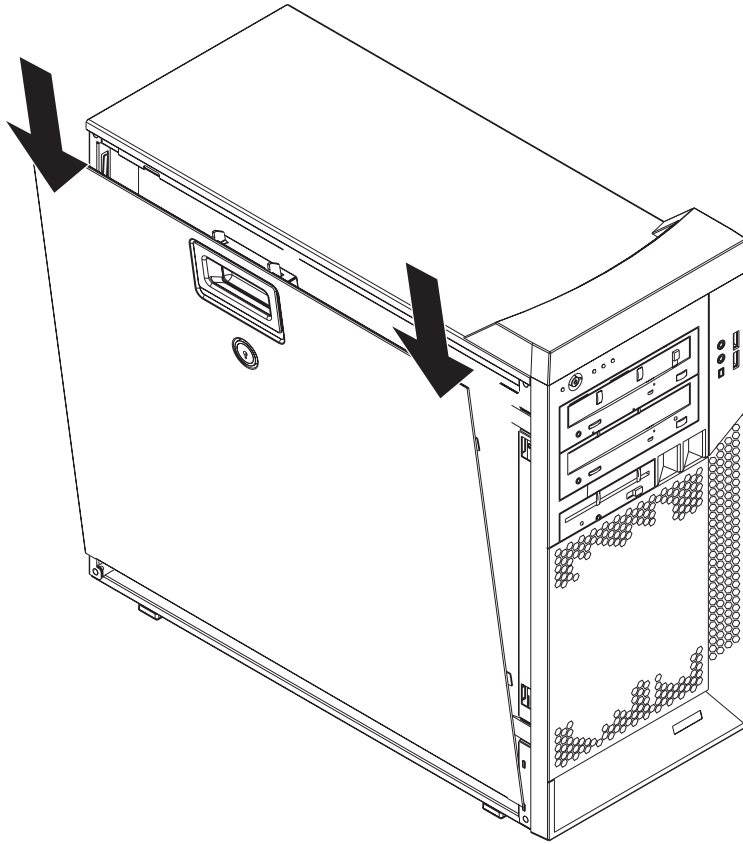


Figure 9. Installing the side cover

**Note:** The rear adapter-retaining bracket rests against the computer side cover. You might find it easier to lay the computer on its side to install the side cover.

1. Make sure that:
  - All cables, adapters, and other components are installed and seated correctly.
  - You have removed all work tools or parts from inside the computer.
  - The cover-release latch is in the unlocked (opened) position before you install the side cover.
2. If you removed the bezel, reinstall it before you install the side cover (see “Installing the two-piece bezel” on page 35).
3. Insert the tabs inside the cover into the slots on the chassis (see Figure 9).

**Note:** Make sure that each tab on the side cover is in its corresponding slot before closing the cover-release latch.

4. Close the cover-release latch to secure the side cover in place.
5. Lock the side cover, if you unlocked it during removal.
6. Reconnect the external cables and power cords to the computer; then, connect the power cords to electrical outlets.
7. Turn on the attached devices; then, turn on the computer.

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

## Removing the two-piece bezel

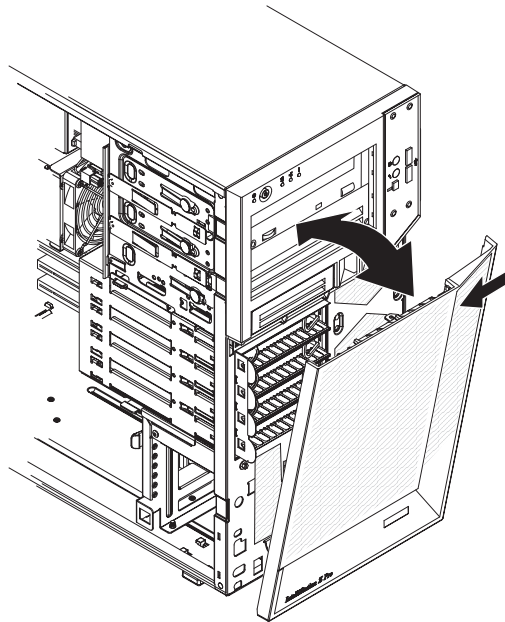
When working with some devices, such as additional optical drives, you must first remove the two-piece bezel to access the device.

### Notes:

1. Before you remove the upper bezel, you must first remove the lower bezel.
2. If you are only removing the lower bezel, you do not have to remove the side cover. However, the side cover must be unlocked.

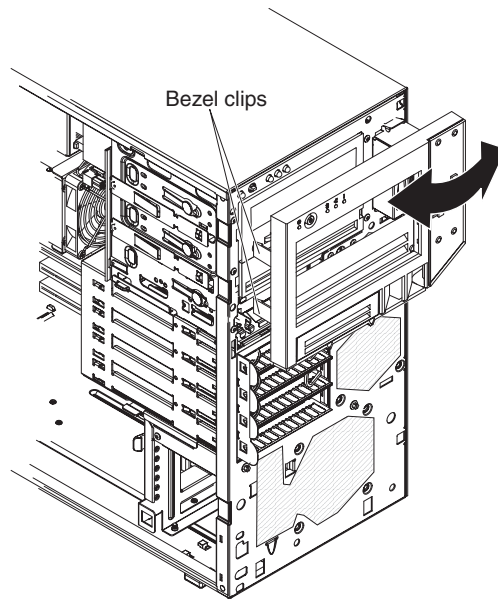
To remove the two-piece bezel, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove the lower bezel.



*Figure 10. Removing the lower bezel*

- a. Press the round blue release button on the upper-right side of the lower bezel.
  - b. Tilt the lower bezel forward; then, lift it up to disengage the bottom tabs from the chassis. Store the bezel for future use.
5. Remove the upper bezel.



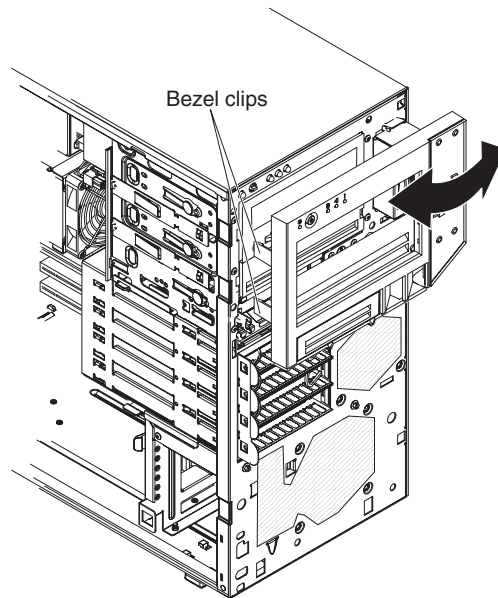
*Figure 11. Removing the upper bezel*

- a. Carefully pull the two bezel clips on the left side of the upper bezel away from the chassis.
- b. Rotate the upper bezel to the right side of the computer to disengage the two right-side tabs from the chassis. Store the bezel for future use.



## Installing the two-piece bezel

To install the two-piece bezel, complete the following steps.



*Figure 12. Installing the upper bezel*

1. Install the upper bezel on the front of the computer chassis:
  - a. Insert the two right-side tabs on the upper bezel into the matching holes on the right side of the chassis.
  - b. Rotate the upper bezel to the left side of the chassis and press the bezel clips into the matching indentations on the left side of the chassis until the bezel clips snap into place.
2. Install the lower bezel on the front of the computer.

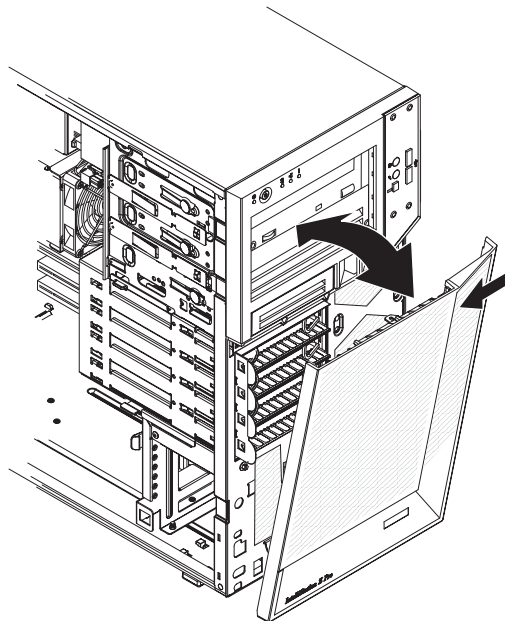


Figure 13. Installing the lower bezel

- a. Insert the two bottom tabs on the lower bezel into the matching holes in the front of the chassis.
- b. Tilt the top of the lower bezel into position on the chassis until the lower bezel locks securely into place.
3. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing an adapter

This section describes the removal of adapters in the PCI Express slots, PCI-X slots 4 and 5, and PCI slot 6.

To remove an adapter, complete the following steps.

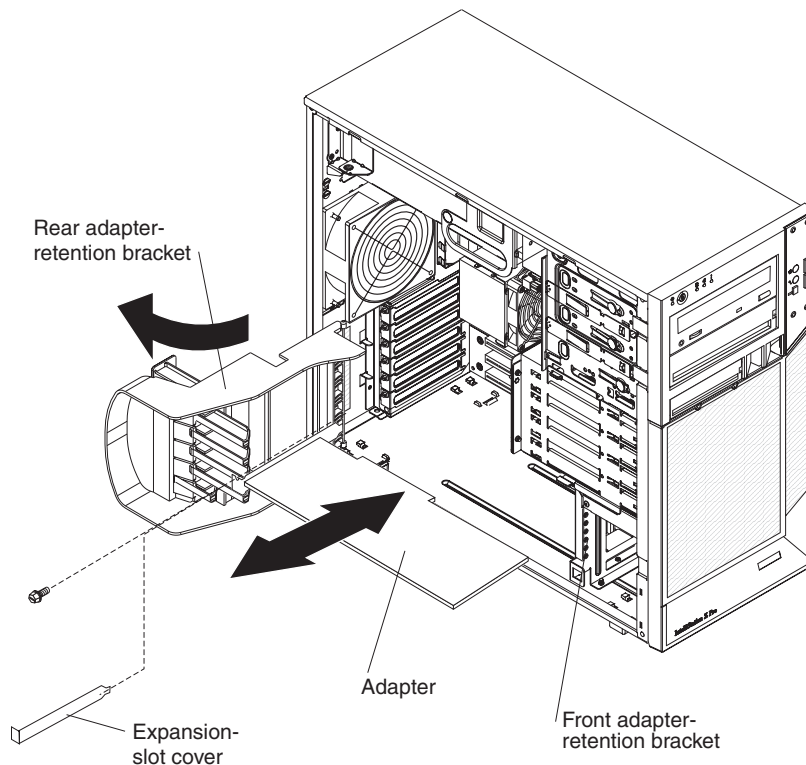


Figure 14. Removing an adapter

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Disconnect any cables to the adapter or any cables that impede access to the adapter.
5. For full-length adapters, rotate the rear adapter-retention bracket to the fully open (unlocked) position. Press the two blue release buttons located on the side of the front adapter-retention bracket that faces the adapters. If you are removing a smaller adapter, rotate only the rear adapter-retention bracket.

**Note:** Some adapters in the computer might be secured with an expansion-slot screw. If a screw is present, remove it before proceeding to the next step.

6. Grasp the adapter and pull it out of the slot.

**Attention:** Expansion-slot covers must be installed in all empty slots. This maintains the electronic emissions standards of the computer and ensures proper ventilation of computer components.

7. If you are instructed to return the adapter, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.
8. If you are not replacing the adapter, install an expansion-slot cover in the expansion-slot opening.

## Installing an adapter

For information about the types of adapters that the computer supports and other information that you might consider when installing an adapter, see the *User's Guide* on the IBM *IntelliStation Documentation* CD.

To install an adapter, complete the following steps:

1. Check the instructions that come with the adapter for any requirements, restrictions, or cabling instructions. It might be easier to route cables before you install the adapter.
2. Follow the instructions that come with the adapter to set jumpers or switches, if any.

**Attention:** Avoid touching the components and gold-edge connectors on the adapter.

3. If you are installing a full-length adapter, remove the blue adapter guide (if any) from the end of the adapter.

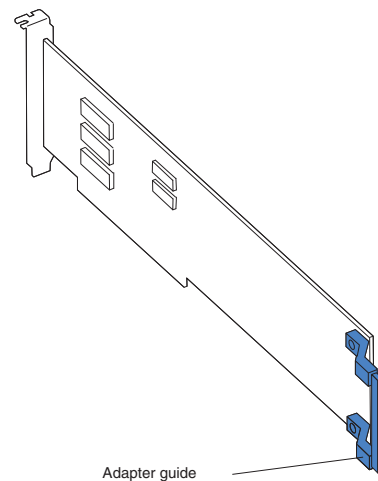


Figure 15. Adapter guide location

4. Carefully grasp the adapter by the top edge or upper corner and move the adapter directly from the static-protective package to the adapter slot. Align the adapter with the expansion-slot guides; then, press the adapter *firmly* into the expansion slot.

**Attention:** Make sure that the adapter is correctly seated in the expansion slot before you turn on the computer. Incomplete installation of an adapter might damage the system board or the adapter.

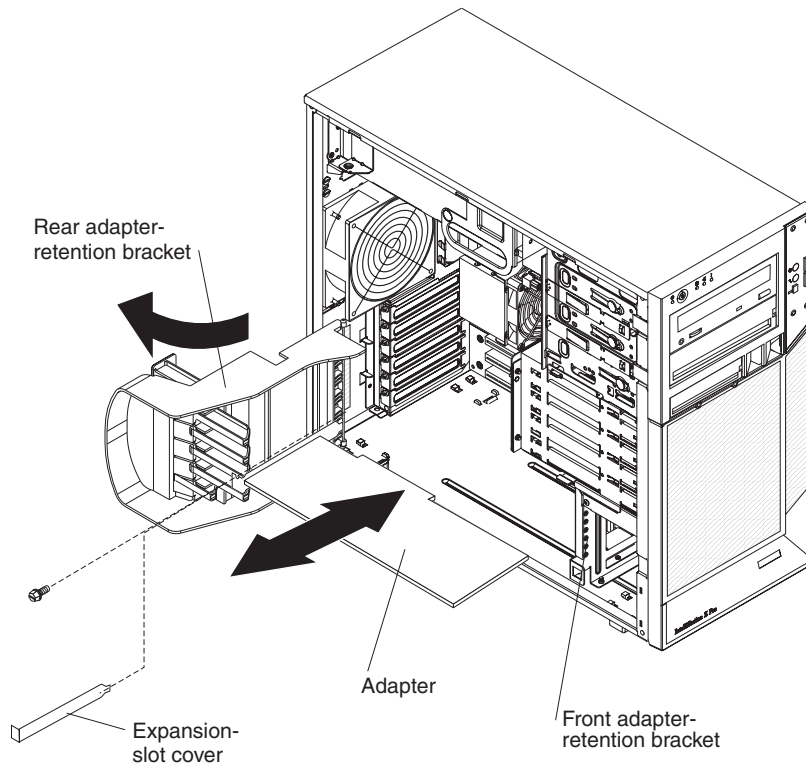


Figure 16. Installing an adapter

5. Rotate the rear adapter-retention bracket to the closed (locked) position.
6. Connect any required cables to the adapter. Make sure that they do not block the flow of air from the fan.
7. If you have installed a full-length adapter, press the blue dot on the top retention tab which is located on the side of the front adapter-retention bracket that faces the fan compartment. When you press the top retention tab, the adapter locks in place.

**Note:** If any adapter in the computer is large or has heavy cables attached to it, you can secure the adapter with a screw. Insert one backup expansion-slot screw through the top of each adapter bracket into the screw hole and secure the adapter before proceeding to the next step.

8. Install the side cover (see “Installing the side cover” on page 32).
9. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the hard drive backplate

To remove the hard drive backplate, complete the following steps.

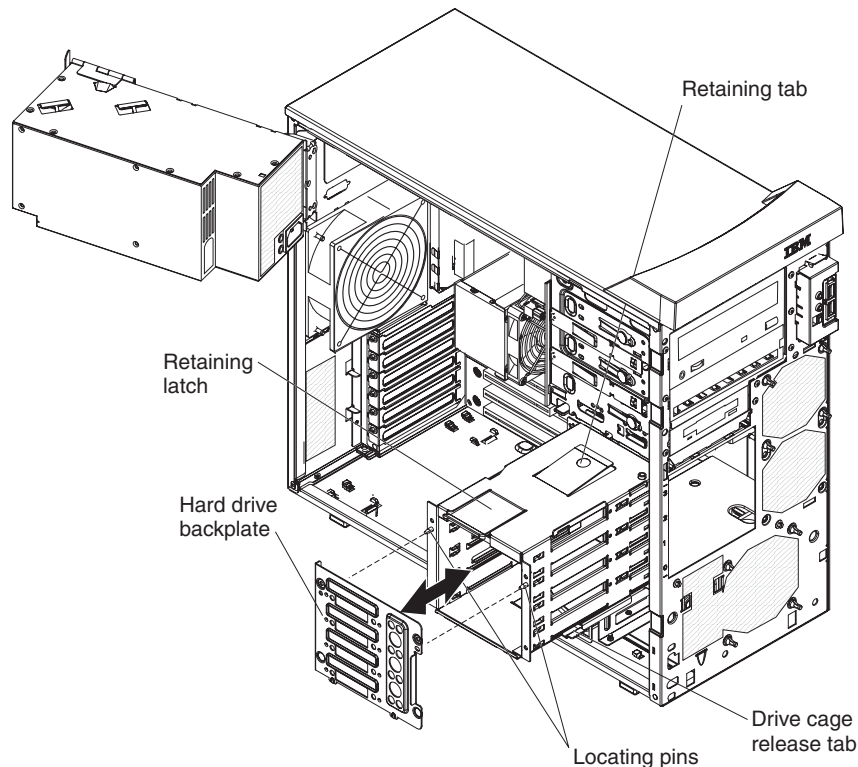


Figure 17. Removing the hard drive backplate

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all power cords and external cables.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove the lower bezel (see “Removing the two-piece bezel” on page 33).
5. Remove the simple-swap hard disk drives that are installed in the hard disk drive cage (see “Removing a simple-swap drive in bay 4, 5, 6, or 7” on page 51).
6. Lift the power-supply handle and rotate the power supply out of the chassis.
7. Press and hold the drive-cage release lever; then, rotate the drive cage completely out of the chassis until the retaining tab on top of the cage locks into place.
8. Disconnect the power cables from the system board.
9. Remove the hard drive fan assembly (see “Removing the hard disk drive fan” on page 54) steps 6, 7, and 8.
10. Disconnect the signal cables from the hard drive backplate.
11. Press up on the retaining latch at the top of the drive cage; then, tilt the top of the simple-swap backplate away from the drive cage until it is clear of the locating pins.
12. Lift the backplate out of the lower lip on the drive cage.

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

## Installing the hard drive backplate

To install the hard drive backplate, complete the following steps.

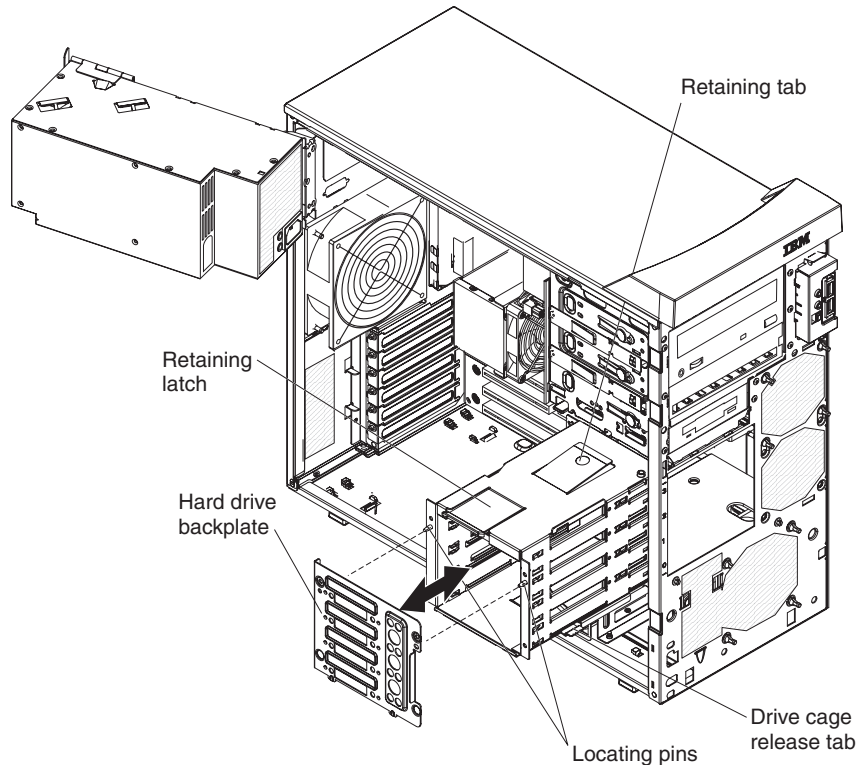


Figure 18. Installing the hard drive backplate

1. Position the bottom edge of the backplate in the lower lip of the drive cage.
2. Tilt the top of the backplate toward the drive cage and over the locating pins until the retaining latch is engaged.
3. Connect the signal cables to the hard drive backplate.
4. Install the hard disk drive fan assembly (see "Installing the hard disk drive fan" on page 55) steps 2 and 3.
5. Reconnect the power cables to the system board.
6. Push the drive cage outward and press in on the drive-cage release lever; then, rotate the drive cage completely into the chassis.
7. Press down on the power-supply release latch and rotate the power supply into the chassis. Return the power-supply handle to the closed position.
8. Install the simple-swap hard disk drives that were removed from the hard disk drive cage (see "Installing a simple-swap drive in bay 4, 5, 6, or 7" on page 52).
9. Install the lower bezel (see "Installing the two-piece bezel" on page 35).
10. Install the side cover (see "Installing the side cover" on page 32).
11. Lock the side cover if you unlocked it during removal.
12. Reconnect the external cables and power cords; then, turn on the attached devices and turn on the computer.

## Removing a DIMM

To remove a DIMM, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Lift the power-supply handle and rotate the power supply out of the chassis.
5. Press and hold the drive-cage release lever; then, rotate the drive cage completely out of the chassis until the retaining tab on top of the cage locks into place.
6. Disconnect any cables that impede access to the DIMMs.

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

7. Carefully open the retaining clips on each end of the DIMM connector and remove the DIMM (see Figure 19).

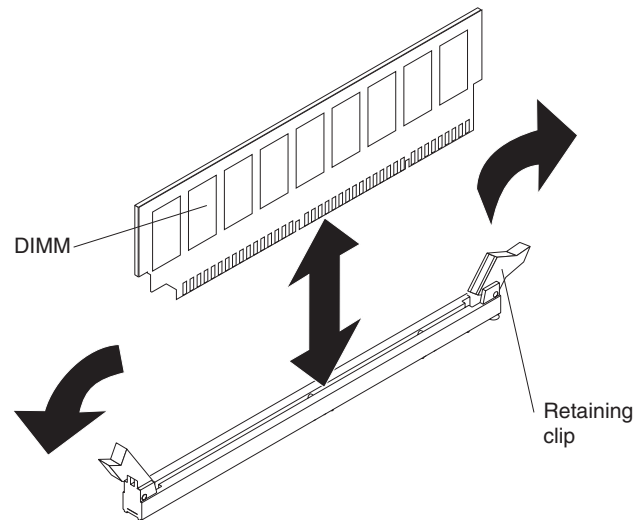


Figure 19. Removing a DIMM

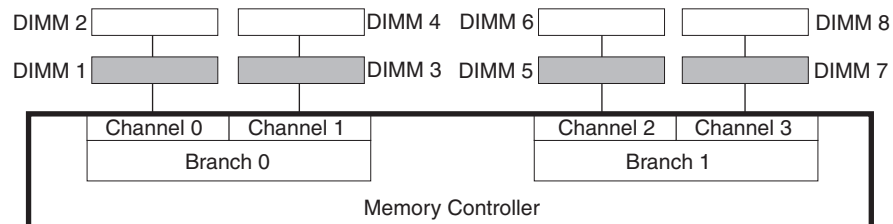
8. If you are instructed to return the DIMM, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.



## Installing a DIMM

The following notes describe the types of DIMMs that the computer supports and other information that you must consider when installing DIMMs:

- When you restart the computer after adding or removing a DIMM, the computer displays a message that the memory configuration has changed.
- The system board contains eight DIMM connectors and supports two-way memory interleaving.
- Install only 1.8 V, 240-pin, 667 MHz, PC2-5300, DDR2 synchronous dynamic random-access memory (SDRAM) with error correcting code (ECC) fully buffered DIMMs. These DIMMs must be compatible with the latest PC2-5300 SDRAM, fully buffered DIMM specification. For a list of supported options for the computer, go to <http://www.ibm.com/intellistation/>; then, select your country and navigate to the list of options for the computer.
- The amount of usable memory will be reduced depending on the system configuration. A certain amount of memory must be reserved for system resources. The basic input/output system (BIOS) displays the total amount of installed memory and the amount of configured memory.
- The DIMM options that are available for the computer are 512 MB, 1 GB, 2 GB, and 4 GB, which come in matched pairs. The computer supports a minimum of 1GB and a maximum of 32 GB of system memory.
- The memory controller has four fully buffered DIMM channels that are organized into two branches. Each branch has two channels, and each channel controls two DIMMs. DIMMs within the channels of a branch must be identical in size, type, speed, and technology. The following illustration shows how the memory controller is organized into branches and channels with two pairs of DIMMs installed.



**Note:** The DIMMs in the computer should be populated from the largest DIMM to the smallest DIMM (for example 2 GB, 1 GB, 512 MB). Populating DIMMs from the largest capacity to the smallest capacity will yield better performance, enabling the operating system to access more of the system memory before passing through the advanced memory buffer (AMB) to access the second DIMM on the channel.

- The computer can operate in two major modes, mirroring and non-mirroring (normal). The computer can also operate in a single-channel mode when one DIMM is installed.
- The computer supports memory mirroring (mirroring mode) and online-spare memory.

- Memory mirroring replicates data in two pairs of DIMMs simultaneously, this allows the computer to continue working if one set of DIMMs fail.

When you use memory mirroring, consider the following information:

- The memory is reduced to half the amount of memory available. For example, the maximum available memory is reduced from 32 GB to 16 GB in the mirroring mode.



- The minimum memory configuration is four identical DIMMs. You must install identical pairs of DIMMs in all four DIMM connections (same size, type, speed, and technology). These DIMMs must span both branches and all four channels. For example, when you assign the first four DIMMs, you must install two DIMMs in branch 0 (one in channel 0 and one in channel 1) and two DIMMs in branch 1 (one in channel 2 and one in channel 3). See the following table for the installation sequence for operating in the mirroring mode.
- When you upgrade the computer to eight DIMMs, the DIMMs in both branches must be identical (same size, type, speed, and technology).
- Both branches operate in dual-channel mode.

The following table shows the DIMM configuration upgrade sequence (mirroring mode).

Number of DIMMs	DIMM connections
4	1, 3, 5, 7
8	1, 3, 5, 7, 2, 4, 6, 8

- Online-spare memory disables a failed pair of DIMMs from the system configuration and activates an online-spare pair of DIMMs to replace the failed pair of DIMMs. For an online-spare pair of DIMMs to be activated, you must have installed an additional pair of DIMMs of the same speed, type, size (or larger), and technology as the failed pair of DIMMs. When you use online-spare memory, consider the following information:
  - You cannot enable online-spare memory while the computer is operating in mirroring mode.
  - The minimum memory configuration is two double-rank DIMMs installed in branch 0, DIMM connection 1 (in channel 0) and DIMM connection 3 (in channel 1).
  - The spare pair of DIMMs must be the same speed, type, size (or larger), and technology as the failed pair of DIMMs.
  - Branch 0 and branch 1 operate independently.
- The following notes apply when the computer operates in the non-mirroring mode (normal mode).
  - The computer comes with two 512 MB DIMMs installed in DIMM connectors 1 and 3. The second pair of DIMMs must be installed in DIMM connectors 5 and 7. The third pair of DIMMs must be installed in DIMM connectors 2 and 4. The fourth pair of DIMMs must be installed in DIMM connectors 6 and 8.
  - DIMMs must be installed in matched pairs. For example, the DIMMs in DIMM connector 1 and 3 must be identical to each other, but do not have to be identical to the DIMMs in DIMM connector 5 and 7. But the DIMMs in DIMM connector 5 and 7 must be identical to each other. The DIMMs in each pair must be the same size, speed, type, and technology as each other but do not have to match the other pairs. You can mix compatible DIMMs from various manufacturers. See the following table for the DIMM configuration upgrade sequence non-mirroring mode (normal mode).

