IBM

IntelliStation Z Pro
Type 6221

User's Guide

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IBM

User's Guide

Note:

Before using this information and the product it supports, read the information in Appendix B, "Warranty information" on page 95, and Appendix C, "Notices" on page 107.

Contents

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

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

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

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

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

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

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

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

.לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

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

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

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

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

Перед установкой продукта прочтите инструкции по
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Statement 1

Danger

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

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

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

Statement 2

CAUTION:
When replacing the lithium battery, use only 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
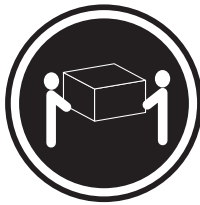
≥18 kg (39.7 lb)   ≥32 kg (70.5 lb)   ≥55 kg (121.2 lb)

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 23

CAUTION:
Do not place any object weighing more than 50 kg (110 lb) on top of rack-mounted devices.

>50 kg (110 lb)

Declaración 23

PRECAUCIÓN:

No coloque ningún objeto que pese más de 50 kg (110 libras) encima de los dispositivos montados en bastidor.

>50 kg (110 libras)

Hinweis 23

ACHTUNG:

Keine Gegenstände, die mehr als 50 kg wiegen, auf Rack-Einheiten ablegen.

>50 kg

Notice nø 23

ATTENTION:

Ne posez pas d'objet dont le poids dépasse 50 kg sur les unités montées en armoire.

>50 kg

Varningsmeddelande 23

VARNING:

Placera inte något föremål som väger mer än 50 kg ovanpå rackmonterade enheter.

>50 kg

Merknad 23

ADVARSEL:

Ikke sett gjenstander som veier mer enn 50 kg oppå enheter som er montert i et kabinett.

>50 kg

Avviso 23

ATTENZIONE:

Non poggiare oggetti che pesano più di 50 kg sulla parte superiore delle unità montate in rack.

>50 kg

Turvaohje 23

Varoitus:

Telineeseen asennettujen laitteiden päälle ei saa asettaa yli 50 kilon painoista esinettä.

>50 kg

Voorschrift 23

WAARSCHUWING:

Plaats geen objecten die meer dan 50 kg wegen op apparaten die in het rek zijn gemonteerd.

>50 kg

Forskrift 23

Pas på!:

Anbring ikke genstande, der vejer mere end 50 kg, oven på enheder, der er monteret i rack.

>50 kg

Instrução 23

CUIDADO:

Não coloque nenhum objeto com peso superior a 50 kg (110 lbs.) sobre dispositivos montados em rack.

>50 kg (110 lbs)

عبارة ٢٣

⚠️

تنبيه :

لا تضع أي عنصر يزن أكثر من ٥٠ كيلوجرام
(١١٠ رطل) أعلى سطح الأجهزة.

أكبر من ٥٠ كيلوجرام (١١٠ رطل)

- Izjava br. 23

⚠️

OPREZ:
Ne postavljajte predmete teže od 50 kg (110 funti) na ormar u koji
su ugrađeni uređaji.

> 50 kg (110 lbs)

Δήλωση 23

ΠΡΟΣΟΧΗ:
Μην τοποθετείτε οποιοδήποτε αντικείμενο με βάρος μεγαλύτερο από 50 kg επάνω σε συσκευές που έχουν προσαρμοσθεί σε ικρίωμα (rack).

> 50 kg

הודעה 23

:זהירות
אל תניחו שם חפץ שמשקלו יותר מ-50 ק"ג על גבי התקנים המורכבים על מסדי מתכווניריח.

50 ק"ג

- 23. ismertető

FIGYELEM:
Keretszerelésű eszközök tetejére ne helyezzen olyan tárgyat, melynek súlya több, mint 50 kg (110 lbs.).

> 50 kg (110 lbs)

・記述 23

⚠ 注意

ラック・モデルのサーバーの上に 50 Kg 以上の物を置かないで
ください。
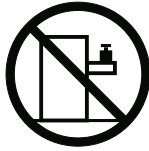
> 50 Kg

경고문 23

⚠

주의:
서랍형 모델의 장치 상단에 50 kg(110 lbs.)이 넘는 물체를 올려
놓지 마십시오.

> 50 kg (110 lbs)

Instrukcja 23

⚠

ZAGROŻENIE:
Nie należy umieszczać przedmiotów cięższych
niż 50 kg (110 funtów.)

> 50 kg (110 funtów)

- Положение 23

ОСТОРОЖНО:
Не ставьте предметы весом более 50 кг на верхнюю крышку устройств, смонтированных на выдвижных полках.

> 50 кг

声明 23

警告：

机柜安装的设备上面不能放置重于 50kg（110 磅）的物品。

> 50 kg (110 磅)

- Príkaz 23

VÝSTRAHA:
Neumiestňujte žiadny predmet vážiaci viac ako 50 kg (110 lbs.) na vrch zariadenia montovaného do stojana.

> 50 kg (110 lbs)

· **Navedba 23**

SVARILO:
Ne postavljajte nobenega predmeta, ki je težji od 50 kg, na vrh naprav, montiranih v stojala.

> 50 kg (110 lbs)

聲明 23

注意：
請勿將任何重量超過 50 公斤 (110 磅) 的物品置於已安裝機架的裝置上方。

> 50 公斤 (110 磅)

Instrukce 23

POZOR:
Neumísťujte nic s hmotností vyšší než 50 kg navrch zařízení namontovaných do stojanu.

>50 kg (110 lbs)

- Инструкција 23

ПРЕДУПРЕДУВАЊЕ:
Не поставувајте предмети потешки од 50 кг. (110 lbs.) над уредите
кои се монтирани во ормари.

> 50 kg (110 lbs)

Instrução 23

CUIDADO:

Não coloque nenhum objeto com peso superior a 50 kg (110 lbs.) sobre dispositivos montados em rack.

>50 kg (110 lbs)

Chapter 1. Introducing the IntelliStation Z Pro computer

Thank you for selecting an IBM® IntelliStation® Z Pro Type 6221 computer. Your computer incorporates many of the latest advances in computing technology and can be expanded and upgraded as your needs change.

If you have access to the Internet, you can obtain up-to-date information about your computer and other IBM computer products at http://www.ibm.com/pc/intellistation/ on the World Wide Web.

The computer model and serial numbers are on labels on the bottom of the computer and on the lower-right side of the bezel. You will need these numbers to register your computer with IBM.

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

The latest version of this publication is available from the IBM Web site. Go to http://www.ibm.com/ and click **Support & downloads**. In the **Technical support** keyword search field, type 6221 and click **Go**. A list of publications for your computer is displayed.

Notices and statements used in this book

The caution and danger statements used in this book also appear in the multilingual *Safety Information* book that is viewable through Access IBM and on the IBM *IntelliStation Documentation* CD. Each statement is numbered for reference to the corresponding statement in the *Safety Information* book.

The notices and statements are:
- **Notes:** 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.

1

Related publications

This *User's Guide* provides general information about your computer, including information about features, how to configure your computer, how to install options, and how to solve problems and get help.

The following documentation contains additional information about your computer. Because your computer comes with IBM-preinstalled software, you might be able to view some of these documents in Access IBM. See "Using Access IBM" on page 13. The following IBM documents can also be found at http://www.ibm.com/ on the World Wide Web.

- *Installation Guide*
  This printed publication contains setup and installation instructions.
- *Hardware Maintenance Manual*
  This publication contains information for trained service technicians. It can be found at http://www.ibm.com/pc/support/ on the World Wide Web.
- Readme files on the *Device Drivers and IBM Enhanced Diagnostics* CD
  Several readme files on this CD contain diagnostic tools and 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 your computer.
- *Safety Information* book
  This publication, viewable through Access IBM and on the IBM *IntelliStation Documentation* CD, contains multilingual caution and danger statements.
- IBM *IntelliStation Documentation* CD
  This CD contains all of the IBM IntelliStation Z Pro Type 6221 computer publications in Portable Document Format (PDF).

Features and specifications

The following table provides a summary of the features and specifications of your IntelliStation Z Pro Type 6221 computer. Some features are not available on all models.

Note: You can use the Configuration/Setup Utility program in your computer to determine the specific type of microprocessor on your system board.

Table 1. Features and specifications

Microprocessor:	Integrated functions:	Electrical input:

• Intel Xeon™ Processor
• 512 KB Level-2 cache
• 533 MHz front-side bus (FSB)
• Support for up to two microprocessors
 	
Memory:
• Minimum: 256 MB
• Maximum: 8 GB
• Type: PC2100, double-data-rate (DDR)
• Connectors: four dual inline memory module (DIMM) connectors, two-way interleaved
 	
Internal Drives:
• Diskette: 1.44 MB (two mode)
• Hard disk drive: IDE or SCSI
• One of the following optical drives:
  – CD-ROM: IDE
  – DVD/CD-RW combo: IDE
  – CD-RW: IDE
 	
Expansion bays:
• Three slim-high, 3.5-inch drive bays (one hard disk drive installed in some models)
• Two 5.25-inch bays (optical drive installed in one bay)
• One 3.5-inch removable-media drive bay (diskette drive installed)
 	
PCI expansion slots:
• Four PCI-X 100 MHz/64-bit
• One PCI 33 MHz/32-bit
 	
Power supply:
One 425 watt output (115-230 V ac)
 	
Cooling:
Two speed-controlled system fans
	• Broadcom 5703 10/100/1000 Ethernet controller on the system board with RJ-45 Ethernet port
	• Two serial ports
	• One parallel port
	• (Some models) Two IEEE 1394 (FireWire) ports (four-pin on front, six-pin on rear)
	• Integrated SCSI controller with RAID capabilities and two Ultra 320 SCSI ports (one internal, one optional external)
	• Four Universal Serial Bus (USB) v2.0 ports (two on front and two on rear of enclosure)
	• Keyboard port
	• Mouse port
	• Audio ports
	  – Line out (front and rear)
	  – Mic (front and rear)
	  – Line in (rear)
	• ATA-100 dual-channel IDE controller
	
	Video adapter: Accelerated graphics port (AGP) Pro 50 video with one of the following:
	• Matrox Millennium G450 (DVI-I) 4X with 32 MB double-data-rate (DDR) synchronous dynamic random access memory (SDRAM) video memory and a single DVI-I or dual analog connectors (or dual VGA monitor capability with the pigtail cable that came with the system)
	• NVIDIA Quadro4 280NVS (LFH-60), AGP 8X, with 64 MB double-data-rate (DDR) SDRAM video memory and dual analog connectors (or dual digital monitor capability with the purchase of an additional pigtail cable)
	• NVIDIA Quadro4 980XGL (DVI-I), AGP 8X, with 128 MB double-data-rate (DDR) SDRAM video memory and dual DVI-I connectors
	• 3Dlabs Wildcat4 7110 (DVI-I), AGP 8X, with 128 MB texture buffer DDR SDRAM video memory and 128 MB frame buffer video memory, and dual DVI-I connectors
		• Sine-wave input (50 or 60 Hz) required
		• Input voltage and frequency ranges automatically selected
		• Input voltage low range:
		  – Minimum: 100 V ac
		  – Maximum: 127 V ac
		• Input voltage high range:
		  – Minimum: 200 V ac
		  – Maximum: 240 V ac
		• Input kilovolt-amperes (kVA) approximately:
		  – Minimum: 0.15 kVA
		  – Maximum: 0.80 kVA
		
		Heat output:
		Approximate heat output in British thermal units (Btu) per hour
		• Minimum configuration: 341 Btu/hour (100 watts)
		• Maximum configuration: 2082 Btu/hour (607 watts)
		
		Environment:
		• Air temperature:
		  – Computer on: 10° to 35°C (50° to 95°F) Altitude: 0 to 2134 m (7000 ft)
		  – Computer off: -40° to +60°C (-40° to 140°F) Maximum altitude: 2133 m (7000 ft)
		• Humidity (operating and storage): 8% to 80%
		
		Acoustical noise emissions:
		• Sound power, idle: 5.3 bel maximum
		• Sound power, operating: 5.6 bel maximum
		
		Size:
		• Height: 438 mm (17.25 in.)
		• Depth: 483 mm (19 in.)
		• Width: 165 mm (6.5 in.)
		• Weight: 16.3 kg (36 lb) to 20.8 kg (45.8 lb) depending upon configuration

What your IntelliStation Z Pro computer offers

Your computer takes advantage of advancements in data storage, memory, systems management, and network environments. Your computer includes:

- *Multiple microprocessor capability*

  Your computer can be upgraded to a symmetric multiprocessing (SMP) computer through a microprocessor upgrade.

- *High-performance accelerated graphics port (AGP) graphics*

  Your computer comes with an AGP graphics adapter installed. This high-performance adapter supports high resolutions and includes many performance-enhancing features for your operating-system environment.

- *Large system memory*

  The memory bus in your computer supports up to 8.0 GB of system memory. The memory controller provides error correction code (ECC) support for up to four industry-standard PC2100, 2.5 V, 184-pin, 133 megahertz (MHz) (bus speed), registered, double-data-rate (DDR), synchronous, dual inline memory modules (DIMMs).

  The memory controller in your computer provides Chipkill™ memory protection if all DIMMs are all type x4 and are 256 MB or larger. Chipkill memory protection technology protects the system during a single chip failure in a DIMM.

- *Systems-management capabilities*

  Your computer comes with features that a network administrator or file server can use to remotely manage and control your computer. Some of the features include Wake on LAN®, Remote Administration, IBM Director Agent, and System Migration Assistant. See "Managing your computer" on page 18 for more information.

- *Integrated network environment support*

  Your computer comes with an Ethernet controller on the system board. This Ethernet controller has an interface for connecting to 10-Mbps, 100-Mbps, or 1-Gbps networks. The computer automatically selects between 10BASE-T, 100BASE-TX, and 1 Gb environments. The controller provides full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the Ethernet local area network (LAN).

Software

Your IBM IntelliStation Z Pro computer comes with Windows® XP Professional[1] preinstalled and a variety of software, including application programs, diagnostic tools, and device drivers.

Important: The software, other than the Microsoft operating system, is licensed under the terms of the IBM International License Agreement for Non-Warranted Programs. Use of your computer signifies acceptance of this license agreement. For detailed instructions about viewing the license agreement, see "Viewing the license agreement" on page 12.

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1. The Microsoft® Certificate of Authenticity is your assurance that the Windows software in your computer is legally licensed from Microsoft Corporation.

Preinstalled software

In addition to the Microsoft operating system, your preinstalled software includes the following programs. Some of these programs might require setup and configuration before use.

- **Access IBM**

  This program provides a central menu of links on your desktop where you can easily access programs and utilities for many of the common tasks that you want to perform. You can start Access IBM from the Windows **start** menu if you do not have an Access IBM icon on your desktop.

- **Adobe Acrobat Reader**

  You can use this program to read portable document format (PDF) files, including your online documentation. You can download the most current versions of Adobe Acrobat Reader for other languages and operating systems from the Adobe Web site at http://www.adobe.com/ on the World Wide Web.

- **IBM Product Registration**

  You can use this program to register your computer with IBM. When you register your computer with IBM, information is entered into an IBM database, which enables IBM to contact you in case of a recall or other problems. Some locations offer extended privileges and services to registered users.

- **Online Books**

  You can use this program to access documentation that contains detailed information about your computer.

- **PC-Doctor for Windows**

  This diagnostics program contains diagnostic tools that you can use within your Windows operating system. In addition to isolating hardware problems, these tools provide information about your computer operating environment and some software components. Support documentation is built into the help system.

- **Device drivers** for factory-installed features are preinstalled on your computer. The latest device drivers are also available at http://www.ibm.com/pc/support/ on the World Wide Web.

- **Product Recovery Program**

  You can use this program to recover the Windows XP operating system and other software programs in the event of a system failure.

  Important: The Product Recovery Program is on a hidden, hard disk drive partition. Do not delete or otherwise destroy this partition.

- **Norton AntiVirus for IBM**

  You can use this program to detect and remove viruses from your computer.

- **IBM RecordNow**

  You can use this program to record data or audio to CD-R or CD-RW media, or to create copies of existing CDs.

- **IBM Drive Letter Access**

  You can use this program to copy files to CD-R or CD-RW media.

You must have Internet access to use some of these programs. For more information about connecting to the Internet, see the operating-system documentation that comes with your computer.

See "Using preinstalled software" on page 11 for additional information about your preinstalled software. For more information about using the recovery programs and solving problems, see Chapter 5, "Solving problems" on page 61.

Important:
1. You can reinstall the device drivers and applications that come with your computer from the directories on your hard disk. For more information about recovering your computer software, see "Recovering your operating system and preinstalled software" on page 86.
2. The device drivers and some programs are also available at http://www.ibm/com/pc/support/ on the World Wide Web and on the *Device Drivers and IBM Enhanced Diagnostics* CD.

Software on CD

In addition to your IBM-preinstalled programs and device drivers, additional software is provided on the *Device Drivers and IBM Enhanced Diagnostics* CD or other CDs. You decide which programs to install based on your needs.

Device Drivers and IBM Enhanced Diagnostics CD
> The diagnostic test programs are stored on the *Device Drivers and IBM Enhanced Diagnostics* CD that comes with your computer. These programs contain the primary methods of testing system components. Some of the preinstalled device drivers are also stored on this CD.

IBM ServeRAID Support CD
> The ServeRAID™ programs are stored on the *IBM ServeRAID Support* CD that comes with your computer. If your computer has a ServeRAID controller installed, or if you are using the integrated SCSI controller with RAID capabilities as a RAID controller, you must use the ServeRAID Manager program to define and configure your disk-array subsystem *before* you install your operating system.

Lotus® SmartSuite®
> Lotus SmartSuite® contains a package of powerful, award-winning productivity applications and everything you need to access the Internet. Your IntelliStation Z Pro computer comes with either a Lotus *SmartSuite* CD or a proof of entitlement to receive one free CD version of Lotus SmartSuite. To install your SmartSuite package, insert the Lotus *SmartSuite* CD into the CD-ROM drive, or contact your network administrator for assistance.

Software available on the World Wide Web

The following list contains some of the software that is available on the World Wide Web at http://www.ibm.com/pc/. For more detailed information about these tools or to download any of this software, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and click **Go**. From the Servers category under the Products column, click **Intel processor-based**; then, click **Systems Management** from the topics on the left. Scroll down and click on a systems management tool to get more details.

IBM Director Agent
> You can use IBM Director Agent to view detailed information about your hardware and software, set up alerts, monitor a variety of system resources, and manage your asset security. IBM Director Agent streamlines and automates personal computer (PC) systems management and support tasks, such as asset deployment and tracking.

Remote Deployment Manager
> Remote Deployment Manager (RDM) is a graphical, server-based system deployment program that enables mass unattended installations of operating systems, software images, device drivers, and BIOS code

updates to remote systems. When used with Wake on LAN, Remote Deployment Manager can remotely turn on your computer so that the installation can be done while the computer is being used.

System Migration Assistant

System administrators can use System Migration Assistant (SMA) to remotely transfer configurations, profile settings, printer device drivers, and files from an IBM or non-IBM computer to supported IBM systems.

Software Delivery Assistant

You can use Software Delivery Assistant to create an image of a single set of applications that can be deployed to different user-groups while taking into account the users application needs.

Reliability, availability, and serviceability features

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

The following is an abbreviated list of the RAS features that your computer supports. Many of these features are explained in later chapters of this publication.

- 24 hours a day, 7 days a week customer support
- 3-year limited warranty
- Advanced Configuration and Power Interface (ACPI)
- Advanced Desktop Management Interface (DMI) features
- Alert Standard Format (ASF) support providing seven standard alerts for components such as fans, voltage, and thermals
- Automatic BIOS recovery to backup image
- Automatic computer restart after power failure, based on BIOS setting
- Automatic error retry or recovery
- Automatic memory downsizing on error detection
- Automatic restart on non-maskable interrupt (NMI)
- Boot-block recovery
- Built-in, menu-driven configuration and setup programs
- Built-in, menu-driven SCSI configuration programs (some models)
- CD-based diagnostic programs
- Chipkill memory protection
- Cooling fans with speed-sensing capability
- Diagnostic support of ServeRAID adapters
- Error codes and messages
- Error correction code (ECC) double data rate (DDR) synchronous dynamic random access memory (SDRAM) with serial presence detect (SPD)
- Integrated Ethernet controller
- Memory change message posted to error log
- Monitoring support for temperatures, voltages, and fan speed
- Power-on self-test (POST)
- Processor serial number access
- Read-only memory (ROM) checksums

- Redundant Ethernet capabilities (requires optional Ethernet adapter) with failover support
- System-error LED on the front bezel and diagnostics LEDs on the system board
- Upgradeable basic input/output system (BIOS) and POST
- Vital product data (VPD); includes serial number information and replacement part numbers, stored in nonvolatile memory, for easier remote maintenance
- Wake on LAN capability

Chapter 2. Operating your computer

This section provides information to help you in the day-to-day use of your computer.

Controls and indicators

This section identifies the controls and indicators on the front and rear of your computer.

Ethernet link status LED

CD-ROM drive activity LED

CD-eject button

Diskette drive activity LED

Diskette-eject button

Hard disk drive activity LED

Power-on LED

Power-control button

Ethernet transmit/receive activity LED

Ethernet transmit/receive activity LED

System error LED

IEEE 1394 (FireWire) connector 1394

Microphone connector

Line out connector

USB port A connector

USB port B connector

CD-eject button

　　Press this button to release a CD from the CD-ROM drive.

CD-ROM drive activity LED

　　When this LED is lit, it indicates that the CD-ROM drive is in use.

Diskette drive activity LED

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

Diskette-eject button

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

Ethernet link status LED

　　This LED is on the Ethernet connector on the back of the computer. When this LED is lit, it indicates that there is an active connection on the Ethernet port.

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 Ethernet transmit/receive activity LEDs: one on the front bezel and the other on the Ethernet connector on the rear of the computer.

Hard disk drive activity LED

　　When this LED is flashing, it indicates that a hard disk drive is in use.

IEEE 1394 (FireWire) connector (some models)
> This connector is used to connect IEEE 1394 devices to your computer.

Line-out connector (green)
> This connector sends stereo audio signals from the computer to external devices, such as speakers with built-in amplifiers, headphones, or the audio line-in jack on a stereo system.