The following table shows the DIMM configuration upgrade sequence (non-mirroring mode).

Number of DIMMs	DIMM connections
First pair	1, 3

Number of DIMMs	DIMM connections
Second pair	5, 7
Third pair	2, 4
Fourth pair	6, 8

To install a DIMM, complete the following steps:

1. Make sure that the retaining clips on each end of the DIMM connector are fully open.
2. Touch the static-protective package that contains the new DIMM to any unpainted metal surface on the computer; then, remove the new DIMM from the package.
3. Turn the DIMM so that the contacts align correctly with the connector.  
**Attention:** To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.
4. Insert the DIMM into the connector (see Figure 20). Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector. If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly installed. Open the retaining clips, remove the DIMM, and reinsert it.

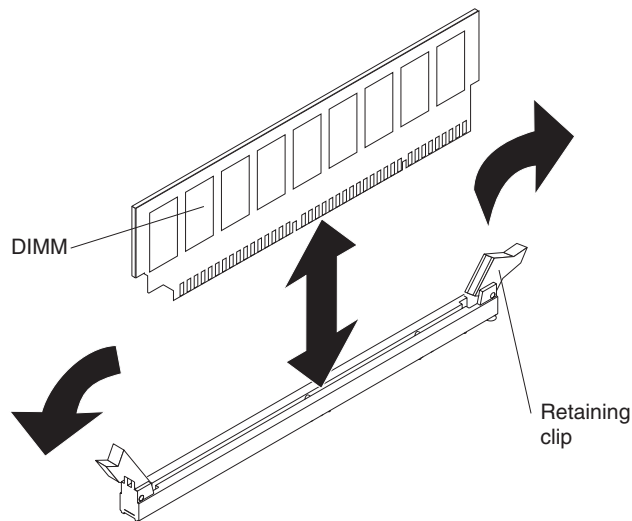


Figure 20. Installing a DIMM

5. Reconnect any cables that you disconnected during removal.
6. Push the drive cage outward, and press in on the drive-cage release lever; then, rotate the drive cage into the chassis.
7. Press down on the power-supply release latch, and rotate the power supply into the chassis. Return the power-supply handle to the closed position.
8. Install the side cover (see "Installing the side cover" on page 32).
9. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the battery

To remove the battery, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove any adapters that impede access to the battery.
5. Remove the battery:
  - a. Use a fingernail to press the top of the battery clip away from the battery (see Figure 21). The battery pops up when released.
  - b. Use your thumb and index finger to lift the battery from the socket.

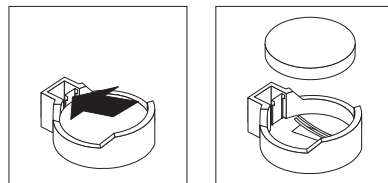


Figure 21. Removing the battery

## Installing the battery

The following notes describe information that you must consider when replacing the battery in the computer:

- When replacing the battery, you must replace it with a lithium battery of the same type from the same manufacturer.
- To order replacement batteries, call 1-800-426-7378 within the United States, and 1-800-465-7999 or 1-800-465-6666 within Canada. Outside the U.S. and Canada, call your IBM marketing representative or authorized reseller.
- After you replace the battery, you must reconfigure the system and reset the system date and time.

- To avoid possible danger, read and follow the following safety statement.

**Statement 2:**



**CAUTION:**

When replacing the lithium battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

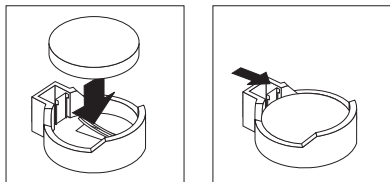
*Do not:*

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

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

To install the battery, complete the following steps:

1. Insert the new battery:
  - a. Tilt the battery so that you can insert it into the socket on the side opposite the battery clip.
  - b. Press the battery down into the socket (see Figure 22) until it clicks into place. Make sure that the battery clip holds the battery securely.



*Figure 22. Installing the battery*

2. Reinstall any adapters that you removed.
3. Install the side cover (see “Installing the side cover” on page 32).
4. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.
5. Start the Configuration/Setup Utility program and reset the configuration:
  - Set the system date and time.
  - Set passwords if necessary.
  - Save the configuration.

## Removing the internal speaker

The internal speaker is on the front panel of the computer.

To remove the speaker, complete the following steps.

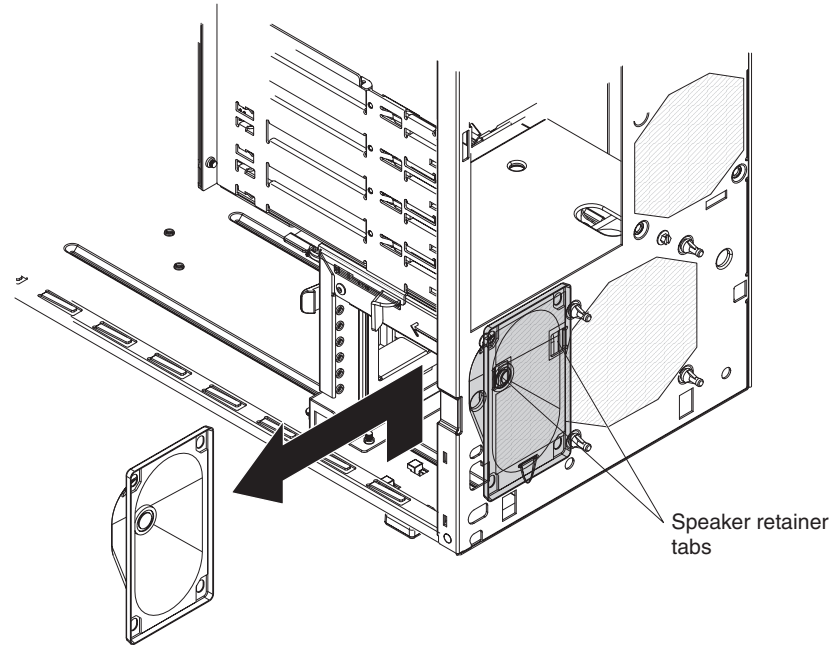


Figure 23. Removing the speaker

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove the lower bezel (see “Removing the two-piece bezel” on page 33).

**Note:** It might be helpful to lay the computer on its left side for the remainder of this procedure.

5. Note where the speaker wire is connected to the system board; then, carefully disconnect the wire from the system board. See “System board internal connectors” on page 9.
6. Press the speaker retainer tabs to detach them from the chassis.
7. Grasp the speaker and slide the speaker out of its retaining tabs toward the top of the chassis; then, lift it out of the chassis (see Figure 23).
8. If you are instructed to return the speaker, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the internal speaker

To install the speaker, complete the following steps:

1. Slide the speaker into the retaining tabs in the front of the chassis.
2. Reconnect the speaker wire to the system board connector.
3. Install the lower bezel (see “Installing the two-piece bezel” on page 35).

4. Install the side cover (see “Installing the side cover” on page 32).
5. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

---

## Removing and replacing Tier 2 CRUs

You can install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your computer.

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

## Removing and installing internal drives

This section describes the removal and installation of internal drives (see Figure 24 for the location of the drive bays). See the *User's Guide* for more information about the types of drives that the computer supports.

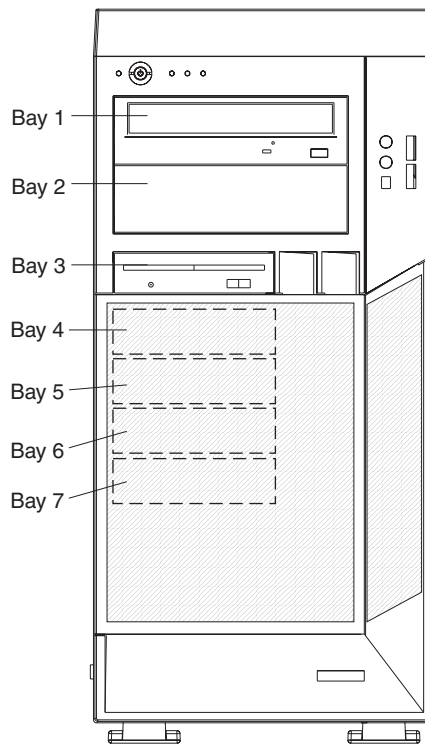


Figure 24. Internal drive bay locations

## Removing a drive in bay 1, 2, or 3

To remove a drive in bay 1, 2, or 3 complete the following steps.

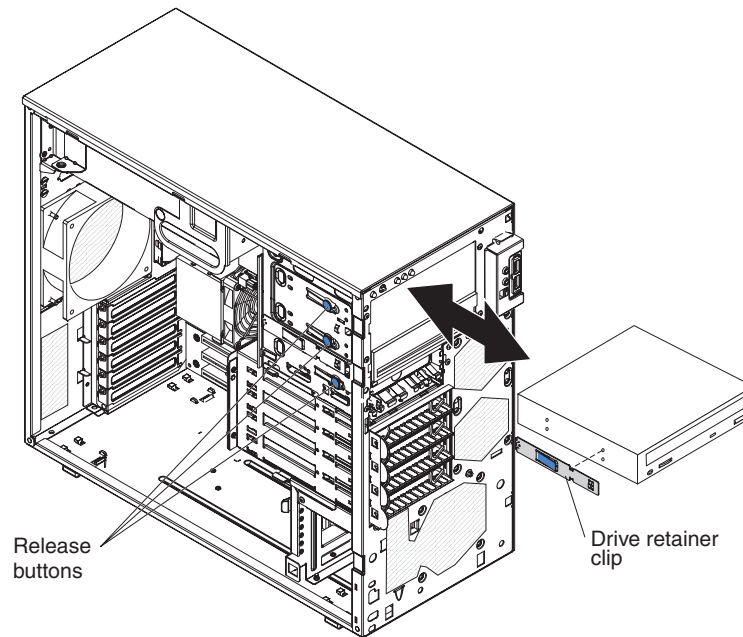


Figure 25. Removing a drive from bay 1, 2, or 3

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove the two-piece bezel (see “Removing the two-piece bezel” on page 33).
5. Disconnect the power and signal cables from the drive that you are removing.
6. To remove a drive from bay 1 or 2, release the drive from the bay by pressing the blue release button on the side of the bay (see Figure 25). Pull the drive out of the computer.
7. To remove a diskette drive from bay 3, press the blue release button on the side of the bay. Pull the drive out of the front of the computer.
8. Remove the drive retainer clip from the side of the drive. Save the clip to use when you install the replacement drive.
9. If you are instructed to return the drive, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing a drive in bay 1, 2, or 3

To install a drive in bay 1, 2, or 3 complete the following steps.

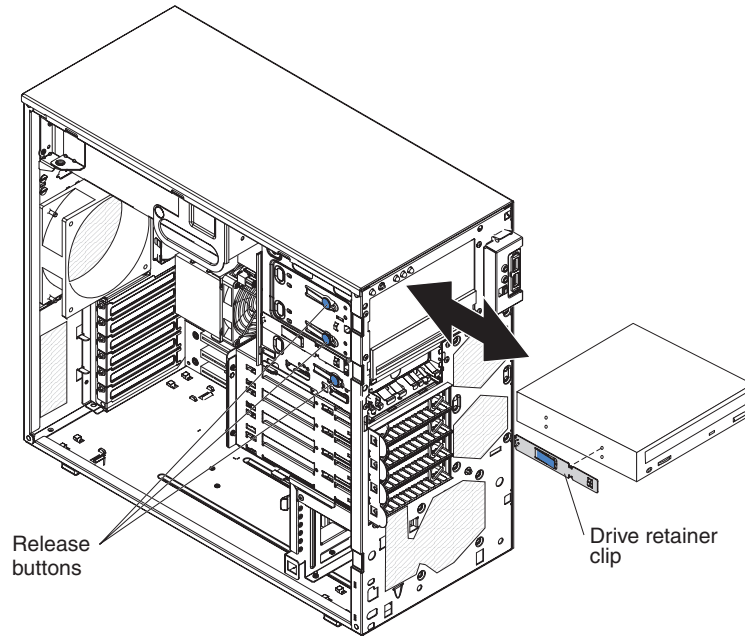


Figure 26. Installing a drive in bay 1, 2, or 3

1. If you are replacing a removed drive with a new drive, make sure that:
  - You have all the cables and other equipment that is specified in the documentation that comes with the new drive.
  - You check the instructions that come with the new drive to determine whether you must set any switches or jumpers on the drive.
  - You have removed the drive clip on the side of the original drive and have it available for installation on the new drive.

**Note:** If you are installing a drive that contains a laser, review the following safety precaution.



### Statement 3



#### CAUTION:

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

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



#### DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following:

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Class 1 Laser Product

Laser Klasse 1

Laser Klass 1

Luokan 1 Laserlaite

Appareil À Laser de Classe 1

2. Touch the static-protective package that contains the new drive to any unpainted metal surface on the computer; then, remove the drive from the package and place it on a static-protective surface.
3. Follow the instructions that come with the drive to set the jumpers or switches.

#### Notes:

- a. You might find it easier to install the new drive into the opening on the front and then attach the cables.
  - b. If you are installing a 3.5-in. drive in bay 2, attach a 5.25-in. conversion kit to the 3.5-in. drive.
4. Install the blue drive-retainer clip into the screw holes on the side of the drive.
  5. Push the drive into the front of the bay until it clicks into place (see Figure 26).
  6. Reconnect the power and signal cables to the drive.

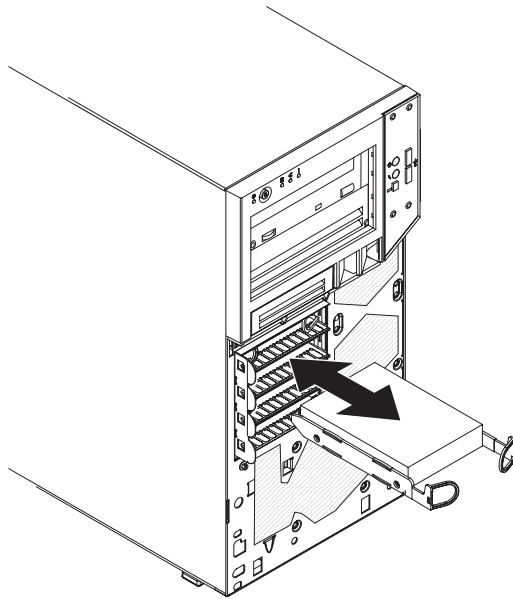
**Note:** Route the signal cable so that it does not block the airflow to the rear of the drives or over the microprocessor.

7. Install the bezel (see “Installing the two-piece bezel” on page 35).
8. Install the side cover (see “Installing the side cover” on page 32).
9. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

### Removing a simple-swap drive in bay 4, 5, 6, or 7

This procedure applies to a computer that has simple-swap hard disk drives.

To remove a simple-swap drive in bay 4, 5, 6, or 7 complete the following steps.



*Figure 27. Removing a simple-swap hard disk drive*

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Unlock the side cover. The bezel will not disengage from the computer if the cover is locked. You do not have to remove the side cover.
4. Remove the lower bezel (see “Removing the two-piece bezel” on page 33).
5. Pull the loops of the drive assembly that is to be removed toward each other; then, pull the assembly out of the bay.
6. If you are instructed to return the drive, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

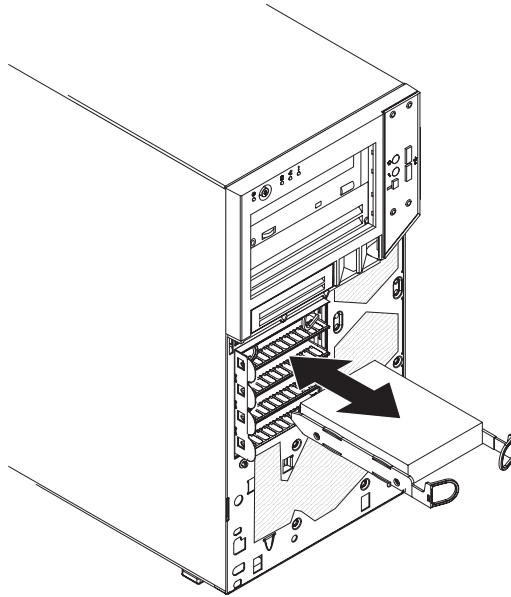
### **Installing a simple-swap drive in bay 4, 5, 6, or 7**

This procedure applies to a computer that has simple-swap hard disk drives.

Some models come with simple-swap SATA or SAS hard disk drives, which are accessible from the front of the computer. Before you install a simple-swap SATA or SAS hard disk drive, read the following information:

- Read the documentation that comes with the hard disk drive for cabling instructions.
- You can install four simple-swap SATA or SAS hard disk drives in the computer. Drives are installed starting in bay 4. Additional drives are then installed in bays 5, 6, and 7.

To install a simple-swap hard disk drive, complete the following steps.



*Figure 28. Installing a simple-swap hard disk drive*

1. Touch the static-protective package that contains the hard disk drive to any unpainted metal surface on the computer; then, remove the drive from the package and place it on a static-protective surface.
2. Align the drive assembly with the guide rails in the bay (the connector end of the drive goes in first). See Figure 28.
3. Pull the loops of the drive assembly toward each other; then, carefully slide the drive assembly into the drive bay until the drive assembly connects to the back panel connector at the rear of the drive bay (you should hear a click).

**Note:** Do not release the loops on the drive assembly until the drive assembly is completely seated.

4. Replace the lower bezel (see “Installing the two-piece bezel” on page 35).
5. Install the side cover, if you removed it (see “Installing the side cover” on page 32).
6. Lock the side cover.
7. Reconnect the external cables and power cords.
8. Turn on the attached devices and the computer.

## Removing the hard disk drive fan

### Attention:

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover removed.

To remove the hard disk drive fan assembly, complete the following steps.

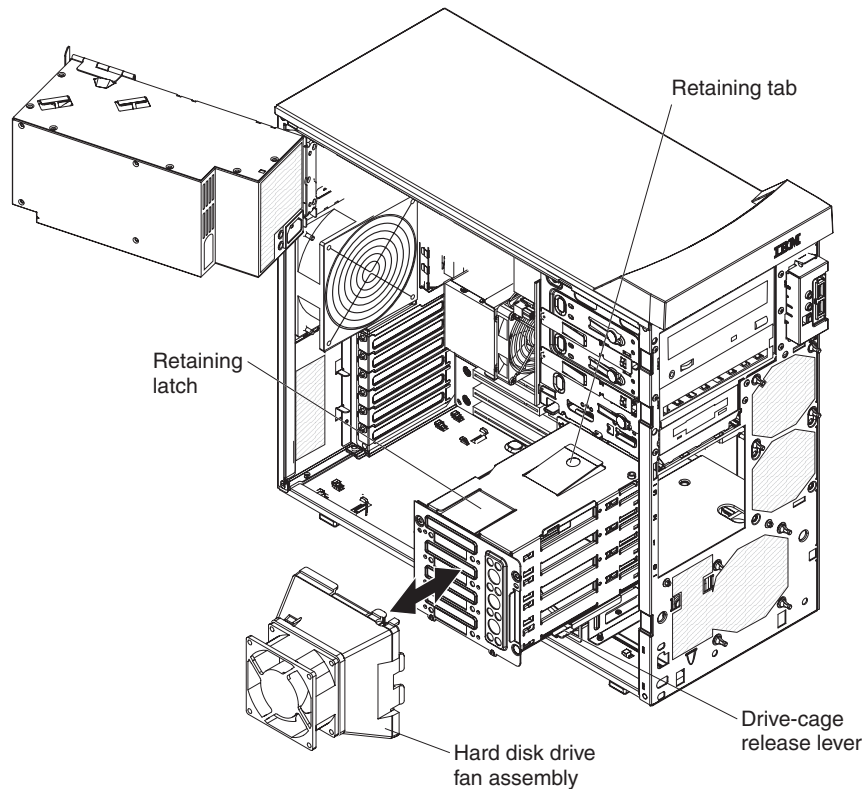
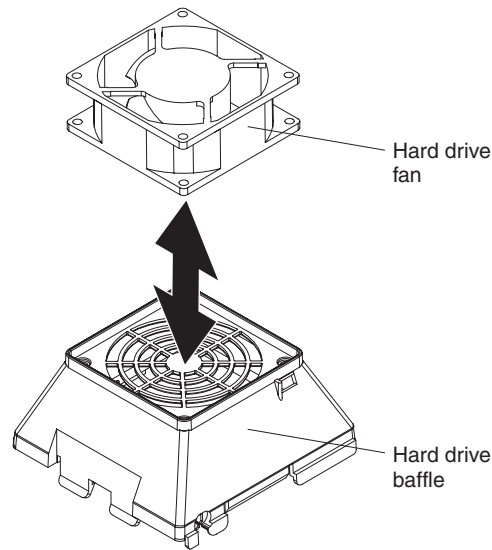


Figure 29. Removing the hard disk drive fan assembly

1. Read the safety information that begins on page vii and "Installation guidelines" on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see "Removing the side cover" on page 31).
4. Lift the power-supply handle and rotate the power supply out of the chassis.
5. Press and hold the drive-cage release lever; then, rotate the drive cage completely out of the chassis until the retaining tab on top of the cage locks into place.
6. Disconnect the hard disk drive fan cable from the system board, and note the location of the connector (see "System board internal connectors" on page 9).
7. Pull up on the fan-assembly retainer tabs at the blue press points; then, lift the assembly away from the drive cage.
8. Set the fan assembly on a level work surface with the fan facing up (see Figure 30 on page 55).



*Figure 30. Removing the hard disk drive fan*

9. Use side cutters to sever the four grommets that secure the fan to the duct, and remove the fan.

**Note:** Grommets are provided with the replacement fan.

10. If you are instructed to return the hard disk drive fan assembly, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

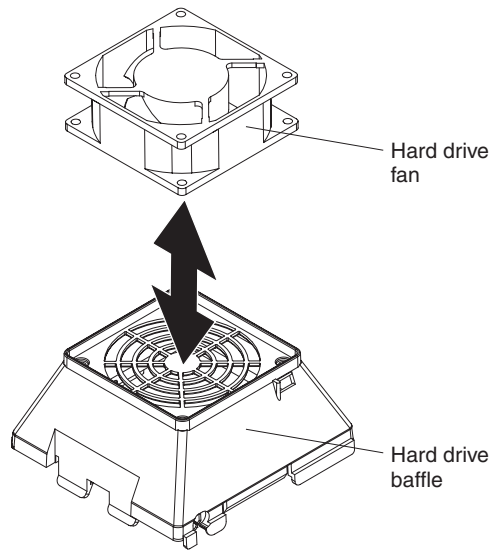
## Installing the hard disk drive fan

### **Attention:**

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover removed.

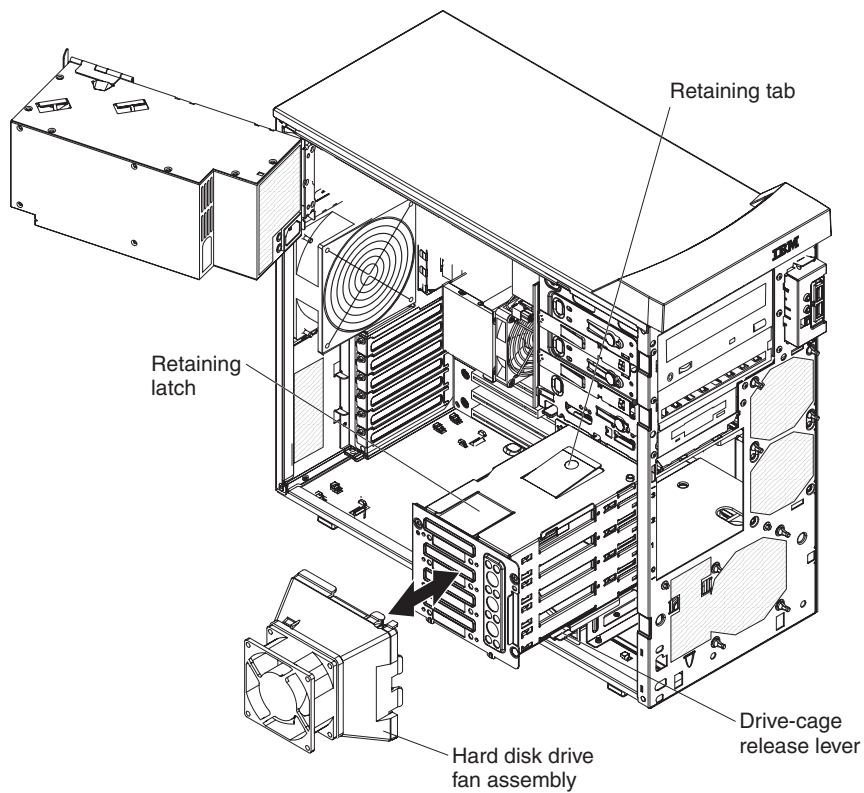
To install the hard disk drive fan assembly, complete the following steps:

1. Position the fan so that the grommets protrude through the holes in the fan assembly; then, use needle-nose pliers to pull the grommets through the holes (see Figure 31).



*Figure 31. Installing the hard disk drive fan*

2. Insert the fan-assembly retainer tabs into the corresponding slots in the drive cage; then, press the fan assembly onto the drive cage (see Figure 32).



*Figure 32. Installing the hard disk drive fan assembly*

3. Connect the hard disk drive fan cable to the system board (see “System board internal connectors” on page 9).

4. Push the drive cage outward, and press in on the drive-cage release lever; then, rotate the drive cage completely into the chassis.
5. Press down on the power-supply release latch and rotate the power supply into the chassis. Return the power supply handle to the closed position.
6. Replace the side cover (see “Installing the side cover” on page 32).
7. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the rear fan

### Attention:

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover removed.

To remove the rear fan, complete the following steps.

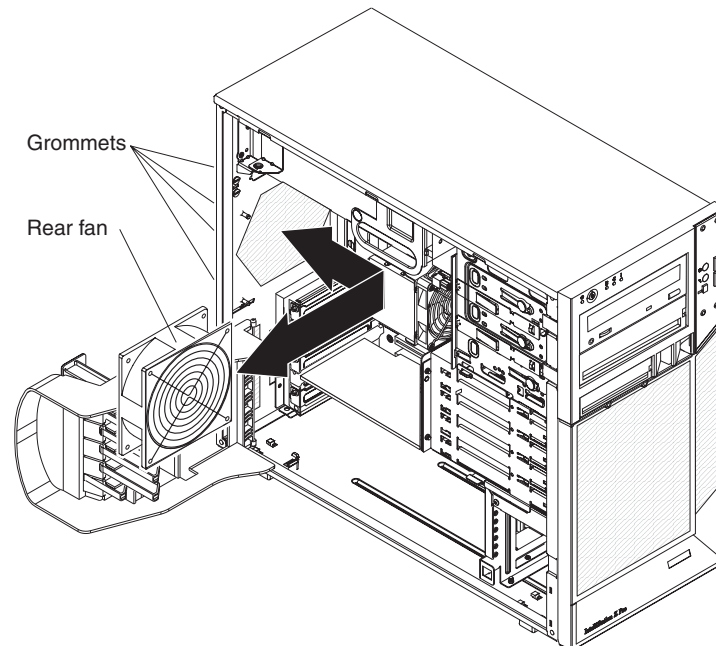


Figure 33. Removing the rear system fan

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove any adapters that impede access to the fan and the fan connector on the system board (see “Removing an adapter” on page 36).
5. Disconnect the rear fan cable from the system board, and note the location of the connector (see “System board internal connectors” on page 9).
6. Grasp the rear fan and pull firmly, extending the rubber extensions (grommets) that secure the fan to the chassis. Pull the grommets through the holes in the fan or chassis and remove them or use side cutters to cut the grommets.

**Note:** Grommets are provided with the replacement fan.

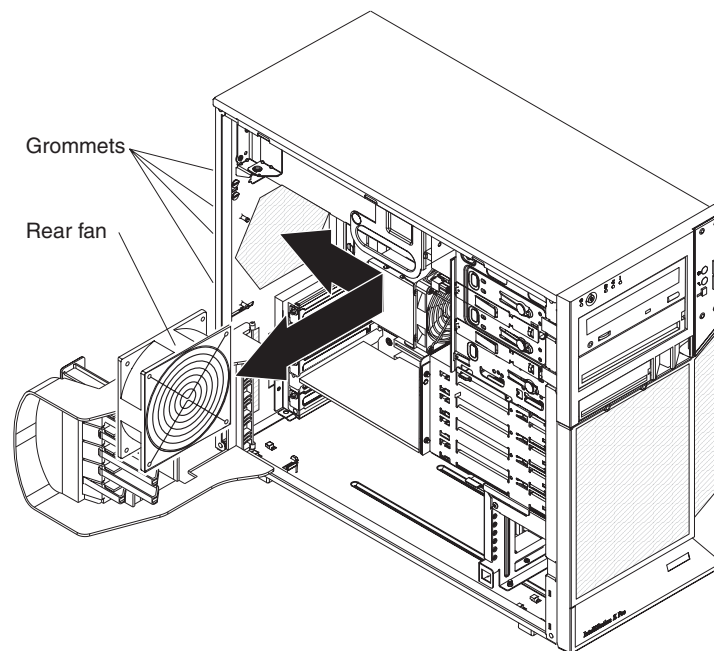
7. Pull the rear system fan up and out of the chassis, making sure that no grommets are left loose in the computer.
8. If you are instructed to return the rear fan assembly, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the rear fan

**Attention:**

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover removed.

To install the rear fan, complete the following steps.



*Figure 34. Installing the rear system fan*

1. Position the fan so that the grommets protrude through the holes in the chassis; then, use needle-nose pliers to pull the grommets through the holes from outside the chassis.
2. Connect the rear fan cable to the system board (see "System board internal connectors" on page 9).
3. Install any adapters that you removed (see "Installing an adapter" on page 37).
4. Replace the side cover (see "Installing the side cover" on page 32).
5. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.



## Removing the expansion slot fan

### Attention:

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover off.

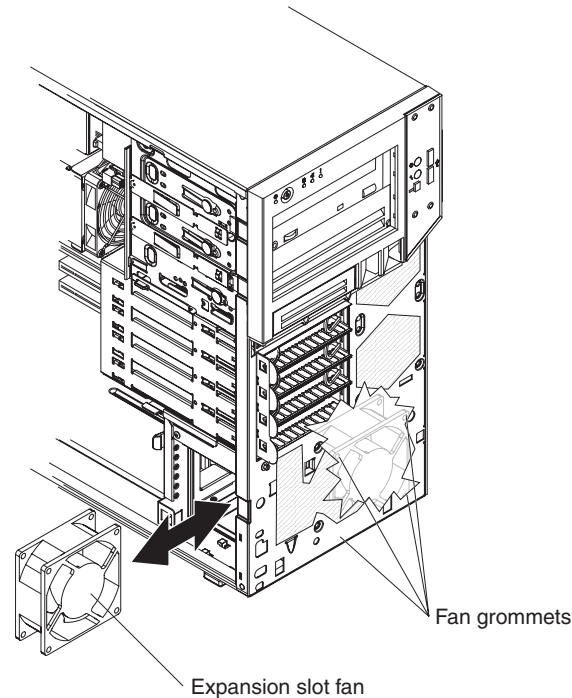


Figure 35. Removing the expansion slot fan

To remove the expansion slot fan, complete the following steps.

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove the lower bezel (see “Removing the two-piece bezel” on page 33).
5. Remove any adapters that impede access to the fan and the fan connector on the system board (see “Removing an adapter” on page 36).
6. Note where the expansion slot fan cable is connected to the system board, and disconnect the cable from the system board (see “System board internal connectors” on page 9).
7. Grasp the expansion slot fan and pull firmly, extending the rubber extensions (grommets). Pull the grommets through the holes in the fan or chassis and remove them, or use side cutters to cut the grommets.

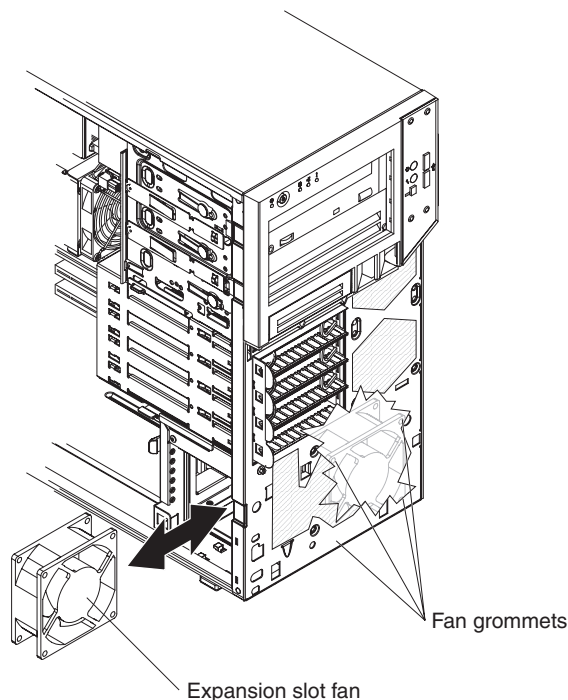
**Note:** Grommets are provided with the replacement fan.

8. Pull the expansion slot fan out of the chassis.
9. If you are instructed to return the expansion slot fan, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the expansion slot fan

### Attention:

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover off.



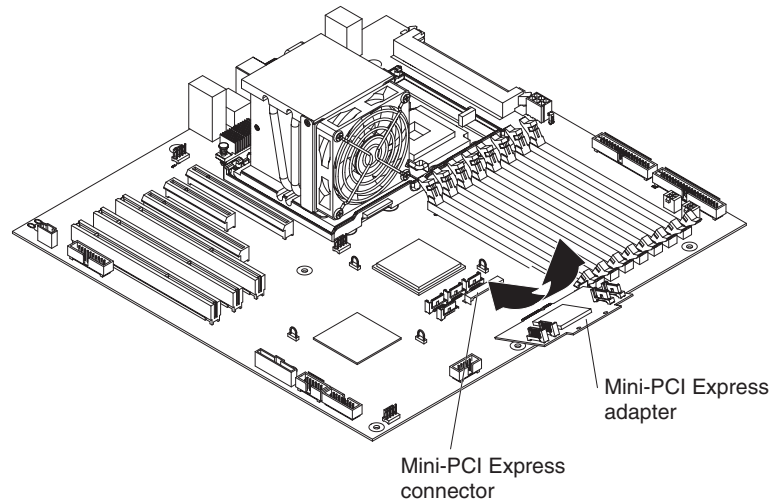
*Figure 36. Installing the expansion slot fan*

To install the expansion slot fan, complete the following steps.

1. Position the replacement fan so that the grommets protrude through the holes in the chassis; then, use needle-nose pliers to pull the grommets through the holes from outside the chassis.
2. Connect the fan cable to the system board (see “System board internal connectors” on page 9).
3. Install any adapters that you removed (see “Installing an adapter” on page 37).
4. Replace the side cover (see “Removing the side cover” on page 31).
5. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the mini-PCI Express adapter

To remove the mini-PCI Express adapter, complete the following steps.



*Figure 37. Removing the mini-PCI Express adapter*

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all power cords and external cables.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Lift the power-supply handle and rotate the power supply out of the chassis.
5. Press and hold the drive-cage release lever; then, rotate the drive cage completely out of the chassis until the retaining tab on top of the cage locks into place.
6. Disconnect the signal cables from the mini-PCI Express adapter.
7. Depress the white retaining clip for the mini-PCI Express adapter; then, pull it away from the system board until it disengages from the mini-PCI Express connector.
8. If you are instructed to return the mini-PCI Express adapter, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the mini-PCI Express adapter

To install the mini-PCI Express adapter, complete the following steps.

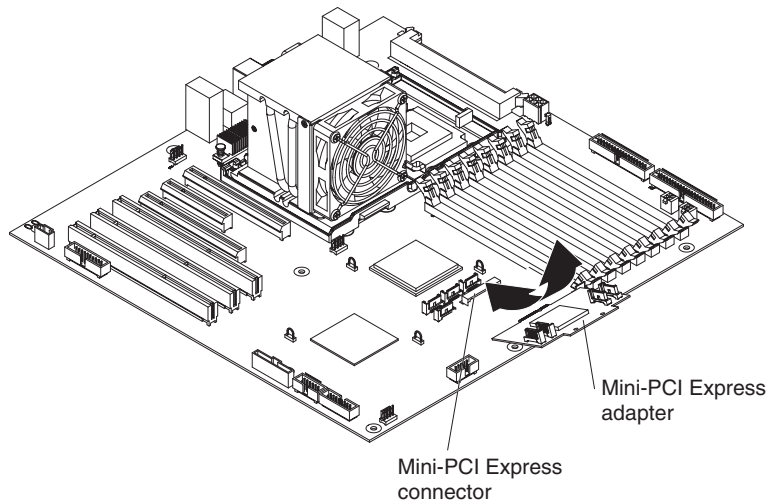


Figure 38. Installing the mini-PCI Express adapter

1. Touch the static-protective package that contains the mini-PCI Express adapter to any unpainted surface on the outside of the computer; then, remove the mini-PCI Express adapter from the package.
2. Position the mini-PCI Express adapter over the mini-PCI Express connector; then, press the mini-PCI Express adapter firmly into the mini-PCI Express connector.
3. Connect the signal cables to the mini-PCI Express adapter.
4. Push the drive cage outward, and press in on the drive-cage release lever; then, rotate the drive cage completely into the chassis.
5. Press down on the power-supply release latch and rotate the power supply into the chassis. Return the power supply handle to the closed position.
6. Install the side cover (see "Installing the side cover" on page 32).
7. Reconnect the external cables and power cords; then, turn on the attached devices and turn on the computer.

## Removing the power switch/LED assembly

To remove the power switch/LED assembly, complete the following steps.

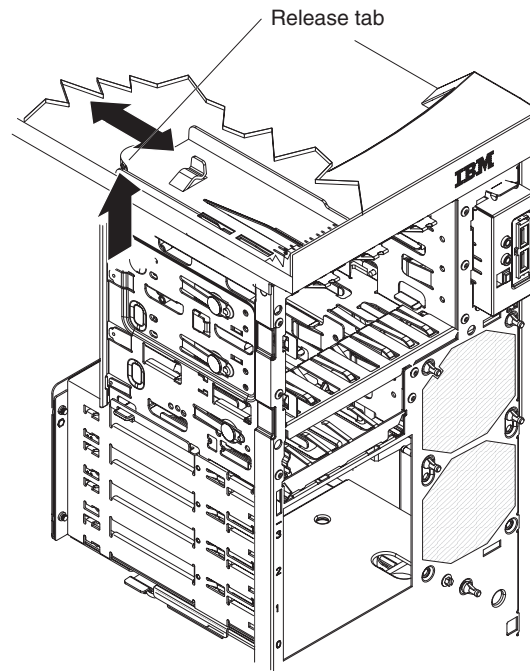


Figure 39. Removing the power switch/LED assembly

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. If an optical drive is installed in bay 1 (see “Removing the two-piece bezel” on page 33).

**Note:** It might be helpful to lay the computer on its left side for the remainder of this procedure.

5. Release the drive from bay one by pressing the blue release button on the side of the bay; then, pull the drive out slightly.
6. Note where the power-switch/LED assembly cable connects to the system board; then, carefully disconnect the cable from the system board.
7. From inside the chassis, press inward on the power-switch release tab (see Figure 39).
8. Pull the assembly toward the rear of the chassis and remove it.
9. If you are instructed to return the power switch/LED assembly, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the power switch/LED assembly

To install the power switch/LED assembly, complete the following steps.

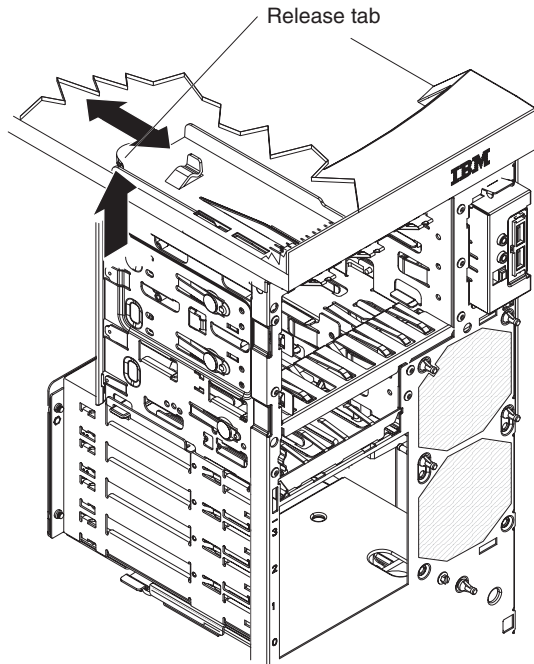
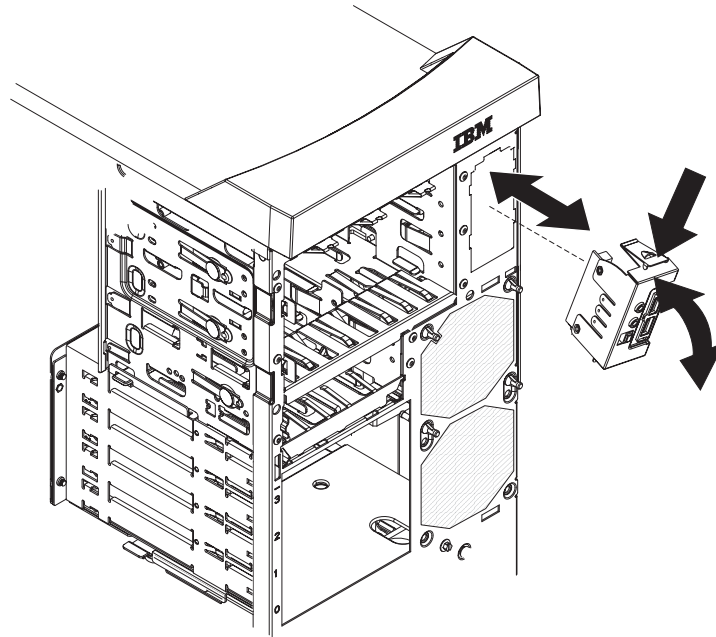


Figure 40. Installing the power switch/LED assembly

1. From inside the chassis, push the power switch/LED assembly toward the front of the chassis until the assembly engages the power switch release tab and clicks into place (see Figure 39).
2. Reconnect the power switch/LED assembly cable to the system board.
3. If an optical drive is in bay 1, push the drive into the drive bay, until it snaps in place.
4. Install the front bezel (see “Installing the two-piece bezel” on page 35).
5. Install the side cover (see “Installing the side cover” on page 32).
6. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the front card/bracket assembly

To remove the front card/bracket assembly, complete the following steps.

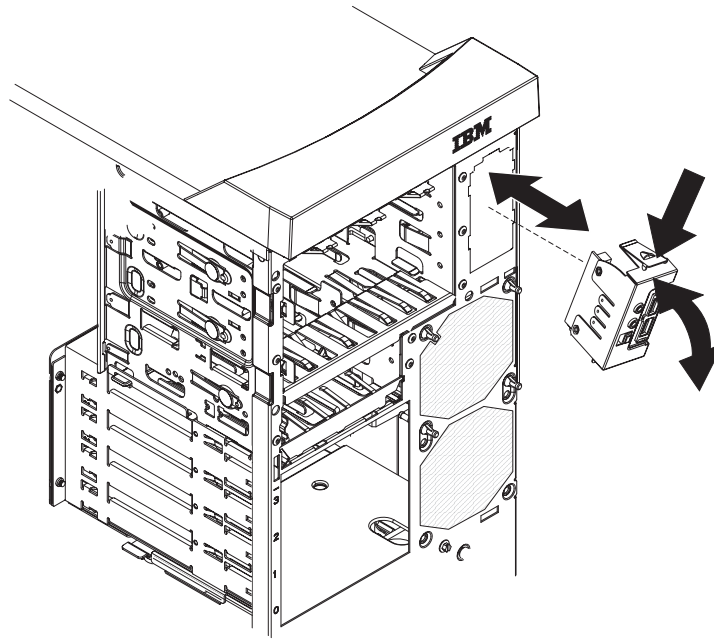


*Figure 41. Removing the card/bracket assembly*

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove the bezel (see “Removing the two-piece bezel” on page 33).
5. Press the latch on the top of the assembly; the top of the assembly detaches from the chassis (see Figure 41).
6. Remove the tab on the bottom part of the assembly from the slot in the chassis.
7. Pull the assembly out slightly, and detach the two cables from the back of the assembly.
8. If you are instructed to return the card/bracket assembly, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the front card/bracket assembly

To install the front card/bracket assembly, complete the following steps.



*Figure 42. Installing the card/bracket assembly*

1. Attach the two cables to the back of the card/bracket assembly.
2. Install the bottom tab of the card/bracket assembly into the slot in the chassis; then, press the top of the assembly into the chassis.
3. Install the bezel (see “Installing the two-piece bezel” on page 35).
4. Install the side cover (see “Installing the side cover” on page 32).
5. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.



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## Removing and replacing FRUs

FRUs must be installed only by trained service technicians.

The illustrations in this document might differ slightly from the hardware.

### Removing the front adapter-retention bracket

To remove the front adapter-retention bracket, complete the following steps.

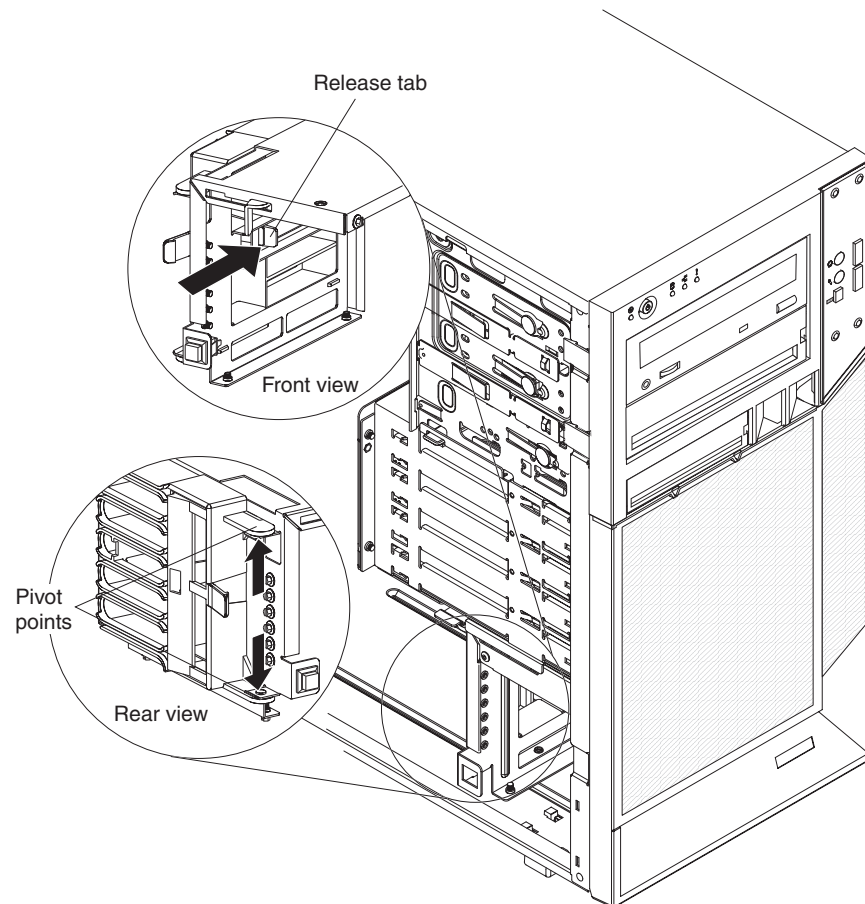


Figure 43. Removing front adapter-retention bracket

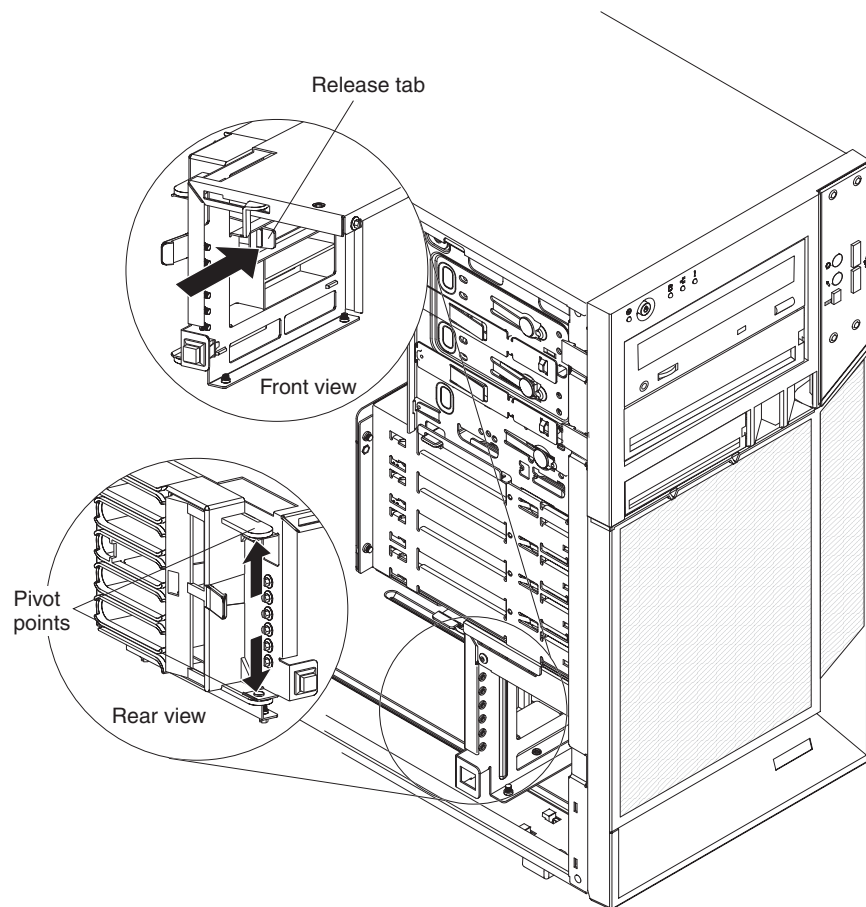
1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).

**Note:** It might be helpful to lay the computer on its left side for the remainder of this procedure.

4. Remove any full-length adapters that are installed (see “Removing an adapter” on page 36).
5. Press the blue dot on the bottom retention tab of the front adapter-retention bracket; then, rotate the retention bracket to a 45 degree angle. This tab is located inside the fan compartment that is next to the front adapter-retention bracket.
6. Push the top and bottom sides of the adapter-retention bracket out of the notches that secure the retention bracket to the chassis, (see Figure 43). Remove the retention bracket from the chassis.
7. If you are instructed to return the adapter-retention bracket, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the front adapter-retention bracket

To install the front adapter-retention bracket, complete the following steps.



*Figure 44. Installing the front adapter-retention bracket*

1. Engage the top and bottom sides of the front adapter-retention bracket with the front adapter-retention bracket openings in the chassis (see Figure 44).

2. Rotate the front adapter-retention bracket back into the chassis.
3. Install any full-length adapters that you removed (see “Installing an adapter” on page 37).
4. Install the side cover (see “Installing the side cover” on page 32).
5. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the rear adapter-retention bracket

To remove the rear adapter-retention bracket, complete the following steps.

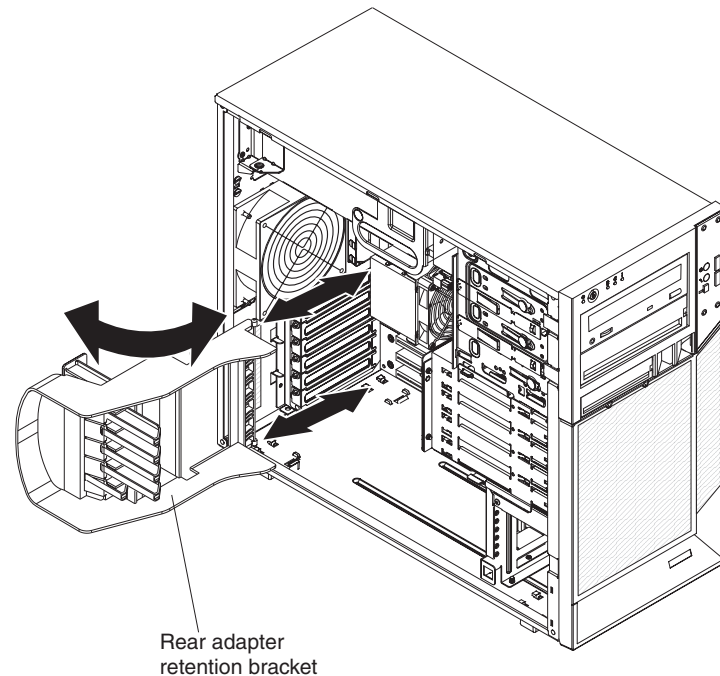


Figure 45. Removing the rear adapter-retention bracket

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove all adapters that are installed (see “Removing an adapter” on page 36).
5. Rotate the rear adapter-retention bracket to a 45-degree angle.
6. Press the top and bottom retention tabs of the adapter-retention bracket toward each other; then, remove the adapter-retention bracket from the chassis.
7. If you are instructed to return the adapter-retention bracket, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the rear adapter-retention bracket

To install the rear adapter-retention bracket, complete the following steps.

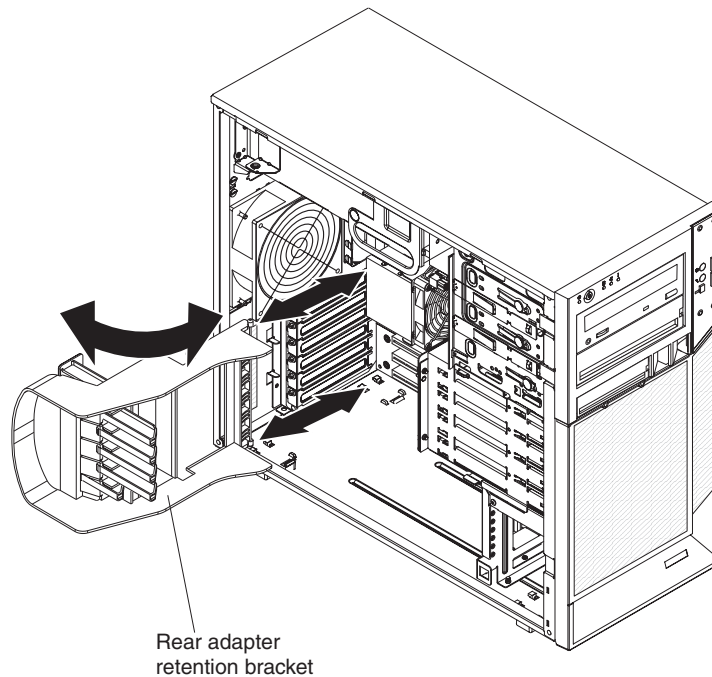


Figure 46. Installing the rear adapter-retention bracket

1. Engage the top and bottom release tabs of the rear adapter-retention bracket with the openings in the chassis, until the release tabs lock securely in place (see Figure 46).
2. Rotate the rear adapter-retention bracket to the locked (closed) position.
3. Replace all adapters that you removed (see “Installing an adapter” on page 37).
4. Replace the side cover (see “Installing the side cover” on page 32).
5. Reconnect the external cables and power cords to the computer; then, connect the power cords to electrical outlets. Turn on the attached devices and turn on the computer.