Microphone connector (pink)
> This connector is used to connect a microphone to record voice or other sounds on the hard disk. You can also use this connector (and a microphone) with speech recognition software.

Power-control button
> Press this button to turn the computer on and off manually. You can install a circular disk, called the power-control button shield, over the power-control button to prevent accidental manual power-off. This disk is provided with your computer.

Power-on LED
> When this LED is lit and does not flash, it indicates that the computer is turned on. When this LED is flashing, it indicates that the computer is off and still connected to an ac power source (standby mode).

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. See "System-board error LEDs" on page 85 and Chapter 5, "Solving problems" on page 61 for additional information.

USB ports
> Use these automatically configures ports to connect universal serial bus (USB) v2.0 devices to your computer, using Plug and Play technology.

Turning on the computer

When the computer is connected to an ac power source but is not turned on, the operating system does not run, and all core logic is shut down; however, the computer can respond to remote requests to turn on the computer. The power-on LED flashes to indicate that the computer is connected to an ac power source but is not turned on (standby mode).

Notes:

1. Turn on all external devices, such as the monitor, before turning on the computer.

2. The power-on LED on the front of the computer is lit when the computer is on and while it is powering-up.

3. You can install a circular disk over the power-control button to prevent accidental manual power-off. This disk, known as the power-control button shield, comes with your computer.

Approximately 20 seconds after the computer is connected to ac power, the power-control button becomes active, and you can turn on the computer and start the operating system by pressing the power-control button. The computer can also be turned on in any of the following ways:

- If a power failure occurs while the computer is turned on, the computer will restart automatically when power is restored.

- When you plug in your computer for the first time, Wake on LAN can turn on the computer.
- If your computer was previously turned on, it must be properly turned off for the Wake on LAN feature to turn on the computer.

What you see and hear when you start your computer depends on the features that are installed and the settings in the Configuration/Setup Utility program.

If power-on self-test (POST) detects a problem, there might be a series of beeps or no beep, and a numeric error message might appear on the screen. Write down any beep series and error code numbers with descriptions, and then see "Troubleshooting charts" on page 78 for the explanation of error codes.

During startup, the following messages might be displayed briefly:
- `To start the Product Recovery Program, Press F11`
- `Press F1 for Configuration/Setup`
- `<<< Press <CTRL><C> to start LSI Logic Configuration Utility >>>`

To use any of these features, press the appropriate function key or keys quickly. The messages appear for only a few seconds. For more information about the programs listed in these messages, see "Using the Configuration/Setup Utility program" on page 21, "Using the LSI Logic Configuration Utility program" on page 24, and "Recovering your operating system and preinstalled software" on page 86.

During startup, you might not see `Press F1 for Configuration/Setup`. If you want to see the prompt, see instructions for displaying the prompt in "Using the Configuration/Setup Utility program" on page 21.

Use the Configuration/Setup Utility program to configure your computer with passwords, PCI adapter configuration, and other options. The Configuration/Setup Utility menu is displayed at the top of the screen. To navigate the menu and screen items, follow the instructions on the right of the screen.

The operating system and application programs start from the hard disk. If your computer is attached to a network, the computer will begin attaching to any LANs and remote applications to which you have access. A network administrator can also "wake up" your computer (start it remotely) to download programs or gather information about computer performance. For more information, see "Wake on LAN" on page 18.

Using preinstalled software

This section contains information to assist you in setting up the preinstalled Microsoft operating system and describes how to use the programs that come with your computer.

Running the operating system setup program

If you are starting your computer for the first time, the Microsoft Windows setup program runs automatically when you start the computer. The program will prompt you to make choices or type information. If you need more detailed information than is provided in this *User's Guide*, see your Microsoft operating-system manual.

Important:

1. After turning on your computer for the first time, you must complete the operating system setup procedure before turning off your computer; otherwise, unexpected results might occur.

2. The setup program might be slightly different from the one described in your operating-system manual. Some choices do not appear because they are preset.

3. During the setup procedure, you must indicate that you accept the license agreement.

4. The Microsoft registration information will already be displayed in the registration field. If the Product ID number is not already displayed, you must type it. The Product ID is on a label attached to the computer.

You will need the following information to complete the setup program:
- The Microsoft documentation that comes with your computer.
- Network information from your network administrator, if your computer is being connected to a network.
- The printer model and port, if a printer is attached directly to your computer.

After the setup procedure finishes and the computer restarts, the Windows desktop opens. Your computer is now ready for use.

Installing other operating systems

Your computer comes with Microsoft Windows XP Professional preinstalled. To install another operating system, follow the instructions in the documentation provided with the operating system.

If you are installing another Microsoft Windows operating system, follow the instructions in the readme file on the *Device Drivers and IBM Enhanced Diagnostics* CD to install the device drivers. If you install other than a Microsoft Windows operating system, you might need additional software or device drivers.

Note: If you experience problems with the device drivers installed from the *Device Drivers and IBM Enhanced Diagnostics* CD, you can obtain the latest device drivers at http://www.ibm.com/pc/support/ on the World Wide Web.

Before installing any operating system, be sure you obtain the latest updates. Contact the operating system manufacturer or, if applicable, check the manufacturer's World Wide Web site to obtain the updates.

Additional information about operating systems is posted periodically at http://www.ibm.com/pc/support/ on the World Wide Web.

Viewing the license agreement

The IBM International License Agreement for Non-Warranted Programs is viewable through Access IBM. Use of your computer signifies acceptance of this agreement. Complete the following steps to view the license agreement:

1. Click **start**.
2. Click **Access IBM**.
3. Click **How do I...**.
4. Click **Solve problems**.
5. Click **IBM International License Agreement**.

Registering your computer

Registering your computer helps IBM provide better service to you. When IBM receives your registration information, it is placed into a central technical support database. If you need technical assistance, the technical-support representative will have information about your computer. In addition, comments about your computer are reviewed by a team dedicated to customer satisfaction and are taken into consideration in making improvements to IBM computers. Use one of the following methods to register your computer:

- Double-click the **IBM Registration** icon on the Windows desktop, and then follow the instructions.
- Register your computer through Access IBM:
   1. Click **start**.
   2. Click **Access IBM**.
   3. Click **How do I...**.
   4. Click **Get started**.
   5. Click **Registering your IBM Computer**, and then follow the instructions in the window.
- Register your computer at http://www.ibm.com/pc/register/ on the World Wide Web.

Note: If you use the registration program that starts through Access IBM or the **IBM Registration** icon on the Windows desktop, you can print the registration information and provide a mailing address if you do not have access to the Internet.

Using Access IBM

Access IBM is an interface through which you can quickly access information or perform specific tasks.

The choices available from the Access IBM Welcome window are:

- **How do I...**

   Select this choice to display information about tasks that are typically performed immediately after you install a new computer, such as personalizing your computer to fit your needs, protecting your data, using recovery tools, upgrading your computer hardware, purchasing IBM services, purchasing IBM options, solving problems, and viewing the IBM International License Agreement for Non-Warranted Programs.

- **Tools & Tips**

   Select this choice to display information about Access Support, AntiVirus tools, data backup and restore tools, configuration backup and restoration tools, diagnostic programs, data migration tools, help, online books, system information and personalization, and updates.

- **On the Web**

   Select this choice to display information about obtaining additional information and support on the World Wide Web.

Complete the following steps to use Access IBM:

1. Double-click the **Access IBM** icon on the Windows desktop. If the **Access IBM** icon is not available on your desktop, click **start → All Programs → IBM Information → Access IBM**.

2. Click one of the tabs on the Access IBM Welcome window (for example, **How do I...**).

3. Click a topic.

Creating an emergency recovery-repair diskette

At your earliest opportunity, create a recovery-repair diskette and store it in a safe place. In the unlikely event that your Windows desktop becomes unusable, you can use the recovery-repair diskette to access the Product Recovery program. Additional information about the diskette is in Access IBM. For information about using this diskette, see "Using the emergency recovery-repair diskette" on page 87.

Complete the following steps to create a recovery-repair diskette:

1. From Access IBM, click the **How do I...** tab; then, click **Protect data**.

2. Click **Creating emergency diskettes**.

3. Click **Recovery Repair diskette**.

4. Follow the instructions on the screen.

Creating an IBM Enhanced Diagnostics diskette

The IBM Enhanced Diagnostics diskette is used to test hardware components on your computer. See "Using an IBM Enhanced Diagnostics diskette" on page 87 for instructions on how to use an IBM Enhanced Diagnostics diskette.

You can create an IBM Enhanced Diagnostics diskette using Access IBM, by downloading a program image from the World Wide Web, or from the *Device Drivers and IBM Enhanced Diagnostics* CD.

Complete the following steps to create the diagnostics diskette using Access IBM:

1. From the Access IBM **Welcome** window, click **How do I...**; then, click **Protect data**.

2. Click **Creating emergency diskettes**.

3. Click **Diagnostic diskette**.

4. Follow the instructions on the screen.

Complete the following steps to create a startable IBM Enhanced Diagnostics diskette from the World Wide Web:

1. Go to http://www.ibm.com/pc/support/ on the World Wide Web.

2. Download the diagnostics file for your computer to a hard disk directory (not to a diskette).

3. Go to a DOS prompt and change to the directory where the file was downloaded.

4. Insert a blank, high-density diskette into diskette drive A.

5. Type `filename a:`

    where *filename* is the name of the file you downloaded from the Web, and press Enter.

The downloaded Web file is self-extracting and will be copied to the diskette. When the copy completes, store the diskette in a safe place.

Complete the following steps to create an IBM Enhanced Diagnostics diskette from the Device Drivers and IBM Enhanced Diagnostics CD:

1. Insert a formatted, blank, high-density diskette into diskette drive A.

2. Insert the *Device Drivers and IBM Enhanced Diagnostics* CD into the CD-ROM drive.
3. At the command prompt, switch to the CD-ROM drive letter. For example, type `e:` (where e is the CD-ROM drive letter), and press Enter.
4. Change to the `PCDR` directory. Type, `cd pcdr` and press Enter.
5. Type `makediag` and press Enter.
6. Follow the instructions on the screen to create the diskette.

Using video features

Your computer has an accelerated graphics port (AGP) graphics adapter that renders 2D or 3D image quality and uses standard video protocol for displaying text and graphic images on a monitor screen. The adapter supports a variety of video modes. Video modes are different combinations of resolution, refresh rate, and color defined by a video standard for displaying text or graphics.

Video device drivers

To take full advantage of the graphics adapter in your computer, some operating systems and application programs require custom video device drivers. These device drivers provide greater speed, higher resolution, more available colors, and flicker-free images.

Device drivers for the graphics adapter and a readme file with instructions for installing the device drivers are provided on the *Device Drivers and IBM Enhanced Diagnostics* CD that comes with your computer and in the ibmtools\drivers directory on the hard disk. Use the device-driver installation instructions if you need to reinstall the device drivers or if you need information about obtaining and installing updated device drivers. For more information about installing device drivers, see "Recovering or installing device drivers" on page 87.

Changing monitor settings

To get the best possible image on your screen and to reduce flicker, you might need to reset the resolution and refresh rate of your monitor. You can view and change monitor settings through your operating system using the instructions in the readme files on the *Device Drivers and IBM Enhanced Diagnostics* CD or in the c:\IBMTools\drivers\ directory on the hard disk of your computer. See your operating-system documentation for more information about monitor settings.

Attention: Before changing monitor settings, review the documentation that comes with your monitor. Using a resolution or refresh rate that is not supported by your monitor might cause the screen to become unreadable and could damage the monitor. The information that comes with your monitor usually includes resolution and screen refresh rates that your monitor supports. If you need additional information, contact the manufacturer of the monitor.

If you are using a cathode ray tube (CRT) monitor, set your monitor for the highest noninterlaced refresh rate that the monitor supports. If your monitor complies with the Video Electronics Standards Association (VESA) display data channel (DDC) standard, it is probably already set to the highest refresh rate the monitor and video controller can support. If you are not sure whether your monitor is DDC-compliant, see the documentation provided with the monitor.

If you are using a flat-panel monitor, the refresh rate does not have to be set to the highest noninterlaced refresh rate that the monitor supports. Flat-panel monitors produce flicker-free images even when they are operating at a minimum 60 Hz noninterlaced rate.

If you have a dual-monitor video adapter, see the video adapter device driver readme file and documentation for more information about enabling dual-monitors.

Using audio features

Your computer has an integrated audio controller that is compatible with the Microsoft Windows Sound System. Your computer also has a single internal speaker and three types of audio connectors. Using the audio controller, you can record and play back sound and music to enhance multimedia applications. Optionally, you can connect amplified speakers to the line-out connector to provide improved sound with multimedia applications.

The audio connectors in your computer are 3.5 mm (0.125-in.) mini-jacks. For the location of the audio connectors, see "Input/output connectors" on page 55.

Microphone (pink)
> This connector is used to connect a microphone to record voice or other sounds on the hard disk (mono input for microphone). With a microphone attached, you can also use speech recognition software. Microphone connectors are on both the front and the rear of the computer.

Line in (blue)
> This connector receives stereo audio signals from external devices, such as the line output from a stereo, television, or a musical instrument. One line-in connector is on the rear of the computer.

Line out (green)
> This connector sends stereo audio signals from the computer to external devices, such as speakers, headphones, or the audio line-in connector on a stereo system. The internal speaker on the computer is disabled when any devices are attached to this connector. Line-out connectors are on both the front and the rear of the computer. Connecting devices to the front line-out connector disables the rear line-out connector.

Using security features

To deter unauthorized use of your computer, you can use anti-intrusion features and other security features that are provided with your computer.

Anti-intrusion features

IBM anti-intrusion features help protect against the theft of computer components, such as the microprocessor, system memory modules, or disk drives.

A cover lock is built into your computer to prevent the cover from being removed. Two identical keys for the cover lock are also supplied. A tag attached to the keys has the key serial number and the address of the key manufacturer.

Important: Keep the key-code number and manufacturer address and phone number in a safe place. Because locksmiths are not authorized to duplicate cover-lock keys, you must order replacement keys from the key manufacturer. You will need the key code when ordering replacement keys.

You can set the chassis-intrusion detector switch inside the computer to alert the network system administrator each time the computer cover is removed. For more information about setting the chassis-intrusion alert, see Chapter 3, "Configuring your computer" on page 21.

Component protection

Your computer has individual component serial numbers that can be registered with a security company. You can also register the entire computer. By registering computer components, you can improve the chances of identifying the components if they are ever stolen and recovered. For more information about component registration, go to the IBM Support page at http://www.ibm.com/pc/us/desktop/assetid/ on the World Wide Web.

Data protection

You can lose data from the hard disk for a variety of reasons. Security violations, viruses, or hard disk drive failures can all contribute to data loss. To help protect against the loss of valuable information, IBM has incorporated the following data-saving features in your computer.

SMART hard disk drive
Your computer comes with a self-monitoring and reporting technology (SMART) hard disk drive that is enabled to report potential hard disk failures. If an error is detected, a DMI-compliant warning message is sent to the monitor screen and, if the computer is part of a network, to an administrator console. When an error is detected, the data on the hard disk can be backed up and the drive replaced.

Virus protection
Your computer has built-in virus protection that can be enabled through the Configuration/Setup Utility program. This built-in protection checks for viruses in the boot record only. Also, Norton AntiVirus for IBM is available on the hard disk.

Integrated RAID capability
The integrated SCSI controller with RAID capabilities in your computer supports redundant array of independent disks (RAID). You can use the LSI Logic Configuration Utility program built into your computer to configure RAID level 1 (mirroring) for a single pair of attached devices.

Locking the keyboard

You can lock the keyboard so that others are unable to use it. If a user password is set using the Configuration/Setup Utility program, the keyboard is locked when you turn on the computer. You must type the password before the keyboard will unlock. You can enable the user password feature with the Configuration/Setup Utility program see "Using passwords" on page 24.

Some operating systems have a keyboard and mouse lock-up feature. See the documentation that comes with your operating system for more information.

Updating system programs

System programs are the basic layer of software built into your computer. They include the power-on self-test (POST), the basic input/output system (BIOS) code, and the Configuration/Setup Utility program. POST is a set of tests and procedures that are performed each time you turn on your computer. BIOS is a layer of software that translates instructions from other layers of software into electrical

signals that the computer hardware can understand. You can use the Configuration/Setup Utility program to view and change the configuration and setup of your computer.

System programs are stored in an electrically erasable programmable read-only module (EEPROM) on the system board. This is sometimes referred to as flash memory.

IBM occasionally makes changes and enhancements to the system programs. When updates are released, they are available as downloadable files on the World Wide Web (see Appendix A, "Getting help and technical assistance" on page 93). You can update system programs by starting your computer using a flash update diskette or by using the Remote Administration feature, if it is enabled. Instructions for using system programs updates are included in a readme file provided with the downloadable files.

Managing your computer

Your computer comes with features that a network administrator or file server can use to remotely manage and control your computer. The following sections describe some of these network management tools.

For more detailed information about these tools or to download any of this software, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and click **Go**. From the Servers category under the Products column, click **Intel processor-based**; then, click **Systems Management** from the topics on the left. Scroll down and click on a systems management tool to get more details.

IBM Director Agent

The IBM Director Agent streamlines and automates personal computer (PC) systems management and support tasks, such as asset deployment and tracking. These utilities are available for IBM computers at no additional charge, helping to reduce total cost of ownership of networked computers. IBM Director Agent is available at http://www.ibm.com/pc/support/ on the World Wide Web.

IBM Director Agent enables you to view detailed information about your computer hardware and software, set up alerts, monitor a variety of system resources, and manage your asset security.

Wake on LAN

A network administrator can use the Wake on LAN feature to turn on your computer from a remote location. When the Wake on LAN feature is used with network-management software, many functions, such as data transfers, software updates, and POST or BIOS updates can be performed on many computers simultaneously.

Remote Administration

A network administrator can use the Remote Administration feature to remotely update the POST and BIOS code in your computer. Network-management software, such as Remote Deployment Manager, is required to take advantage of this feature.

Remote Deployment Manager

Remote Deployment Manager is a graphical, server-based program that performs mass unattended installations of operating systems, software, device drivers, and

BIOS code updates to remote systems. Used with the Wake on LAN feature, Remote Deployment Manager can remotely turn on your computer, so that installations can be done while the computer is not being used.

Software Migration Assistant

Software Migration Assistant (SMA) enables administrators to remotely transfer configurations, profile settings, printer device drivers, and files from an IBM or non-IBM computer to supported IBM systems.

Software Delivery Assistant

You can use Software Delivery Assistant to create an image of a single set of applications that can be deployed to different user-groups while taking into account the users application needs.

Shutting down your operating system

When you are ready to turn off the computer, use the shutdown procedure for your operating system to save data and prevent damage to your applications. See your operating system manual for more information.

If you are using the preinstalled Microsoft Windows XP operating system, complete the following steps to shut down your operating system and computer:

1. Save and close all files with which you are working.
2. Close all open applications.
3. Click the Windows **start** button.
4. Click **Turn Off Computer**; then, click **Turn Off** to confirm.

Turning off the computer

When you turn off the computer and leave it connected to ac power, the computer can respond to remote requests to turn on the computer. To remove all power from the computer, you must disconnect it from the power source.
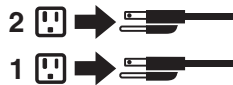
Some operating systems require an orderly shutdown before you turn off the computer. See your operating-system documentation for information about shutting down the operating system.

Statement 5

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

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

- You can turn off your computer from the operating system. If this feature is supported by your operating system, it will turn off the computer after performing an orderly shutdown of the operating system.

  To turn off the computer from the Microsoft Windows XP operating system, click **start → Turn Off Computer**; then, select **Turn Off**.

- You can press the power-control button on the front of the computer. If this feature is supported by your operating system, it will turn off the computer after performing an orderly shutdown of the operating system.

  Note: After turning off the computer, wait at least 5 seconds before you press the power-control button to turn on the computer again.

- You can press and hold the power-control button for more than 4 seconds to cause an immediate shutdown of the computer. You can use this feature to turn off the computer if the operating system stops functioning.

- The computer can turn itself off as an automatic response to a critical system failure.

Chapter 3. Configuring your computer

The following configuration programs are available to configure your computer:

- **Configuration/Setup Utility program**

  The Configuration/Setup Utility program is part of the basic input/output system (BIOS) code that comes with your computer. You can use this program to configure serial port assignments, change interrupt request (IRQ) settings, change the device startup sequence, set the date and time, set passwords, and set the chassis-intrusion alert. See "Using the Configuration/Setup Utility program".

- **LSI Logic Configuration Utility**

  With the built-in LSI Logic Configuration Utility program, you can configure the integrated SCSI controller with RAID capabilities and the devices that are attached to it. See "Using the LSI Logic Configuration Utility program" on page 24.

- **ServeRAID Manager**

  The ServeRAID programs come with your computer. If your computer has a ServeRAID controller installed, or if you are using the integrated SCSI controller with RAID capabilities as a RAID controller, you must use the ServeRAID Manager program to define and configure your disk-array subsystem *before* you install your operating system. See "Using ServeRAID Manager" on page 25 for more information.

- **Ethernet controller configuration process**

  To configure the integrated Ethernet controller, see "Configuring the Gigabit Ethernet controller" on page 26.

Using the Configuration/Setup Utility program

This section provides the instructions for starting the Configuration/Setup Utility program and descriptions of the menu choices that are available.

Starting the Configuration/Setup Utility program

Complete the following steps to start the Configuration/Setup Utility program:

1. Turn on the computer and watch the monitor screen. If your 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 go off, and restart the computer.

2. When the message `Press F1 for Configuration/Setup` appears on the screen during startup, press F1. (This prompt appears on the screen for only a few seconds. You must press F1 quickly.)

   Note: If you have set both administrator and user passwords, you must type the administrator password to access the full Configuration/Setup Utility menu.