## Removing the DIMM fan assembly

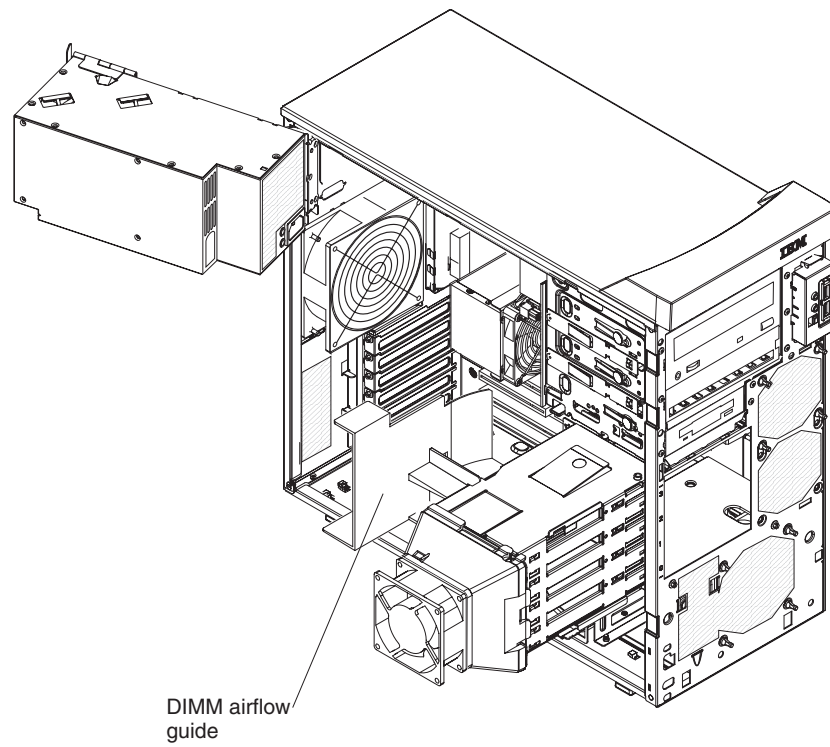
### Attention:

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover off.

To remove the DIMM fan assembly, complete the following steps:

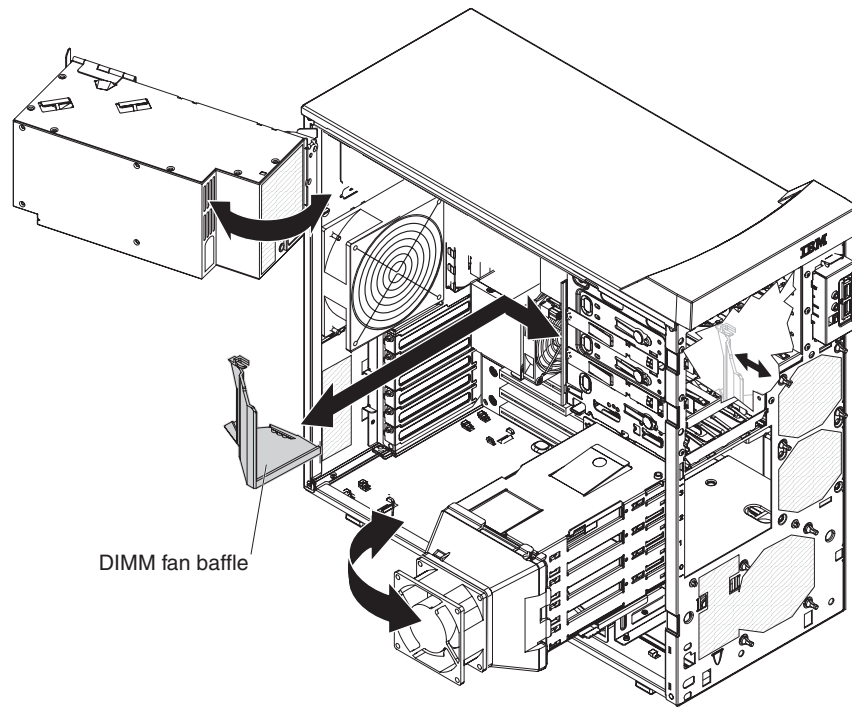
1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).
4. Remove the bezel (see “Removing the two-piece bezel” on page 33).
5. Lift the power-supply handle and rotate the power supply out of the chassis.

6. Press and hold the drive-cage release lever; then, rotate the drive cage completely out of the chassis until the retaining tab on top of the cage locks into place (see Figure 47).



*Figure 47. DIMM airflow guide*

7. If any cables are routed through the DIMM fan baffle, remove them before removing the DIMM fan baffle.
8. From inside the chassis, grasp the DIMM fan baffle and pull it out of the chassis (see Figure 48).



*Figure 48. Removing the DIMM fan baffle*

9. Disconnect the DIMM fan cable from the system board, and note the location of the connector (see “System board internal connectors” on page 9).
10. Grasp the DIMM fan and pull firmly, extending the rubber extensions (grommets) that secure the fan to the chassis. Pull the grommets through the holes in the fan or chassis and remove them, or use side cutters to cut the grommets (see Figure 49).

**Note:** Grommets are provided with the replacement fan.

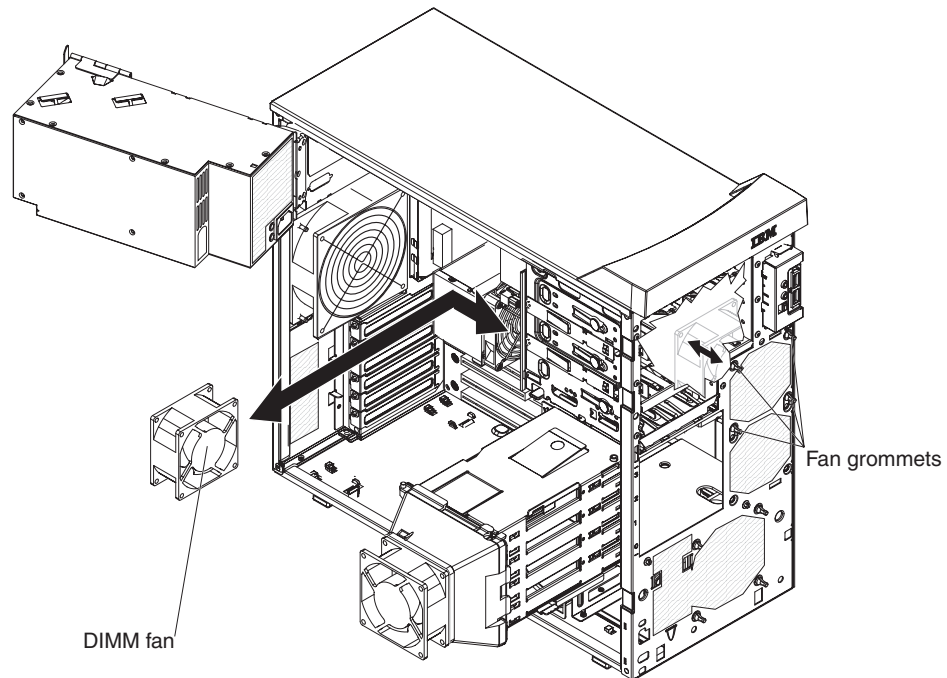


Figure 49. Removing the DIMM fan

11. Remove the fan from the chassis, making sure that no grommets are left loose in the chassis.
12. If you are instructed to return the DIMM fan assembly, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the DIMM fan assembly

### Attention:

- Replace a failed fan within 48 hours.
- To ensure proper cooling and airflow, do not operate the computer for more than 30 minutes with the side cover off.

To install the DIMM fan assembly, complete the following steps:

1. Position the fan so that the grommets protrude through the holes in the chassis; then, use needle-nose pliers to pull the grommets through the holes from outside the chassis (see Figure 50).

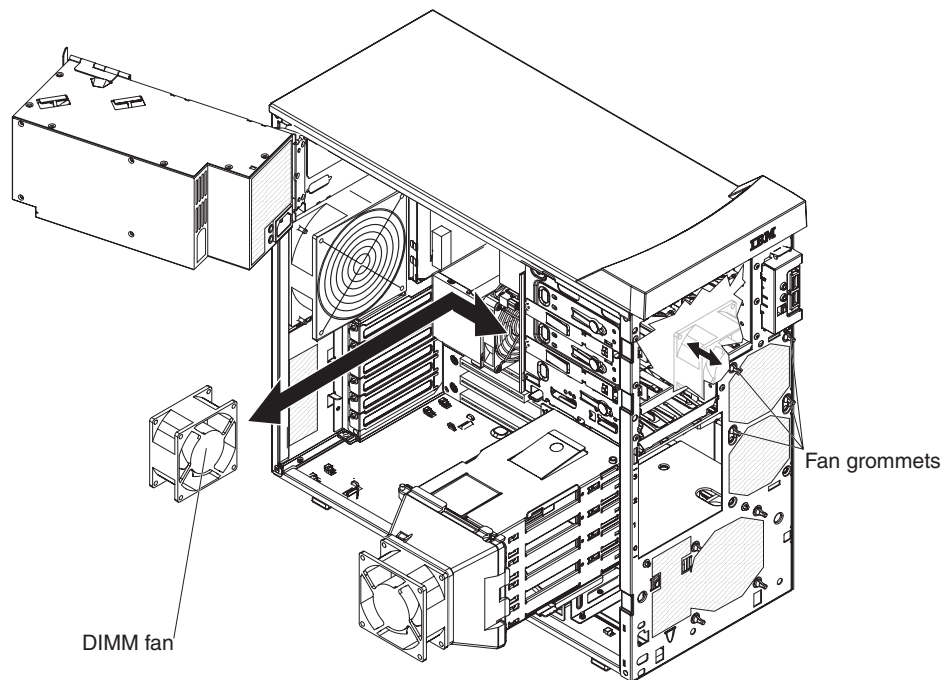


Figure 50. Installing the DIMM fan

2. Connect the DIMM fan cable to the system board (see “System board internal connectors” on page 9).
3. Slide the fan baffle into the fan baffle tab in the front of the chassis until it locks in place (see Figure 51).

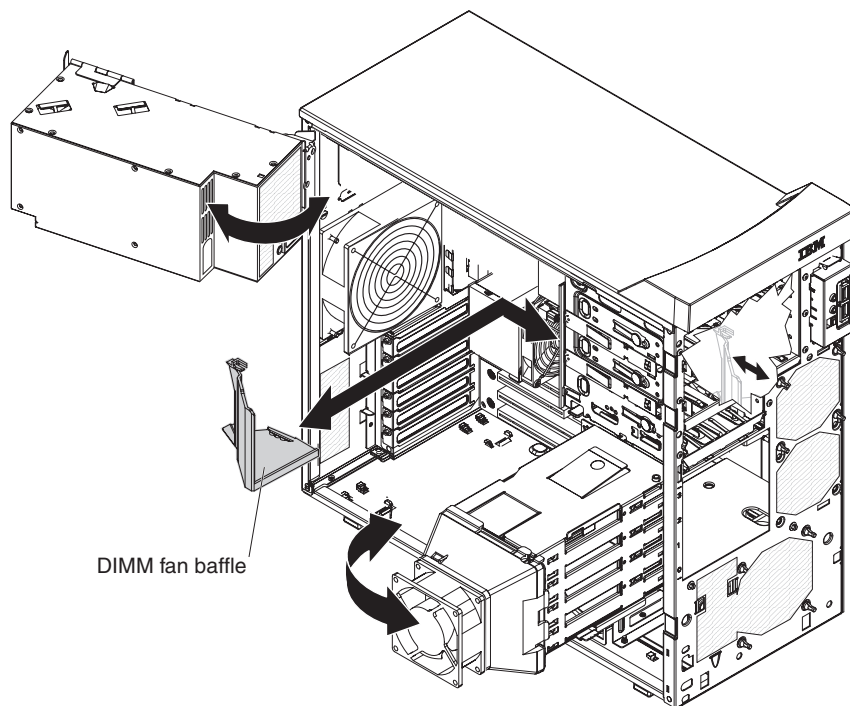


Figure 51. Installing the DIMM fan baffle



4. Secure any cables that you removed from the fan baffle.
5. Push the drive cage outward, and press in on the drive-cage release lever; then, rotate the drive cage completely into the chassis.
6. Press down on the power-supply release latch and rotate the power supply into the chassis. Return the power-supply handle into position.
7. Replace the bezel (see “Installing the two-piece bezel” on page 35).
8. Replace the side cover (see “Installing the side cover” on page 32).
9. Reconnect all external cables and power cords; then, turn on all attached devices and the computer.

## Removing the microprocessor and fan sink

To remove the microprocessor and fan sink, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Turn the computer on its side so that it is lying flat, with the cover facing up.
4. Remove the side cover (see “Removing the side cover” on page 31).
5. Lift the power-supply handle and rotate the power supply out of the chassis.
6. Press and hold the drive-cage release lever; then, rotate the drive cage completely out of the chassis until the retaining tab on top of the cage locks into place.
7. Disconnect any cables that impede access to the fan sink and microprocessor.  
**Attention:** The fan-sink retention lever is spring-loaded when the fan sink is in place. Releasing the lever too quickly or allowing it to spring upward can damage the fan sink and surrounding components.
8. To remove the fan sink from the microprocessor complete the following steps.

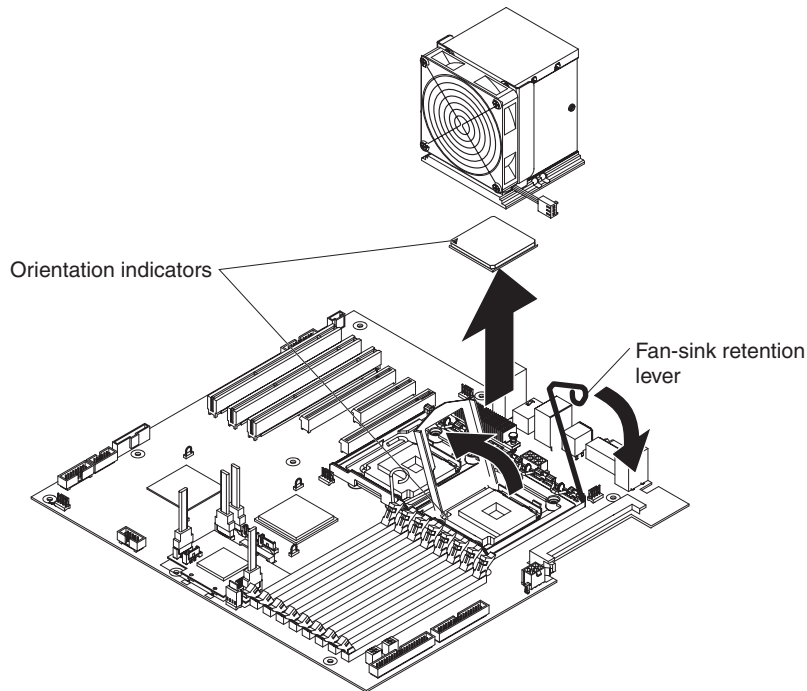


Figure 52. Removing the fan sink and microprocessor

- a. Disconnect the fan-sink cable from the system board (see “System board internal connectors” on page 9).
- b. Release the fan-sink retention lever by pressing down on the end, moving it to the side and slowly releasing it to the open (up) position.

**Important:** Be careful when handling the microprocessor and fan sink. If the microprocessor and fan sink will be reused, do not contaminate the thermal material between them.

- c. Tip the top of the fan sink toward the front of the chassis while sliding it away from the lower flange of the retention module; then, remove it from the chassis. After removal, place the fan sink on its side on a clean, flat surface.

**Attention:** The microprocessor retention latch is spring-loaded when the microprocessor is in place. Releasing the latch too quickly or allowing it to spring upward can damage the microprocessor and surrounding components.

9. Release the microprocessor retention latch by pressing down on the end, moving it to the side, and slowly releasing it to the open (up) position (see Figure 53).
10. Open the microprocessor bracket frame by lifting up the tab on the top edge (see Figure 53).

**Attention:** Use the vacuum tool that comes with the replacement part to remove the microprocessor. Dropping the microprocessor during removal can damage the contacts. Also, contaminants on the microprocessor contacts, such as oil from your skin, can cause connection failures between the contacts and the socket.

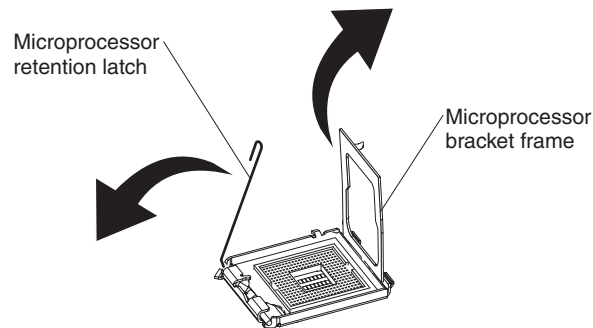


Figure 53. Microprocessor bracket frame

11. Remove the microprocessor by using the vacuum tool and completing the following steps (see Figure 54).

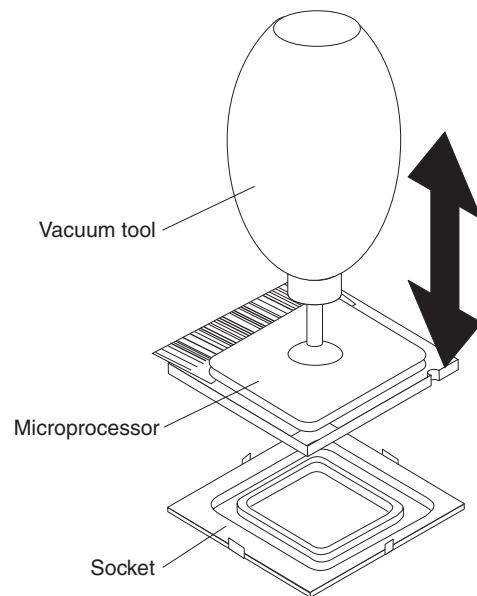


Figure 54. Removing the microprocessor

- a. Squeeze and hold the bladder of the vacuum tool; then, place the suction cup on the microprocessor and release the bladder.
  - b. Using the tool, carefully lift the microprocessor straight up and out of the socket, and place it on a static-protective surface.
  - c. Squeeze the bladder of the vacuum tool to release the microprocessor from the suction cup.
12. If you are instructed to return the microprocessor and fan sink, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the microprocessor and fan sink

The following notes describe information that you must consider when installing an additional microprocessor in the computer:

- Read the documentation that comes with the microprocessor to determine whether you must update the computer BIOS code. The most current level of BIOS code for the computer is available from <http://www.ibm.com/support/>.

- To ensure proper computer operation, use microprocessors that have the same cache size and type, and the same clock speed. Microprocessor internal and external clock frequencies must be identical. You can use the Configuration/Setup Utility program to determine the specific type of microprocessor on the system board.

**Important:** The first microprocessor must always be installed in the microprocessor 1 socket.

- The microprocessor speeds are automatically set for this computer; therefore, you do not have to set any microprocessor frequency-selection jumpers or switches.
- Terminator cards are not required for empty microprocessor sockets.
- For additional illustrations of the system-board components, see “System board option connectors” on page 8.
- To order additional microprocessor options, contact your IBM marketing representative or authorized reseller.
- For a list of supported microprocessor options for your computer, see <http://www.ibm.com/servers/eserver/serverproven/compat/us/iserver.html/>.

The Microsoft Windows XP operating system that comes preinstalled on the computer automatically configures itself when an additional microprocessor is installed. Other operating systems might have to be manually configured to support an additional microprocessor.

To install the microprocessor and the fan sink, complete the following steps.

1. Make sure that the microprocessor socket lever and cover are in the fully open position.

**Attention:** Use the vacuum tool that comes with the replacement part to install the microprocessor. Dropping the microprocessor during installation can damage the contacts. Also, contaminants on the microprocessor contacts, such as oil from your skin, can cause connection failures between the contacts and the socket.

2. Install the microprocessor.

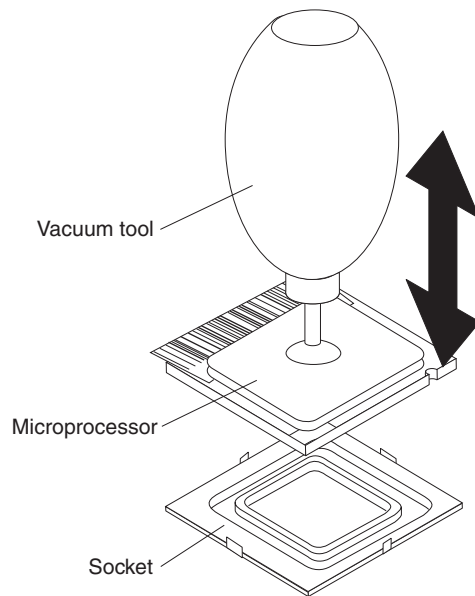


Figure 55. Installing the microprocessor

- a. Squeeze and hold the bladder of the vacuum tool; then, place the suction cup on the microprocessor and release the bladder (see Figure 55).

**Note:** To maintain the correct orientation between the microprocessor and the microprocessor socket during installation, observe the following information:

- The microprocessor has two notches that are keyed to two tabs on the sides of the socket.
  - A triangle-shaped indicator on one corner of the microprocessor points to a 45-degree angle on one corner of the socket.
- b. Using the vacuum tool, carefully place the microprocessor into the socket.
  - c. Squeeze the bladder of the vacuum tool to release the microprocessor from the suction cup.
3. Close the microprocessor bracket frame; then, close the microprocessor retention latch and lock it securely in place (see Figure 56).

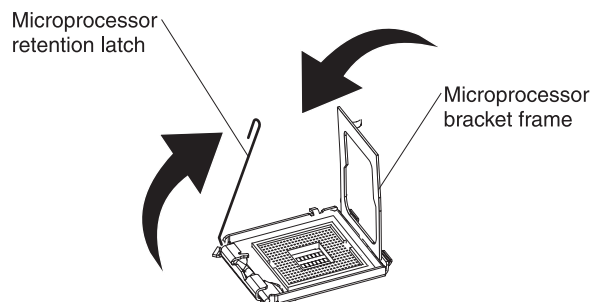


Figure 56. Microprocessor bracket frame

4. Install the fan sink.
  - a. Make sure that the fan-sink retention lever is in the fully open position.

**Important:** Be careful when handling the microprocessor and fan sink. Do not contaminate the thermal material between them.

- b. Slide the bottom edge of the fan sink under the lower flange of the retention module; then, place the top of the fan sink onto the top of the retention module.
- c. Close the fan-sink retention lever and lock it securely in place.

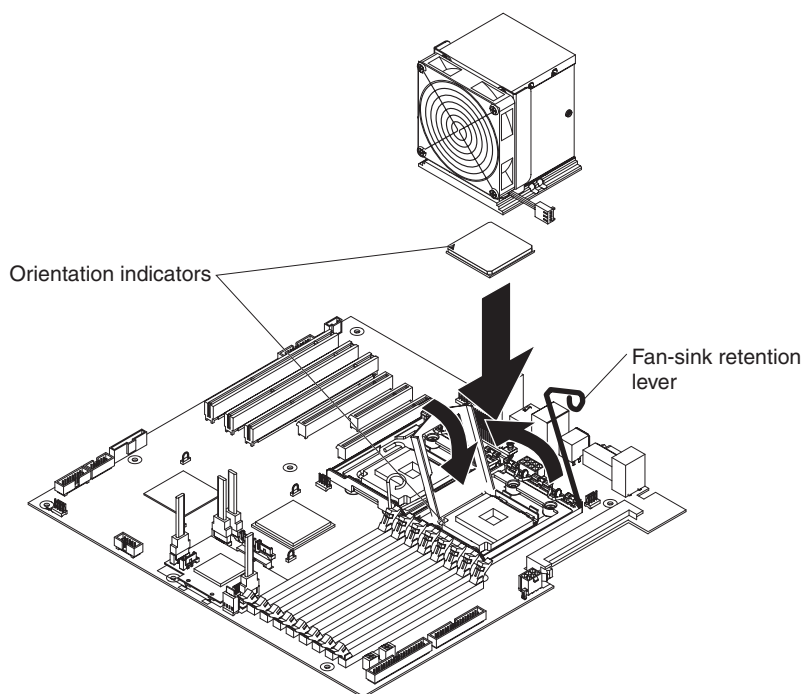


Figure 57. Installing the fan sink and microprocessor

5. Reconnect the fan-sink cable to the system board (see “System board internal connectors” on page 9).
6. Reconnect any cables that you disconnected during the removal of the original microprocessor.
7. Push the drive cage outward, and press in on the drive-cage release lever; then, rotate the drive cage completely into the chassis.
8. Press down on the power-supply release latch and rotate the power supply into the chassis. Return the power supply handle to the closed position.
9. Install the side cover (see “Installing the side cover” on page 32).
10. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the power supply

When you remove or install a power supply, observe the following precautions.

**Statement 8:**



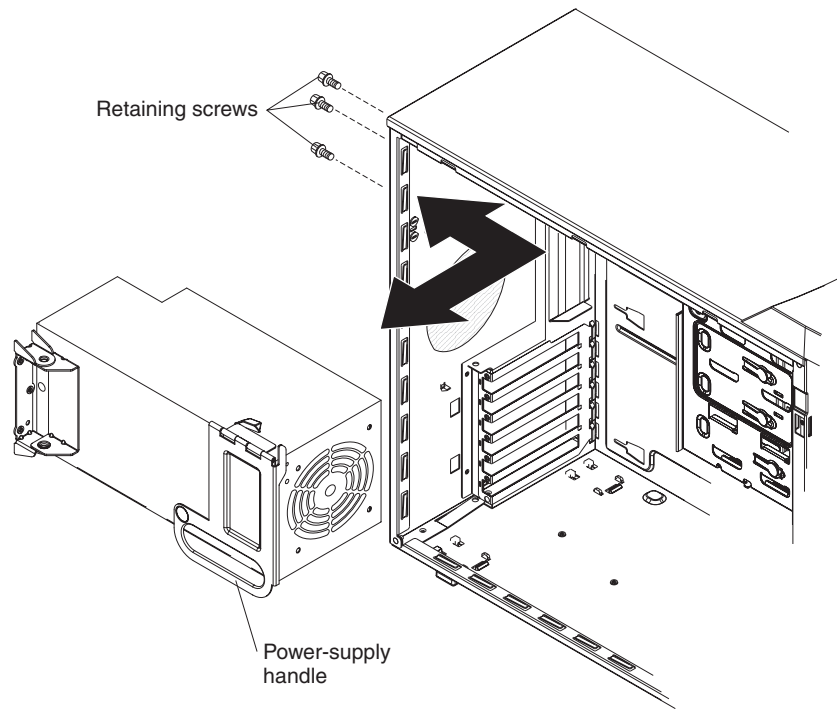
**CAUTION:**

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



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

To remove the power supply, complete the following steps.



*Figure 58. Removing the power supply*

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).

**Note:** It might be helpful to lay the computer on its left side for the remainder of this procedure.

4. Disconnect the cables from the power supply to the system board and all internal components.

**Attention:** Support the power supply while removing the mounting screws. After the screws are removed, the power supply is loose and can damage other components in the computer.

5. While supporting the power supply, remove the three power-supply retaining screws that secure it to the chassis. Store the retaining screws for use with the replacement power supply.
6. Support the power supply; then, lift the power-supply handle and rotate the power supply out of the chassis (see Figure 58).
7. Lift the power supply out of the chassis.
8. If you are instructed to return the power supply, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the power supply

### Important:

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

To install the power supply, complete the following steps.