3. Follow the instructions that appear on the screen.

Configuration/Setup Utility menu choices

From the Configuration/Setup Utility main menu, you can select settings that you want to change. A typical Configuration/Setup Utility main menu is shown in the following illustration.

```
IBM Setup - (c) Copyright IBM Corporation  2002

              Configuration/Setup Utility
              • System Summary
              • System Information
              • Devices and I/O Ports
              • Date and Time
              • System Security
              • Start Options
              • Advanced Setup
              • PC Health Status
              • Error Logs

                Save Settings
                Restore Settings
                Load Default Settings

              • Exit Setup


        <F1>  Help              <↑> <↓>  Move
        <Esc> Exit              <Enter> Select
```
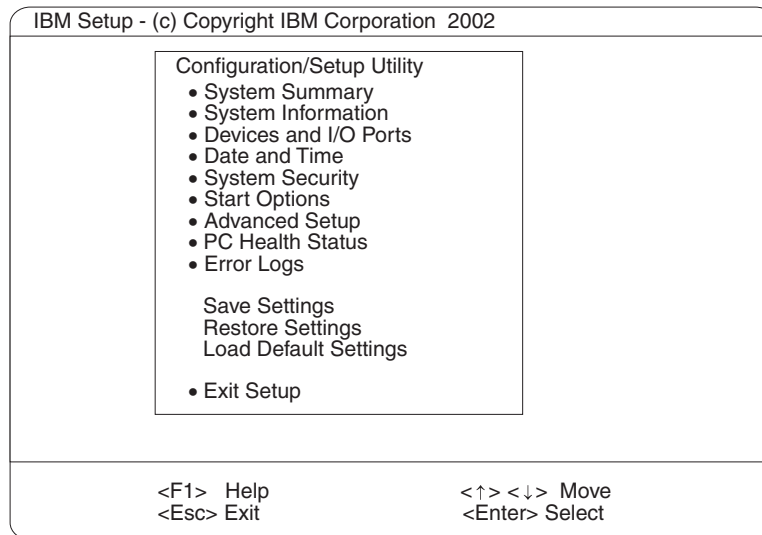
Notes:

1. You can press F1 to display Help information for a selected menu item.
2. The choices on some menus might differ slightly, depending on the BIOS version in your computer.

The following choices are available from the main menu:

- **System Summary**

  This choice contains general information about your computer, such as a summary of components and computer configuration. You can view information about the type and speed of the microprocessor and the amount of memory that is installed. System summary information appears on both the full and limited Configuration/Setup Utility menus.

  Changes that you make to configuration settings appear on this summary screen. You cannot edit the fields of the configuration and system information.

- **System Information**

  Select this choice to display information about your computer. Changes that you make on other menus might appear on this summary screen. You cannot edit any fields. The **System Information** choice appears only on the full Configuration/Setup Utility main menu.

  – **Product Data**

    Select this choice to view system information, such as the machine type and model, the computer serial number, and the revision level or issue date of the BIOS and diagnostics code stored in the electrically erasable programmable ROM (EEPROM).

  – **System Card Data**

    Select this choice to view information about the system board.

- **Devices and I/O Ports**

  Select this choice to view or change the assignments for devices and input/output (I/O) ports. This choice appears only on the full Configuration/Setup Utility main menu.

You can use this choice also to enable or disable the integrated SCSI controller with RAID capabilities and Ethernet (LAN) controllers, and standard ports (serial, parallel, and so on).

– The default setting is **Enabled** for all the controllers you can control from this menu. If you select **Disabled**, the system will not configure the disabled device and the operating system will not detect the device. (This is equivalent to unplugging the device.)

– If the integrated SCSI controller with RAID capabilities is disabled and no SCSI adapter is installed, the computer will have no SCSI capability.

– If the on-board Ethernet controller is disabled and no Ethernet adapter is installed, the computer will have no Ethernet capability.

• **Date and Time**

Use this menu choice to set the system date and time. The system time is in a 24-hour format: hour:minute:second.

• **System Security**

Select this choice to set a power-on or an administrator password. See "Using passwords" on page 24 for more information. You also can enable the chassis-intrusion detector to alert you each time the computer cover is removed.

• **Start Options**

Select this choice to view or change the start options. Start options take effect when you start your computer. You can designate keyboard operating characteristics, such as the keyboard speed, or specify whether the computer starts with the keyboard number lock on or off.

The computer uses a startup sequence to determine the device from which the operating system starts. For example, you can define a startup sequence that checks for a startable diskette in the diskette drive; then, checks the hard disk drive, and then checks a network adapter. You can enable a virus-warning test that checks for changes in the master boot record at startup. You also can choose to run POST in the quick mode, or read the microprocessor serial number.

• **Advanced Setup**

Select this choice to change values for advanced hardware features, such as Cache Control and PCI configuration.

A message displays above the choices on this menu to alert you that the system might malfunction if these options are configured incorrectly. Follow the instructions on the screen carefully.

– **Power Management Setup**

Select this choice to enable or disable system power settings. This includes automatic power-on settings such as Wake on LAN.

– **Chipset Feature**

Select this choice to modify settings that control features of the core chip set on the system board.

Attention: Do not make changes to the Chipset Feature unless directed to do so by an IBM authorized service representative.

– **Processor Control**

Select this choice to enable or disable the microprocessor cache and hyper-threading.

Attention: Do not make changes to the Processor Control unless directed to do so by an IBM authorized service representative.

- **PC Health Status**

  Select this choice to display the computer temperature and voltage status, and fan speeds.

- **Error Logs**

  Select **POST Error Log** to view the three most recent error codes and messages that the system generated during POST.

  Select **Clear event/error logs** from the **POST Error Log** menu to clear the POST Error Log.

- **Save Settings**

  Select this choice to save your customized settings.

- **Restore Settings**

  Select this choice to delete your changes.

- **Load Default Settings**

  Select this choice to cancel your changes.

- **Exit Setup**

  If you have made any changes and not saved them, the program will prompt you to save the changes or exit without saving the changes.

Using passwords

You can use any combination of up to seven characters (A–Z, a–z, and 0–9) for the user (power-on) password or the administrator password. When you have set one or both of the passwords, record the passwords and keep them in a secure place.

If both a user and administrator password are set, you can type either password at the password prompt that appears as you start your computer. However, if you want to change the settings in the Configuration/Setup Utility program, you must type the administrator password to access the full configuration menus. If you type the user password, you can only view limited information in the Configuration/Setup Utility program.

Keep a record of your password in a secure place. If you forget the user or administrator password, you can regain access to the computer through one of the following methods:

- If you have forgotten the user password and an administrator password is set, type the administrator password at the power-on prompt. Start the Configuration/Setup Utility program and change the user password.

- Clear CMOS settings by changing the position of the CMOS recovery jumper (JBAT1). See "Erasing a lost or forgotten password (clearing CMOS)" on page 89 for instructions.

- Remove the battery and then install the battery. See "Replacing the battery" on page 90 for instructions.

Using the LSI Logic Configuration Utility program

LSI Logic Configuration is a built-in, menu-driven configuration utility program that you can use to:

- Perform a low-level format of a SCSI hard disk drive
- Set a SCSI device scan order
- Set a SCSI ID for a controller

Notes:

1. The integrated SCSI controller with RAID capabilities in your computer supports redundant array of independent disks (RAID). You can use the LSI Logic Configuration Utility program built into your computer to configure RAID level 1 for a single pair of attached devices.

2. If you install a different type of RAID adapter in your computer, use the configuration method supplied with the RAID adapter to view or change SCSI settings for attached devices.

The following sections provide the instructions needed to start the LSI Logic Configuration Utility program and to format a SCSI hard disk drive.

Starting the LSI Logic Configuration Utility program

Complete the following steps to start the LSI Logic Configuration Utility program:

1. Turn on the computer.

2. When the `<<< Press <CTRL><C> to start LSI Logic Configuration Utility >>>` prompt appears, press Ctrl+C. If an administrator password has been set, you are prompted to type the password to start the LSI Logic Configuration Utility program.

3. Use the arrow keys to select a controller (channel) from the list of adapters; then, press Enter.

4. Follow the instructions on the screen to change the settings of the selected items; then, press Enter. The **Device Properties** and **Mirroring Properties** choices produce additional screens of parameters to review or change.

Formatting a SCSI hard disk drive

Low-level formatting removes all data from the hard disk. If there is data you want to save, back up the hard disk before performing this procedure. Complete the following steps to format a drive.

Note: Before you format a SCSI hard disk, make sure that it is not part of a mirrored pair. From the list of adapters, select the controller (channel) for the drive to format. Select **Mirroring Properties** and make sure the mirroring value for the drive is set to **None**.

1. From the list of adapters, select the controller (channel) for the drive to format.

2. Select **Device Properties**.

3. Use the arrow keys (↑ or ↓) to highlight the drive to format.

4. Use the arrow keys (← or →) or the End key to scroll to the right.

5. Select the **Format**; then, press Enter to begin the low-level formatting operation.

Using ServeRAID Manager

You can use the ServeRAID Manager program, provided on the *IBM ServeRAID Support* CD, to:

- Configure a redundant array of independent disks (RAID)
- Restore a SCSI hard disk to factory-default settings, erasing all data
- View your RAID configuration and associated devices
- Monitor operation of your RAID controllers

The ServeRAID Manager program operates in two ways:

- Startable-CD mode

- As an installed software program

See the ServeRAID documentation on the *IBM ServeRAID Support* CD for additional information about RAID technology and instructions for using ServeRAID Manager. The *Installation Guide* for your computer also contains instructions for using ServeRAID Manager to configure your integrated SCSI controller with RAID capabilities.

Attention:

1. When setting up RAID mirroring, you must set the hard disk drive containing the operating system as the primary drive. Failure to do so will erase the operating system and applications that came pre-installed on your computer.
2. Installing an optional RAID adapter in your computer will require that you reload the operating system and applications.

Notes:

1. The integrated SCSI controller with RAID capabilities in your computer supports only RAID level 1.
2. If you install a different type of RAID adapter in your computer, use the configuration method supplied with the RAID adapter to view or change SCSI settings for attached devices.

Before you install your operating system, you must configure the controller that is attached to the hard disk drives. You must use the configuration program on the *IBM ServeRAID Support* CD to configure the integrated SCSI controller with RAID capabilities or to configure an optional IBM ServeRAID controller.

Notes:

1. You cannot use the *ServerGuide™ Setup and Installation* CD to configure the optional controllers.
2. To update the firmware and BIOS for an optional ServeRAID controller, you must use the *IBM ServeRAID Support* CD that comes with the ServeRAID option.

Configuring the 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 1000-Mbps 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 of the network (10BASE-T, 100BASE-TX, or 1000BASE-T) and automatically operates at that rate, in full-duplex or half-duplex mode, as appropriate. The Ethernet controller supports optional modes, such as teaming, priority packets, load balancing, fault tolerance, and virtual LANs, which provide better performance, security, and throughput. These modes apply to the integrated Ethernet controller and to controllers on supported Ethernet adapters.

You do not need to set any jumpers or configure the controller. However, you must install a device driver to enable the operating system to address the controller. The device drivers are available on the *Device Drivers and IBM Enhanced Diagnostics* CD. For the latest device drivers and information about configuring your Ethernet controller, go to the IBM Support Web site at http://www.ibm.com/pc/support.

Chapter 4. Installing options

This chapter provides instructions for installing or replacing options in your computer. For a list of supported options for your computer, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and navigate to the list of options for your computer.

Installation guidelines

Before you begin installing options in your computer, read the following information:

- Review the safety information beginning on page vii, "Installation guidelines", and "Handling static-sensitive devices" on page 28. These guidelines will help you work safely with your computer and options.
- Make sure that you have an adequate number of properly grounded electrical outlets for your computer, monitor, and other devices that you will connect to the computer.
- Back up all important data before you make changes to disk drives.
- Have a small flat-blade screwdriver available.
- When you need to access the inside of the computer to install options, you might find it easier to lay the computer on its side. Before laying the computer on its side, rotate the two front stabilizing feet a quarter turn inward toward the computer, so that they do not break. Before returning the computer to an upright position, rotate the front stabilizing feet a quarter turn outward from the computer. See "Moving the stabilizing feet" on page 30 for more information.
- The blue color on components and labels identifies touch points where you can grip a component, move a latch, and so on.
- For a list of supported options for your computer, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and navigate to the list of options for your computer.

System reliability considerations

To help ensure proper system cooling and system reliability, make sure that:

- Each of the drive bays has a drive or a filler panel and electromagnetic compatibility (EMC) shield installed.
- 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 (over 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.
- Do not remove the air baffle when the computer is operational. Operating the computer without the air baffle might cause the microprocessor to overheat.
- Microprocessor socket 2 always contains either a microprocessor baffle or a microprocessor and heatsink.

Handling static-sensitive devices

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

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

- Limit your movement. Movement can cause static electricity to build up around you.
- 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 your computer cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.
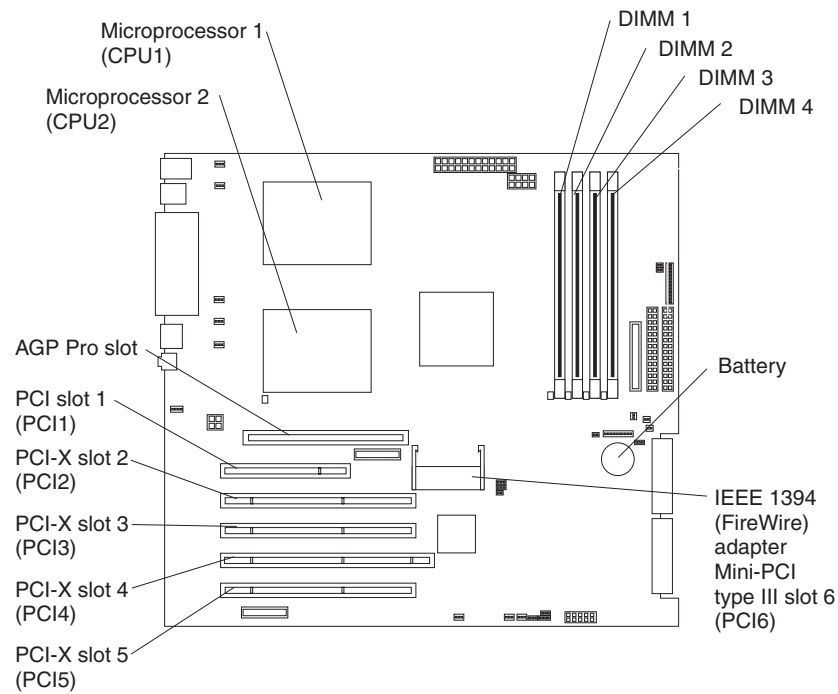
Major components of the computer

The following illustration shows the major components in the computer.
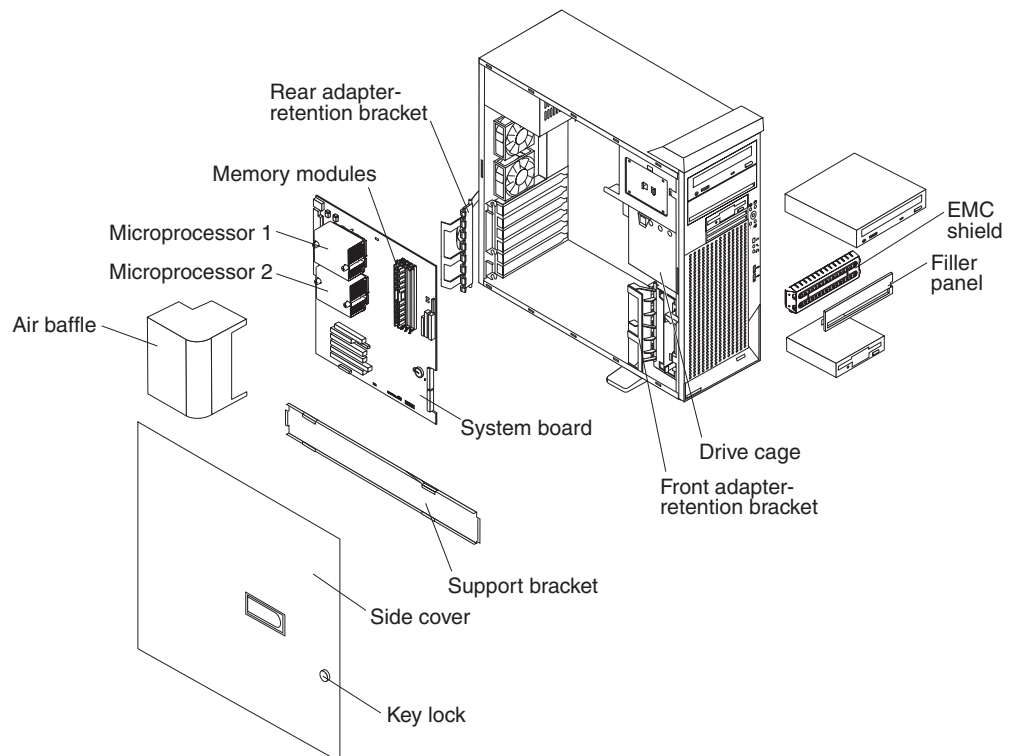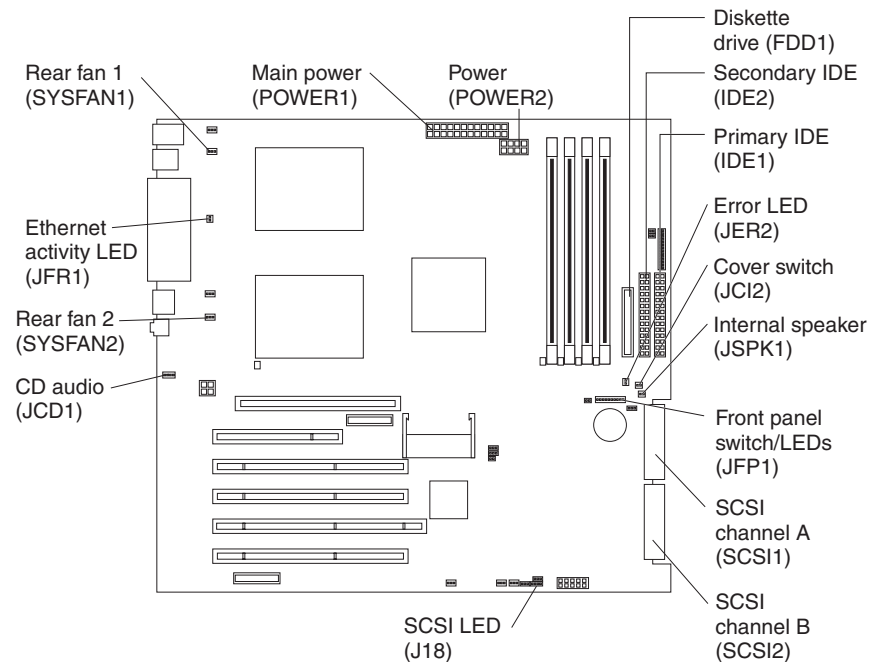
System-board option connectors

The following illustration shows the system-board connectors for user-installable options.
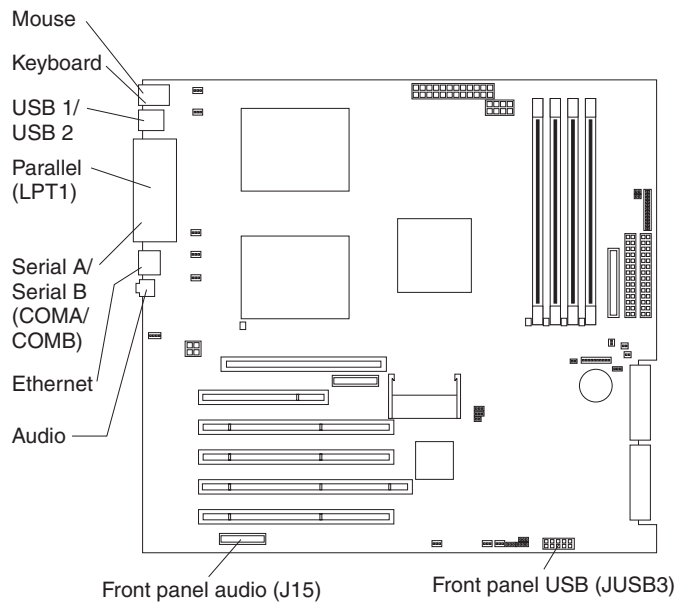
Microprocessor 1 (CPU1)
Microprocessor 2 (CPU2)
AGP Pro slot
PCI slot 1 (PCI1)
PCI-X slot 2 (PCI2)
PCI-X slot 3 (PCI3)
PCI-X slot 4 (PCI4)
PCI-X slot 5 (PCI5)
DIMM 1
DIMM 2
DIMM 3
DIMM 4
Battery
IEEE 1394 (FireWire) adapter Mini-PCI type III slot 6 (PCI6)

System-board internal connectors

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

Rear fan 1 (SYSFAN1)
Main power (POWER1)
Power (POWER2)
Ethernet activity LED (JFR1)
Rear fan 2 (SYSFAN2)
CD audio (JCD1)
SCSI LED (J18)
Diskette drive (FDD1)
Secondary IDE (IDE2)
Primary IDE (IDE1)
Error LED (JER2)
Cover switch (JCI2)
Internal speaker (JSPK1)
Front panel switch/LEDs (JFP1)
SCSI channel A (SCSI1)
SCSI channel B (SCSI2)

System-board external connectors

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

Mouse

Keyboard

USB 1/
USB 2

Parallel
(LPT1)

Serial A/
Serial B
(COMA/
COMB)

Ethernet

Audio

Front panel audio (J15)   Front panel USB (JUSB3)

Installing options

This section provides instructions for installing hardware options in your computer.

Moving the stabilizing feet

The two front feet on the bottom of the computer rotate 90 degrees to provide additional stability.