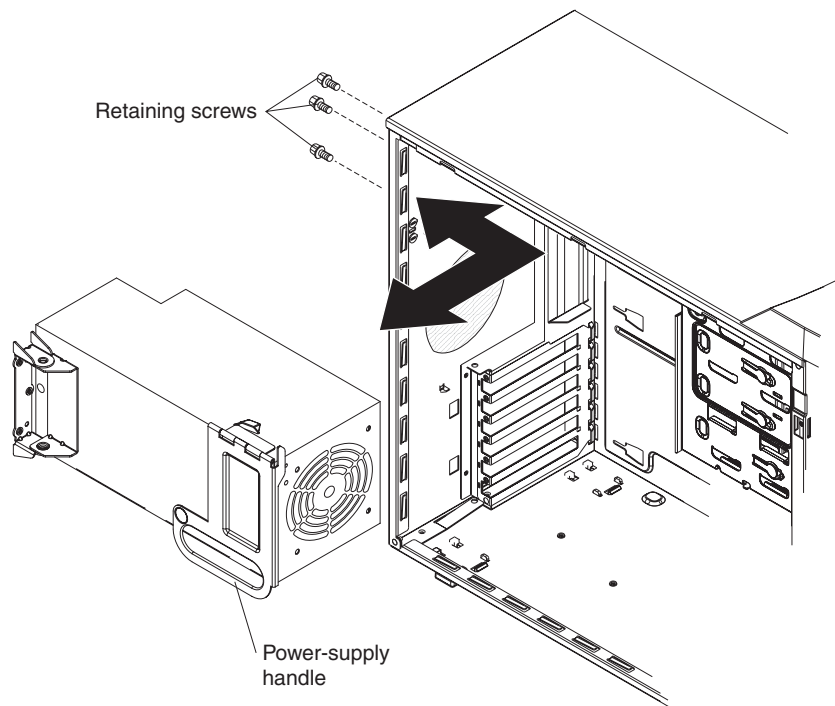


Figure 59. Installing the power supply

1. Position the power supply in the chassis so that the screw holes in the power supply are aligned with the corresponding holes in the rear of the chassis.
2. Support the power supply while installing the three power-supply retaining screws that secure the power supply to the chassis.
3. Reconnect the cables from the power supply to the system board and all internal components.
4. Install the side cover (see "Installing the side cover" on page 32).



5. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Removing the system board

To remove the system board, complete the following steps.

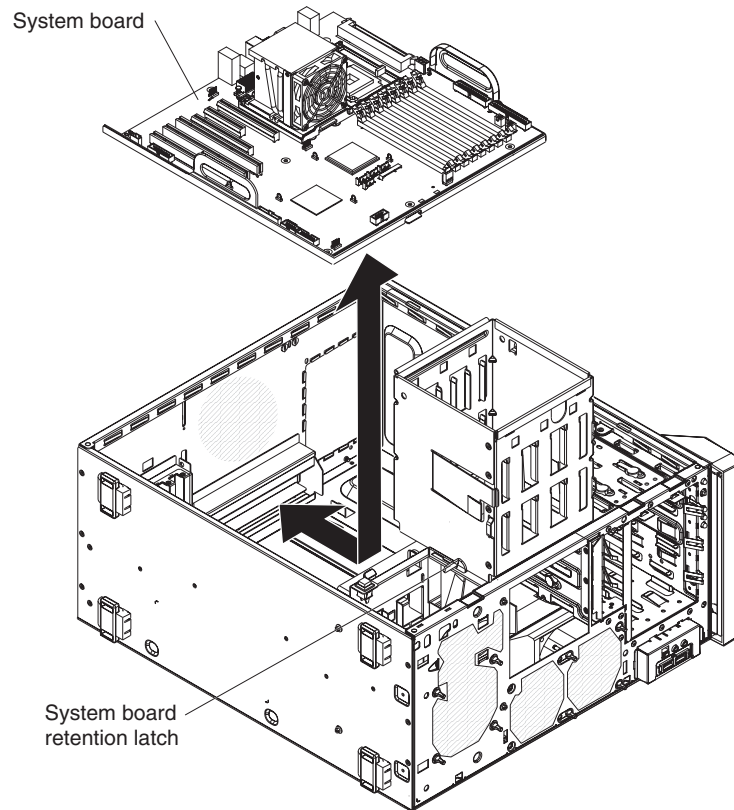


Figure 60. Removing the system board

1. Read the safety information that begins on page vii and “Installation guidelines” on page 29.
2. Turn off the computer and all attached devices; then, disconnect all external cables and power cords.
3. Remove the side cover (see “Removing the side cover” on page 31).

**Note:** It might be helpful to lay the chassis on its left side for the remainder of this procedure.

4. Disconnect the cables from the power supply to the system board and all internal components.
5. Lift the power-supply handle and rotate the power supply out of the chassis.
6. Press and hold the drive-cage release lever; then, rotate the drive cage completely out of the chassis until the retaining tab on top of the cage locks into place.
7. Disconnect the cables on the system board, and note the cable routing and connector locations (see “System board internal connectors” on page 9).

**Note:** You might have to remove adapters before you can disconnect some cables.

8. Remove any installed adapters (see “Removing an adapter” on page 36).
9. Remove the mini-PCI Express adapter (see “Removing the mini-PCI Express adapter” on page 60).

10. Remove the core-chip air baffle. Grasp the handle on the air baffle and lift the air baffle out of the computer.
11. Remove the microprocessors and fan sinks (see “Removing the microprocessor and fan sink” on page 75).
12. Remove the VRM if one is installed. See the *User’s Guide* for the location of the VRM.
13. Remove the DIMM air baffle (see “Removing the DIMM fan assembly” on page 70).
14. Remove the memory modules (see “Removing a DIMM” on page 41).
15. Move the system board retention latch toward the rear of the chassis.
16. Slide the system board toward the front of the chassis to disengage it from the slots in the chassis; then, lift the system board out of the chassis.
17. If you are instructed to return the system board, follow all packaging instructions, and use any packaging materials for shipping that are supplied to you.

## Installing the system board

To install the system board, complete the following steps.

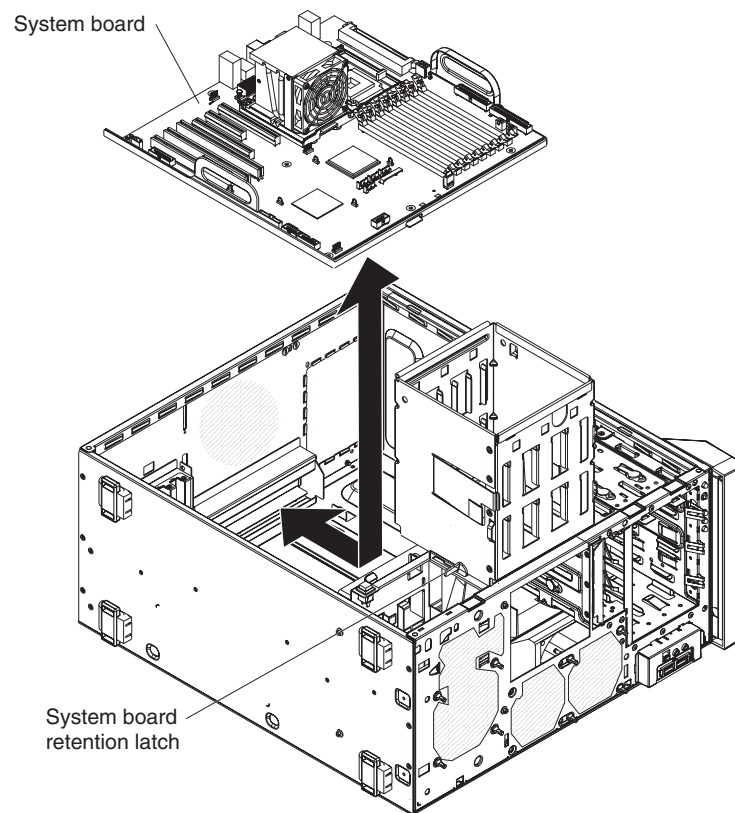


Figure 61. Installing the system board

1. Position the system board so that it is aligned with the slots in the chassis; then, slide the system board toward the rear of the chassis until it locks securely into place.
2. Slide the system board retention latch toward the front of the chassis.
3. Install the memory modules (see “Installing a DIMM” on page 42).

4. Install the DIMM fan baffle (see “Installing the DIMM fan assembly” on page 73).
5. Install the VRM if you removed one. See the *User's Guide* for instructions for installing the VRM.
6. Install the microprocessors and fan sinks (see “Installing the microprocessor and fan sink” on page 77).
7. Replace the air baffle over the core chip on the system board.
8. Install the mini-PCI Express adapter (see “Installing the mini-PCI Express adapter” on page 62).
9. Install any adapters that you removed (see “Installing an adapter” on page 37).
10. Reconnect any cables to the system board that you removed or disconnected.
11. Push the drive cage outward, and press in on the drive-cage release lever; then, rotate the drive cage completely into the chassis.
12. Press down on the power-supply release latch and rotate the power supply into the chassis. Return the power supply handle to the closed position.
13. Reconnect the cables from the power supply to the system board and all internal components.
14. Install the side cover (see “Installing the side cover” on page 32).
15. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

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## Chapter 5. Diagnostics

This chapter describes the diagnostic tools that are available to help you solve problems that might occur in the computer.

If you cannot locate and correct the problem using the information in this chapter, see Appendix A, “Getting help and technical assistance,” on page 149 for more information.

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### Diagnostic tools

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

- **POST beep codes and error messages**

The power-on self-test (POST) generates beep codes and messages to indicate successful test completion or the detection of a problem. See “POST” for more information.

- **Troubleshooting tables**

These tables list problem symptoms and actions to correct the problems. See “Troubleshooting tables” on page 107 for more information.

- **Diagnostic programs, messages, and error codes**

The diagnostic programs are the primary method of testing the major components of the computer. The diagnostic programs are stored on a hidden partition on the hard disk. See “Diagnostic programs, messages, and error codes” on page 122 for more information.

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### POST

When you turn on the computer, it performs a series of tests to check the operation of computer components and some optional devices in the computer. This series of tests is called the power-on self-test, or POST.

If a power-on password is set, you must type the password and press Enter, when prompted, for POST to run.

If POST is completed without detecting any problems, a single beep sounds, and the computer startup is completed.

If POST detects a problem, more than one beep might sound, or an error message is displayed. See “Beep code descriptions” and “POST error codes” on page 94 for more information.

### POST beep codes

A beep code is a combination of short and long beeps or a series of short beeps separated by pauses. For example, a “1-2-3” beep code is one short beep, a pause, two short beeps, a pause, and three short beeps. A beep code other than one beep indicates that POST has detected a problem. To determine the meaning of a beep code, see “Beep code descriptions.” If no beep code sounds, see “No-beep symptoms” on page 92.

#### Beep code descriptions

The following table describes the beep codes and suggested actions to correct the detected problems.

A single problem might cause more than one error message. When this occurs, correct the cause of the first error message. The other error messages usually will not occur the next time POST runs.

**Exception:** If there are multiple error codes that indicate a microprocessor error, the error might be in a microprocessor or in a microprocessor socket. See “Microprocessor problems” on page 112 for information about diagnosing microprocessor problems.

Table 6. POST beep codes

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Beep code	Description	Action
1-1-2	Microprocessor register test has failed.	(Trained service technician only) Replace the microprocessor.
1-1-3	CMOS write/read test has failed.	<ol style="list-style-type: none"> <li>1. Reseat the battery.</li> <li>2. Clear CMOS. See “Erasing a lost or forgotten password (clearing CMOS)” on page 145 for information about how to clear CMOS.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
1-1-4	BIOS read-only memory (ROM) checksum has failed.	<ol style="list-style-type: none"> <li>1. Recover the BIOS code.</li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>
1-2-1	Programmable interval timer test has failed.	(Trained service technician only) Replace the system board.
1-2-2	DMA initialization has failed.	(Trained service technician only) Replace the system board.
1-2-3	DMA page register write/read test has failed.	(Trained service technician only) Replace the system board.
1-2-4	RAM refresh verification has failed.	(Trained service technician only) Replace the system board.

Table 6. POST beep codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Beep code	Description	Action
1-3-1	First 64 Kb RAM test has failed.	<ol style="list-style-type: none"> <li>1. Reseat the DIMM.</li> <li>2. Replace the lowest-numbered pair of DIMMs with an identical good pair of DIMMs; then, restart the computer. If the beep code error remains, go to step 3. Return one DIMM at a time from the failed pair that you removed earlier back into its connector, restarting the computer after each DIMM, to identify the failed DIMM.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. DIMMs</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
2-1-1	Secondary DMA register test has failed.	(Trained service technician only) Replace the system board.
2-1-2	Primary DMA register test has failed.	(Trained service technician only) Replace the system board.
2-1-3	Primary interrupt mask register test has failed.	(Trained service technician only) Replace the system board.
2-1-4	Secondary interrupt mask register test has failed.	(Trained service technician only) Replace the system board.
2-2-2	Keyboard controller test has failed.	<ol style="list-style-type: none"> <li>1. Reseat the keyboard cable.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Keyboard</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
2-2-3	CMOS power failure and checksum checks have failed.	<ol style="list-style-type: none"> <li>1. Reseat the battery.</li> <li>2. Clear CMOS. See “Erasing a lost or forgotten password (clearing CMOS)” on page 145 for information about how to clear CMOS.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 6. POST beep codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Beep code	Description	Action
2-4-1	Video failed; system believed operable.	<ol style="list-style-type: none"> <li>1. Reseat the video adapter.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Video adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
3-1-1	Timer tick interrupt test has failed.	(Trained service technician only) Replace the system board.
3-1-2	Interval timer channel 2 test has failed.	(Trained service technician only) Replace the system board.
3-1-3	RAM test has failed above address 0FFFFh.	<ol style="list-style-type: none"> <li>1. Reseat the DIMM.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. DIMM</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
3-1-4	Time-of-day clock test has failed.	<ol style="list-style-type: none"> <li>1. Reseat the battery.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
3-2-1	Serial port test has failed.	(Trained service technician only) Replace the system board.
3-2-3	Math coprocessor test has failed.	Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>1. (Trained service technician only) Optional microprocessor</li> <li>2. (Trained service technician only) Microprocessor</li> <li>3. (Trained service technician only) System board</li> </ol>



Table 6. POST beep codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Beep code	Description	Action
3-2-4	Failure comparing CMOS memory size against actual.	Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>1. DIMM</li> <li>2. Battery</li> <li>3. (Trained service technician only) System board</li> </ol>
3-3-1	A memory size mismatch has occurred.	<ol style="list-style-type: none"> <li>1. Reseat the following components:               <ol style="list-style-type: none"> <li>a. DIMM</li> <li>b. Battery</li> </ol> </li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. DIMM</li> <li>b. Battery</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
3-3-2	A critical SMBUS error occurred (I2C bus has failed).	<ol style="list-style-type: none"> <li>1. Disconnect the power cord, wait 30 seconds, and retry.</li> <li>2. Reseat the following components:               <ol style="list-style-type: none"> <li>a. DIMM</li> <li>b. (Trained service technician only) Microprocessor</li> </ol> </li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. DIMM</li> <li>b. (Trained service technician only) Microprocessor</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 6. POST beep codes (continued)

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Beep code	Description	Action
3-3-3	<p>No operational memory in the system.</p> <p><b>Attention:</b> In some memory configurations, the 3-3-3 beep code might sound during POST followed by a blank display screen. If this occurs and the <b>Boot Fail Count</b> feature in the <b>Startup Option</b> menu of the Configuration/Setup Utility program is set to <b>Enabled</b> (its default setting), you must restart the computer three times to force the system BIOS to reset the memory connector from <b>Disabled</b> to <b>Enabled</b>.</p>	<ol style="list-style-type: none"> <li>If you just installed memory, make sure that the new memory is correct for your computer.</li> <li>Make sure that the DIMMs are installed in pairs; then, restart the computer.</li> <li>Reseat the DIMMs.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>DIMMs</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>

## No-beep symptoms

The following table describes situations in which no beep code sounds when POST is completed.

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
No-beep symptom	Description	Action
No beep during POST.	A system board failure occurred.	<p>Make sure that:</p> <ul style="list-style-type: none"> <li>The speaker cable is connected to the speaker jumper (J76).</li> <li>The BIOS setting for the speaker is Enable/Disable in the Configuration/Setup Utility program (required if BIOS level is 1.40A or later).</li> <li>(Trained service technician only) Replace the speaker.</li> <li>(Trained service technician only) Replace the system board.</li> </ul>
No beep, no video, and the system-error LED is off.	A system board failure occurred.	(Trained service technician only) Replace the system board.
No beep, no video, and the system-error LED is lit.	An undetermined failure has occurred.	See “Solving undetermined problems” on page 146 for more information.

## Error logs

The POST error log contains the three most recent error codes and messages that were generated during POST. The system-event/error log contains messages that were generated during POST and all system status messages from the service processor.

The system-event/error log is limited in size. When the log is full, new entries will not overwrite existing entries; therefore, you must periodically clear the system event/error log through the Configuration/Setup Utility program (the menu choices are described in the *User's Guide*). When you are troubleshooting an error, be sure to clear the system-event/error log so that you can find current errors more easily.

Entries that are written to the system-event/error log during the early phase of POST show an incorrect date and time as the default time stamp; however, the date and time are corrected as POST continues.

Each system event/error log entry appears on its own page. To move from one entry to the next, use the Up Arrow (↑) and Down Arrow (↓) keys.

When you are troubleshooting PCI or PCI Express slots, note that the error logs report the PCI or PCI Express buses numerically. The numerical assignments vary depending on the configuration. You can check the assignments by running the Configuration/Setup Utility program (see the *User's Guide* for more information).

You can view the contents of the POST error log and the system event/error log from the Configuration/Setup Utility program. For complete information about using the Configuration/Setup Utility program, see the *User's Guide*.

To view the error logs, complete the following steps:

1. Turn on the computer.
2. When the prompt Press F1 for Configuration/Setup appears, press F1.
3. Select **Error Logs**.
4. Use one of the following procedures:
  - To view the POST error log, select **POST Error Log**.
  - To view the system-event/error log, select **System Event/Error Log**.

## POST error codes

The following table describes the POST error codes and suggested actions to correct the detected problems.

Table 7. POST error codes

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
062	<p>The computer failed to start on three consecutive attempts.</p> <p>All caches are disabled. Repeatedly turning the computer on and off or resetting the computer might cause this problem.</p>	<ol style="list-style-type: none"> <li>Run the Configuration/Setup Utility program and make sure that all settings are correct. Use the <b>Cache Control</b> selection in the <b>Advanced Setup</b> menu of the Configuration/Setup Utility program to enable the caches.</li> <li>Reseat the following components: <ol style="list-style-type: none"> <li>Battery</li> <li>(Trained service technician only) Microprocessor</li> </ol> </li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>Battery</li> <li>(Trained service technician only) Microprocessor</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol> <p><b>Note:</b> When the problem is corrected, be sure to enable the caches.</p>
101	Timer tick interrupt failure.	(Trained service technician only) Replace the system board.
102	Timer 2 test failure.	(Trained service technician only) Replace the system board.
106	Diskette control error.	(Trained service technician only) Replace the system board.
129	An internal cache (L1) error occurred.	<ol style="list-style-type: none"> <li>(Trained service technician only) Reseat the microprocessor.</li> <li>(Trained service technician only) Reseat the optional microprocessor.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>(Trained service technician only) Microprocessor</li> <li>(Trained service technician only) Optional microprocessor</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
151	A real-time clock (RTC) error occurred.	<ol style="list-style-type: none"> <li>1. Run the diagnostics program.</li> <li>2. Reseat the battery.</li> <li>3. Clear CMOS. See “Erasing a lost or forgotten password (clearing CMOS)” on page 145 for information about how to clear CMOS.</li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
161	The real-time clock battery has failed.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program, select <b>Load Default Settings</b>, make sure that the date and time are correct, and save the settings.</li> <li>2. Reseat the battery.</li> <li>3. Clear CMOS. See “Erasing a lost or forgotten password (clearing CMOS)” on page 145 for information about how to clear CMOS.</li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
162	<p>A change in the device configuration occurred. This error occurs under one or more of the following conditions:</p> <ul style="list-style-type: none"> <li>• A new device has been installed.</li> <li>• A device has been moved to a different location or cable connection.</li> <li>• A device has been removed or disconnected from a cable.</li> <li>• A device is failing and is no longer recognized by the computer as being installed.</li> <li>• An external device is not turned on.</li> <li>• An invalid checksum is detected in the battery-backed memory.</li> </ul>	<ol style="list-style-type: none"> <li>1. Make sure that all external devices are turned on. You must turn on external devices before turning on the computer.</li> <li>2. If you did not add, remove, or change the location of a device, a device is probably failing. Running the diagnostic program might isolate the failing device. See “Running the diagnostic programs” on page 122 or “Using the IBM Enhanced Diagnostics diskette or CD” on page 133.</li> <li>3. Run the Configuration/Setup Utility program, select <b>Load Default Settings</b>, and save the settings.</li> <li>4. Reseat the following components: <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. Failing device</li> </ol> </li> <li>5. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. Failing device (if the device is a FRU, the device must be replaced by a trained service technician only.</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
163	The time of day has not been set.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program, select <b>Load Default Settings</b>, make sure that the date and time are correct, and save the settings.</li> <li>2. Reseat the battery.</li> <li>3. Clear CMOS. See “Erasing a lost or forgotten password (clearing CMOS)” on page 145 for information about how to clear CMOS.</li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Battery</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
164	A change in the memory configuration occurred. This message might appear after you add or remove memory.	<ol style="list-style-type: none"> <li>1. If POST error message 289 also occurred, follow the actions for the 289 POST error code first.</li> <li>2. If you just installed or removed memory, run the Configuration/Setup Utility program, and save the new configuration settings.</li> <li>3. Reseat the DIMMs.</li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. DIMMs</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
175	The service processor flash code is damaged or not loaded.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Replace the system board.</li> </ol>
177 and 178	A security hardware error occurred.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>
184	The power-on password information stored in the computer has been removed.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program, select <b>Load Default Settings</b>, and save the settings.</li> <li>2. Reseat the battery.</li> <li>3. Clear CMOS. See “Erasing a lost or forgotten password (clearing CMOS)” on page 145 for information about how to clear CMOS.</li> <li>4. Replace the battery.</li> <li>5. (Trained service technician only) Replace the system board.</li> </ol>
185	The drive startup sequence information is corrupted.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program, select <b>Load Default Settings</b>, and save the settings.</li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>
187	The VPD serial number is not set. <b>Note:</b> The system serial number is set in the VPD EEPROM at the time of manufacturing. If the system board has been replaced, the system serial number will be invalid and must be reset.	<ol style="list-style-type: none"> <li>1. Restart the computer.</li> <li>2. Update the BIOS code to set the serial number. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>3. (Trained service technician only) Replace the system board.</li> </ol>
188	The EEPROM CRC #2 is damaged.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
189	An attempt has been made to access the computer with an incorrect password three times.	Restart the computer and enter the administrator password; then, run the Configuration/Setup Utility program and change the power-on password.
196	Microprocessor cache mismatch.	Make sure that the microprocessors are of the same type and speed.
198	Microprocessor speed mismatch.	Make sure that the microprocessors are of the same type and speed.
199	Microprocessors not in recommended configurations.	Make sure that the microprocessors are of the same type and speed.
201	An error occurred during the memory controller test. This error can be caused by: <ul style="list-style-type: none"> <li>• Incorrectly installed memory</li> <li>• A failing memory module</li> <li>• A system board problem</li> </ul>	<ol style="list-style-type: none"> <li>1. If you just installed memory, make sure that the new memory is correct for the computer.</li> <li>2. Reseat the DIMM.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. DIMM</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
229	An internal cache (L2) error occurred.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Reseat the microprocessor.</li> <li>2. (Trained service technician only) Reseat the optional microprocessor.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor</li> <li>b. (Trained service technician only) Optional microprocessor</li> </ol> </li> </ol>
289	An error occurred during POST memory tests and a DIMM was disabled.	<ol style="list-style-type: none"> <li>1. If you just installed memory, make sure that the new memory is correct for the computer.</li> <li>2. If the DIMM was disabled by the user, run the Configuration/Setup Utility program and enable the DIMM.</li> <li>3. Reseat the DIMM.</li> <li>4. Replace the DIMM.</li> </ol>



Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
301 and 303	An error occurred during the keyboard and keyboard controller test. These error messages also might be accompanied by continuous beeping.	<ol style="list-style-type: none"> <li>1. If you just connected a new mouse or other pointing device, turn off the computer and disconnect that device. Wait at least 5 seconds; then, turn on the computer. If the error message goes away, replace the device.</li> <li>2. Make sure that nothing is resting on the keyboard or pressing on a key.</li> <li>3. Make sure that no key is stuck.</li> <li>4. Reseat the keyboard cable and make sure that it is connected to the correct connector on the computer.</li> <li>5. After installing a USB keyboard, run the Configuration/Setup Utility program to enable keyboardless operation and prevent the POST error message from being displayed during startup.</li> <li>6. Run the diagnostic tests to isolate the computer component that failed.</li> <li>7. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Keyboard</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
602	An invalid diskette boot record error occurred.	<ol style="list-style-type: none"> <li>1. Reseat the diskette drive cable.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Diskette drive cable</li> <li>b. Diskette drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
604	An error occurred during a diskette drive test.	<ol style="list-style-type: none"> <li>1. Make sure that the Configuration/Setup Utility program correctly reflects the type of diskette drive that is installed.</li> <li>2. Reseat the diskette drive cable.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Diskette drive cable</li> <li>b. Diskette drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
662	A diskette drive configuration error occurred.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program and diagnostics.</li> <li>2. Reseat the diskette drive cable.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Diskette drive cable</li> <li>b. Diskette drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
1162	The serial port configuration conflicts with another device in the system.	<ol style="list-style-type: none"> <li>1. Make sure that the interrupt request (IRQ) and I/O port assignments needed by the serial port are available.</li> <li>2. If all interrupts are being used by adapters, remove an adapter to make an interrupt available to the serial port, or force other adapters to share an interrupt.</li> <li>3. Make sure that the serial port setting is correct in the Configuration/Setup Utility program. If the setting is not correct, change it and save the settings.</li> <li>4. (Trained service technician only) Replace the system board.</li> </ol>
11xx	A system board serial port 1 error occurred (xx can be any number or letter).	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>
1601	A BIOS code update is required.	<ol style="list-style-type: none"> <li>1. Download and install the latest level of the BIOS code.</li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>
1762	A hard disk drive configuration error occurred.	<ol style="list-style-type: none"> <li>1. Make sure that the hard disk drive is set correctly in the Configuration/Setup Utility program.</li> <li>2. Reseat the hard disk drive cable.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Hard disk drive</li> <li>b. Hard disk drive cable</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
178x	An error occurred during the hard disk drive x test (x = 0 to 3).	<ol style="list-style-type: none"> <li>1. Reseat the hard disk drive x cable.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Hard disk drive x</li> <li>b. Hard disk drive cable x</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
1800	No more hardware interrupt available for the PCI adapter.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. Remove the adapter.</li> </ol>
1808	Unsupported PCI device is installed.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program, select <b>Devices and I/O Ports</b>, and make sure that the device is enabled.</li> <li>2. Reseat each adapter.  <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first; if no LEDs are lit, reseat each adapter one at a time, restarting the computer each time, to isolate the failing adapter.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
1962	No valid startup devices were found. The computer cannot find the startup drive or operating system.	<ol style="list-style-type: none"> <li>1. Reseat the hard disk drive cable.</li> <li>2. Make sure that the hard disk drive that you want to start from is in the startup sequence.               <ol style="list-style-type: none"> <li>a. Run the Configuration/Setup Utility program, and select <b>Startup Option</b>.</li> <li>b. Check the list of startup devices in the <b>Startup Device</b> data fields. Is the drive that you want to start from in the startup sequence?                   <p><b>Yes</b> Exit from this screen; then, select <b>Exit Setup</b> to exit the Configuration/Setup menu. Go to step 2c.</p> <p><b>No</b> Follow the instructions on the screen to add the drive; then, save the changes and exit the Configuration/Setup menu. Restart the computer.</p> </li> <li>c. Is an operating system installed?                   <p><b>Yes</b> Turn off the computer. Go to step 2d.</p> <p><b>No</b> Install the operating system in the computer; then, follow your operating-system instructions to shut down and restart the computer.</p> </li> <li>d. During computer startup, watch for messages indicating a hardware problem.</li> <li>e. If the error message still appears, run the diagnostics to isolate the problem.</li> </ol> </li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Hard disk drive cable</li> <li>b. Hard disk drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
2400	A video controller test failure occurred.	<ol style="list-style-type: none"> <li>1. Reseat the video adapter.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Video adapter (if installed)</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
2462	A video memory configuration error occurred.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program and load the default settings.</li> <li>2. Reseat the video adapter.</li> <li>3. Replace the video adapter.</li> </ol>
5962	An IDE CD or DVD drive configuration error occurred.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program and load the default settings.</li> <li>2. Reseat the following components:               <ol style="list-style-type: none"> <li>a. CD or DVD drive cable</li> <li>b. Battery</li> </ol> </li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. CD or DVD drive</li> <li>b. CD or DVD drive cable</li> <li>c. Battery</li> <li>d. (Trained service technician only) System board</li> </ol> </li> </ol>
8603	<p>An error occurred during the mouse (pointing device) controller test. The addition or removal of a mouse, or a failing system board can cause this error.</p> <p><b>Note:</b> This error also can occur if electrical power was lost for a very brief period and then restored. In this case, turn off the computer for at least 5 seconds; then, turn it back on.</p>	<ol style="list-style-type: none"> <li>1. Reseat the mouse (pointing device) cable and make sure that it is connected to the correct connector on the computer.</li> <li>2. Complete the following steps:               <ol style="list-style-type: none"> <li>a. Turn off the computer.</li> <li>b. Disconnect the mouse (pointing device) from the computer.</li> <li>c. Turn on the computer.</li> </ol> <p>If the error message does not reappear, the mouse (pointing device) is probably failing. See the documentation that comes with the device for additional testing information.</p> </li> <li>3. Run the diagnostic tests to isolate the problem.</li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Mouse (pointing device)</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
00012000	A processor machine check error occurred.	<ol style="list-style-type: none"> <li>1. Update the system BIOS code.</li> <li>2. (Trained service technician only) Reseat the microprocessor.</li> <li>3. (Trained service technician only) Replace the microprocessor.</li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
00019502	Microprocessor 1 failed.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Reseat the microprocessor.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
00019xxx	Microprocessor x is not functioning.	<ol style="list-style-type: none"> <li>1. Make sure that microprocessor x is installed correctly.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor x</li> <li>b. VRM if installed</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
00151200	Unrecoverable error, microprocessor x reported IERR.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Reseat the microprocessor.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor x</li> <li>b. VRM if installed</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
00180100	A PCI adapter has requested memory resources that are not available.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. Reseat each adapter.  <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first. If no LEDs are lit, reseat each adapter one at a time, restarting the computer each time to isolate the failing adapter.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
00180200	No more I/O space is available for the PCI adapter.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. Reseat each adapter. <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first. If no LEDs are lit, reseat each adapter one at a time, restarting the computer each time to isolate the failing adapter.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
00180300	There is no memory available above 1MB for the PCI adapter.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. Reseat each adapter. <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first. If no LEDs are lit, reseat each adapter one at a time, restarting the computer each time to isolate the failing adapter.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
00180400	There is no memory available below 1MB for the PCI adapter.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. Reseat each adapter. <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first. If no LEDs are lit, reseat each adapter one at a time, restarting the computer each time to isolate the failing adapter.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
00180500	PCI option read-only memory checksum error.	<ol style="list-style-type: none"> <li>1. Reseat each adapter. <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first. If no LEDs are lit, reseat each adapter one at a time, restarting the computer each time to isolate the failing adapter.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
00180600	PCI device built-in self test failure, PCI bridge error.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program.</li> <li>2. Reseat each adapter. <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first. If no LEDs are lit, reseat each adapter one at a time, restarting the computer each time to isolate the failing adapter.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
00180700	PCI device not responding.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program, select <b>Devices and I/O Ports</b>, and make sure that the device is enabled.</li> <li>2. Reseat each adapter. <b>Note:</b> If an error LED is lit on an adapter, reseat that adapter first; if no LEDs are lit, reseat each adapter one at a time, restarting the computer each time, to isolate the failing adapter.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Failing adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
00180xxx	The PCI adapter has requested resources that are not available.	<ol style="list-style-type: none"> <li>1. Reorder the adapters in the PCI slots.</li> <li>2. Make sure that the boot device is positioned early in the scan order so that it is executed by POST.</li> <li>3. Make sure that all adapters are set correctly in the Configuration/Setup Utility program, changing memory settings if necessary.</li> <li>4. Remove an adapter to make more memory available to the adapters.</li> <li>5. Disable the BIOS on the adapter (see the documentation that comes with the adapter).</li> <li>6. (Trained service technician only) Replace the system board.</li> </ol>
00181000	General PCI error.	<ol style="list-style-type: none"> <li>1. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>



Table 7. POST error codes (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
Error code	Description	Action
012980xx	Microprocessor 1 error.	<ol style="list-style-type: none"> <li>1. Make sure that both microprocessors have the same cache size and type, and the same clock size.</li> <li>2. Download and update the BIOS code. For more information about downloading and updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor 1</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
012981xx	Microprocessor 2 error	<ol style="list-style-type: none"> <li>1. Make sure that both microprocessors have the same cache size and type, and the same clock size.</li> <li>2. Download and update the BIOS code. For more information about downloading and updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor 2</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
I9990650	AC power has been restored.	<ol style="list-style-type: none"> <li>1. Reseat the power cord.</li> <li>2. (Trained service technician only) Check for interruption of the external power.</li> <li>3. Replace the power cord.</li> </ol>
Other numbers	POST found an error.	Follow the instructions on the screen.

## Troubleshooting tables

Use the troubleshooting tables to find solutions to problems that have identifiable symptoms.

If you cannot find the problem in these tables, see “Running the diagnostic programs” on page 122 for information about testing the computer.

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

1. Remove the software or device that you just added.
2. Run the diagnostic tests to determine whether the computer is running correctly.
3. Reinstall the new software or new device.

## CD or DVD drive problems

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>	
Symptom	Action
CD or DVD drive is not recognized.	<ol style="list-style-type: none"> <li>1. Make sure that: <ul style="list-style-type: none"> <li>• The IDE channel to which the CD or DVD drive is attached (primary or secondary) is enabled in the Configuration/Setup Utility program.</li> <li>• All cables and jumpers are installed correctly.</li> <li>• The signal cable and connector are not damaged and the connector pins are not bent.</li> <li>• The correct device driver is installed for the CD or DVD drive.</li> </ul> </li> <li>2. Run the CD-ROM, CD-RW, or DVD drive diagnostic programs.</li> <li>3. Reseat the CD or DVD drive cable.</li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. CD or DVD drive cable</li> <li>b. CD or DVD drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
A CD or DVD is not working correctly.	<ol style="list-style-type: none"> <li>1. Clean the CD or DVD.</li> <li>2. Run the CD-ROM, CD-RW, or DVD drive diagnostic programs.</li> <li>3. Check the connector and signal cable for bent pins or damage.</li> <li>4. Reseat the CD or DVD drive cable.</li> <li>5. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. CD or DVD drive cable</li> <li>b. CD or DVD drive</li> </ol> </li> </ol>
The CD or DVD drive tray is not working.	<ol style="list-style-type: none"> <li>1. Make sure that the computer is turned on.</li> <li>2. Insert the end of a straightened paper clip into the manual tray-release opening.</li> <li>3. Reseat the CD or DVD drive cable.</li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. CD or DVD drive cable</li> <li>b. CD or DVD drive</li> </ol> </li> </ol>

## Diskette drive problems

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>	
Symptom	Action
The diskette drive activity LED stays lit, or the computer bypasses the diskette drive.	<ol style="list-style-type: none"> <li>If there is a diskette in the drive, make sure that: <ul style="list-style-type: none"> <li>The diskette drive is enabled in the Configuration/Setup Utility program.</li> <li>The diskette is good and not damaged. (Try another diskette if you have one).</li> <li>The diskette is inserted correctly in the drive.</li> <li>The diskette contains the necessary files to start the computer.</li> <li>The software is working correctly.</li> <li>The cable is connected correctly (in the correct orientation).</li> </ul> </li> <li>To prevent diskette drive read/write errors, make sure that the distance between monitors and diskette drives is at least 76 mm (3 in.).</li> <li>Run the diskette drive diagnostic test.</li> <li>Reseat the diskette drive cable.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>Diskette drive cable</li> <li>Diskette drive</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>

## General problems

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>	
Symptom	Action
A cover lock is broken, an indicator LED is not working, or a similar problem has occurred.	If the part is a CRU, replace it. If the part is a FRU, the part must be replaced by a trained service technician.

## Hard disk drive problems

<ul style="list-style-type: none"><li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li><li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li><li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li></ul>	
Symptom	Action
Not all drives are recognized by the hard disk drive diagnostic test (the Fixed Disk test).	Remove the drive that is indicated by the diagnostic tests; then, run the hard disk drive diagnostic test again. If the remaining drives are recognized, replace the drive that you removed with a new one.
The computer stops responding during the hard disk drive diagnostic test.	Remove the hard disk drive that was being tested when the computer stopped responding, and run the diagnostic test again. If the hard disk drive diagnostic test runs successfully, replace the drive that you removed with a new one.
A hard disk drive was not detected while the operating system was being started.	Reseat all hard disk drives and cables; then, run the hard disk drive diagnostic tests again.
A hard disk drive passes the diagnostic Fixed Disk Test, but the problem remains.	Run the diagnostic SCSI Attached Disk Test. <b>Note:</b> This test is not available on computers that have RAID arrays or computers that have IDE or SATA hard disk drives that do not use the on-board mini-PCI Express adapter.

## Intermittent problems

<ul style="list-style-type: none"><li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li><li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li><li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li></ul>	
Symptom	Action
A problem occurs only occasionally and is difficult to detect.	Make sure that: <ul style="list-style-type: none"><li>• All cables and cords are connected securely to the rear of the computer and attached options.</li><li>• When the computer is turned on, air is flowing from the front of the computer at the fan grille. If there is no airflow, the fan is not working. This can cause the computer to overheat and shut down.</li><li>• Make sure that the SAS bus and devices are configured correctly and that the last external device in each SAS chain is terminated correctly.</li><li>• See “Solving undetermined problems” on page 146.</li></ul>

## Keyboard, mouse, or pointing-device problems

For problems with a USB, mouse or pointing device, see “USB port problems” on page 117.

<ul style="list-style-type: none"><li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li><li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li><li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li></ul>	
Symptom	Action
All or some keys on the keyboard do not work.	<ol style="list-style-type: none"><li>1. Make sure that:<ul style="list-style-type: none"><li>• The keyboard cable is securely connected to the computer, and the keyboard and mouse cables are not reversed.</li><li>• The computer and the monitor are turned on.</li></ul></li><li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:<ol style="list-style-type: none"><li>a. Keyboard</li><li>b. (Trained service technician only) System board</li></ol></li></ol>
The mouse or pointing device does not work.	<ol style="list-style-type: none"><li>1. Make sure that:<ul style="list-style-type: none"><li>• The mouse or pointing-device cable is securely connected and the keyboard and mouse cables are not reversed.</li><li>• The mouse or pointing device drivers are installed correctly.</li></ul></li><li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:<ol style="list-style-type: none"><li>a. Mouse or pointing device</li><li>b. (Trained service technician only) System board</li></ol></li></ol>

## Memory problems

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Symptom	Action
The amount of system memory displayed is less than the amount of installed physical memory.	<ol style="list-style-type: none"><li>1. Make sure that:<ul style="list-style-type: none"><li>• The memory modules are seated correctly.</li><li>• You have installed the correct type of memory.</li><li>• If you changed the memory, you updated the memory configuration in the Configuration/Setup Utility program.</li><li>• All banks of memory are enabled. The computer might have automatically disabled a memory bank when it detected a problem, or a memory bank might have been manually disabled.</li></ul></li><li>2. Check the POST error log for error message 289:<ul style="list-style-type: none"><li>• If the DIMM was disabled by a system-management interrupt (SMI), replace the DIMM.</li><li>• If the DIMM was disabled by the user or by POST, run the Configuration/Setup Utility program and enable the DIMM. Save the settings and restart the computer.</li></ul></li><li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:<ol style="list-style-type: none"><li>a. DIMM</li><li>b. (Trained service technician only) System board</li></ol></li></ol>

## Microprocessor problems

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Symptom	Action
The computer emits a continuous beep during POST, indicating that the startup (boot) microprocessor is not working correctly.	<ol style="list-style-type: none"><li>1. (Trained service technician only) Reseat the microprocessor.</li><li>2. (Trained service technician only) Remove microprocessor 2 and restart the computer.<ul style="list-style-type: none"><li>• If no beep code occurs, microprocessor 2 might have failed. Replace the microprocessor.</li><li>• If the beep code remains, remove microprocessor 1; then, restart the computer. If no beep code occurs, microprocessor 1 might have failed. Replace the microprocessor.</li></ul></li></ol>

## Monitor or video problems

Some IBM monitors have their own self-tests. If you suspect a problem with your monitor, see the documentation that comes with the monitor for instructions for testing and adjusting the monitor.

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>	
Symptom	Action
The screen is blank.	<ol style="list-style-type: none"> <li>1. Make sure that: <ul style="list-style-type: none"> <li>• The computer power cord is connected to the computer and a working electrical outlet.</li> <li>• The monitor cables are connected correctly.</li> <li>• The monitor is turned on and the brightness and contrast controls are adjusted correctly.</li> </ul> <p><b>Important:</b> In some memory configurations, the 3-3-3 beep code might sound during POST, followed by a blank monitor screen. If this occurs and the <b>Boot Fail Count</b> option in the <b>Startup Options</b> of the Configuration/Setup Utility program is enabled (its default setting), you must restart the computer three times to reset the configuration settings to the default configuration (the memory connector or bank of connectors enabled).</p> </li> <li>2. Make sure that damaged BIOS code is not affecting the video; see “Recovering from a BIOS update failure” on page 139.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Monitor</li> <li>b. Video adapter (if one is installed)</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
Only the cursor appears.	See “Solving undetermined problems” on page 146.
The monitor works when you turn on the computer, but the screen goes blank when you start some application programs.	<ol style="list-style-type: none"> <li>1. Make sure that: <ul style="list-style-type: none"> <li>• The application program is not setting a display mode that is higher than the capability of the monitor.</li> <li>• You installed the necessary device drivers for the applications.</li> </ul> </li> <li>2. Replace the monitor.</li> </ol>
The monitor has screen jitter, or the screen image is wavy, unreadable, rolling, distorted.	<ol style="list-style-type: none"> <li>1. If the monitor self-tests show that the monitor is working correctly, consider the location of the monitor. Magnetic fields around other devices (such as transformers, appliances, fluorescent lights, and other monitors) can cause screen jitter or wavy, unreadable, rolling, or distorted screen images. If this happens, turn off the monitor. <p><b>Attention:</b> Moving a color monitor while it is turned on might cause screen discoloration.</p> <p>Move the device and the monitor at least 305 mm (12 in.) apart, and turn on the monitor.</p> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>a. To prevent diskette drive read/write errors, make sure that the distance between the monitor and any external diskette drive is at least 76 mm (3 in.).</li> <li>b. Non-IBM monitor cables might cause unpredictable problems.</li> </ol> </li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Monitor</li> <li>b. Video adapter (if one is installed)</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>	
Symptom	Action
Wrong characters appear on the screen.	<ol style="list-style-type: none"> <li>If the wrong language is displayed, update the BIOS code with the correct language. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>Video adapter (if one is installed)</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>

## Optional-device problems

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>	
Symptom	Action
An IBM optional-device that was just installed does not work.	<ol style="list-style-type: none"> <li>Make sure that:               <ul style="list-style-type: none"> <li>The device is designed for the computer (see <a href="http://www.ibm.com/servers/eserver/serverproven/compat/us/iserver.html">http://www.ibm.com/servers/eserver/serverproven/compat/us/iserver.html</a>).</li> <li>You followed the installation instructions that came with the device and the device is installed correctly.</li> <li>You have not loosened any other installed device or cables.</li> <li>You updated the configuration information in the Configuration/Setup Utility program. Whenever memory or any other device is changed, you must update the configuration.</li> </ul> </li> <li>Reseat the device that you just installed.</li> <li>Replace the device that you just installed.</li> </ol>
An IBM optional device that used to work does not work now.	<ol style="list-style-type: none"> <li>Make sure that all of the option hardware and cable connections for the device are secure.</li> <li>If the device comes with test instructions, use those instructions to test the device.</li> <li>If the failing device is a SAS device, make sure that:               <ul style="list-style-type: none"> <li>The cables for all external SAS options are connected correctly.</li> <li>The last device in each SAS chain, or the end of the SAS cable, is terminated correctly.</li> <li>Any external SAS device is turned on. You must turn on an external SAS device before turning on the computer.</li> </ul> </li> <li>Reseat the failing device.</li> <li>Replace the failing device.</li> </ol>



## Power problems

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>	
Symptom	Action
The power-control button does not work, and the reset button, if supported, does work.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Reseat the power switch/LED assembly cable.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. (Trained service technician only) Power switch/LED assembly</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
The computer does not start.	<ol style="list-style-type: none"> <li>1. Make sure that:               <ul style="list-style-type: none"> <li>• The power cords are correctly connected to the computer and to a working electrical outlet.</li> <li>• The type of memory that is installed is correct.</li> </ul> </li> <li>2. If you just installed an optional device, remove it, and restart the computer. If the computer now starts, you might have installed more devices than the power supply supports.</li> <li>3. Override the front panel power-control button:               <ol style="list-style-type: none"> <li>a. Disconnect the computer power cords.</li> <li>b. Reconnect the power cords.</li> </ol> </li> <li>4. (Trained service technician only) If the computer does not start, replace the system board.</li> <li>5. See “Solving undetermined problems” on page 146.</li> </ol>
The computer does not turn off.	<ol style="list-style-type: none"> <li>1. Determine whether you are using an Advanced Configuration and Power Interface (ACPI) or a non-ACPI operating system. If you are using a non-ACPI operating system, complete the following steps:               <ol style="list-style-type: none"> <li>a. Press Ctrl+Alt+Delete.</li> <li>b. Turn off the computer by pressing the power-control button for 4 seconds.</li> <li>c. If computer fails POST and the power-control button does not work, disconnect the ac power cord.</li> </ol> </li> <li>2. If the problem remains or if you are using an ACPI-aware operating system, the problem might be with the system board.</li> </ol>

## Printer problems

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Symptom	Action
The printer does not work.	<p>Make sure that:</p> <ul style="list-style-type: none"><li>• The printer is turned on and is online.</li><li>• The printer signal cable is connected to the correct serial or parallel connector on the computer (see “System board external connectors” on page 10).</li></ul> <p><b>Note:</b> Non-IBM printer cables might cause unpredictable results.</p> <ul style="list-style-type: none"><li>• You have assigned the printer port correctly in the operating system or application program.</li><li>• You have assigned the printer port correctly in the Configuration/Setup Utility program.</li><li>• You have run the tests that are described in the documentation that comes with the printer.</li></ul>

## Serial port problems

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Symptom	Action
The number of serial ports that are identified by the operating system is less than the number of installed serial ports.	<ol style="list-style-type: none"><li>1. Make sure that:<ul style="list-style-type: none"><li>• Each port is assigned a unique address in the Configuration/Setup Utility program and none of the serial ports are disabled.</li><li>• The serial port adapter (if one is present) is seated correctly.</li></ul></li><li>2. Replace the failing serial port adapter.</li></ol>
A serial device does not work.	<ol style="list-style-type: none"><li>1. Make sure that:<ul style="list-style-type: none"><li>• The device is compatible with the computer.</li><li>• The serial port is enabled and is assigned a unique address.</li><li>• The device is connected to the correct connector (see “System board external connectors” on page 10).</li></ul></li><li>2. Reseat the failing serial device.</li><li>3. Replace the following components one at a time, in the order shown, restarting the computer each time:<ol style="list-style-type: none"><li>a. Failing serial device</li><li>b. (Trained service technician only) System board</li></ol></li></ol>

## Software problems

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Symptom	Action
A suspected software problem occurred.	<ol style="list-style-type: none"><li>1. To determine whether the problem is caused by the software, make sure that:<ul style="list-style-type: none"><li>• The computer has the minimum memory that is needed to use the software. For memory requirements, see the information that comes with the software. If you have just installed an adapter or memory, you might have a memory-address conflict.</li><li>• The software is designed to operate on the computer.</li><li>• Other software works on the computer.</li><li>• The software works on another computer.</li></ul></li><li>2. If you received any error messages when using the software program, see the information that comes with the software for a description of the messages and suggested solutions to the problem.</li><li>3. Contact the place where you purchased the software.</li></ol>

## USB port problems

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

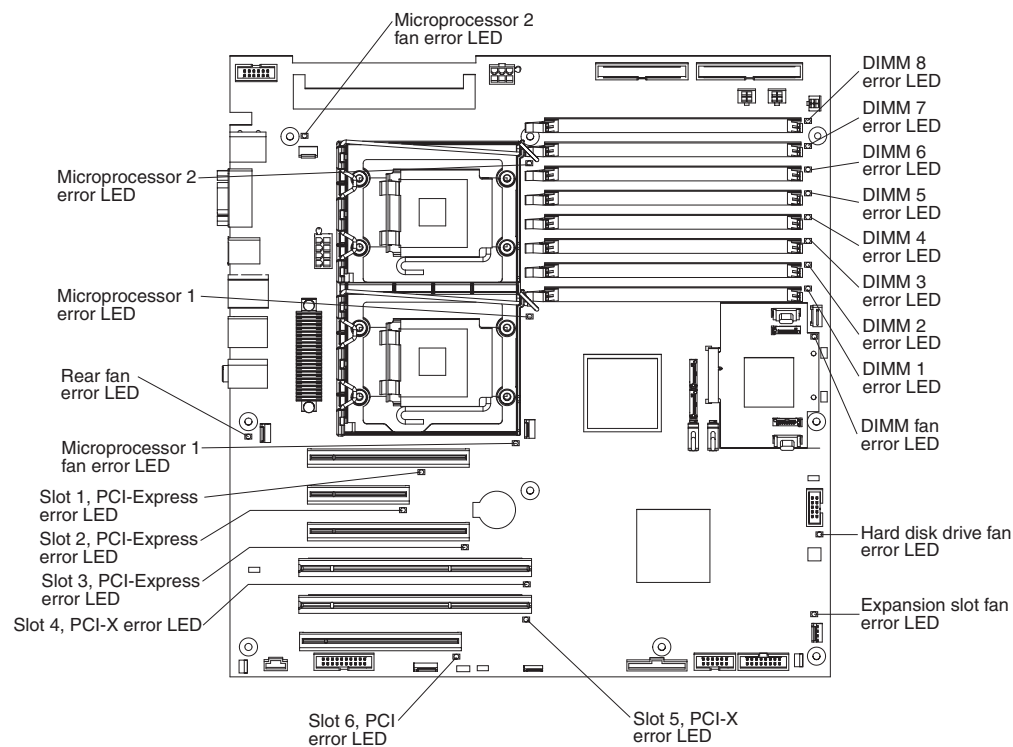
Symptom	Action
All or some keys on the USB keyboard do not work.	<ol style="list-style-type: none"><li>1. If you have installed a USB keyboard, run the Configuration/Setup Utility program and enable keyboardless operation to prevent the POST error message 301 from being displayed during startup.</li><li>2. See <a href="http://www.ibm.com/servers/eserver/serverproven/compat/us/iserver.html/">http://www.ibm.com/servers/eserver/serverproven/compat/us/iserver.html/</a> for keyboard compatibility information.</li><li>3. Make sure that the computer and the monitor are turned on.</li><li>4. If a USB hub is in use, disconnect the USB device from the hub and connect it directly to the computer.</li><li>5. Replace the following components one at a time, in the order shown, restarting the computer each time:<ol style="list-style-type: none"><li>a. Keyboard</li><li>b. (Trained service technician only) System board</li></ol></li></ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Symptom	Action
The USB mouse or USB pointing device does not work.	<ol style="list-style-type: none"> <li>1. Make sure that: <ul style="list-style-type: none"> <li>• The mouse is compatible with the computer. See <a href="http://www.ibm.com/servers/eserver/serverproven/compat/us/iserver.html">http://www.ibm.com/servers/eserver/serverproven/compat/us/iserver.html</a>.</li> <li>• The mouse or pointing-device USB cable is securely connected to the computer.</li> <li>• The mouse or pointing device drivers are installed correctly.</li> <li>• Keyboardless operation has been enabled in the Configuration/Setup Utility program.</li> </ul> </li> <li>2. If a USB hub is in use, disconnect the USB device from the hub and connect it directly to the computer.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Mouse or pointing device</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
A USB device does not work.	<ol style="list-style-type: none"> <li>1. Make sure that: <ul style="list-style-type: none"> <li>• The correct USB device driver is installed.</li> <li>• The operating system supports USB devices.</li> <li>• A standard PS/2 keyboard or mouse is not connected to the computer. If it is, a USB keyboard or mouse will not work during POST.</li> </ul> </li> <li>2. Make sure that the USB configuration options are set correctly in the Configuration/Setup Utility program menu (see the <i>User's Guide</i> for more information).</li> <li>3. If you are using a USB hub, disconnect the USB device from the hub and connect it directly to the computer.</li> </ol>
A message such as Power surge on Port USB or A USB device has exceeded the limits of its hub port is displayed on Windows operating systems.	This message indicates that a safety feature has been enabled in the computer to protect it from damage when a USB device draws too much power. Contact the manufacturer of the USB device to see whether a hardware upgrade or fix is available for the USB device.

## Error LEDs

The following is an illustration of the system board LEDs. The system board has error LEDs that will help to locate the source of the error. Run the diagnostic programs to find out the cause of the error (see “Running the diagnostic programs” on page 122).



The computer is designed so that LEDs remain lit when the computer is connected to an ac power source but is not turned on, provided that the power supply is operating correctly. This feature helps you to isolate the problem when the operating system is shut down.

Many errors are first indicated by a lit system-error LED on the front-panel assembly of the computer. If this LED is lit, one or more LEDs elsewhere in the computer might also be lit and can direct you to the source of the error.

Before you work inside the computer to view the LEDs, read the safety information that begins on page vii and “Handling static-sensitive devices” on page 30.

If an error occurs, view the computer LEDs in the following order:

1. Check the front-panel assembly on the front of the computer. If the system-error LED is lit, it indicates that an error has occurred.
2. Check the front and rear of the computer to determine whether any component LEDs are lit.
3. Remove the computer cover and look inside the computer for lit LEDs. Certain components inside the computer have LEDs that will be lit to indicate the location of a problem. For example, a DIMM error will light the LED next to the failing DIMM on the system board.

Look at the system service label inside of the computer side cover, which gives an overview of internal components. This information can often provide enough information to correct the error.