When installing options in the computer, you might find it easier to lay the computer on its side. If you do so, rotate the feet in towards the computer, so they do not break off due to the weight of the computer.
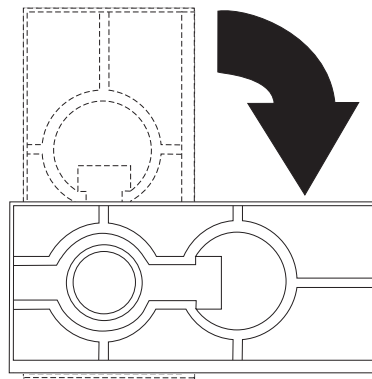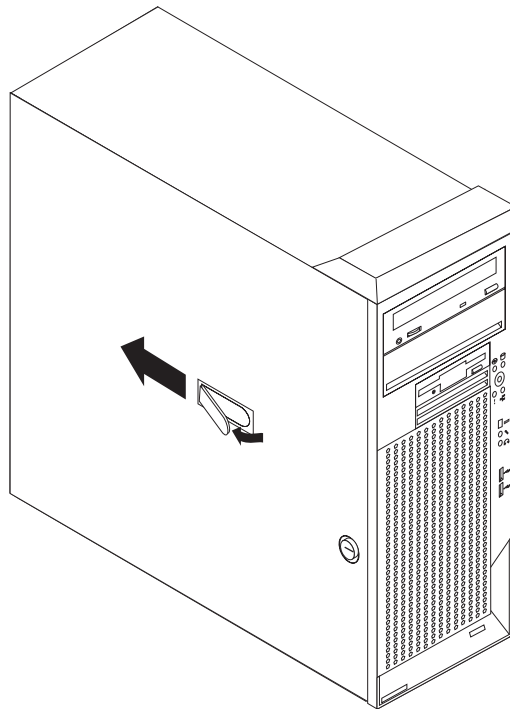
Removing the side cover

To remove the side cover, you might find it easier to lay the computer on its side. If you do, move the stabilizing feet so that they do not break (see "Moving the stabilizing feet" on page 30).

Complete the following steps to remove the side cover of the computer:

1. Review the safety information beginning on page vii.
2. Turn off the computer and all attached devices (see "Turning off the computer" on page 20).
3. Disconnect all power cords; then disconnect all external cables.
4. Unlock the side cover; then, pull the cover release latch away from the computer, and push the cover toward the rear of the computer. Lift the side cover off the computer and set it aside.

For instructions for replacing the side cover, see "Replacing the side cover" on page 53.

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

Removing the bezel

When working with some devices, such as the diskette drive, you must first remove the bezel to access the device.

Complete the following steps to remove the bezel:

1. Remove the side cover ("Removing the side cover" on page 31).
2. Locate the bezel-release lever; then, press the bezel-release lever toward the front of the computer.
3. Pull the top of the bezel away from the chassis; then, push the bezel down to disengage the bottom tabs.
4. Remove the bezel from the computer and store the bezel in a safe place.
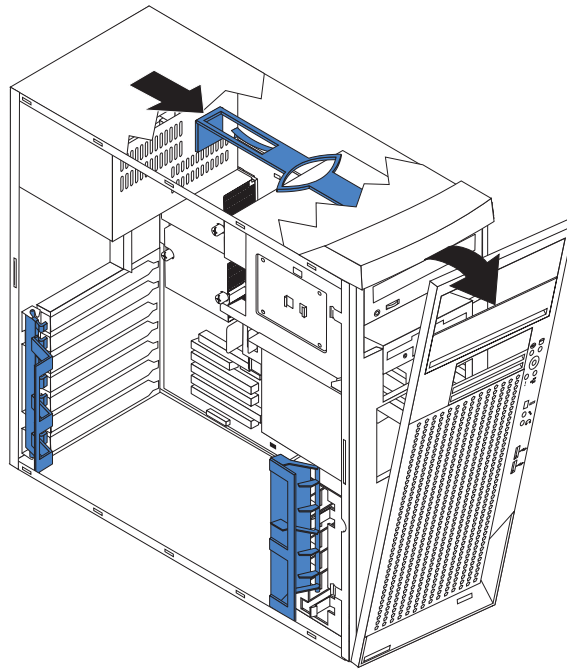
For instructions for replacing the bezel, see "Replacing the bezel" on page 52.

Removing and installing the support bracket

When working with some devices, such as hard disk drives, adapters, and memory modules, you must first remove the support bracket to access the device.

Complete the following steps to remove the support bracket:

1. Remove the side cover ("Removing the side cover" on page 31).
2. Pull out on the rear end of the support bracket approximately 150 mm (6 in.).
3. Disengage the front end of the support bracket from the computer and set the bracket aside.
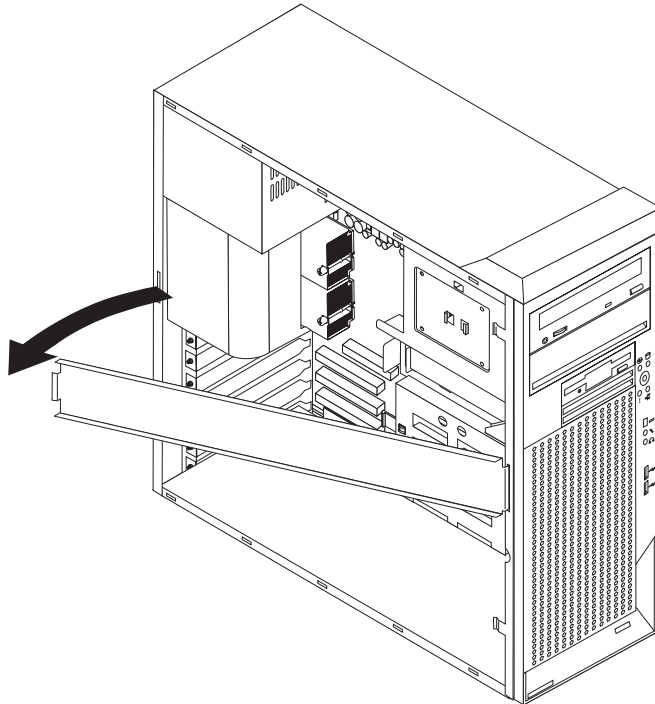
To reinstall the support bracket, reverse the previous steps.

Working with adapters

Your computer comes with adapter connectors or *slots.* The AGP video adapter is installed in the AGP Pro slot, and some models have an IEEE 1394 (FireWire) adapter installed in mini-PCI slot 6 (PCI6). You can install up to five additional optional adapters in your computer in PCI slot 1 (PCI1) and PCI-X slots 2 through 5 (PCI2 through PCI5).

See "System-board option connectors" on page 29 for the locations of expansion slots on the system board.

Adapter considerations

Before you install an adapter, review the following information:

- Read the documentation that comes with your operating system.
- Locate the documentation that comes with the adapter and follow those instructions in addition to the instructions in this chapter. If you need to change the switch or jumper settings on your adapter, follow the instructions that come with the adapter.
- You can install only a 32-bit adapter in the 32-bit PCI slot 1; 64-bit adapters can be installed only in the 64-bit PCI-X slots 2 through 5.

- You can install full-length adapters in all five expansion slots; however, full-length, double-width adapters will not fit in slot 5 and are not supported. None of the expansion slots are hot-plug.
- The 32-bit PCI slot 1 supports 5.0 V signaling PCI adapters; it does not support 3.3 V signaling adapters or 64-bit adapters.
- The 64-bit PCI-X slots 2 through 5 support 3.3 V signaling PCI or PCI-X adapters; they do not support 5.0 V signaling adapters.
- The PCI bus configuration is as follows:
  - The 32-bit PCI slot 1 and mini-PCI slot 6 (for the IEEE 1394 controller) are on the 33 MHz PCI bus.

    Note: If your computer did not come with a IEEE 1394 (FireWire) adapter installed in mini-PCI slot 6, do not install an adapter in this slot. It is not supported.
  - The 64-bit PCI-X slots 2 and 3 and the integrated Ethernet controller are on the 100 MHz PCI-X bus, channel A.
  - The 64-bit PCI-X slots 4 and 5 and the integrated SCSI controller with RAID capabilities are on the 100 MHz PCI bus, channel B.
- To provide failover protection, an optional Ethernet adapter can be installed only in PCI-X slots 2 through 5.
- Installing an optional RAID adapter in your computer will require that you reload the operating system and applications that came pre-installed on your computer.
- The system scans the AGP slot, mini-PCI slot 6, PCI expansion slot 1, and PCI-X expansion slots 2 through 5 to assign system resources. Then, the system starts the PCI devices in the following order, if you have not changed the default startup sequence: AGP slot, mini-PCI slot 6, PCI expansion slot 1, system-board integrated drive electronics (IDE) or SCSI devices, and then PCI-X expansion slots 2 through 5.
- For a list of supported options for your computer, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and navigate to the list of options for your computer.

Installing an adapter

Note: The AGP Pro slot and PCI slot 1 must be empty for you to access the IEEE 1394 (FireWire) adapter in mini-PCI slot 6. If you are replacing the IEEE 1394 adapter, the optional PCI adapter and the AGP video adapter will need to be temporarily removed.

Complete the following steps to install an adapter in your computer:
1. Review the safety information beginning on page vii, "Installation guidelines" on page 27, and "Handling static-sensitive devices" on page 28.
2. Turn off the computer and all attached devices.
3. Disconnect all power cords; then disconnect all external cables.
4. Remove the side cover (see "Removing the side cover" on page 31).
5. Determine which slot you will use for the adapter. 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.
6. Rotate the rear adapter-retention bracket to the open (unlocked) position and remove it from the computer. Rotate the front adapter-retention bracket to the open position. If you are installing a smaller adapter, remove only the rear adapter-retention bracket.

7. If there is an adapter already installed in the slot, remove it and place it on a static-protective surface.

   If the slot is empty, remove the expansion-slot cover. From the rear of the computer, press on the slot cover. Grasp it and pull it out of the expansion slot. Store it in a safe place for future use.

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

8. Set any jumpers or switches on the adapter or system board according to the documentation that comes with the adapter.

   Attention: Be certain 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.

9. Remove the adapter from the static-protective package, carefully grasp the adapter by the top edge or upper corners, and align it with the expansion slot guides; then, press the adapter *firmly* into the expansion slot. Move the adapter directly from the static-protective package to the adapter slot. Avoid touching the components and gold-edge connectors on the adapter.

Expansion slot cover

Rear adapter-retention bracket

Adapter

Front adapter-retention bracket
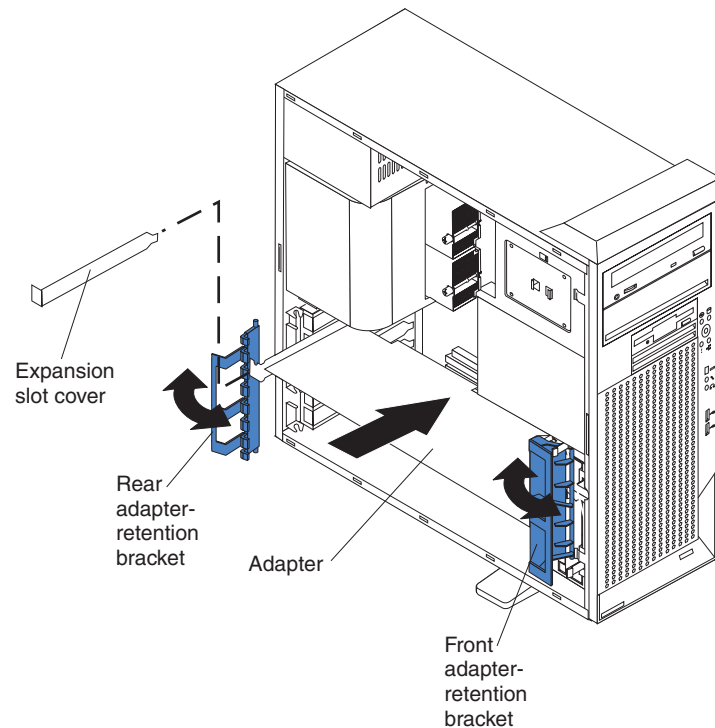
10. Connect required cables to the adapter. Route cables so that they do not block the flow of air from the fans. If you are installing an optional SCSI adapter, see "Cabling an optional SCSI adapter" on page 36 for additional information.

11. If you have another adapter to install, repeat steps 5 through 10.

12. If you have installed a full-length adapter, rotate the front adapter-support bracket to the closed (locked) position.

13. Reinstall the rear adapter-retention bracket; then, rotate the bracket to the closed (locked) position.

    Note: If any adapters in your computer are large or have heavy cables attached to them, you can remove the rear adapter-retention bracket

and secure all of the adapters with expansion-slot screws. The expansion-slot screws are stored on the back of the computer next to slot 1.

14. If you have other options to install, do so now; otherwise, continue with step 15.

15. Replace the support bracket (see "Removing and installing the support bracket" on page 33).

16. Replace the side cover (see "Replacing the side cover" on page 53).

17. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.
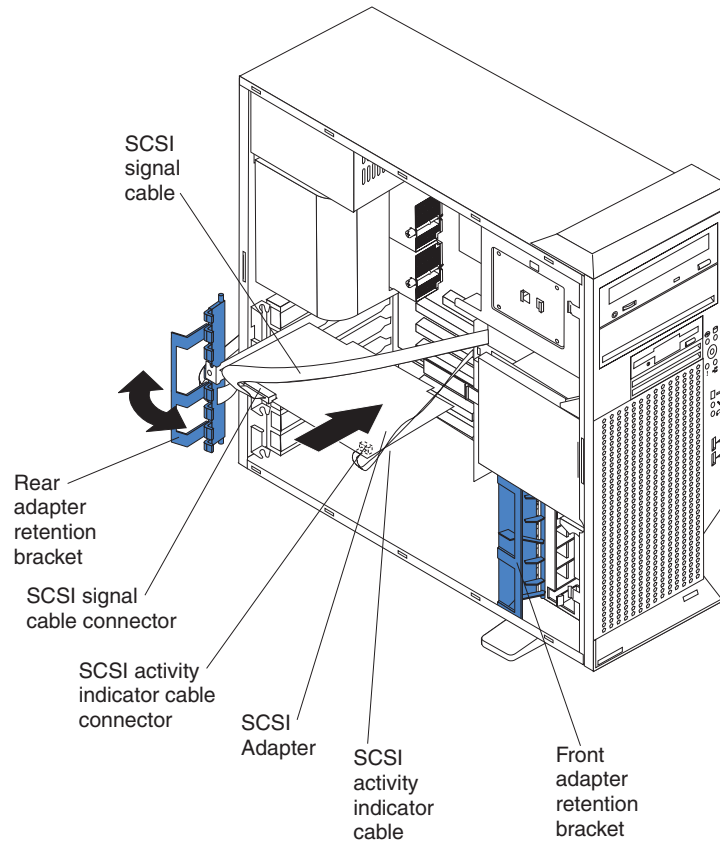
Cabling an optional SCSI adapter

You can install an optional SCSI adapter in your computer to control the internal hard disk drives. With a SCSI adapter installed you can configure the internal hard disk drives into disk arrays. You can also cable a SCSI adapter to external hard disk drives. See your SCSI adapter option documentation for complete instructions for installing a SCSI adapter in your computer and for additional information about SCSI adapters.

Note: An optional SCSI adapter or cable option is required to connect external SCSI devices.

Complete the following steps to cable an optional SCSI adapter:

1. Install the SCSI adapter (see "Installing an adapter" on page 34).

2. Connect the SCSI-signal cable to the adapter and to one or more of the signal-cable connectors to the rear of the SCSI devices.

3. Connect the SCSI-activity-indicator cable to the adapter and to the SCSI-LED connector (J18) on the system board. See "System-board internal connectors" on page 29 for the location of the SCSI-LED connector.

SCSI
signal
cable

Rear
adapter
retention
bracket

SCSI signal
cable connector

SCSI activity
indicator cable
connector

SCSI
Adapter

SCSI
activity
indicator
cable

Front
adapter
retention
bracket

4. Complete the installation of the optional SCSI adapter.
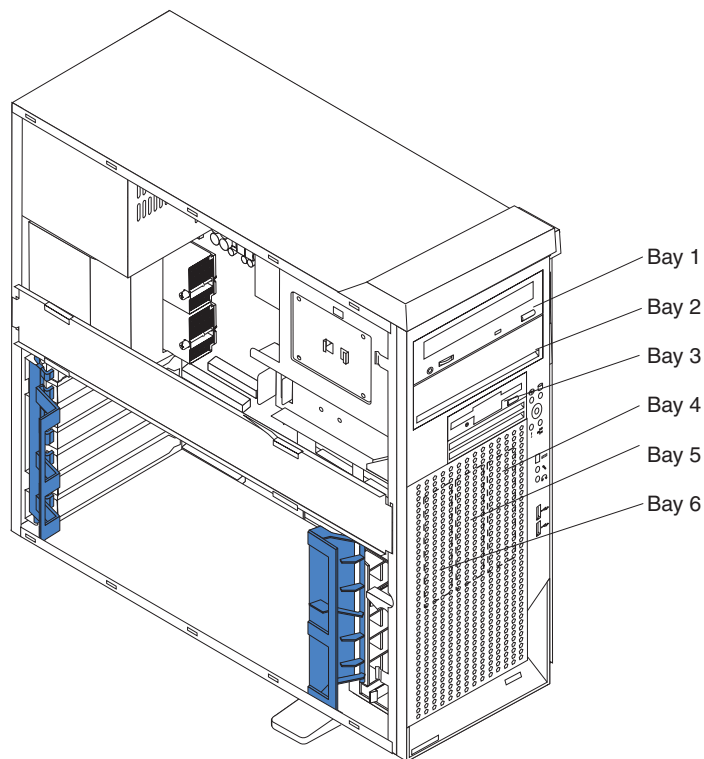
Installing internal drives

Depending on your computer model, you might have one or more of the following drives installed:

- Diskette
- Hard disk
- CD-ROM, CD-RW, or DVD/CD-RW combo

Internal drive bays

Your IntelliStation Z Pro computer comes with an IDE CD-ROM, CD-RW, or DVD/CD-RW combo drive in bay 1, a 3.5-in., 1.44 MB diskette drive in bay 3, and a hard disk drive installed in bay 4.

Notes:

1. Diskette drives, tape drives, CD-ROM, DVD/CD-RW, and DVD-ROM drives are examples of removable-media drives. You can install removable-media drives in bays 1, 2, and 3 only.

2. The integrated IDE controller in your computer supports the connection of up to four IDE devices.

3. You can install a 3.5-in. slim-high or 5.25-in. half-high removable-media drive, such as a tape backup, CD-RW, or DVD drive, in bay 2.

4. The IntelliStation Z Pro computer supports only one diskette drive.

5. To install a 3.5-in. drive in a 5.25-in. bay, you must use the 5.25-in. conversion kit, supplied with the option.

6. The electromagnetic interference (EMI) integrity and cooling of the computer are protected by having all bays and PCI slots covered or occupied. When you install a drive or PCI adapter, save the EMC shield and filler panel from the bay or the PCI adapter slot cover in the event you later remove the option.

7. For a complete list of supported options for your computer, go to
   http://www.ibm.com/pc/ on the World Wide Web; then, select your country and
   navigate to the list of options for your computer.

Preinstallation steps

Some of these steps are required only during the initial installation of an internal
drive.

1. Review the safety information beginning on page vii, "Installation guidelines" on
   page 27, and the documentation that comes with your drive.

2. Verify that you have all the cables and other equipment specified in the
   documentation that comes with the drive.

3. Choose the bay in which you want to install the drive.

4. Check the instructions that come with the drive to see if you need to set any
   switches or jumpers on the drive. If you are installing a SCSI device, be sure to
   set the SCSI ID for that device.

Installing a drive in bay 2

Complete the following steps to install a drive in bay 2:

1. Follow the instructions in "Preinstallation steps" on page 39.

2. Turn off the computer and all attached devices.

3. Disconnect all power cords; then disconnect all external cables.

4. Remove the side cover (see "Removing the side cover" on page 31).

5. Remove the support bracket (see "Removing and installing the support
   bracket" on page 33).

6. Use a screwdriver to pry the filler panel and EMC shield away from the
   computer.

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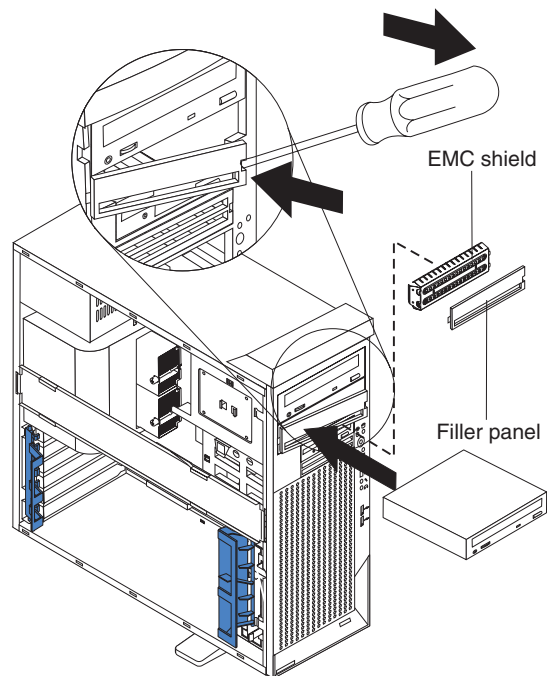   safety precaution.

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.

EMC shield

Filler panel

7. Touch the static-protective package containing the drive to any unpainted metal surface on the computer; then, remove the drive from the package and place it on a static-protective surface.

8. Set any jumpers or switches on the drive according to the documentation that comes with the drive.

   Note: You might find it easier to install the new drive into the appropriate opening on the front, and then attach the cables.

9. If you are installing a 5.25-in. drive in bay 2, push the drive into the bay; then, use the two screws to attach the drive to the drive cage. If you are installing a 3.5-in. drive in bay 2, you must attach the 5.25-in. conversion kit, supplied with your option, to the 3.5-in. drive.

10. Determine whether the drive is an IDE or SCSI device; then, connect one end of the appropriate signal cable into the back of the drive and make sure that the other end of this cable is connected into the appropriate IDE or SCSI connector on the system board. See "Power and signal cables for internal drives" on page 43 for additional information about cabling drives and "System-board internal connectors" on page 29 for the location of IDE and SCSI connectors on the system board. If there are open connectors on the cables connecting an existing IDE drive, this cable can be used to connect the new drive. The 3-connector SCSI cable that comes with your computer cannot be used to connect a SCSI drive in bay 2.

11. Route the signal cable so that it does not block the air flow to the rear of the drives or over the microprocessor and memory.