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## Power-supply LEDs

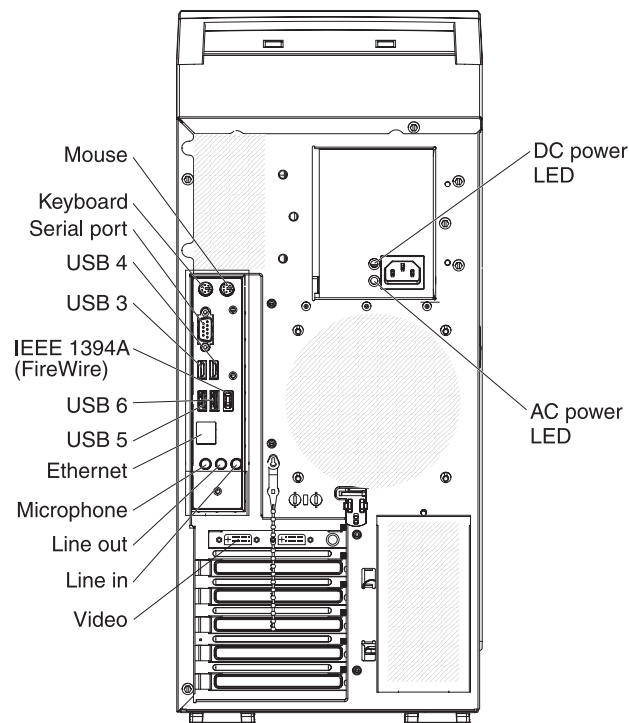
The following minimum configuration is required for the DC LED on the power supply to be lit:

- Power supply
- Power backplane
- Power cord

The following minimum configuration is required for the computer to start:

- One microprocessor in microprocessor socket 1
- Two 512 MB DIMMs
- One power supply
- Power backplane
- Power cord
- Five cooling fans

The following illustration shows the locations of the rear connectors and power-supply LEDs.



The following table describes the problems that are indicated by various combinations of the power-supply LEDs and the power-on LED on the front information panel and suggested actions to correct the detected problems.

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Power-supply LEDs		Front information panel power-on LED	Description	Action
AC	DC			
Off	Off	Off	No power to the computer, or a problem with the ac power source.	<ol style="list-style-type: none"> <li>1. Check the ac power to the computer.</li> <li>2. Make sure that the power cord is connected to a functioning power source.</li> <li>3. Replace the power supply.</li> </ol>
Lit	Off	Off	DC source power problem.	<ol style="list-style-type: none"> <li>1. Remove the ac power from the power supply, then reconnect the ac power.</li> <li>2. View the system-error log (see “Error logs” on page 93).</li> </ol>
Lit	Lit	Off	Standby power problem.	Replace the power supply.
Lit	Lit	Flashing	The power is good.	The computer is not powered on. No action is necessary.
Lit	Lit	Lit	The power is good.	The computer is powered on. No action is necessary.

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## Diagnostic programs, messages, and error codes

The diagnostic programs are the primary method of testing the major components of the computer. As you run the diagnostic programs, text messages and error codes are displayed on the screen and are saved in the test log. A diagnostic text message or error code indicates that a problem has been detected; to determine what action you should take as a result of a message or error code, see “Diagnostic error codes” on page 124.

You can download the latest version of the diagnostics programs from <http://www.ibm.com/support/> and use the downloaded file to create an IBM Enhanced Diagnostics diskette or CD. See “Creating an IBM Enhanced Diagnostics diskette or CD” on page 132 for instructions.

**Note:** When using diagnostics with a USB keyboard and mouse attached, you must first enable USB emulation:

1. Restart the computer and press F1 to start the Configuration/Setup Utility program.
2. Select **Startup Option**.
3. Make sure that the **Legacy USB Support** option is enabled.

## Running the diagnostic programs

The IBM Enhanced Diagnostics programs isolate problems from the computer hardware and software. The programs run independently of the operating system. This method of testing is generally used when other methods are not accessible or have not been successful in isolating a problem that is suspected to be hardware related.

You can run the diagnostic programs through the operating system or by using an IBM Enhanced Diagnostics diskette or CD that you have created (see “Using the IBM Enhanced Diagnostics diskette or CD” on page 133 and “Creating an IBM Enhanced Diagnostics diskette or CD” on page 132).

To run the diagnostic programs, complete the following steps:

1. Start the IBM Enhanced Diagnostics programs.
  - To start the IBM Enhanced Diagnostics programs in a Windows® operating system, complete the following steps:
    - a. Restart the computer. When the message To start the Product Recovery program is displayed, quickly press F11.
    - b. Select **System utilities**.
    - c. Select **Run diagnostics** to start the diagnostics programs.
  - To start the IBM Enhanced Diagnostics programs in a Red Hat® Linux™ operating system, complete the following steps:
    - a. Restart the computer.
    - b. When the operating-system selection menu is displayed, select **IBM Preload Recovery & Diagnostics**.
    - c. Select **Run diagnostics** to start the diagnostics programs.
  - To start the IBM Enhanced Diagnostics programs using a diskette or CD, insert the IBM Enhanced Diagnostics diskette or CD and restart the computer (see “Using the IBM Enhanced Diagnostics diskette or CD” on page 133).



2. Follow the instructions on the screen.
3. When the applicable diagnostics programs are complete, you can view the results in the test log (see “Viewing the test logs” on page 124).  
The test log records data about system failures and other pertinent information. The test log will not contain any information until after the diagnostic program has run.

To determine what action you should take as a result of a diagnostic text message or error code see the table in “Diagnostic error codes” on page 124.

If the diagnostic programs do not detect any hardware errors but the problem remains during normal computer operations, a software error might be the cause. If you suspect a software problem, see the information that comes with your software.

A single problem might cause more than one error message. When this happens, correct the cause of the first error message. The other error messages usually will not occur the next time you run the diagnostic programs.

**Exception:** If there are multiple error codes that indicate a microprocessor error, the error might be in a microprocessor or in a microprocessor socket. See “Microprocessor problems” on page 112 for information about diagnosing microprocessor problems.

If the computer stops during testing and you cannot continue, restart the computer and try running the diagnostic programs again. If the problem remains, replace the component that was being tested when the computer stopped.

## Diagnostic text messages

Diagnostic text messages are displayed while the tests are running. A diagnostic text message contains one of the following results:

**Passed:** The test was completed without any errors.

**Failed:** The test detected an error.

**User Aborted:** You stopped the test before it was completed.

**Not Applicable:** You attempted to test a device that is not present in the computer.

**Aborted:** The test could not proceed because of the computer configuration.

**Warning:** The test could not be run. There was no failure of the hardware that was being tested, but there might be a hardware failure elsewhere, or another problem prevented the test from running; for example, there might be a configuration problem, or the hardware might be missing or is not being recognized.

The result is followed by an error code or other additional information about the error.

## Viewing the test logs

To view the summary test log when the tests are completed, select **Utility** from the top of the screen and then select **View Test Log**. To view the detailed test log, press Tab from within the summary test log. The test-log data is maintained only while you are running the diagnostic programs. When you exit from the diagnostic programs, the test log is cleared.

To save the test log to a file on a diskette or to the hard disk, click **Save Log** on the diagnostic programs screen and specify a location and name for the saved log file.

**Note:** To save the test log to a diskette, you must use a diskette that you have formatted yourself; this function does not work with preformatted diskettes. If the diskette has sufficient space for the test log, the diskette can contain other data.

## Diagnostic error codes

The following table describes the error codes that the diagnostic programs might generate and suggested actions to correct the detected problems.

If the diagnostic programs generate error codes that are not listed in the table, make sure that the latest levels of BIOS code and firmware are installed.

In the error codes, x can be any numeral or letter. However, if the three-digit number in the central position of the code is 000, 195, or 197, *do not* replace a CRU or FRU.

These numbers appearing in the central position of the error code have the following meaning:

- 000** The computer passed the test. Do not replace a CRU or FRU.
- 195** The Esc key was pressed to end the test. Do not replace a CRU or FRU.
- 197** This is a warning error, but it does not indicate a hardware failure; do not replace a CRU or FRU. Take the action that is indicated in the Action column, but do not replace a CRU or FRU. See the description of **Warning** in "Diagnostic text messages" on page 123 for more information.

<ul style="list-style-type: none"><li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li><li>See Chapter 3, "Parts listing, Type 9228 and 9232," on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li><li>If an action step is preceded by "(Trained service technician only)," that step must be performed only by a trained service technician.</li></ul>		
Error code	Description	Action
005-XXX-000	Failed video test.	<ol style="list-style-type: none"><li>Reseat the video adapter.</li><li>Replace the video adapter.</li></ol>
011-XXX-000	Failed COM1 serial port test.	<ol style="list-style-type: none"><li>(Trained service technician only) Make sure that the loopback plug is connected correctly to the COM1 serial port.</li><li>(Trained service technician only) Replace the system board.</li></ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
014-XXX-000	Failed parallel port test.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Make sure that: <ul style="list-style-type: none"> <li>• The loopback plug is connected correctly to the parallel port.</li> <li>• The parallel port is not disabled in the Configuration/Setup Utility program.</li> <li>• The BIOS code is at the latest level.</li> </ul> </li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>
020-XXX-000	Failed PCI interface test.	<ol style="list-style-type: none"> <li>1. Reseat the adapter.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
035-002-0nn	ServeRAID™ interface timeout.	<ol style="list-style-type: none"> <li>1. Make sure that the ServeRAID adapter is configured correctly. Obtain the basic and extended configuration status bytes and see the ServeRAID documentation for more information.</li> <li>2. Reseat the following components: <ol style="list-style-type: none"> <li>a. Adapter cable</li> <li>b. ServeRAID adapter</li> </ol> </li> <li>3. Replace the components listed in step 2 one at a time, in the order shown, restarting the server each time.</li> </ol>
035-253-0nn	ServeRAID controller 0nn initialization failure; 0nn = the controller number.	<ol style="list-style-type: none"> <li>1. Make sure that the ServeRAID adapter is configured correctly. See the ServeRAID documentation for more information.</li> <li>2. Reseat the following components: <ol style="list-style-type: none"> <li>a. Adapter cable</li> <li>b. ServeRAID adapter</li> </ol> </li> <li>3. Replace the components listed in step 2 one at a time, in the order shown, restarting the server each time.</li> </ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
035-253-s99	RAID adapter initialization failure.	<ol style="list-style-type: none"> <li>1. Make sure that the ServeRAID adapter is configured correctly. See the ServeRAID documentation for more information.</li> <li>2. Reseat the following components: <ol style="list-style-type: none"> <li>a. ServeRAID adapter</li> <li>b. Adapter cable</li> </ol> </li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. ServeRAID adapter</li> <li>b. Adapter cable</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
035-254-0nn	Setup error; unable to allocate memory to run test.	Check the system resources and make more memory available (see “Starting the Configuration/Setup Utility program” on page 14); then, run the test again.
035-255-0nn	Internal error.	<ol style="list-style-type: none"> <li>1. Reseat the following components: <ol style="list-style-type: none"> <li>a. SAS hard disk drive cable</li> <li>b. Mini-PCI Express adapter</li> </ol> </li> <li>2. Replace the following components one at a time, in the order shown, restarting the server each time: <ol style="list-style-type: none"> <li>a. SAS hard disk drive cable</li> <li>b. Mini-PCI Express adapter</li> </ol> </li> </ol>
035-260-0nn	System to controller interface failure.	<ol style="list-style-type: none"> <li>1. Reseat the ServeRAID adapter.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. ServeRAID adapter</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
035-265-0nn	Adapter Communication error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-266-0nn	Adapter CPU test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
035-267-0nn	Adapter Local RAM test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-268-0nn	Adapter NVSRAM test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-269-0nn	Adapter Cache test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-271-0nn	Adapter XOR engine test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-272-0nn	Adapter Drive test error.	Replace the attached drive.
035-273-0nn	Adapter Drive error.	Replace the attached drive.
035-274-0nn	Adapter Parameters set error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-275-001	Adapter Communication error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-276-001	Adapter CPU test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-277-001	Adapter Local RAM test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-278-001	Adapter NVSRAM test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
035-279-001	Adapter Cache test error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-280-001	Adapter Drive test error.	Replace the attached drive.
035-281-001	Adapter Drive error.	Replace the attached drive.
035-282-001	Adapter Parameters set error.	<ol style="list-style-type: none"> <li>1. Update the ServeRAID adapter firmware (see “Updating the firmware” on page 13).</li> <li>2. Reseat the ServeRAID adapter.</li> <li>3. Replace the ServeRAID adapter.</li> </ol>
035-283-001	Adapter Battery error.	Replace the battery module on the ServeRAID adapter.
035-xxx-099	No adapters were found.	Reseat the following components: <ol style="list-style-type: none"> <li>1. ServeRAID adapter</li> <li>2. Adapter cable</li> </ol>
035-xxx-s99	Failed RAID test on PCI slot S. S = number of failing PCI slot.	<ol style="list-style-type: none"> <li>1. Reseat the following components:               <ol style="list-style-type: none"> <li>a. ServeRAID adapter</li> <li>b. Adapter cable</li> </ol> </li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. ServeRAID adapter</li> <li>b. Adapter cable</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
035-xxx-cnn	c = ServeRAID channel number, nn = SAS ID of failing fixed disk drive.	<ol style="list-style-type: none"> <li>1. Check the system-event/error log before replacing a FRU.</li> <li>2. Reseat the hard disk drive on channel C, SAS ID nn.</li> <li>3. Replace the hard disk drive on channel C, SAS ID nn.</li> </ol>
035-xxx-snn	S = number of failing PCI slot, nn = SAS ID of failing fixed disk.	<ol style="list-style-type: none"> <li>1. Check the system-event/error log before replacing a FRU.</li> <li>2. Reseat the SAS disk with ID nn.</li> <li>3. Replace the SAS disk with ID nn.</li> </ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
089-XXX-001	Failed microprocessor test.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Make sure that the microprocessor is installed and seated correctly.</li> <li>2. If the computer does not have the latest level of BIOS code installed, update the BIOS code to the latest level. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor 1</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
089-XXXX-002	Failed optional microprocessor.	<ol style="list-style-type: none"> <li>1. (Trained service technician only) Make sure that the microprocessor is installed and seated correctly.</li> <li>2. If the computer does not have the latest level of BIOS code installed, update the BIOS code to the latest level. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. (Trained service technician only) Microprocessor 2</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
201-XXX-0nn	Failed memory test. <b>Note:</b> Where <i>nn</i> : 1=DIMM 1; 2=DIMM 2; 3=DIMM 3; 4=DIMM 4; 5=DIMM 5; 6=DIMM 6; 7=DIMM 7; 8=DIMM 8.	<ol style="list-style-type: none"> <li>1. Reseat DIMM <i>nn</i>.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. DIMM <i>nn</i></li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
201-XXX-999	Multiple DIMM failure, see the error text.	<ol style="list-style-type: none"> <li>1. See the error text for the failing DIMMs.</li> <li>2. Reseat the failing DIMMs.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. (Trained service technician only) Failing DIMMs</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
206-XXX-000	Failed diskette drive test.	<ol style="list-style-type: none"> <li>1. Run the test with another diskette.</li> <li>2. Reseat the diskette drive cables and run the test again.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Diskette drive cable</li> <li>b. Diskette drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
215-XXX-000	Failed IDE CD-ROM, CD-RW or DVD drive test.	<ol style="list-style-type: none"> <li>1. Run the test with another CD or DVD in the drive.</li> <li>2. Reseat the CD or DVD drive cables and run the test again.</li> <li>3. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. CD or DVD drive cable</li> <li>b. CD or DVD drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
217-198-XXX	Could not establish drive parameters.	<ol style="list-style-type: none"> <li>1. Reseat the following components and run the test again. <ol style="list-style-type: none"> <li>a. SAS cable</li> <li>b. SAS mini-PCI Express adapter</li> </ol> </li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. SAS cable</li> <li>b. SAS mini-PCI Express adapter</li> <li>c. Hard disk drive</li> </ol> </li> </ol>



- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
217-XXX-001	Failed Fixed disk test.	<ol style="list-style-type: none"> <li>1. Reseat the hard disk drive cables and run the test again.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Hard disk drive cable</li> <li>b. Hard disk drive</li> <li>c. (Trained service technician only) System board</li> </ol> </li> </ol>
301-XXX-000	Failed keyboard test.	<ol style="list-style-type: none"> <li>1. Make sure that the keyboard cable is securely connected to the computer and the keyboard and mouse cables are not reversed.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Keyboard</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
302-XXX-000	Failed mouse test.	<ol style="list-style-type: none"> <li>1. Make sure that the pointing device (mouse) cable is correctly connected to the computer and the keyboard and mouse cables are not reversed.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Pointing device (mouse)</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
405-XXX-000	Failed Ethernet test on the controller on the system board.	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program and make sure that the Ethernet adapter is not disabled and that the BIOS code is at the latest level.</li> <li>2. (Trained service technician only) Replace the system board.</li> </ol>
405-XXX-00n	Failed Ethernet test on the adapter in PCI slot <i>n</i> .	<ol style="list-style-type: none"> <li>1. Run the Configuration/Setup Utility program and select <b>PCI Slot/Device Information</b> in the <b>Advanced Setup</b> menu. Compare the MAC address of the Ethernet adapter in the PCI slot (in the PCI Slot/Device Information) to the MAC address of the failing device on the diagnostics screen. If the MAC addresses match, this is the failing adapter.</li> <li>2. Reseat the Ethernet adapter in slot <i>n</i>.</li> <li>3. Replace the Ethernet adapter in slot <i>n</i>.</li> </ol>

## Creating an IBM Enhanced Diagnostics diskette or CD

You can create an IBM Enhanced Diagnostics diskette from the Product Recovery program. You can create an IBM Enhanced Diagnostics diskette or CD from the World Wide Web.

### Notes:

1. To create and use a diskette or CD, a diskette drive, or a CD or DVD/CD combo drive must be installed in the computer.
2. When using diagnostics with a USB keyboard and mouse attached, you must first enable USB emulation. Restart the computer and press F1 to start the Configuration/Setup Utility program, (click **Devices and I/O Ports → Internal Floppy Disk**).

To create an IBM Enhanced Diagnostics diskette from the Product Recovery program partition, complete the following steps:

1. Restart the computer.
2. When the message To start the Product Recovery Program, Press F11 appears, quickly press F11.
3. Select **System utilities**.
4. Select **Create IBM Enhanced Diagnostics Diskette**.
5. Follow the instructions on the screen.

To download the latest CD image of the IBM Enhanced Diagnostics from the Web and create a startable IBM Enhanced Diagnostics CD, complete the following steps:

1. Go to <http://www.ibm.com/support>.
2. Download the CD image of the diagnostics file, using a writeable optical device (CD-RW or DVD/CD-RW combo drive).

## Using the IBM Enhanced Diagnostics diskette or CD

To start the IBM Enhanced Diagnostics from a diskette or CD; complete the following steps.

**Note:** Before restarting the computer, make sure that the drive that contains the IBM Enhanced Diagnostics diskette or CD is first in the startup sequence in the Configuration/Setup Utility program.

1. Turn off the computer and any peripheral devices.
2. Insert the IBM Enhanced Diagnostics diskette or CD into the drive.
3. Turn on all attached devices; then, turn on the computer.
4. Follow the instructions on the screen.
5. When the tests are completed, use one or more of the following procedures:
  - View the summary test log by pressing F3, or by selecting **Utility** from the top of the screen and selecting **View Test Log**. Press Page Up and Page Down to view the entire log.
  - View the detailed test log by pressing Tab while in the summary test log. Press Page Up and Page Down to view the entire log.
  - Save the test log to a file on a diskette or to the hard disk by selecting **Utility** from the top of the screen and selecting **Save Test Log**.

**Notes:**

- a. To save the test log to a diskette, you must use a diskette that you have formatted yourself; this function does not work with preformatted diskettes. If the diskette has sufficient space for the test log, the diskette can contain other data.
  - b. The test-log data is maintained only while the diagnostic programs are active. When you exit from the diagnostic programs, the test log is cleared. Save the test log to a file on a diskette or to the hard disk if you want to refer to it later.
6. When you have completed the diagnostics procedure, remove the diskette or CD from the drive before restarting the computer.

If the hardware passes the IBM Enhanced Diagnostics but the problem remains during normal computer operations, a software error might be the cause. If you suspect a software problem, see the information that comes with the software package.

## System board error LEDs

Figure 62 shows the locations of the error LEDs on the system board. Each error LED is lit to indicate a problem with a specific component. After a problem is corrected, the LED will not be lit the next time the computer is restarted. If the problem remains, the LED will continue to be lit. The error LEDs remain lit until the error log is cleared, this prevents spurious errors from going undetected.

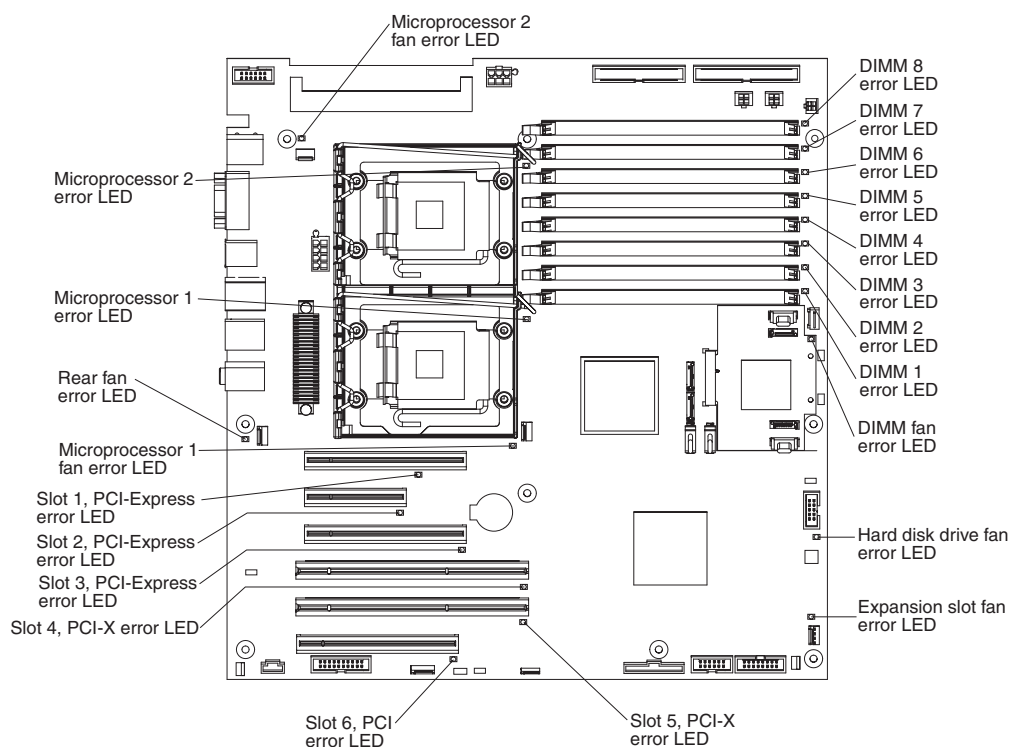


Figure 62. System board error LED locations

Table 8. System board error LED descriptions

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
LED	Description	Action
DIMM fan	DIMM fan has failed.	<ol style="list-style-type: none"> <li>Reseat the DIMM fan cable.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>DIMM fan</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>

Table 8. System board error LED descriptions (continued)

<ul style="list-style-type: none"> <li>Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
LED	Description	Action
DIMM x	A memory failure occurred on DIMM x.	<ol style="list-style-type: none"> <li>Reseat DIMM x.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>DIMM x</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>
Expansion slot fan	Expansion slot fan has failed.	<ol style="list-style-type: none"> <li>Reseat the expansion slot fan cable.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>Expansion slot fan</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>
Hard disk drive fan	The hard disk drive fan has failed.	<ol style="list-style-type: none"> <li>Reseat the hard disk drive fan cable.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>Hard disk drive fan</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>
Microprocessor fan	A microprocessor fan has failed.	<ol style="list-style-type: none"> <li>Reseat the microprocessor fan cable.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>Microprocessor fan</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>
Microprocessor x	A microprocessor has failed.	<ol style="list-style-type: none"> <li>(Trained service technician only) Reseat microprocessor x.</li> <li>Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>Microprocessor x</li> <li>(Trained service technician only) System board</li> </ol> </li> </ol>
PCI slot	A PCI adapter has failed.	<ol style="list-style-type: none"> <li>Reseat the PCI adapter cable.</li> <li>Replace the PCI adapter.</li> </ol>

Table 8. System board error LED descriptions (continued)

<ul style="list-style-type: none"> <li>• Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.</li> <li>• See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).</li> <li>• If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.</li> </ul>		
LED	Description	Action
Rear fan	The rear fan has failed.	<ol style="list-style-type: none"> <li>1. Reseat the rear fan cable.</li> <li>2. Replace the following components one at a time, in the order shown, restarting the computer each time:               <ol style="list-style-type: none"> <li>a. Rear fan</li> <li>b. (Trained service technician only) System board</li> </ol> </li> </ol>
System-error LED	A system error has occurred.	<ol style="list-style-type: none"> <li>1. If another error LED is also lit, follow the actions for that LED.</li> <li>2. (Trained service technician only) If no other LED is lit, replace the system board.</li> </ol>

## Emergency recovery-repair diskettes (Windows)

In some instances, an emergency recovery-repair diskette is helpful. This section describes how to create and use this diskette in Windows.

### Notes:

1. To create and use an emergency recovery-repair diskette, you must add a diskette drive to the computer.
2. When using diagnostics with a USB keyboard and mouse attached, you must first enable USB emulation. Restart the computer and press F1 to start the Configuration/Setup Utility program, (click **Devices and I/O Ports** → **Internal Floppy Disk**).

## Creating an emergency recovery-repair diskette in Windows

In Windows, you can create a recovery-repair diskette from the c:\ibmtools directory or from the Product Recovery program partition.

To create a recovery-repair diskette from the c:\ibmtools directory, complete the following steps:

1. Start the computer and operating system.
2. Use Windows Explorer to display the directory structure of the hard disk.
3. Open the c:\ibmtools folder.
4. Double-click **rrdisk.bat** and follow the instructions on the screen.

To create a recovery-repair diskette from the Product Recovery program partition, complete the following steps:

1. Shut down the operating system and turn off the computer.
2. Wait for at least 5 seconds; then, press and hold the F11 key while you restart the computer. When a menu appears, release the F11 key.

3. Use one of the following procedures:
  - If a menu is displayed in which you can select an operating system, use the arrow keys to select the operating system that is currently installed, press Enter, and then continue with the next step.
  - If an operating-system menu is not displayed, continue with the next step.
4. From the Product Recovery main menu, use the arrow keys to select **System utilities**, and then press Enter.
5. Use the arrow keys to select **Create a Recovery Repair diskette**, and then press Enter.
6. Follow the instructions on the screen.

## Using the recovery-repair diskette in Windows

In some circumstances, files on the hard disk might become damaged so that the F11 prompt is not displayed when you start the computer. If you have attached a diskette drive to the computer and created a recovery-repair diskette, use the following procedure to access the Product Recovery program on the hard disk. For instructions for creating a recovery-repair diskette, see “Creating an emergency recovery-repair diskette in Windows” on page 136. To run the recovery-repair diskette, complete the following steps:

1. Insert the recovery-repair diskette into the diskette drive.
2. Turn off the computer.
3. Turn on the computer, and follow the instructions on the screen.

If the repair operation is completed without errors, the F11 prompt will be displayed the next time you restart the computer.

If an error message is displayed during the repair operation and the repair operation cannot be completed, you might have a problem with the Product Recovery program or the partition that contains the Product Recovery program. Use a *Product Recovery* CD to access the Product Recovery program.

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## Recovering the operating system and preinstalled software

This section contains instructions for recovering BIOS code, device drivers, the operating system, and other support software.

### Recovering the operating system

The Product Recovery program is on a hidden partition on the hard disk. The Product Recovery program runs independently of the operating system and reinstalls the operating system and preinstalled software.

**Attention:** If you are using FDISK, Disk Management, or another utility to reformat the hard disk, you might see the partition where the Product Recovery program is stored. Do not delete this partition; otherwise, the Product Recovery program will be lost.

If the hard disk drive, including the partition that contains the Product Recovery program, becomes damaged or if you replace the hard disk drive, use the *IBM Product Recovery* CD to recover the preinstalled operating system, application programs, and device drivers.

To recover the Windows operating system, complete the following steps.