12. Connect the power cable to the back of the drive. The connectors are keyed and can be inserted only one way.

13. If you have other options to install or remove, do so now.

14. Replace the support bracket (see "Removing and installing the support bracket" on page 33).

15. Replace the side cover (see "Replacing the side cover" on page 53).

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

Replacing a diskette drive in bay 3

Complete the following steps to replace a diskette drive in bay 3:

1. Follow the instructions in "Preinstallation steps" on page 39.
2. Turn off the computer and all attached devices.
3. Disconnect all power cords; then disconnect all external cables.
4. Remove the side cover (see "Removing the side cover" on page 31).
5. Remove the bezel (see "Removing the bezel" on page 32).
6. Remove the support bracket (see "Removing and installing the support bracket" on page 33).
7. Remove the existing drive by disconnecting the cables in the rear of the diskette drive; then, press on the oval cutout to release the drive and gently pull it out the front.
8. Remove the retainer from the left side of the diskette drive and place it on the new diskette drive.
9. Install the diskette drive by sliding the drive into the bay so that the metal tab of the drive aligns with the oval cutout and the drive locks into place; then, connect the cables at the rear of the drive.
10. If you have other options to install or remove, do so now.
11. Replace the support bracket (see "Removing and installing the support bracket" on page 33).
12. Replace the bezel (see "Replacing the bezel" on page 52).
13. Replace the side cover (see "Replacing the side cover" on page 53).
14. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

## Installing a hard disk drive in bay 4, 5, or 6

Bays 4, 5, and 6 are in the drive cage. The drive cage is behind the front of the adapter-support bracket.

Note: You might find it useful to work with the computer laying on its side.

Complete the following steps to install a drive in bay 4, 5, or 6:

1. Follow the instructions in "Preinstallation steps" on page 39.
2. Turn off the computer and all attached devices.
3. Disconnect all power cords; then disconnect all external cables.
4. Remove the side cover (see "Removing the side cover" on page 31).
5. Remove the support bracket (see "Removing and installing the support bracket" on page 33).

6. Grasp the drive cage and rotate the cage out of the computer until it locks into place with the drive-cage retention tab and the open ends of the drive slots and installed drives are facing you. Ensure that the drive cage locks into place over the drive-cage retention tab by rotating the drive cage all the way out of the computer.
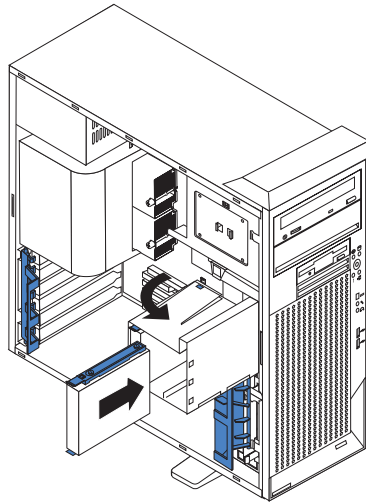
7. Attach the blue guide rails to the side of the drive using the screws that are provided.

8. Slide the drive into the drive cage until the plastic tabs on the drive guide rails lock into place in the drive cage. Clear any cables that might impede the replacement of the drive cage.

9. Determine whether the drive is an IDE or SCSI device; then, connect one end of the appropriate signal cable into the back of the drive and make sure that the other end of this cable is connected into the appropriate IDE or SCSI connector on the system board. See "Power and signal cables for internal drives" on page 43 for additional information about cabling drives and "System-board internal connectors" on page 29 for the location of IDE and SCSI connectors on the system board. If there are open connectors on the cables connecting existing IDE or SCSI drives, these cables can be used to connect the new drive.

10. Route the signal cable so that it does not block the air flow to the rear of the drives or over the microprocessor and memory.

11. Connect the power cable to the back of the drive. The connectors are keyed and can be inserted only one way.

12. Push the drive cage outward, and press in on the drive-cage release tab; then, rotate the cage back into the computer.
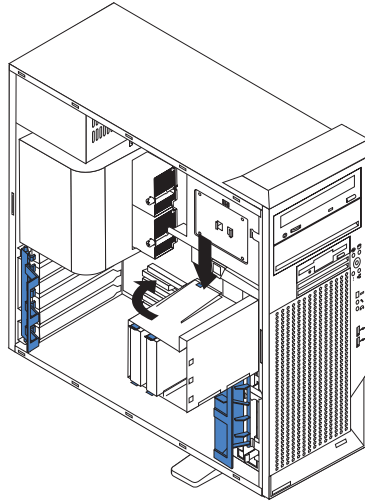
13. If you have other options to install or remove, do so now.
14. Replace the support bracket (see "Removing and installing the support bracket" on page 33).
15. Replace the side cover (see "Replacing the side cover" on page 53).
16. Reconnect the external cables and power cords; then, turn on the attached devices and the computer.

Power and signal cables for internal drives

Your computer uses cables to connect IDE and SCSI devices to the power supply and to the system board. (See "System-board internal connectors" on page 29 for the location of system-board connectors.) Review the following information before connecting power and signal cables to internal drives:

- The drives that are preinstalled in your computer come with power and signal cables attached. If you replace any drives, remember which cable is attached to which drive.
- When you install a drive, ensure that one of the drive connectors of the signal cable is connected to the drive and that the connector at the other end of the signal cable is connected to the system board.
- The computer has two IDE buses, primary and secondary. Each of these buses supports up to two IDE devices. The primary IDE bus uses connector IDE1 on the system board and the secondary IDE bus uses connector IDE2.
- If you have only one IDE device on a cable, it must be set as a master device.
- If two IDE devices are used on a single cable, one must be designated as the master device and the other as the subordinate device; otherwise, the computer might not recognize some of the IDE devices. The master and subordinate designation is determined by switch or jumper settings on each IDE device.
- If two IDE devices are on a single cable and only one is a hard disk drive, the hard disk drive must be set as a master device.

The following cables are provided:

- **Power cables:** Four-wire power cables connect the drives to the power supply. At the end of these cables are plastic connectors that can be attached to different drives; these connectors vary in size.

- **Signal cables:** Signal cables are typically flat cables, also called ribbon cables, that connect IDE, SCSI, and diskette drives to the system board. Two or three types of signal cable come with your computer.
  - **IDE:** The wider IDE signal cable has three connectors. One of these connectors is attached to the drive, one is a spare, and the third is attached to the primary or secondary IDE connector on the system board. The spare connector can be used to connect additional IDE drives to your computer.

    The CD-ROM drive is attached to an ATA 100 signal cable. ATA 100 signal cables are color-coded. The blue connector is attached to the system board. The black connector is attached to the master IDE device. The gray middle connector is attached to the subordinate IDE device. If you are installing an additional hard disk drive, you must change the switch or jumper setting on the CD-ROM drive to make the drive a subordinate device, set the switch or jumper setting on the new drive to master, and change the connector used for the CD-ROM drive to the gray middle connector. The new drive will be connected to the black master IDE device connector.
  - **Diskette drive:** The narrower signal cable has two connectors. One is attached to the diskette drive, and the other is attached to the connector (FDD1) on the system board.
  - **SCSI:** A round SCSI cable connects SCSI devices to the integrated SCSI controller with RAID capabilities on the system board. For more information about connecting SCSI devices, see the SCSI documentation.

Installing memory modules

Adding memory to your computer is an easy way to make programs run faster. You can increase the amount of memory in your computer by installing memory modules. Your IntelliStation Z Pro computer uses industry-standard PC2100 double-data-rate (DDR) dual inline memory modules (DIMMs).

Notes:

1. The system board contains four DIMM connectors and supports two-way memory interleaving.
2. The DIMM options available for your computer are 128 MB, 256 MB, 512 MB, 1 GB, and 2 GB. Your computer supports a minimum of 256 MB and a maximum of 8 GB of system memory.
3. 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 BIOS will display the total amount of installed memory and the amount of configured memory.
4. Your computer comes with two 256 MB or 512 MB DIMMs (for a total of 512 MB or 1024 MB) installed in the DIMM 3 and DIMM 4 memory connectors. When you install additional DIMMs, be sure to install them as a pair in DIMM connectors 1 and 2.
5. DIMMs must be installed in matched pairs. The first pair of DIMMs you install in DIMM 3 and DIMM 4 memory connectors must be the same size, speed, type, and technology. You can mix compatible DIMMs from various manufacturers. If you install a second pair of DIMMs in DIMM 1 and DIMM 2 memory connectors, they do not have to be the same size, speed, type, and technology as the DIMMs you installed in DIMM 3 and DIMM 4 memory connectors. However, the size, speed, type, and technology of the DIMMs you install in DIMM 1 and DIMM 2 memory connectors must match each other.
6. Install only 133 MHz (memory bus), 2.5 V, 184-pin, double-data-rate (DDR), PC2100, registered synchronous dynamic random-access memory (SDRAM)

with error correcting code (ECC) DIMMs. These DIMMs must be compatible with the latest PC2100 SDRAM Registered DIMM specification. For a list of supported options for your computer, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and navigate to the list of options for your computer.

7. Your computer supports Chipkill memory if the DIMMs are all type x4 and are 256 MB or larger. Using any 128 MB DIMMs or DIMMs that are not type x4 on your computer disables Chipkill memory.

Complete the following steps to install a DIMM:

1. Review the safety information beginning on page vii, "Installation guidelines" on page 27, and "Handling static-sensitive devices" on page 28.
2. Turn off the computer and all attached devices.
3. Disconnect all power cords; then disconnect all external cables.
4. Remove the side cover (see "Removing the side cover" on page 31).
5. Remove the support bracket (see "Removing and installing the support bracket" on page 33).
6. You might find it easier to install memory modules if you rotate the drive cage out of the computer. Grasp the drive cage and rotate until it locks into place. See the illustration on page 42 for additional information.
7. Locate the DIMM connectors on the system board. Determine the connectors into which you will install the DIMMs. Install the DIMMs in the order shown in the following table.

Table 2. DIMM installation sequence

Installation order	DIMM connectors	Diagnostic reference
First	DIMM 3 and DIMM 4	Bank 2
Second	DIMM 1 and DIMM 2	Bank 1

8. Open the retaining clips and, if necessary, remove any existing DIMM.
9. Touch the static-protective package containing the DIMM to any unpainted metal surface on the computer. Then remove the new DIMM from the package.
10. Gently open the retaining clip on each end of the DIMM slot. Turn the DIMM so that the pins align correctly with the connector.

11. Insert the DIMM into the connector. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector. 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, then reinsert it.
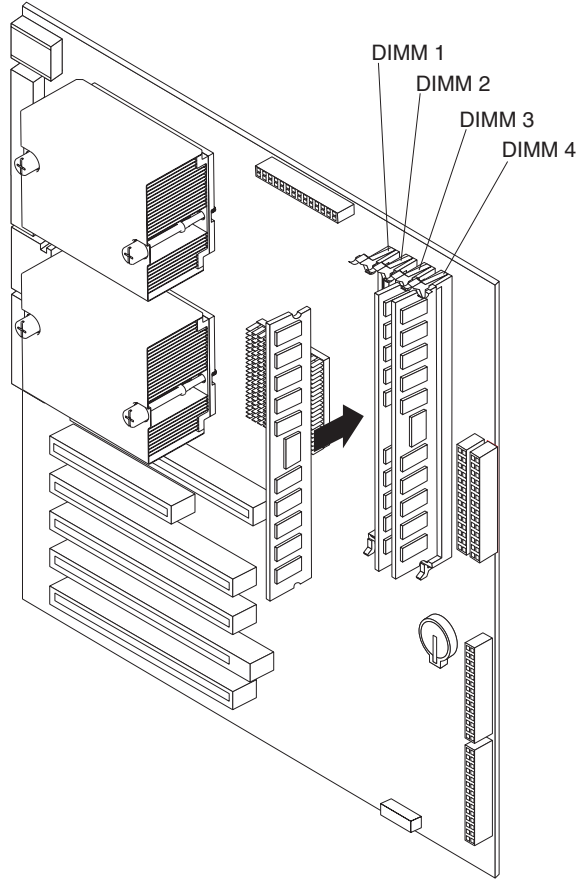
12. If you have other options to install or remove, do so now.
13. Push the drive cage outward, and press in on the drive-cage release tab; then, rotate the cage back into the computer.
14. Replace the support bracket (see "Removing and installing the support bracket" on page 33).
15. Replace the side cover (see "Replacing the side cover" on page 53).
16. Reconnect the external cables and power cords. Turn on the attached devices, and turn on the computer.

Installing an additional microprocessor

Your computer comes with one microprocessor installed on the system board. Your computer supports up to two microprocessors. With two microprocessors, your computer can operate as a symmetric multiprocessing (SMP) computer. With SMP, certain operating systems and application programs can distribute the processing load among the microprocessors.

Before you begin:

- Thoroughly review the documentation that comes with the microprocessor to determine the required BIOS update. The latest level of BIOS code for your computer is available through the World Wide Web. See "Getting help and information from the World Wide Web" on page 93 for the World Wide Web addresses.
- (Optional) Obtain an SMP-capable operating system. For a list of supported supported operating systems and other options for your computer, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and navigate to the list of options for your computer.

Attention: To ensure proper computer operation when you install an additional microprocessor, 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 in your computer to determine the specific type of microprocessor on your system board.

Important: A microprocessor must always be installed in socket CPU1 of the system board.

Notes:

1. To order additional microprocessor options, contact your IBM marketing representative or authorized reseller.
2. Terminator cards are not required for empty microprocessor sockets. However, for airflow, an empty microprocessor socket must contain a microprocessor baffle.
3. The microprocessor speeds are automatically set for this computer; therefore, you do not need to set any microprocessor frequency-selection jumpers or switches.
4. If you need to replace a microprocessor, call for service.
5. For additional illustrations of the system-board components, see "System-board option connectors" on page 29.

Configuring the operating system

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

Installing an additional microprocessor on Windows NT:

If Windows NT is preinstalled on the computer, follow these steps:

1. Backup the hard disk.
2. Run the Multiprocessor Upgrade Option program, *addcpu.exe* before you install the second microprocessor. The Multiprocessor Upgrade Option program is at http://www.ibm.com/pc/support on the World Wide Web. From the IBM support

page, type **addcpu** in the Search field and press Enter. In addition, download and read the addcpu.pdf file for instructions about adding a second microprocessor.

3. Continue with step 1 of "Installing the additional microprocessor" on page 49.

***Installing a additional microprocessor on Windows 2000:***

If Windows 2000 is preinstalled on the computer, follow these steps:

Note: Be sure to check the Microsoft web page at http://www.microsoft.com for updates to these instructions. From the Microsoft web page, type **multiprocessor support** in the Search field and press Enter.

1. Backup the hard disk.
2. Do the following:
   a. From the desktop, click **Start → Settings → Control Panel**.
   b. On the Control Panel window, double-click the **System** icon.
   c. On the System Properties window, select the **Hardware** tab; then, click the **Device Manager** button.
   d. On the Device Manager window, click on the plus sign (**+**) next to the Computer node to expand the list; then, double-click on **ACPI Uniprocessor PC**.
   e. On the Advanced Configuration and Power Interface (ACPI) PC Properties window, select the **Driver** tab; then, click the **Update Driver** button.
   f. On the Update Device Driver Wizard window, click **Next**.
   g. On the next window, click the **Display a known list of drivers for this device so that I can choose a specific driver** radio button; then, click **Next**.
   h. On the next window, click the **Show all hardware of this device class** radio button. Under the Models field, select **ACPI Multiprocessor PC**; then, click **Next**.
   i. If the configuration shown in the wizard is satisfactory, click **Next** to save the configuration.
   j. Click **Finish** to complete the process.
   k. When prompted as to whether you want to restart your computer, select **Yes**.
3. Continue with step 1 of "Installing the additional microprocessor" on page 49.

Installing the additional microprocessor

Complete the following steps to install an additional microprocessor.
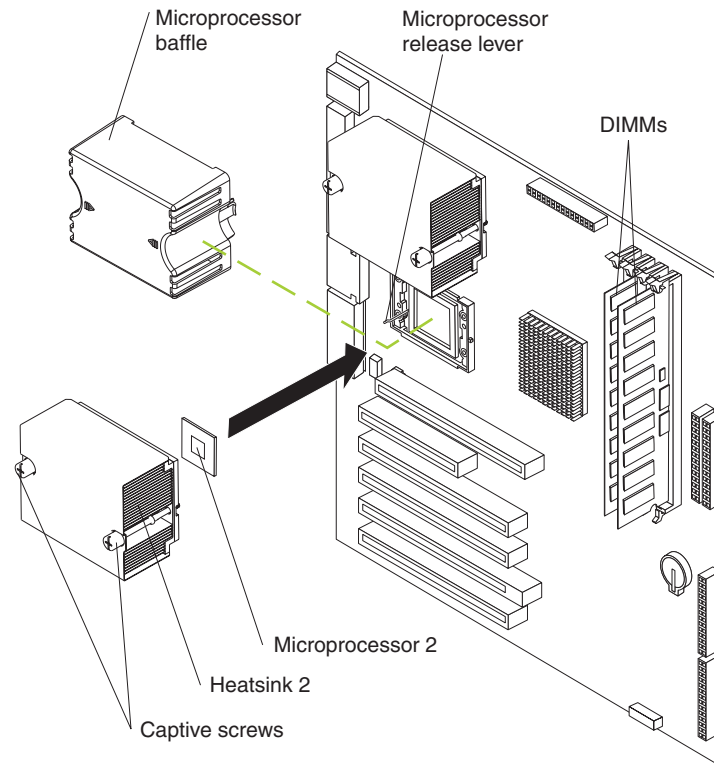
Microprocessor baffle

Microprocessor release lever

DIMMs

Microprocessor 2

Heatsink 2

Captive screws

1. Review the safety information beginning on page vii, "Installation guidelines" on page 27, and "Handling static-sensitive devices" on page 28.
2. Turn off the computer and all attached devices.
3. Disconnect all power cords; then disconnect all external cables.
4. Remove the side cover (see "Removing the side cover" on page 31).
5. Remove the support bracket ("Removing and installing the support bracket" on page 33).
6. Remove the air baffle by unhooking it from its retaining tabs and lifting it off the chassis.
7. Locate the second microprocessor socket (connector CPU2) on the system board.
8. Remove the microprocessor baffle from the second microprocessor socket.
9. If the second microprocessor socket is covered with protective film, peel and remove the film.
10. Install the microprocessor:
    a. Touch the static-protective package containing the new microprocessor to any *unpainted* metal surface on the computer; then, remove the microprocessor from the package.
    b. Pull out and lift up on the microprocessor-release lever to unlock the microprocessor socket.
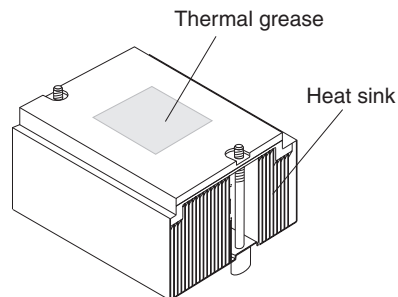
Attention:

1) Do not use excessive force when pressing the microprocessor into the socket.

2) Make sure that the microprocessor is oriented and aligned correctly with pin number 1 in the socket before you try to close the microprocessor-release lever. The following illustration shows the alignment marks for both microprocessors and sockets.
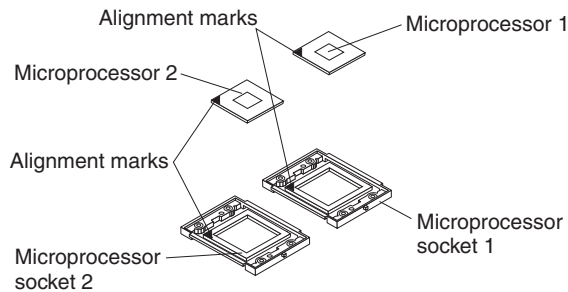
c. Center the microprocessor over the microprocessor socket. Align the triangle on the corner of the microprocessor with the triangle on the corner of the socket and carefully press the microprocessor into the socket.

d. Carefully close the microprocessor-release lever to secure the microprocessor in the socket.

Attention: Do not set the heat sink down after you remove the plastic cover and do not touch the thermal grease on the bottom of the heat sink. Touching the thermal grease will contaminate it. If the thermal grease on the microprocessor or heat sink becomes contaminated, contact your service technician.

11. Install the heat sink on the microprocessor:

a. Remove the plastic cover from the bottom of the heat sink.

b. Align and place the heat sink on top of the microprocessor, grease side down, in the retention bracket. Press firmly on the heat sink.

Attention: Alternate the tightening of the two captive screws to prevent damage to the microprocessor. Ensure that the screws are completely tightened (until they stop); otherwise, damage to the microprocessor will occur.

c. Secure the heat sink to the microprocessor by tightening the captive screws. Alternate between the two captive screws in the heat sink while tightening them.

12. Install the air baffle.

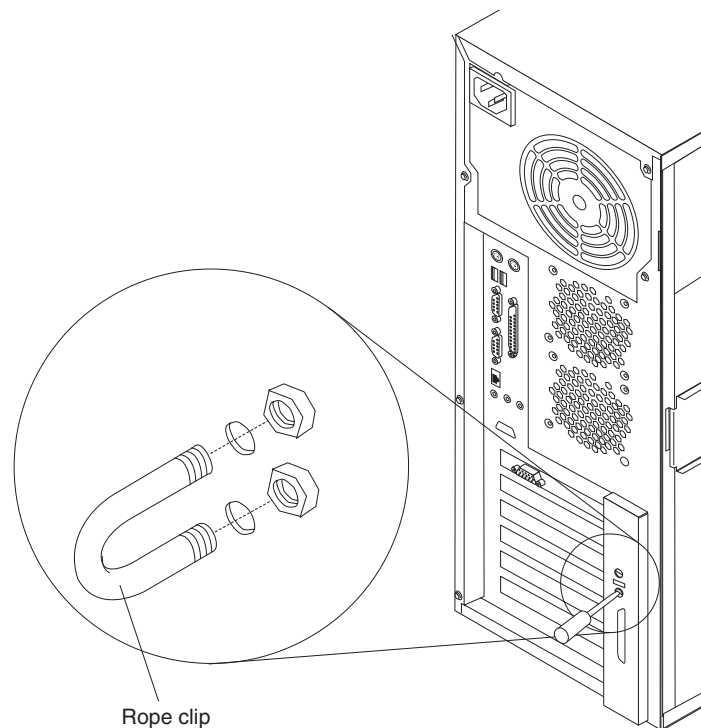13. If you have other options to install or remove, do so now.

14. Replace the support bracket (see "Removing and installing the support bracket" on page 33).

15. Replace the side cover (see "Replacing the side cover" on page 53).

16. Reconnect the external cables and power cords. Turn on the attached devices, and turn on the computer.

Installing a security rope clip

To help prevent theft, you can add a security rope clip and cable to your computer.
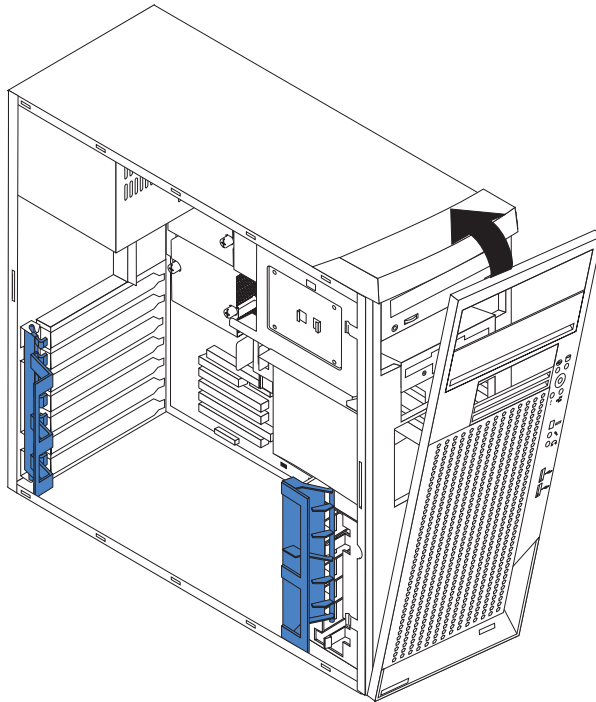
Complete the following steps to install a rope clip:

1. Turn off the computer and all attached devices.

2. Disconnect all power cords; then disconnect all external cables.

3. Remove the side cover (see "Removing the side cover" on page 31).

4. Use a screwdriver to remove the two metal knockouts.

5. Insert the rope clip through the rear panel; then, attach and tighten the nuts.

6. Thread a cable through the rope clip and around an object that is not part of or permanently secured to the building structure or foundation, and from which the cable cannot be removed. Fasten the cable ends together with a lock. After you add the security cable, be certain it does not interfere with other cables connected to the computer.

Rope clip

7. If you have other options to install or remove, do so now.

8. Replace the side cover (see "Replacing the side cover" on page 53).

9. Reconnect the external cables and power cords. Turn on the attached devices, and turn on the computer.

Replacing the bezel

The following illustration shows how to install the bezel on the computer.

Complete the following steps to replace the bezel:

1. Insert the two tabs on the bottom of the bezel into the matching holes on the computer chassis.
2. Push the top of the bezel toward the computer until the two tabs at the top of the bezel snap into place.

Replacing the side cover

If you removed the support bracket, reinstall it before you replace the side cover. See "Removing and installing the support bracket" on page 33.

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 replace the side cover.

Complete the following steps to replace the side cover:

1. Before installing the cover, check that all cables, adapters, and other components are installed and seated correctly and that you have not left loose tools or parts inside the computer.

2. Place the bottom lip of the side cover over the bottom edge of the computer chassis.

3. Rotate the side cover to a vertical position, inserting the tabs at the top of the side cover into the matching slots in the computer chassis.

4. Slide the side cover forward until it locks in place. Press down on the cover-release-latch button as you close the cover-release latch to lock the side cover.
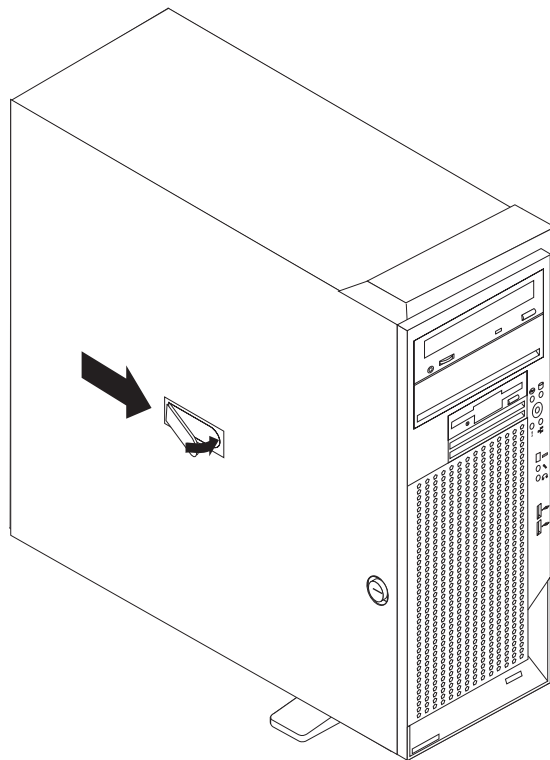
5. If you have not done so already, make sure that the two front stabilizing feet are rotated outward so that they properly support the computer. Rotate each foot outward 90 degrees (see "Moving the stabilizing feet" on page 30).

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.

Connecting external options

If you install an optional SCSI adapter, or use the secondary channel on the integrated SCSI controller for external devices, you can attach external SCSI devices, such as a SCSI storage expansion enclosure, to your computer. To use secondary channel for external SCSI devices, remove the SCSI knockout from the rear of the computer and secure the free end of the secondary channel cable in the new opening.

You can connect a number of optional external devices to the connectors on the rear and front of the computer.

Complete the following steps to attach an external device:

1. Review the "Installation guidelines" on page 27, the safety precautions listed in Statement 1 and Statement 5 in the safety information on page vii, and the documentation that comes with your options.
2. Be sure that your computer and all attached devices are turned off.
3. Follow the instructions that come with the option to prepare it for installation and to connect it to the computer.

Note: If you are attaching a SCSI device, see "Ultra320 SCSI connector" on page 58 for SCSI ID and cabling information.

Input/output connectors

Connect optional external devices to the connectors on the front and rear of the computer.

Your computer has the following input/output (I/O) connectors:
- One audio line in (rear of computer)
- Two audio line out (front and rear of computer)
- Two audio microphone (front and rear of computer)
- One Ethernet (RJ-45)
- Two IEEE 1394 (FireWire) (some models)
- One keyboard
- One mouse
- One parallel
- Two serial
- One Ultra320 SCSI (some models)
- Four universal serial bus (USB) v2.0 ports
- One video

The following illustration shows the locations of these connectors.
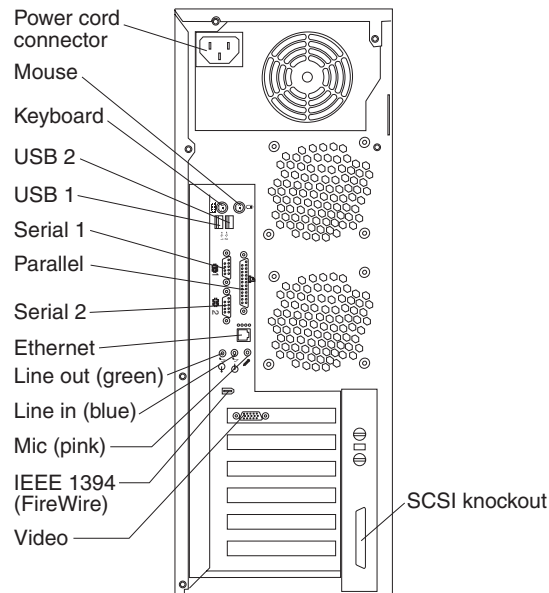
The following sections describe these connectors.

Audio connectors

The audio connectors are used to connect external audio equipment to the computer.
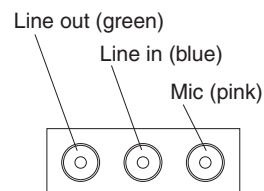
Microphone

There are two microphone connectors, one on the front and one on the rear of the computer. Connect a microphone to this connector to record sounds onto the hard disk or to use speech recognition software.

Line in

There is one line-in connector on the rear of the computer. The computer receives audio signals through this connector from an external audio device.

Line out

There are two line-out connectors, one on the front and one on the rear of the computer. The computer sends audio signals through this connector to powered speakers with built-in amplifiers, headphones, a multimedia keyboard, or the audio line-in connector on a stereo system. The internal speaker in your computer is disabled when any device is attached to either the front or rear line-out connector. Connecting devices to the front line-out connector disables the rear line-out connector.

Auxiliary-device (pointing-device) connector

There is one auxiliary-device connector on the rear of the computer. Use this connector to connect a mouse or other pointing device. The following illustration shows an auxiliary-device connector.
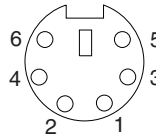
Ethernet (RJ-45) connector

There is one Ethernet connector on the rear of the computer. Use this connector to connect the computer to a 10-Mbps, 100-Mbps, or 1000-Mbps network. The following illustration shows an Ethernet connector.
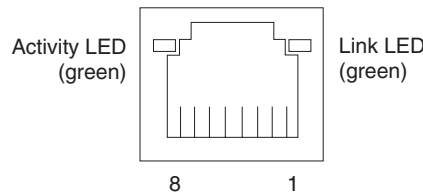
Connect a Category 3, 4, or 5 unshielded twisted-pair (UTP) cable to this connector. The 100BASE-TX and 1000BASE-T Fast Ethernet standards require Category 5 or higher cabling.

The Ethernet connector has two LEDs, one that indicates Ethernet-link status and one that indicates transmit/receive activity. When the Ethernet-link status LED is lit, it indicates that there is an active connection on the Ethernet port. Activity between the computer and the network is indicated by the Ethernet transmit/receive activity LEDs on the front and rear of the computer (see "Controls and indicators" on page 9).
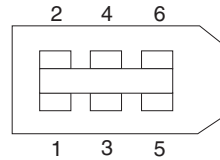
IEEE 1394 (FireWire) connectors

There is one 4-pin IEEE 1394 connector on the front of the computer and one 6-pin IEEE 1394 connector on the rear of the computer. Use these connectors to connect IEEE 1394 devices. The following illustrations show the IEEE 1394 connectors.
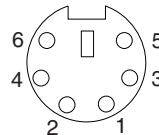
4-pin IEEE 1394 (FireWire) connector (front):

```
 4  3  2  1
```
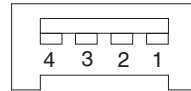
6-pin IEEE 1394 (FireWire) connector (rear):

```
  2   4   6



  1   3   5
```

Keyboard connector

There is one keyboard connector on the rear of the computer. Use this connector to connect a PS/2® (non-USB) keyboard. The following illustration shows a keyboard connector.

```
6        5
4        3
   2  1
```

If you attach a keyboard to this connector, USB ports and devices are disabled during the power-on self-test (POST).

Parallel connector

There is one parallel connector on the rear of the computer. Use this connector to connect a parallel device. The following illustration shows a parallel connector.

```
13                        1
 o o o o o o o o o o o o o
  o o o o o o o o o o o o
25                       14
```
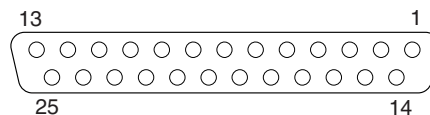
The parallel connector supports three standard Institute of Electrical and Electronics Engineers (IEEE) 1284 modes of operation: standard parallel port (SPP), enhanced parallel port (EPP), and extended capability port (ECP). If you configure the parallel port to operate in bidirectional mode, it supports the ECP and EPP modes. When the parallel connector is configured as bidirectional, use an IEEE 1284-compliant cable that does not exceed 3 meters (9.8 ft). Use the Configuration/Setup Utility program to configure the parallel connector as bidirectional.

Complete the following steps to view or configure the parallel connector:

1. Restart the computer.
2. Press and hold the F1 key to launch the Configuration/Setup Utility program.
3. On the Configuration/Setup Utility menu, use the cursor keys on the keyboard to select **Devices → Parallel Port**.
4. Follow the instructions on the screen to save your changes and exit from the Configuration/Setup Utility menu.
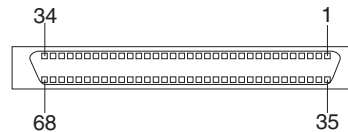
Serial connectors

There are two serial connectors on the rear of the computer. Use these connectors to connect serial devices. The following illustration shows a serial connector.

```
  1           5
   ○ ○ ○ ○ ○
    ○ ○ ○ ○
  6           9
```
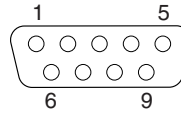
Ultra320 SCSI connector

An optional external SCSI connector might be installed on the rear of the computer. Use this connector to connect external SCSI devices. The following illustration shows the SCSI standard 68-pin, female D-shell SCSI connector.

```
  34                                1
    ▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯
    ▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯▯
  68                               35
```

Your computer has an integrated SCSI controller with RAID capabilities. This dual-channel controller supports two independent, Ultra320 SCSI channels. The SCSI connectors for both channels are on the system board. Each channel supports up to 15 SCSI devices. This controller uses:

- Double-transition clocking to achieve up to 320 MB-per-second data-transfer rates
- Domain name validation to negotiate compatible data-transfer speeds with each device
- Cyclic-redundancy checking (CRC), instead of the usual parity checking, to improve data reliability
- An active terminator for SCSI bus termination

SCSI cabling requirements

You can install three internal SCSI devices using the SCSI signal cable that comes with some computer models. If you plan to attach external SCSI devices, you must order an additional SCSI cable, remove the SCSI knockout from the rear of the computer, and connect the new cable from the system board to this opening. To select and order the correct cables for use with external devices, contact your IBM reseller or IBM marketing representative. When using an optional SCSI adapter, you must also connect the SCSI adapter to the SCSI LED (J18) connector on the system board receive an indication of SCSI hard-disk drive activity. See "System-board internal connectors" on page 29 for the location of the SCSI connectors.

Setting SCSI IDs

Each SCSI device connected to a SCSI controller must have a unique SCSI ID. This ID enables the SCSI controller to identify the device and ensure that different devices on the same SCSI channel do not attempt to transfer data simultaneously. SCSI devices that are connected to different SCSI channels can have duplicate SCSI IDs. See the information that is provided with the device for instructions about setting its SCSI ID.

Universal Serial Bus connectors

There are four Universal Serial Bus (USB) v2.0 connectors, two on the front of the computer and two on the rear of the computer. Use the USB connectors to connect

optional telephony and multimedia devices. USB 2.0 technology transfers data at up to 480 megabits per second (Mbps) with a maximum of 127 external devices and a maximum signal distance of 5 meters (16 ft) per segment (if the device that is attached to the computer is a USB 2.0 device). If the computer has multiple USB devices attached to it, the USB hub must be USB 2.0, otherwise, all USB 2.0 devices will transfer data at 12 Mbps. Using Plug and Play technology, USB devices are configured automatically. The following illustration shows a USB connector.
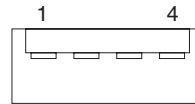
Use a 4-pin USB cable to connect external devices to USB connectors.

If you connect a PS/2 (non-USB) keyboard to the keyboard connector, USB ports and devices are disabled during power-on self-test (POST).

If you connect a USB keyboard that has a mouse port, the keyboard emulates a mouse, and you cannot disable the mouse settings in the Configuration/Setup Utility program.

Video connector

The Accelerated Graphics Port (AGP) adapter, which is in the AGP slot on the system board, provides the video connector. This connector is on the rear of the computer. Use the video connector to connect a monitor or other display. The following illustrations show the different types of video connector that can come with your computer.
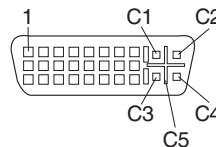
Analog video connector:

This connector is on the Matrox DVI-I to dual VGA pigtail cable and on the NVIDIA LFH-60 to dual VGA pigtail cable.
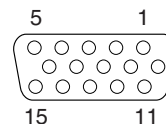
Digital (DVI-I) video connector:

This connector is on the Matrox Millennium G450, NVIDIA Quadro4 980XGL, and 3Dlabs Wildcat4 7110 video adapters.

Low force helical-60 (LFH-60) video connector:

This connector is on the NVIDIA Quadro4 280NVS video adapter.

Some models come with a digital video interface (DVI) connector for connecting a digital monitor. If you have problems viewing information with a second monitor, see "Changing monitor settings" on page 15.

Models with the Matrox Millennium G450 DVI-I video adapter come with a DVI-I to dual-analog monitor pigtail cable.

Models with the Wildcat4 7110 or NVIDIA Quadro4 980XGL video adapter come with a DVI-I to VGA style analog converter for each DVI-I connector.

Attention: On the Wildcat4 7110 video adapter, the first or only monitor must be connected to the bottom connector (connector number 1).

Models with the NVIDIA Quadro4 280NVS video adapter come with a low force helical-60 (LFH-60) to dual-analog monitor pigtail cable. If you want to setup two digital monitors, you will need to purchase a separate dual-digital monitor cable.

Chapter 5. Solving problems

This section provides basic troubleshooting information to help you identify and resolve some problems that might occur.

If you cannot locate and correct the problem using the information in this chapter, see Appendix A, "Getting help and technical assistance" on page 93 for more information.

Diagnostic tools overview

The following tools are available to help you identify and resolve hardware-related problems:

- **Computer Support flowchart**

  The Computer Support flowchart on the following page will help you determine how to access help from IBM and register your computer.

- **POST beep codes and error messages**

  The power-on self-test generates beep codes and messages to indicate successful test completion or the detection of a problem. See "Power-on self-test (POST)" on page 63 for more information.

- **Diagnostic programs**

  The system diagnostic programs are stored on the *Device Drivers and IBM Enhanced Diagnostics* CD. These programs are the primary methods of testing the major components of your computer. See "Diagnostic programs and error messages" on page 72 for more information.
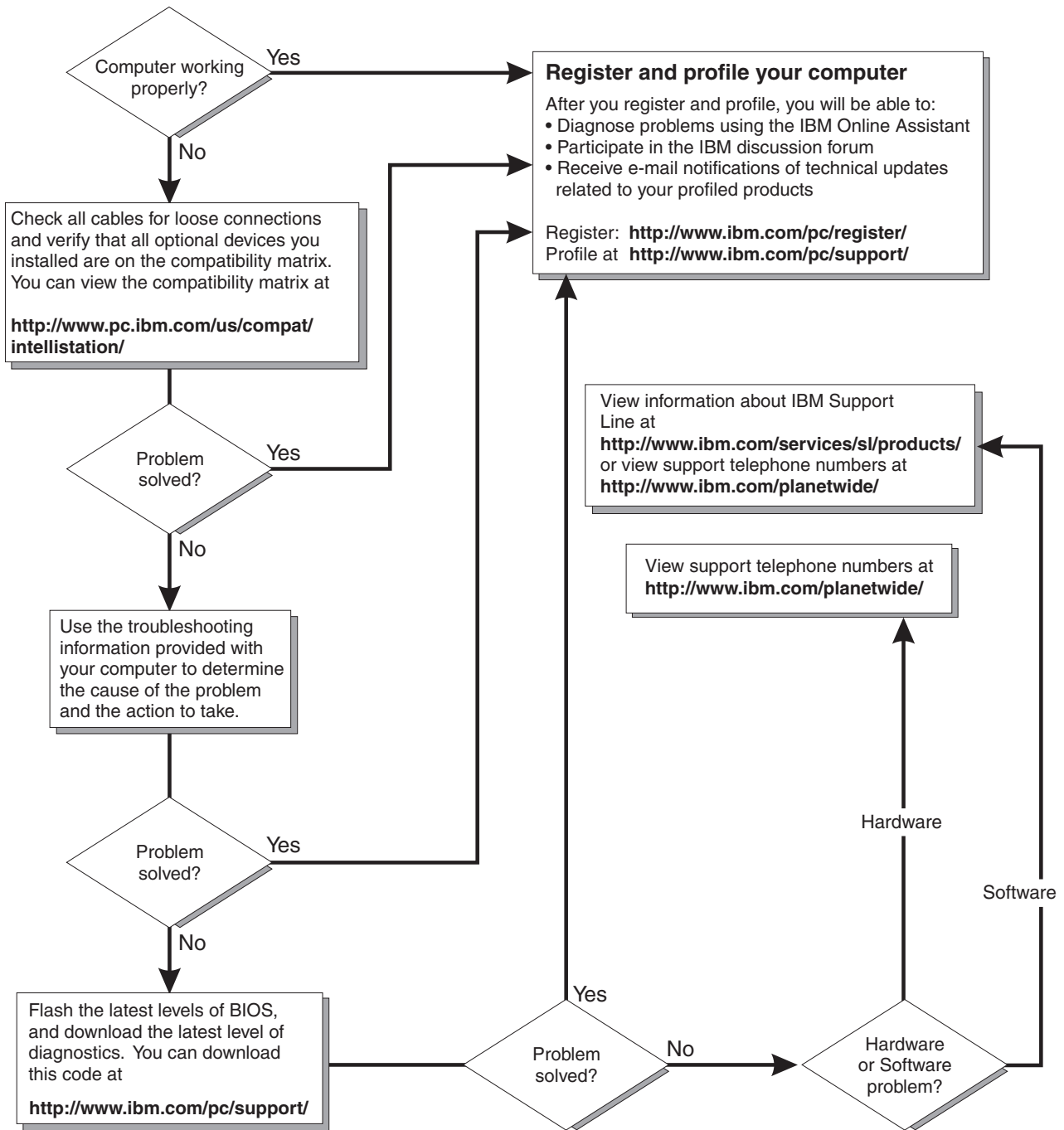
- **Troubleshooting charts**

  These charts list problem symptoms and steps to correct each problem. See the "Troubleshooting charts" on page 78 for more information.

- **System-board error LEDs**

  An LED on the system board might be lit to help isolate an error indicated by the system error LED on the front of the computer. See the "System-board error LEDs" on page 85 for more information.

Computer Support

Computer working properly? —Yes→

Register and profile your computer

After you register and profile, you will be able to:
- Diagnose problems using the IBM Online Assistant
- Participate in the IBM discussion forum
- Receive e-mail notifications of technical updates related to your profiled products

Register: **http://www.ibm.com/pc/register/**
Profile at **http://www.ibm.com/pc/support/**

No↓

Check all cables for loose connections and verify that all optional devices you installed are on the compatibility matrix. You can view the compatibility matrix at

http://www.pc.ibm.com/us/compat/ intellistation/

Problem solved? —Yes→

No↓

Use the troubleshooting information provided with your computer to determine the cause of the problem and the action to take.