**Note:** The recovery process replaces all information stored on drive C. If possible, back up your data files before starting this process. The recovery process does not affect any other drives.

1. If possible, shut down the operating system.
2. If the computer is still on, turn it off.

**Note:** If the computer will not turn off after you hold down the power-control button for at least 4 seconds, disconnect the power cord and wait a few seconds before reconnecting it.

3. Turn on the computer, and wait for the prompt To start the Product Recovery Program, press F11.

If the DOS command prompt or the F11 prompt is not displayed, see “Using the recovery-repair diskette in Windows” on page 137.

4. Quickly press F11, and wait for the program menu.
5. Select **Full recovery** and follow the instructions on the screen.
6. When recovery is complete, exit from the program.
7. Restart the computer.

To recover the Red Hat Linux operating system, complete the following steps.

**Note:** The recovery process replaces all information that is stored on drive C. If possible, back up your data files before starting this process.

1. If possible, shut down the operating system.
2. If the computer is still on, turn it off.

**Note:** If the computer will not turn off after you hold down the power-control button for at least 4 seconds, disconnect the power cord and wait a few seconds before reconnecting it.

3. Turn on the computer and wait for the operating system menu to be displayed; then, quickly select **IBM Preload Recovery & Diagnostics**.
4. Select the recovery options that you want and follow the instructions on the screen.

**Note:** To restore the operating system, device drivers, and application programs, select a full recovery.

5. When recovery is complete, exit from the program. The computer restarts automatically.

## Recovering or installing device drivers

Restoring the factory-preinstalled device drivers is part of the Product Recovery program and the *Device Drivers* CD.

Before you can recover or install device drivers, the operating system must be installed on the computer. Make sure that you have the documentation and software media for the device before you start recovering or installing device drivers.

Device drivers for IBM devices and the instructions to install them (readme.txt) are on the *Device Drivers* CD and in the c:\ibmtools\drivers\ directory.

The latest device drivers are also available at <http://www.ibm.com/support/>.



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## Updating the BIOS code on the computer

Periodically, IBM might post new levels of BIOS code on the Web. Always check <http://www.ibm.com/support/> for the latest level of BIOS code, device drivers, documentation, and hints and tips. You can use one of the following methods to update the BIOS code in the computer:

- Download the BIOS code update file directly to the hard disk.
- Download the BIOS code update file to a diskette (attach an external USB portable diskette drive if the computer does not have an integrated diskette drive); then, update the BIOS code on the computer.
- Download the BIOS code update file to a CD, using a CD-RW or DVD/CD-RW combo drive; then, start the computer with the CD in the drive to update the BIOS code on the computer.

One file is available for each method. The description next to each file indicates the type of medium to which you can download the file. A readme file is available with instructions for installing the BIOS code update.

To download the BIOS (flash) update files, complete the following steps:

1. Go to <http://www.ibm.com/support/>.
2. In the **Download** category, click **Downloads and drivers**.
3. In the **Brand** field, select **IntelliStation**.
4. In the **Family** field, select **IntelliStation Z Pro**.
5. In the **Type** field, select **9228 or 9232** and click **Continue**.
6. Scroll down to the **BIOS** category and click the + icon next to the package for the correct operating system to view the available files.
7. Select the check box for each file that is to be downloaded, then click **Continue**.
8. Follow the instructions on the screen to complete the download and install the downloaded files.
9. Restart the computer.

See the readme file for additional information about how to install the image files.

**Note:** Always reset the Configuration/Setup Utility program to the default values after updating the BIOS code.

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## Recovering from a BIOS update failure

If power to the computer is interrupted while the BIOS code is being updated, the computer might not restart correctly or might not display video. If this happens, complete the following steps to recover:

1. Read the safety information that begins on page vii and “Handling static-sensitive devices” on page 30.
2. Turn off the computer and all attached devices.
3. Disconnect the power cord.
4. Remove the side cover.
5. Locate the BIOS recovery jumper (J80) on the system board (see Figure 63 on page 140). Remove any adapters that impede access to the jumper.

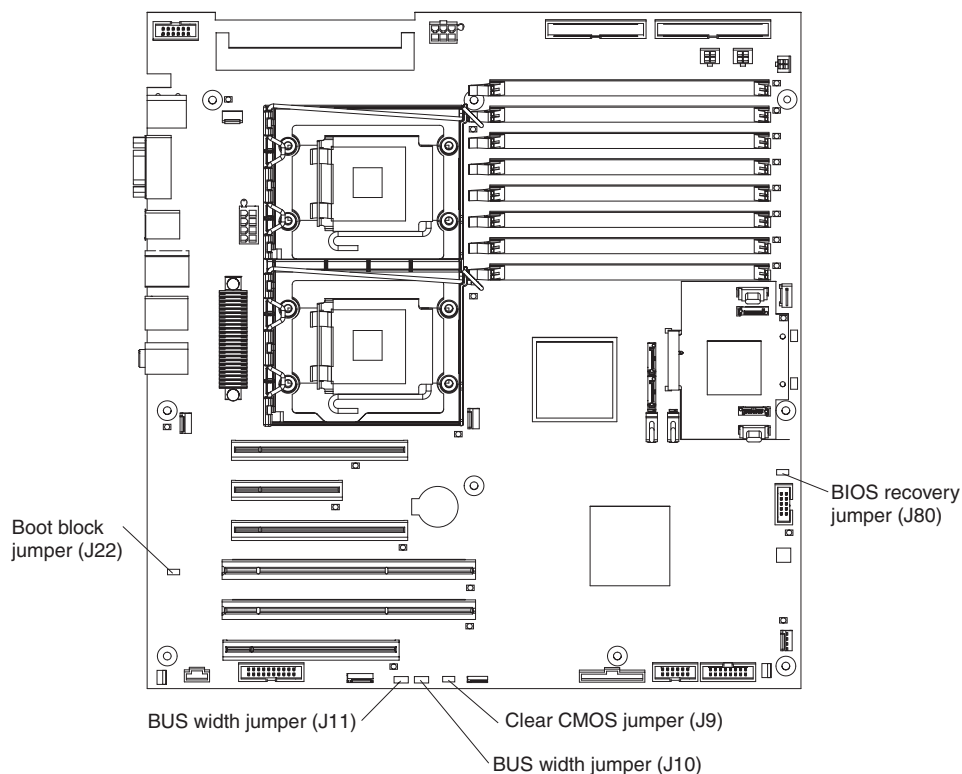


Figure 63. Recovery jumper locations

6. Move the BIOS recovery jumper to pins 2 and 3.
7. Replace any adapters that were removed; then, replace the side cover.
8. Connect the computer to a power source, keyboard, monitor, and mouse.
9. Insert the update CD into the CD or DVD drive.
10. Turn on the computer and the monitor.

**Note:** After the update session is completed, remove the CD from the drive and turn off the computer. After the BIOS recovery is complete, the computer will power down.

11. Disconnect all power cords; then, remove the computer cover.
12. Remove any adapters that impede access to the jumper; then, return the BIOS recovery jumper to pins 1 and 2.
13. Replace any adapters that you removed; then, replace the cover.
14. Reconnect all external cables and power cords.
15. Turn on the attached devices and turn on the computer to restart the operating system.

## Interrupt status port register error procedures

Use interrupt status port register (ISPR) error procedures to help you solve ServeRAID problems. A complete list of error codes is listed in "ServeRAID error codes" on page 142.

### EF10 (Default ISPR)

1. There is no ISPR error.

**9zxx through Bzxx** (SAS bus error caused by cables, termination, defective drives, or a similar problem)

1. Isolate between the SAS subsystem and the controller by disconnecting all SAS cables from the suspected adapter, and restart the computer.

**Attention:** Do not press F5. Doing so changes the computer configuration.

If an ISPR error remains, complete the following steps until the error is corrected:

- a. Reseat the controller.
- b. Replace the controller.

**Note:** If the adapter or controller detects a configuration change. *Do not* select **Save Changes**. Instead, press F10 to bypass any options to this effect.

2. If the ISPR error is EF10 after the cables are disconnected, complete the following steps:
  - a. Identify which channel is causing the error according to the second digit (z) of the original ISPR code as indicated in the following table.

Table 9. SAS identifier

SAS channel code (z)	Channels
1	Channel 1
2	Channel 2
3	Channel 1 and 2
4	Channel 3
5	Channel 1 and 3
6	Channel 2 and 3
7	Channel 1, 2, and 3
8	Channel 4
9	Channel 1 and 4
A	Channel 2 and 4
B	Channel 1, 2, and 4
C	Channel 3 and 4
D	Channel 1, 3, and 4
E	Channel 2, 3, and 4
F	Channel 1, 2, 3, and 4

- b. Confirm that the channels that are identified from the error in step 2a are the cause of the error by making sure that the error occurs *only* when the suspected channel is reconnected.
- c. Check the termination of the identified channel.
- d. If the computer has hard disk drive status cables, make sure that the cables are connected correctly. Reconnect all cables that you removed in step 1.
- e. Disconnect one drive at a time from the channel that was identified in step 2a; then, restart the computer to determine which drive is causing the error.
- f. Reconnect the SAS cable.
- g. Reconnect the SAS backplane.

**FFFF or other code not listed**

1. Place download jumpers on the controller and try to update the firmware code on the adapter.
2. Isolate between the SAS subsystem and the controller by disconnecting all SAS cables from the suspected adapter, and restart the computer.  
**Attention:** Do not press F5. Doing so changes the computer configuration.  
 If the ISPR code is EF10 after the cables are disconnected, complete the following steps until the error is corrected:
  - a. Identify which channel is causing the error by reconnecting cables one at a time and restarting the computer until the error occurs again.
  - b. Check the termination of the identified channel in step 2a.
  - c. Disconnect one drive at a time from the channel that you identified in step 2a and restart the computer each time to determine which drive is causing the problem.
  - d. Reconnect the SAS cable to the channel that you identified in step 2a.
  - e. Reconnect the backplane to the channel that you identified in step 2a.
3. If original ISPR code remains after all SAS cables are disconnected and the computer is restarted, complete the following steps until the error is corrected:
  - a. Reseat the controller.
  - b. Replace the controller.

## ServeRAID error codes

In the following error codes, x can be any number or letter.

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
1xxx	A microcode checksum error occurred.	<ol style="list-style-type: none"> <li>1. Reseat the ServeRAID controller.</li> <li>2. Replace the ServeRAID controller.</li> </ol>
2xxx	A code DRAM error occurred.	<ol style="list-style-type: none"> <li>1. Install the download jumpers, and update the BIOS code and firmware for the controller. Then, remove the jumpers. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>2. Reseat the ServeRAID controller.</li> <li>3. Replace the ServeRAID controller.</li> </ol>
3000-31xx	A code DRAM error occurred.	<ol style="list-style-type: none"> <li>1. Install the download jumpers, and update the BIOS code and firmware for the controller. Then, remove the jumpers. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>2. Reseat the ServeRAID controller.</li> <li>3. Replace the ServeRAID controller.</li> </ol>

- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
3200	A code DRAM error occurred.	<ol style="list-style-type: none"> <li>1. Install the download jumpers, and update the BIOS code and firmware for the controller. Then, remove the jumpers. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>2. Reseat the ServeRAID controller.</li> <li>3. Replace the ServeRAID controller.</li> </ol>
4xxx thru 5xxx	A Code DRAM error occurred.	<ol style="list-style-type: none"> <li>1. Install the download jumpers, and update the BIOS code and firmware for the controller. Then, remove the jumpers. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>2. Reseat the ServeRAID controller.</li> <li>3. Replace the ServeRAID controller.</li> </ol>
7xxx thru 8xxx	A host/local PCI bus interface error occurred.	<ol style="list-style-type: none"> <li>1. Update the BIOS code and firmware for the controller. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> </ol>
9003	A ServeRAID controller error occurred.	<ol style="list-style-type: none"> <li>1. Update the BIOS code and firmware for the controller. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>2. Make sure that the computer supports the controller.</li> <li>3. Replace the integrated RAID controller on the computer.</li> </ol>
9xxx thru BZxx	A SAS bus error was caused by the cables, termination, defective drives, or other components. Z refers to the specific channel or channels that cause the error.	<ol style="list-style-type: none"> <li>1. Follow the instructions in “Interrupt status port register error procedures” on page 140.</li> <li>2. Make sure that the SAS cable is connected correctly.</li> <li>3. Reseat the following components: <ol style="list-style-type: none"> <li>a. Hard disk drive</li> <li>b. ServeRAID controller</li> </ol> </li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Hard disk drive</li> <li>b. ServeRAID controller</li> </ol> </li> </ol>

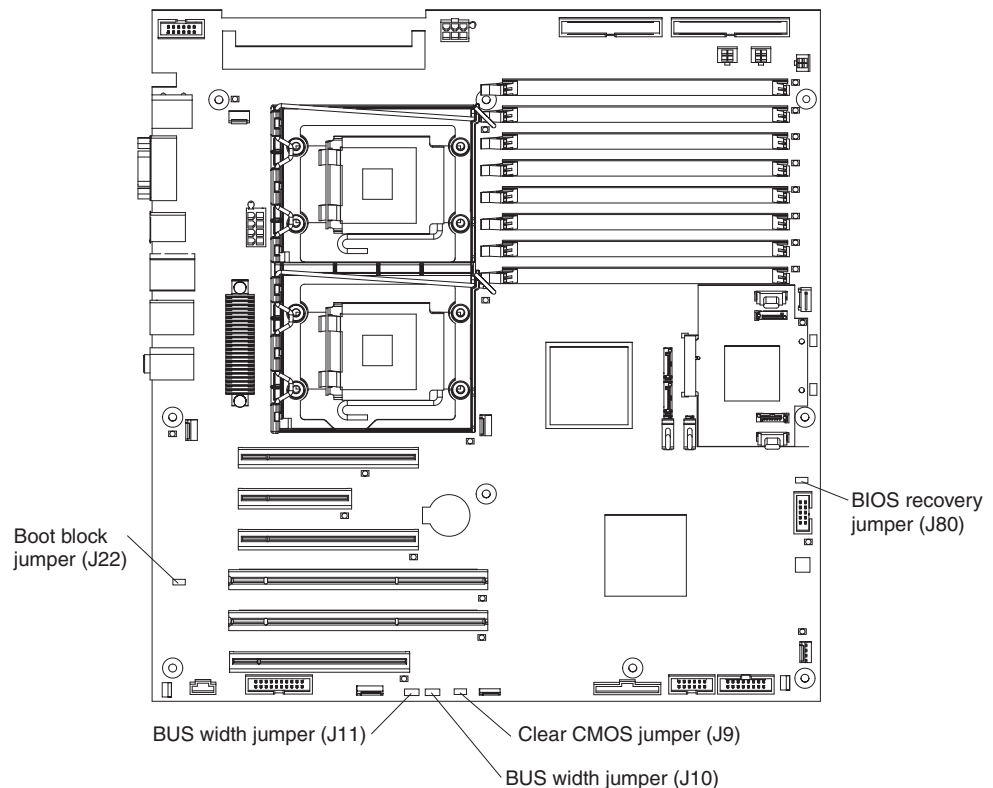
- Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.
- See Chapter 3, “Parts listing, Type 9228 and 9232,” on page 19 to determine which components are customer replaceable units (CRU) and which components are field replaceable units (FRU).
- If an action step is preceded by “(Trained service technician only),” that step must be performed only by a trained service technician.

Error code	Description	Action
EF FE	The firmware code is corrupt or the download jumpers are in place.	<ol style="list-style-type: none"> <li>1. Update the BIOS code and firmware for the controller. Then, remove the jumpers. For more information about updating the BIOS code, see “Updating the BIOS code on the computer” on page 139.</li> <li>2. Reseat the ServeRAID controller.</li> <li>3. Replace the ServeRAID controller.</li> </ol>
FFFF or other code not listed	A SAS bus error occurred.	<ol style="list-style-type: none"> <li>1. Follow the instructions in “Interrupt status port register error procedures” on page 140.</li> <li>2. Make sure that the SAS cable is connected correctly.</li> <li>3. Reseat the following components: <ol style="list-style-type: none"> <li>a. Hard disk drive</li> <li>b. ServeRAID controller</li> </ol> </li> <li>4. Replace the following components one at a time, in the order shown, restarting the computer each time: <ol style="list-style-type: none"> <li>a. Hard disk drive</li> <li>b. ServeRAID controller</li> </ol> </li> </ol>

## Erasing a lost or forgotten password (clearing CMOS)

If the power-on or administrator password is lost or forgotten, you can regain access to the computer through one of the following methods:

- If you have forgotten the power-on password and an administrator password is set, type the administrator password at the power-on prompt; then, start the Configuration/Setup Utility program and change the power-on password (see the *User's Guide* on the IBM *IntelliStation Documentation* CD for more information).
- Remove the battery and then reinstall the battery (see “Removing the battery” on page 45 and “Installing the battery” on page 45).
- Clear CMOS settings by changing the position of the CMOS recovery jumper (J9). The following illustration shows the location of the Clear CMOS jumper.



To set the CMOS recovery jumper and erase a forgotten password, complete the following steps:

1. Read the safety information that begins on page vii and “Handling static-sensitive devices” on page 30.
2. Turn off the computer and all attached devices.
3. Disconnect the power cord.
4. Remove the cover.
5. Locate the CMOS recovery jumper (J9) on the system board (see Figure 63 on page 140), and remove any adapters that impede access to the jumper.
6. Move the CMOS recovery jumper from pins 1 and 2 to pins 2 and 3.
7. Wait 60 seconds; then, return the CMOS recovery jumper to pins 1 and 2.
8. Replace any adapters that were removed; then, replace the cover.
9. Connect the computer to a power source, keyboard, monitor, and mouse.

**Note:** You can now start the computer one time and start the Configuration/Setup Utility program without having to use the power-on password. At this time, you can either delete the old power-on password or set a new power-on password. If you do not change or delete the password, the next time you start the computer, the original power-on password will be reinstated.

10. Turn on the computer and start the Configuration/Setup Utility program.
11. Follow the instructions to erase the existing password or to create a new password.
12. Click **Save Settings** and exit the Configuration/Setup Utility program.

---

## Solving power problems

Power problems can be difficult to solve. For example, a short circuit can exist anywhere on any of the power-distribution buses. Usually, a short circuit will cause the power subsystem to shut down because of an overcurrent condition. To diagnose a power problem, use the following general procedure:

1. Turn off the computer, and disconnect all ac power cords.
2. Check for loose cables in the power subsystem. Also check for short circuits, for example, if a loose screw is causing a short circuit on a circuit board.
3. Remove adapters and disconnect the cables and power connectors to all internal and external devices until the computer is at the minimum configuration that is required to start the computer (see “Solving undetermined problems”).
4. Reconnect all ac power cords and turn on the computer. If the computer starts successfully, replace adapters and devices one at a time until the problem is isolated.

If the computer does not start from the minimum configuration, replace the components in the minimum configuration one at a time until the problem is isolated.

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## Solving Ethernet controller problems

See the Ethernet controller documentation on the *Device Drivers* CD for information about problems that might occur with the Ethernet controller.

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## Solving undetermined problems

If the diagnostic tests did not diagnose the failure or if the computer is inoperative, use the information in this section.

If you suspect that a software problem is causing failures (continuous or intermittent), see “Software problems” on page 117.

Damaged data in CMOS memory or damaged BIOS code can cause undetermined problems. To reset the CMOS data, use the clear CMOS jumper to override the power-on password and clear the CMOS memory; see “Erasing a lost or forgotten password (clearing CMOS)” on page 145. If you suspect that the BIOS code is damaged, see “Recovering from a BIOS update failure” on page 139.

Check the LEDs on the power supply. If the LEDs indicate that the power supply is working correctly, complete the following steps:

1. Turn off the computer.
2. Make sure that the computer is cabled correctly.



3. Remove or disconnect the following devices (one at a time) until you find the failure (turn on the computer and reconfigure each time):
  - Any external devices
  - Surge suppressor device (on the computer)
  - Modem, printer, mouse, or non-IBM devices
  - Each adapter
  - Hard disk drives
  - Memory modules. The minimum configuration requirement is 1 GB (two 512 MB DIMMs).

The following minimum configuration is required for the computer to start:

- Power supply
  - System board
  - Microprocessor
  - Memory (with a minimum of two 512 MB DIMMs)
4. Turn on the computer. If the problem remains, suspect the following components in the following order:
    - Power supply
    - System board

If the problem is solved when you remove an adapter from the computer but the problem recurs when you reinstall the same adapter, that adapter might be the cause of the problem; if the problem recurs when you replace the adapter with a different one, suspect the system board.

If you suspect a networking problem and the computer passes all system tests, a network cabling problem that is external to the computer might be the cause.

---

## Problem determinations tips

Since you might have a variety of hardware and software configurations, have the following information available when requesting assistance from IBM Support. IBM Support will use this information to assist you in determining the problem.

- Machine type and model
- Microprocessor or hard disk drive upgrades
- Failure symptom
  - Do diagnostics fails?
  - What, when, where, single, or multiple systems?
  - Is the failure repeatable?
  - Has this configuration ever worked?
  - If it has been working, what changes were made prior to it failing?
  - Is this the original reported failure?
- Diagnostics version
  - Type and version level
- Hardware configuration
  - Print (print screen) configuration currently in use
  - BIOS level
- Operating system software
  - Type and version level

### Notes:

1. Comparing the configuration and software setup between working and non-working systems often leads to problem resolution.

2. Identical systems are only considered identical systems if they:
  - Are the exact machine type and models
  - Have the same BIOS level
  - Have the same adapters or attachments in the same locations
  - Have the same address jumpers, terminators, or cabling
  - Have the same software version and levels
  - Have the same diagnostics code (version)
  - Have the same configuration options set in the computer.
  - Have the same setup for the operating system control files

---

## Calling IBM for service

See Appendix A, “Getting help and technical assistance,” on page 149 for information about calling IBM for service.

When you call for service, have as much of the following information available as possible:

- Machine type and model
- Microprocessor or hard disk upgrades
- Failure symptoms
  - Does the computer fail the diagnostic programs? If so, what are the error codes?
  - What occurred? When? Where? Did it occur on a single or multiple computers?
  - Is the failure repeatable?
  - Has the current computer configuration ever worked?
  - What changes, if any, were made before it failed?
  - Is this the original reported failure, or has this failure been reported before?
- Diagnostic program type and version level
- Hardware configuration (print the screen with the system summary information)
- BIOS code level
- Operating-system type and version level

You can solve some problems by comparing the configuration and software setups between working and nonworking computers. When you compare computers to each other for diagnostic purposes, consider them identical only if all the following factors are exactly the same in all the computers:

- Machine type and model
- BIOS level
- Adapters and attachments, in the same locations
- Address jumpers, terminators, and cabling
- Software versions and levels
- Diagnostic programs type and version level
- Configuration option settings
- Operating-system control-file setup

---

## Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This appendix contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your or IntelliStation system or optional device, and whom to call for service, if it is necessary.

---

### Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system. Information about diagnostic tools is in the IBM *IntelliStation Documentation CD* or *Problem Determination and Service Guide* at the IBM Support Web site.
- Go to the IBM support Web site at <http://www.ibm.com/support/> to check for technical information, hints, tips, and new device drivers or to submit a request for information.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documentation that is provided with your IBM product. The documentation that comes with IBM systems also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with documentation that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

---

### Using the documentation

Information about your IBM system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/support/> and follow the instructions. Also, some documents are available through the IBM Publications Center at <http://www.ibm.com/shop/publications/order/>.

---

### Getting help and information from the World Wide Web

On the World Wide Web, the IBM Web site has up-to-date information about IBM systems, optional devices, services, and support. The address for IBM System x and xSeries information is <http://www.ibm.com/systems/x/>. The address for IBM IntelliStation information is <http://www.ibm.com/intellistation/>.

You can find service information for IBM systems and optional devices at <http://www.ibm.com/support/>.

---

## Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with System x and xSeries servers, BladeCenter products, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, see <http://www.ibm.com/services/sl/products/>.

For more information about Support Line and other IBM services, see <http://www.ibm.com/services/>, or see <http://www.ibm.com/planetwide/> for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

---

## Hardware service and support

**Important:** When you call for service, you will be asked to provide the four-digit machine type of your system, which is \*\*\* 9228 or 9232 \*\*\*.

You can receive hardware service through IBM Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. See <http://www.ibm.com/planetwide/> for support telephone numbers, or in the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

---

## Appendix B. Notices

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## Important notes

Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

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

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

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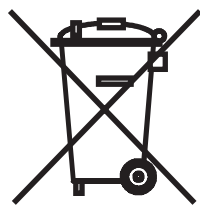
Some software may differ from its retail version (if available), and may not include user manuals or all program functionality.

---

## Product recycling and disposal

This unit must be recycled or discarded according to applicable local and national regulations. IBM encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. IBM offers a variety of product return programs and services in several countries to assist equipment owners in recycling their IT products. Information on IBM product recycling offerings can be found on IBM's Internet sites at <http://www.ibm.com/ibm/recycle/us/index.shtml> and <http://www.ibm.com/ibm/environment/products/index.shtml>.

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This appliance is labeled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

注意：このマークは EU 諸国およびノルウェーにおいてのみ適用されます。

この機器には、EU 諸国に対する廃電気電子機器指令 2002/96/EC(WEEE) のラベルが貼られています。この指令は、EU 諸国に適用する使用済み機器の回収とリサイクルの骨子を定めています。このラベルは、使用済みになった時に指令に従って適正な処理をする必要があることを知らせるために種々の製品に貼られています。

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L'étiquette du système respecte la Directive européenne 2002/96/EC en matière de Déchets des Equipements Electriques et Electroniques (DEEE), qui détermine les dispositions de retour et de recyclage applicables aux systèmes utilisés à travers l'Union européenne. Conformément à la directive, ladite étiquette précise que le produit sur lequel elle est apposée ne doit pas être jeté mais être récupéré en fin de vie.

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---

## Battery return program

This product may contain a sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries outside the United States, go to <http://www.ibm.com/ibm/environment/products/index.shtml> or contact your local waste disposal facility.

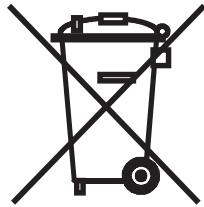
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**For Taiwan:** Please recycle batteries.





**For the European Union:**



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This notice is provided in accordance with Royal Decree 106/2008 of Spain: The retail price of batteries, accumulators, and power cells includes the cost of the environmental management of their waste.

**For California:**

Perchlorate material – special handling may apply. See <http://www.dtsc.ca.gov/hazardouswaste/perchlorate/>.

The foregoing notice is provided in accordance with California Code of Regulations Title 22, Division 4.5 Chapter 33. Best Management Practices for Perchlorate Materials. This product/part may include a lithium manganese dioxide battery which contains a perchlorate substance.

---

## Electronic emission notices

IBM IntelliStation Z Pro Type 9228 and 9232

### Federal Communications Commission (FCC) statement

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

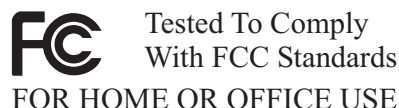
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM authorized dealers. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**Responsible party:**

International Business Machines Corporation  
New Orchard Road  
Armonk, NY 10504  
Telephone: 1-919-543-2193



## Industry Canada Class B emission compliance statement

This Class B digital apparatus complies with Canadian ICES-003.

## Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

## European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class B Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class B equipment were derived for typical residential environments to provide reasonable protection against interference with licensed communication devices.

European Community contact:  
IBM Technical Regulations  
Pascalstr. 100, Stuttgart, Germany 70569  
Telephone: 0049 (0)711 785 1176  
Fax: 0049 (0)711 785 1283  
E-mail: tjahn@de.ibm.com

## Notice for South Korea and translations (MIC)

### Class B Equipment

Please note that this equipment has been approved for non-business use with regards to electromagnetic interference. As such, this equipment can be used in all areas, including residential areas.

## Japanese Voluntary Control Council for Interference (VCCI) statement

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。  
取扱説明書に従って正しい取り扱いをして下さい。

This is a Class B product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.



---

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