Problem solved? —Yes→

No↓

Flash the latest levels of BIOS, and download the latest level of diagnostics. You can download this code at

http://www.ibm.com/pc/support/

Problem solved? —Yes→ / —No→

Hardware or Software problem? —Hardware↑ / —Software→

View information about IBM Support Line at **http://www.ibm.com/services/sl/products/** or view support telephone numbers at **http://www.ibm.com/planetwide/**

View support telephone numbers at **http://www.ibm.com/planetwide/**

Power-on self-test (POST)

When you turn on the computer, the power-on self-test (POST) performs a series of tests to check the operation of system components and some of the installed options.

If POST finishes without detecting any problems, the first window of your operating system or application program appears.

If POST detects a problem, more than one beep might sound, an error message might appear on your screen, or both.

Notes:
1. If you have a user password set, you must type the password and press Enter, when prompted, before the operating system will load.
2. A single problem might cause several error messages. When this occurs, work to correct the cause of the first error message. After you correct the cause of the first error message, the other error messages typically will resolve the next time you run the test.

POST beep codes

The possible types of beep codes are:

No beeps
> No beep codes indicates that your computer successfully completed POST without finding any errors.

Continuous beep
> Your startup (boot) microprocessor has failed, or your system board or speaker subsystem might contain a failing component. If the system continues through POST with no errors, call for service. If no video appears, the startup processor has failed.

Beep codes for specific failures
> Beep codes indicating specific system problems are listed in the following table.

Table 3. POST beep codes

Beep code	Description	Action
1-1-2	Microprocessor register test has failed.	Call for service
1-1-3	CMOS write/read test has failed.	
1-1-4	BIOS EEPROM checksum has failed.	
1-2-1	Programmable Interval Timer test has failed.	
1-2-2	DMA initialization has failed.	
1-2-3	DMA page register write/read test has failed.	
1-2-4	RAM refresh verification has failed.	Reseat the memory modules or install a memory module. If the problem remains, call for service.
1-3-1	First 64 Kb RAM test has failed.	
1-3-2	First 64 Kb RAM parity test has failed.	

Table 3. POST beep codes (continued)

Beep code	Description	Action
2-1-1	Secondary DMA register test has failed.	Call for service
2-1-2	Primary DMA register test has failed.	
2-1-3	Primary interrupt mask register test has failed.	
2-1-4	Secondary interrupt mask register test has failed.	
2-2-2	Keyboard controller test has failed.	
2-2-3	CMOS power failure and checksum checks have failed.	
2-2-4	CMOS configuration information validation has failed.	
2-3-2	Screen memory test has failed.	Call for service
2-3-3	Screen retrace tests have failed.	
2-3-4	Search for video ROM has failed.	
2-4-1	Screen test indicates the screen is operable.	
3-1-1	Timer tick interrupt test has failed.	
3-1-2	Interval timer channel 2 test has failed.	
3-1-3	RAM test has failed above address 0FFFFH.	
3-1-4	Time-of-Day clock test has failed.	
3-2-1	Serial port test has failed.	
3-2-2	Parallel port test has failed.	
3-2-4	Comparison of CMOS memory size against actual has failed.	
3-3-1	A memory size mismatch has occurred.	Reseat the memory modules or install a memory module. If the problem remains, call for service.
3-3-2	Critical SMBUS error occurred (I2C bus has failed).	Call for service
3-3-3	No optional memory in the system. **Attention:** 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 **Boot Fail Count** feature in the Start Options of the Configuration/Setup Utility program is set to **Enabled** (its default setting), you must restart the computer three times to force the system BIOS to reset the memory connector from **Disabled** to **Enabled**.	Reseat the memory modules or install a memory module. If the problem remains, call for service.

POST error messages

The following table provides information about the POST error messages that can appear during startup.

Table 4. POST error messages

POST message	Description
062	The computer failed to boot on three consecutive attempts. All caches are disabled. Repeatedly turning the computer on and then off or resetting the computer might cause this problem. **Action:** Take the following steps to correct the problem: 1. Start the Configuration/Setup Utility program and verify that all settings are correct. Use the **Cache Control** selection in the Advanced Setup menu of the Configuration/Setup Utility program to enable the caches. 2. Install a new battery. See "Replacing the battery" on page 90 for instructions. If the problem remains, call for service. When the problem is corrected, be sure to enable the caches.
101, 102, and 106	An error occurred during the system board and microprocessor test. **Action:** Call for service.
114	An adapter read-only memory (ROM) error occurred. **Action:** Remove the options. If you can start the computer without the options installed, reinstall each option one at a time and retest after each is reinstalled. When an option fails, replace it. If you cannot isolate and correct the problem, call for service.
129	An error was detected in the L1 cache of one of the microprocessors. **Action:** Take the following steps to correct the problem: 1. If you just installed a microprocessor, verify that the microprocessor is installed and seated correctly. 2. If the problem remains, call for service.
151	A real-time clock (RTC) error or CMOS checksum error occurred. **Action:** Take the following steps to correct the problem: 1. Restart the computer. 2. If the problem remains, call for service.
161	The real-time clock battery has failed. **Action:** Replace the battery yourself or call for service. You can use the computer until you replace the battery. However, you must run the Configuration/Setup Utility program and set the time and date and other custom settings each time you turn on the computer.

Table 4. POST error messages (continued)

POST message	Description
162	A change in device configuration occurred. This error occurs under one or more of the following conditions: • A new device has been installed. • A device has been moved to a different location or cable connection. • A device has been removed or disconnected from a cable. • A device is failing and is no longer recognized by the computer as being installed. • An external device is not turned on. • An invalid checksum is detected in the battery-backed memory. **Action:** Verify that all external devices are turned on. You must turn on external devices before turning on the computer. 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 "Creating an IBM Enhanced Diagnostics diskette" on page 14 and "Using an IBM Enhanced Diagnostics diskette" on page 87. If the problem remains, call for service.
163	The time of day has not been set. **Action:** Set the correct date and time. If the date and time are set correctly and saved, but the 163 error message reappears, call for service. You can use the computer until the system is serviced, but any application programs that use the date and time will be affected.
164	A change in the memory configuration occurred. This message might appear after you add or remove memory. **Note:** The computer can be used with decreased memory capacity. **Action:** Take the following steps to correct the problem: 1. If POST error message 289 also occurred, follow the instructions for that error message first. 2. If you just installed or removed memory, run the Configuration/Setup Utility program; then, exit, saving the new configuration settings. If the message appears again, shut down the computer, reseat the memory modules, and restart the computer. If the problem remains, call for service.
175	A vital product data (VPD) error occurred. **Action:** Call for service.
176, 177, and 178	A security hardware error occurred. **Action:** Check for indications that someone has tampered with the computer. If no one has tampered with the computer, call for service.
184	The power-on password information stored in your computer has been removed. **Action:** From the Configuration/Setup Utility program main menu, select **System Security.** Then, follow the instructions on the screen. If this information cannot be restored, call for service.
185	A power failure damaged the stored information about the drive-startup sequence. **Action:** From the Configuration/Setup Utility program main menu, select **Start Options**; then, follow the instructions on the screen. If this information cannot be restored, call for service.
186	A system board or hardware error occurred. **Action:** Call for service.

Table 4. POST error messages (continued)

POST message	Description
187	The VPD serial number is not set. **Action:** When a supported Remote Supervisor Adapter (RSA) is installed, the system serial number is set in the VPD EEPROM each time the computer is restarted. If the system board has been replaced, the system serial number will be invalid and should be set. To view the system serial number, select **System Information** from the main menu of the Configuration/Setup Utility program and then select **Product Data.** If the problem remains, call for service.
188	A vital product data (VPD) error occurred. **Action:** Call for service.
189	An attempt has been made to access the computer with invalid passwords. After three incorrect attempts, the computer locks up; that is, the logon data fields are no longer available to the user.
201	An error occurred during the memory controller test. This error can be caused by: • Incorrectly installed memory • A failing memory module • A system board problem **Action:** Take the following steps to correct the problem: 1. If you just installed memory, verify that the new memory is correct for your computer. Also verify that the memory is installed and seated correctly. 2. If the problem remains, call for service.
229	An error was detected in the L2 cache of one of the microprocessors. **Action:** Take the following steps to correct the problem: 1. If you just installed a microprocessor, verify that the microprocessor is installed and seated correctly. 2. If the problem remains, call for service.
289	An error occurred during POST memory tests and a failing DIMM was disabled. **Note:** You can use the computer with decreased memory. **Action:** Take the following steps to correct the problem: 1. If you just installed memory, verify that the new memory is correct for your computer. Also verify that the memory is installed and seated correctly. Start the Configuration/Setup Utility program and select **Memory Settings** from the Advanced Setup menu to enable the DIMM. 2. If the problem remains, replace the failing DIMM. If the problem remains, call for service.

301 and 303	An error occurred during the keyboard and keyboard controller test. These error messages also might be accompanied by continuous beeping.
	Action: Take the following steps to correct the problem:
	1. Ensure that:
	  • Nothing is resting on the keyboard and pressing a key.
	  • No key is stuck.
	  • The keyboard cable is connected correctly to the keyboard and to the correct connector on the computer.
	2. After installing a USB keyboard, you might need to use the Configuration/Setup Utility program to enable keyboardless operation and prevent the POST error message from being displayed during startup.
	
	Running the diagnostic tests can isolate the computer component that failed, but you must have your system serviced. If the error message remains, call for service.
	Note: 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.

Table 4. POST error messages (continued)

POST message	Description
602	Invalid diskette boot record **Action:** Take the following steps to correct the problem: 1. Replace the diskette. 2. If the problem remains, make sure that the diskette drive cables are correctly and securely connected. 3. If the problem remains, replace the diskette drive. If the problem remains, call for service.
604	An error occurred during a diskette drive test. **Action:** Take the following steps to correct the problem: 1. Verify that the Configuration/Setup Utility program correctly reflects the type of diskette drive that you have installed. 2. Run the diagnostic tests. If the diagnostic tests fail, call for service.
662	A diskette drive configuration error occurred. **Action:** If you removed a diskette drive, make sure that the diskette drive setting is correct in the Configuration/Setup Utility program. If the setting is not correct, change it. If the problem remains, call for service.
962	A parallel port configuration error occurred. **Action:** If you changed a hardware option, make sure that the parallel port setting is correct in the Configuration/Setup Utility program. If the setting is not correct, change it. If the problem remains, call for service.
11*xx*	An error occurred during the system-board serial port test. **Action:** If you have a serial device attached to your computer, verify that the serial cable is connected correctly. If it is, use the following procedure: 1. Turn off the computer. 2. Disconnect the serial cable from the serial port. 3. Wait five seconds; then, turn on the computer. If the POST error message does not reappear, either the serial cable or the device is probably failing. See the documentation that comes with the serial device for additional testing information. If the POST error message reappears, call for service.
1162	The serial port configuration conflicts with another device in the system. **Action:** Take the following steps to correct the problem: 1. Make sure the IRQ and I/O port assignments needed by the serial port are available. 2. If all interrupts are being used by adapters, you might need to remove an adapter to make an interrupt available to the serial port, or force other adapters to share an interrupt.
1600	The Advanced System Management processor is not functioning. **Action:** Take the following steps to correct the problem: 1. Verify that the jumpers for the system-management processor are set correctly. 2. Disconnect the computer from all electrical sources, wait for 30 seconds, reconnect the computer to the electrical sources, and restart the computer. If the problem remains, call for service.
1601	An Advanced System Management Flash update is needed. **Action:** Download and install the latest Advanced System Management flash update.

Table 4. POST error messages (continued)

POST message	Description
1762	Hard disk configuration error. **Action:** Take the following steps to correct the problem: 1. Make sure that the hard disk drive is set correctly in the Configuration/Setup Utility program. 2. Make sure that the hard disk drive cables are correctly and securely connected. 3. If the problem remains, replace the hard disk drive. If the problem remains, call for service.
1800	A PCI adapter has requested a hardware interrupt that is not available. **Action:** Take the following steps to correct the problem: 1. Make sure that the PCI adapter and all other adapters are set correctly in the Configuration/Setup Utility program. If the interrupt resource settings are not correct, change the settings. 2. If all interrupts are being used by other adapters, you might need to remove an adapter to make an interrupt available to the PCI adapter, or force other adapters to share an interrupt.

1962	No valid startup devices were found. The system cannot find the startup drive or operating system.
	Action: Be sure that the drive you want to start from is in the startup sequence.
	1. Select **Start Options** from the Configuration/Setup Utility program main menu. If you are unable to set the startup sequence, call for service.
	2. Check the list of startup devices in the **Startup device** data fields. Is the drive you want to start from in the startup sequence?
	    Yes Exit from this screen; then, select **Exit Setup** to exit the Configuration/Setup menu. Go to step 3.
	    No Follow the instructions on the screen to add the drive; then, save the changes and exit the Configuration/Setup menu. Restart the computer.
	3. Is an operating system installed?
	    Yes Turn off the computer. Go to step 4.
	    No Install the operating system in your computer; then, follow your operating system instructions to shut down and restart the computer.
	4. During computer startup, watch for messages indicating a hardware problem.
	
	If the same error message appears, call for service.

2400	An error occurred during the testing of the video controller on the system board. This error can be caused by a failing system board or a failing video adapter (if one is installed). **Action:** Call for service.
2462	A video memory configuration error occurred. **Action:** Call for service.
5962	An IDE CD-ROM configuration error occurred. **Action:** Check the signal and power cable connections to the CD-ROM drive. If the problem remains, call for service.

Table 4. POST error messages (continued)

POST message	Description
8603	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. **Note:** 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. **Action:** Ensure that the keyboard and mouse (pointing device) are attached to the correct connectors. If they are connected correctly, use the following procedure: 1. Turn off the computer. 2. Disconnect the mouse from the computer. 3. Turn on the computer. If the POST error message does not reappear, the mouse is probably failing. See the documentation that comes with the mouse for additional testing information. If the problem remains, replace the mouse or pointing device. If the POST error message reappears, run the diagnostic tests to isolate the problem. If the diagnostic tests do not find a problem and the POST error message remains, call for service.
00012000	Processor machine check. **Action:** Take the following steps to correct the problem: 1. Update the system BIOS. 2. If the problem remains, replace the microprocessor.
00019501	Microprocessor 1 is not functioning. **Action:** Replace microprocessor 1. If the problem remains, call for service.
00019502	Microprocessor 2 is not functioning. **Action:** Replace microprocessor 2. If the problem remains, call for service.
00019701	The microprocessor failed the built-in self test. **Action:** Replace the microprocessor. If the problem remains, call for service.
00180100	A PCI adapter has requested memory resources that are not available **Action:** Take the following steps to correct the problem: 1. Make sure that the PCI adapter and all other adapters are set correctly in the Configuration/Setup Utility program. If the memory resource settings are not correct, change the settings. 2. If all memory resources are being used, you might need to remove an adapter to make memory available to the PCI adapter. Disabling the adapter BIOS on the adapter might correct the error. See the documentation provided with the adapter.
00180200	A PCI adapter has requested an I/O address that is not available, or the PCI adapter might be defective. **Action:** Take the following steps to correct the problem: 1. Make sure that the I/O address for the PCI adapter and all other adapters are set correctly in the Configuration/Setup Utility program. 2. If the I/O port resource settings are correct, the PCI adapter might be defective. Call for service.
00180300	A PCI adapter has requested a memory address that is not available, or the PCI adapter might be defective. **Action:** Take the following steps to correct the problem: 1. Make sure that the memory address for all other adapters are set correctly in the Configuration/Setup Utility program. If the memory resource settings are not correct, change the settings. 2. If the memory resource settings are correct, the PCI adapter might be defective. Call for service.

Table 4. POST error messages (continued)

POST message	Description
00180400	A PCI adapter has requested a memory address that is not available. **Action:** If all memory addresses are being used, you might need to remove an adapter to make memory address space available to the PCI adapter. Disabling the adapter BIOS on the adapter might correct the error. See the documentation provided with the adapter.
00180500	A PCI adapter ROM error occurred. **Action:** Remove the PCI adapters. If you can start the computer without the adapters, reinstall each adapter one at a time and retest after each is reinstalled. When an adapter fails, replace it. If you cannot isolate and correct the problem, call for service.
00180600	A PCI-to-PCI bridge error occurred. More than one PCI bus tried to access memory below 1 MB. **Action:** Remove the PCI adapter that has the PCI bridge. If you can start the computer without the adapter, reinstall and retest the adapter. If the adapter fails, replace it. If you cannot isolate and correct the problem, call for service.
00180700	*xxxxyyyy* Planar PCI device does not respond or disabled by user. (Where *xxxx* is the PCI vendor ID and *yyyy* is the PCI device ID.) **Action:** Start the Configuration/Setup Utility program, select Devices and I/O Ports, and make sure that the device is enabled. If the problem remains, call for service.
00180800	An unsupported PCI device is installed. **Action:** Remove the PCI adapters. If you can start the computer without the adapters, reinstall each adapter one at a time and retest after each is reinstalled. When an adapter fails, replace it. If the problem remains, call for service.
00181000	PCI error. **Action:** Remove the PCI adapters. If you can start the computer without the adapters, reinstall each adapter one at a time and retest after each is reinstalled. When an adapter fails, replace it. If the problem remains, call for service.
01295085	The ECC checking hardware test failed. **Action:** Call for service.
01298001	No update data is available for the processor. **Action:** Update the system BIOS to a level that supports the microprocessors installed in the computer.
01298101	The update data for the microprocessor is incorrect. **Action:** Update the system BIOS to a level that supports the microprocessors installed in the computer.
01298200	Microprocessor speed mismatch **Action:** The microprocessors installed do not run at the same speed; install microprocessors with identical speeds.
I9990301	A hard disk drive error occurred. **Action:** Call for service.
I9990305	POST could not find an operating system. **Action:** Install an operating system. If you have already installed the operating system, check the drive startup sequence. If the drive sequence is correct, run the diagnostic tests to verify that the hard disk drive is functioning correctly. If there is a problem with the hard disk drive (such as a bad sector), you might need to reinstall the operating system. If you cannot reinstall the operating system, call for service.

Table 4. POST error messages (continued)

POST message	Description
I9990650	AC power has been restored. **Action:** No action is required. This message appears each time AC power is restored to the computer after an AC power loss.
Other Numbers	POST found an error. **Action:** Follow the instructions on the screen.

Diagnostic programs and error messages

The system diagnostic programs are stored on the *Device Drivers and IBM Enhanced Diagnostics* CD that comes with your computer. These programs are the primary method of testing the major components of your computer and assist in isolating problems in the computer hardware and software. The diagnostic programs run independently of the operating system and *must be run from either a CD or diskette*.

This diskette, known as an IBM Enhanced Diagnostics diskette, can be created using Access IBM. You can also download the latest version of the diagnostics programs from http://www.ibm.com/pc/support on the World Wide Web and use the downloaded file to create an IBM Enhanced Diagnostics diskette. See "Using an IBM Enhanced Diagnostics diskette" on page 87 for instructions.

Note: When using diagnostics with a USB keyboard and mouse attached, first go into the Configuration/Setup Utility and enable USB emulation.
1. Restart the computer and press F1 to access the Configuration/Setup Utility.
2. Select Devices and I/O Ports.
3. Select USB Setup.
4. Make sure USB Keyboard and Mouse are enabled.

Diagnostic error messages indicate that a problem exists; they are not intended to be used to identify a failing part. Troubleshooting and servicing complex problems that are indicated by error messages should be performed by trained service personnel.

Sometimes the first error to occur causes additional errors. In this case, the computer displays more than one error message. Always follow the suggested action instructions for the *first* error message that appears.

The following sections contain the error codes that might be displayed in the detailed test log and summary log, when running the diagnostic programs.

The error code format is as follows:

fff-ttt-iii-date-cc-text message

where:

fff   is the three-digit function code that indicates the function being tested when the error occurred. For example, function code 201 is for memory.

ttt   is the three-digit failure code for the exact test failure. (These codes are for trained service personnel and are described in the *Hardware Maintenance Manual*.)

iii   is the three-digit device ID. (These codes are for trained service personnel and are described in the *Hardware Maintenance Manual*.)

date   is the date that the diagnostic test was run and the error recorded.

cc   are the check digits that are used to verify the validity of the information.

text message
        is the diagnostic message that indicates the reason for the problem.

Text messages

The diagnostic text message format is as follows:

Function Name: Result (test specific string)

where:

Function Name
        is the name of the function being tested when the error occurred. This corresponds to the function code (fff) given in the previous list.

Result
        can be one of the following:

   Passed
           This result occurs when the diagnostic test is completed without any errors.

   Failed This result occurs when the diagnostic test discovers an error.

   User Aborted
           This result occurs when you stop the diagnostic test before it is complete.

   Not Applicable
           This result occurs when you specify a diagnostic test for a device that is not present.

   Aborted
           This result occurs when the test could not proceed because of the system configuration.

   Warning
           This result occurs when a possible problem is reported during the diagnostic test, such as when a device that is to be tested is not installed.

Test Specific String
        is additional information that is used to analyze the problem.

Starting the diagnostic programs and viewing the test log

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.

Note: If you already are running the diagnostic program, begin with step 4.

Complete the following steps to view the test log:

1. Insert the IBM Enhanced Diagnostics diskette or the *Device Drivers and IBM Enhanced Diagnostics* CD.
2. Shut down your operating system and restart the computer.
3. If a user password is set, the system prompts you for it. Type the password, and press Enter.
4. Run the appropriate diagnostics program and when the Diagnostic Programs screen appears, select **Utility**.
5. Select **View Test Log** from the list that appears; then, follow the instructions on the screen.
6. Save the test log to a file on a diskette or to your hard disk.

   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 may contain other data.
   b. The system maintains the test-log data while the system is turned on. When you turn off the power to the computer, the test log is cleared.

Diagnostic error message tables

The following tables provide descriptions of the error messages that might be listed in the test log after you run the diagnostic programs.

Important: If error messages are displayed that are not listed in the following table, make sure that your computer has the latest level of BIOS code installed.

Code	Function	Result	Text message	Action
001	Core system	Failed	System board, ECC Test	Call for service.
			System board	
005	Video port	Failed	System board	1. Replace video adapter (if installed). 2. If the problem remains, call for service.
011	Serial port	Failed	Integrated serial port	1. Make sure loopback plug is installed and rerun test.
014	Parallel port		Integrated parallel port	2. If the problem remains, call for service.
015	USB interface	Aborted	Can NOT test USB interface while it is in use. **Note:** If you have a USB keyboard or mouse attached, you cannot run the diagnostic program for the USB interface.	1. Turn off the computer. 2. Replace the USB keyboard and mouse with a standard keyboard and mouse. 3. Turn on the computer. 4. Run the diagnostic test again.
		Failed	System board	Call for service.

Code	Function	Result	Text message	Action
020	PCI interface	Failed	System board	Call for service.
030	SCSI interface	Failed	SCSI adapter in slot *n* failed register/counter/power test (where *n* is the slot number of the failing adapter)	See the information provided with the adapter for instructions. If the problem remains, call for service.
035	RAID adapter	Failed	RAID adapter is not configured properly	1. Check RAID adapter cable. 2. Replace RAID adapter. 3. Replace SCSI hard disk drive. 4. If the problem remains, call for service.
089	Microprocessor	Failed	Any failure message	1. Verify the microprocessor is installed and seated correctly. 2. If your machine does not have the latest level of BIOS installed, update the BIOS. 3. If the problem remains, call for service.
180	Status display	Failed	Any failure message	Call for service.
201	System memory	Failed	DIMM is in location DIMM *n* (where *n* is the number of the socket that contains the failing DIMM)	1. Reseat the failing DIMM. 2. If the problem remains, replace the DIMM. 3. If the problem remains, call for service.
			Test setup error: Corrupt BIOS in ROM	If your computer does not have the latest level BIOS installed, update the BIOS to the latest level. If the problem remains, call for service.
			Test setup error: Corrupt DMI BIOS, information in BIOS is not as expected	

Code	Function	Result	Text message	Action
202	Microprocessor	Failed	Any failure message	1. Verify the microprocessor is installed and seated correctly. 2. If your machine does not have the latest level of BIOS installed, update the BIOS. 3. If the problem remains, call for service.
206	Diskette drive	Failed	Internal diskette drive bay	1. Rerun the diagnostic with a different diskette. 2. If the problem remains, call for service.
215	CD-ROM	Failed	On system board.	1. Rerun the diagnostic with a different CD-ROM. 2. Verify that the cables are properly connected to the CD-ROM drive. 3. If the problem remains, call for service.
215	CD-ROM	Aborted	The CD-ROM drive is not present.	
217	Hard disk drive	Failed	BIOS drive # *n* (where n is the drive bay number)	1. Verify that the cables are properly connected to the hard disk drive and that these cables are properly terminated. 2. If the problem remains, call for service.
301	Keyboard	Failed	On system-board keyboard test failed	1. Verify that the keyboard cable is connected to the correct port (not the mouse port). 2. Replace the keyboard cable. 3. Replace the keyboard. 4. If the problem remains, call for service.

Code	Function	Result	Text message	Action
302	Mouse	Failed	On system-board pointing device test failed.	1. Verify that the pointing device cable is connected to the correct port (not the keyboard port). 2. Replace the pointing device. 3. If the problem remains, call for service.
305	Video monitor		Any message	See the information that came with the monitor.
405	Ethernet	Failed	In PCI slot *n* (where *n* is the PCI slot number in which the failing Ethernet adapter is installed)	1. Verify that Ethernet is enabled in BIOS. 2. Replace the Ethernet adapter in slot *n.* 3. If the problem remains, call for service.
			On system board	1. Verify that Ethernet is enabled in BIOS. 2. If the problem remains, call for service.
415	Modem	Failed	Any failure message	1. Check modem cable. 2. Replace modem. 3. If the problem remains, call for service.

Small computer system interface (SCSI) messages

If you receive a SCSI error message when running the SCSISelect Utility program, one or more of the following might be causing the problem:

- A failing SCSI device (adapter or drive)
- An improper SCSI configuration
- Duplicate SCSI IDs in the same SCSI chain
- An improperly installed SCSI terminator
- A defective SCSI terminator
- An improperly installed cable
- A defective cable

To solve the problem, verify that:

- The external SCSI devices are turned on. External SCSI devices must be turned on *before* the computer.
- The cables for all external SCSI devices are connected correctly.
- The last device in each SCSI chain is terminated properly.
- The SCSI devices are configured correctly.

If you have verified these items and the problem persists, run the diagnostic programs to obtain additional information about the failing device. If the error remains or recurs, call for service.

Note: If your system does not have a SCSI hard disk drive, ignore any message that indicates that the BIOS code is not installed.

PC-Doctor for Windows

Your computer contains PC-Doctor for Windows, which is designed specifically for the Windows operating environment. Because these diagnostics work with the operating system, they test hardware and analyze certain software components. These diagnostic programs are especially useful for isolating operating-system and device-driver problems.

Complete the following steps to use PC-Doctor for Windows:

1. On the Windows desktop, click **start → All Programs → PC-Doctor → PC-Doctor**.
2. Follow the instructions on the screen. Help is available online.

Troubleshooting charts

You can use the troubleshooting charts in this section to find solutions to problems that have definite symptoms.

Important: If diagnostic error messages are displayed that are not listed in the following tables, make sure that your system has the latest levels of BIOS code installed.

See "Starting the diagnostic programs and viewing the test log" on page 73 to test the computer. If you have run the diagnostic test programs or if running the tests does not detect the problem, call for service.

Look for the symptom in the left column of the chart. Instructions and probable solutions to the problem are in the right column. If you have just added new software or a new option and your system is not working, complete the following steps before using the troubleshooting chart:

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

CD-ROM drive problems

CD-ROM Drive symptom	Suggested action
CD-ROM drive is not recognized.	Verify that: • The IDE channel to which the CD-ROM drive is attached (primary or secondary) is enabled in the Configuration/Setup Utility program. • All cables and jumpers are installed correctly. • The correct device driver is installed for the CD-ROM drive. If the problem remains, call for service.
CD is not working properly.	Clean the CD. If the problem remains, call for service.

CD-ROM Drive symptom	Suggested action
CD-ROM drive tray is not working. (The computer must be turned on.)	Insert the end of a straightened paper clip into the manual tray-release opening. If the problem remains, call for service.

Diskette drive problems

Diskette drive symptom	Suggested action
Diskette drive activity LED stays on, or the system bypasses the diskette drive.	1. If there is a diskette in the drive, verify that: • The diskette drive is enabled in the Configuration/Setup utility program. • The diskette is good and not damaged. (Try another diskette if you have one.) • The diskette is inserted correctly in the drive. • The diskette contains the necessary files to start the computer. • The software program is working properly. • The cable is installed correctly (in the proper orientation). 2. To prevent diskette drive read/write errors, be sure the distance between monitors and diskette drives is at least 76 mm (3 in.). If the problem remains, call for service.

Expansion enclosure problems

Expansion enclosure symptom	Suggested action
The SCSI expansion enclosure used to work but does not work now.	1. Verify that: • The cables for all external SCSI options are connected correctly. • The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly. • Any external SCSI option is turned on. You must turn on an external SCSI option before turning on the computer. 2. For more information, see your SCSI expansion enclosure documentation.

Hard disk drive problems

Hard disk drive symptom	Suggested action
Not all drives are recognized by the hard disk drive diagnostic test (Fixed Disk test).	1. Remove the first drive not recognized and try the hard disk drive diagnostic test again. 2. If the remaining drives are recognized, replace the drive you removed with a new one. If the problem remains, call for service.
System stops responding during hard disk drive diagnostic test.	1. Remove the hard disk drive being tested when the computer stopped responding and try the diagnostic test again. 2. If the hard disk drive diagnostic test runs successfully, replace the drive you removed with a new one. If the problem remains, call for service.

General problems

General problem symptom	Suggested action
Problems such as broken cover locks or indicator LEDs not working	Call for service.

Intermittent problems

Intermittent problem symptom	Suggested action
A problem occurs only occasionally and is difficult to detect.	Verify that: • All cables and cords are connected securely to the rear of the computer and attached options. • When the computer is turned on, air is flowing from the rear of the computer at the fan grill. If there is no airflow, the fan is not working. This causes the computer to overheat and shut down. • Ensure that the SCSI bus and devices are configured correctly and that the last external device in each SCSI chain is terminated correctly. If the problem remains, call for service.

Keyboard, mouse, or pointing-device problems

Keyboard, mouse, or pointing-device symptom	Suggested action
All or some keys on the keyboard do not work.	Verify that: • The keyboard cable is securely connected to the system, and the keyboard and mouse cables are not reversed. • Both the computer and the monitor are turned on. • Try using another keyboard. If the problem remains, call for service.
The mouse or pointing device does not work.	Verify that: • The mouse or pointing-device cable is securely connected, and that the keyboard and mouse cables are not reversed. • The mouse device drivers are installed correctly. • Both the computer and the monitor are turned on. • Try using another mouse or pointing device. If the problem remains, call for service.

Memory problems

Memory symptom	Suggested action

The amount of system memory displayed is less than the amount of physical memory installed.	1. Verify that:
	  • The memory modules are seated properly.
	  • You have installed the correct type of memory.
	  • If you changed the memory, you updated the memory configuration with the Configuration/Setup Utility program.
	  • All banks of memory on the DIMMs are enabled. The computer might have automatically disabled a DIMM bank when it detected a problem or a DIMM bank could have been manually disabled.
	2. Check POST error log for error message 289:
	  • If the DIMM was disabled by a system-management interrupt (SMI), replace the DIMM.
	  • If the DIMM was disabled by the user or by POST:
	    a. Start the Configuration/Setup Utility program.
	    b. Enable the DIMM.
	    c. Save the configuration and restart the computer.
	
	If the problem remains, call for service.

Microprocessor problems

Microprocessor symptom	Suggested action
The computer emits a continuous tone during POST. (The startup (boot) microprocessor is not working properly.)	Call for service.

Monitor problems

Monitor symptom	Suggested action
Testing the monitor.	See the information that comes with the monitor for adjusting and testing instructions. (Some IBM monitors have their own self-tests.)

The screen is blank.	Verify that:
	• The computer power cord is plugged into the computer and a working electrical outlet.
	• The monitor cables are connected properly.
	• The monitor is turned on and the Brightness and Contrast controls are adjusted correctly.
	• If the computers are C2T chained together, verify that:
	  – The C2T chain cables are securely connected to the computers.
	  – The C2T breakout cable is connected properly.
	  – A computer that is turned on is selected.
	
	Important: 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 **Boot Fail Count** feature in the Start Options of the Configuration/Setup Utility program is set to **Enabled** (its default setting), you must restart the computer three times to force the system BIOS code to reset the CMOS values to the default configuration (memory connector or bank of connectors enabled).
	
	If the problem remains, call for service.

Monitor symptom	Suggested action
Only the cursor appears.	Call for service.
The monitor works when you turn on the computer but goes blank when you start some application programs.	Verify that: • The application program is not setting a display mode higher than the capability of the monitor. • The primary monitor cable is connected to the video port or C2T device breakout cable. • You installed the necessary device drivers for the applications. If the problem remains, call for service.
The screen is wavy, unreadable, rolling, distorted, or has screen jitter.	If the monitor self-tests show the monitor is working properly, 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. (Moving a color monitor while it is turned on might cause screen discoloration.) Then move the device and the monitor at least 305 mm (12 in.) apart. Turn on the monitor. **Notes:** 1. To prevent diskette drive read/write errors, be sure the distance between monitors and diskette drives is at least 76 mm (3 in.). 2. Non-IBM monitor cables might cause unpredictable problems. 3. An enhanced monitor cable with additional shielding is available for the 9521 and 9527 monitors. For information about the enhanced monitor cable, contact your IBM reseller or IBM marketing representative. If the problem remains, call for service.
Wrong characters appear on the screen.	If the wrong language is displayed, update the BIOS code with the correct language. If the problem remains, call for service.
No video.	1. Make sure the correct machine is selected, if applicable. 2. Make sure all cables are locked down. If the problem remains, call for service.

Option problems

Option symptom	Suggested action

An IBM option that was just installed does not work.	1. Verify that:
	  • The option is designed for the computer (For a list of supported options for your computer, go to http://www.ibm.com/pc/ on the World Wide Web; then, select your country and navigate to the list of options for your computer.).
	  • You followed the installation instructions that came with the option.
	  • The option is installed correctly.
	  • You have not loosened any other installed options or cables.
	  • You updated the configuration information in the Configuration/Setup Utility program. Whenever memory or an option is changed, you must update the configuration.
	2. Replace the option you just installed.
	
	If the problem remains, call for service.

Option symptom	Suggested action

An IBM option that used to work does not work now.	1. Verify that all of the option hardware and cable connections are secure.
	2. If the option comes with its own test instructions, use those instructions to test the option.
	3. If the failing option is a SCSI option, verify that:
	  • The cables for all external SCSI options are connected correctly.
	  • The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly.
	  • Any external SCSI option is turned on. You must turn on an external SCSI option before turning on the computer.
	4. Replace the failing option.
	
	If the problem remains, call for service.

Parallel port problems

Parallel port symptom	Suggested action
A parallel device does not work.	Verify that: 1. The device is compatible with the computer. 2. The parallel port is enabled. If the problem remains, call for service.

Power problems

Power symptom	Suggested action
Power switch does not work and reset button, if supported, does work.	Call for service.
The computer does not turn on.	Verify that: • The power cords are properly connected to the computer. • The electrical outlet functions properly. • The type of memory installed is correct. • If you just installed an option, remove it, and restart the computer. If the computer now turns on, you might have installed more options than the power supply supports. If the problem remains, call for service.
The computer does not turn off.	Verify whether you are using an ACPI or non-ACPI operating system. If you are using a non-ACPI operating system: 1. Press Ctrl+Alt+Delete. 2. Turn off the system by holding the power-control button for 4 seconds. 3. If computer fails during BIOS POST and power-control button does not work, remove the AC power cord. If the problem remains, call for service.

Printer problems

Printer symptom	Suggested action
The printer does not work.	Verify that: 1. The printer is turned on and is online. 2. The printer signal cable is connected to the correct serial or parallel port on the computer. **Note:** Non-IBM printer cables might cause unpredictable results. 3. You have assigned the printer port correctly in your operating computer or application program. 4. You have assigned the printer port correctly using the Configuration/Setup Utility program. 5. You have run the tests described in the documentation that comes with your printer. If the problem remains, call for service.

Serial port problems

Serial port symptom	Suggested action
The number of serial ports identified by the operating system is less than the number of serial ports installed.	Verify that: • Each port is assigned a unique address by the Configuration/Setup Utility program and none of the serial ports is disabled. • The serial-port adapter, if you installed one, is seated properly. If the problem remains, call for service.

A serial device does not work.	1. Verify that:
	  • The device is compatible with the computer.
	  • The serial port is enabled and is assigned a unique address.
	  • The device is connected to the correct port.
	2. Run serial port diagnostics.
	3. Replace the failing serial device.
	
	If the problem remains, call for service.

Software problems

Software problem symptom	Suggested action

Suspected software problem.	1. To determine if problems are caused by the software, verify that:
	  • The computer has the minimum memory needed to use the software. For memory requirements, see the information that comes with the software.
	  Note: If you have just installed an adapter or memory, you might have a memory address conflict.
	  • The software is designed to operate on the computer.
	  • Other software works on the computer.
	  • The software that you are using works on another system.
	
	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.
	2. If you have verified these items and the problem remains, contact your software place of purchase.

Universal Serial Bus (USB) port problems

Universal Serial Bus (USB) port symptom	Suggested action
A USB device does not work.	Verify that: • You are not trying to use a USB device during POST if you have a standard (non-USB) keyboard attached to the keyboard port. **Note:** If a standard (non-USB) keyboard is attached to the keyboard port, the USB is disabled and no USB device will work during POST. • The correct USB device driver is installed. • The operating system supports USB devices. If the problem remains, call for service.

System-board error LEDs

The following illustration shows the location of the LEDs on the system board. You might need to refer to this illustration when solving problems with the computer.
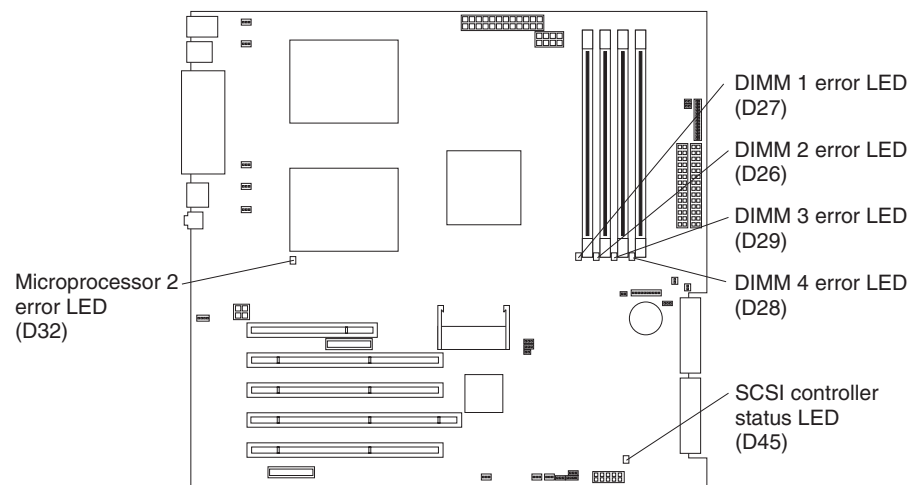
Each error LED turns on to indicate a problem with a specific component. After a problem is corrected, its LED will not turn on the next time the computer is restarted; if the problem remains, the LED will turn on again. For information about how to correct problems indicated by the error LEDs, see the "Diagnostic error message tables" on page 74 and the"Troubleshooting charts" on page 78.

Software error messages

These messages appear if a problem or conflict is detected by the application program, the operating system, or both. Error messages for operating system and other software problems are typically text messages, but they also can be numeric codes. For information about these software error messages, see the information supplied with the operating system and application program.

To determine if problems are caused by the software, verify that:

• Your computer has the minimum memory requirements needed to use the software. For memory requirements, see the information that comes with the software.

  Note: If you have just installed an adapter or memory, you might have a memory address conflict.

• The software is designed to operate on your computer.

- Other software works on your computer.
- The software that you are using works on another computer.

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 solutions to the problem.

If the problem remains, contact your place of purchase.

Troubleshooting the Ethernet controller

See the Ethernet controller documentation on the *Device Drivers and IBM Enhanced Diagnostics* CD for information about problems that might occur with the 1 Gbps Ethernet controller.

Recovering your 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

Your computer has the Product Recovery program on a hidden partition of the hard disk drive. The Product Recovery program reinstalls your operating system and preinstalled software. The Product Recovery program runs independently of the operating system.

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 or the Product Recovery program will be lost.

If your hard disk drive, including the partition where the Product Recovery program resides, becomes damaged or you replace the hard disk drive, contact IBM to order the *IBM Product Recovery* CD to recover your preinstalled operating system, application programs, and device drivers. See Appendix A, "Getting help and technical assistance" on page 93 for details.

Attention: The Product Recovery program will erase all files on drive C only. A *full recovery* will restore the operating system, device drivers, and all original applications that came with the computer from IBM.

Complete the following steps to recover the operating system.

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

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

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

3. Turn on your 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 emergency recovery-repair diskette" on page 87.

4. Quickly press F11, and wait for the program menu.

5. Select the recovery options you want and follow the instructions on the screen.

6. When recovery is complete, exit from the program. Remove the CD from the CD-ROM or DVD-ROM drive, if you have not already done so.

7. Restart the computer.

Recovering or installing device drivers

Device drivers for IBM devices and the instructions to install them (readme.txt) are on the *Device Drivers and IBM Enhanced Diagnostics* CD and in the c:\ibmtools\drivers\ directory. Restoring the factory-preinstalled device drivers is part of the Product Recovery program and the *Device Drivers and IBM Enhanced Diagnostics* CD*.

Notes:

1. Before you can recover or install device drivers, your operating system must be installed on your computer.

2. Before you start recovering or installing device drivers, make sure that you have the documentation and software media for the device.

3. The latest device drivers are also available at http://www.ibm.com/pc/support/ on the World Wide Web.

Using the emergency recovery-repair diskette

In some circumstances, files on your hard disk might become unusable so that the F11 prompt is not displayed when you start up your computer. You can use the recovery-repair diskette to access the Product Recovery program and attempt to restore system function. For instructions about how to create this diskette, see "Creating an emergency recovery-repair diskette" on page 14.

Complete the following steps to access the Product Recovery program on the hard disk:

1. Insert the recovery-repair diskette.

2. Turn off your computer.

3. Turn on your computer, and follow the directions on the screen.

Note: If the repair operation finishes without error, the F11 prompt will be displayed the next time you restart your 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. To obtain a *Product Recovery* CD, contact IBM. See Appendix A, "Getting help and technical assistance" on page 93 for details.

Using an IBM Enhanced Diagnostics diskette

The IBM Enhanced Diagnostics diskette is used to test hardware components on your computer. See "Creating an IBM Enhanced Diagnostics diskette" on page 14 for instructions about how to create an IBM Enhanced Diagnostics diskette.

Note: You can run the diagnostics program directly from the *Device Drivers and IBM Enhanced Diagnostics* CD without making an IBM Enhanced Diagnostics diskette.

Complete the following steps to start the IBM Enhanced Diagnostics diskette:

1. Turn off any attached devices and your computer.
2. Insert the IBM Enhanced Diagnostics diskette into the diskette drive.
3. Turn on all attached devices; then, turn on your computer.
4. Follow the instructions on the screen.

When the tests have been completed, you can view the test log by selecting **Utility** from the top of the screen.

Recovering from a POST/BIOS update failure

If power to your computer is interrupted while POST/BIOS code is being updated (flash update), your computer might not restart (reboot) correctly. If this happens, use the following procedure to recover:

1. Review the safety information beginning on page vii and "Handling static-sensitive devices" on page 28.
2. Turn off the computer and all attached devices.
3. Unplug the power cord.
4. Remove the side cover and support bracket. (See "Removing the side cover" on page 31 and "Removing and installing the support bracket" on page 33.)
5. Locate the boot block recovery jumper (J12) on the system board, removing any adapters that impede access to the jumper. The following illustration shows the location of the jumper on the system board.
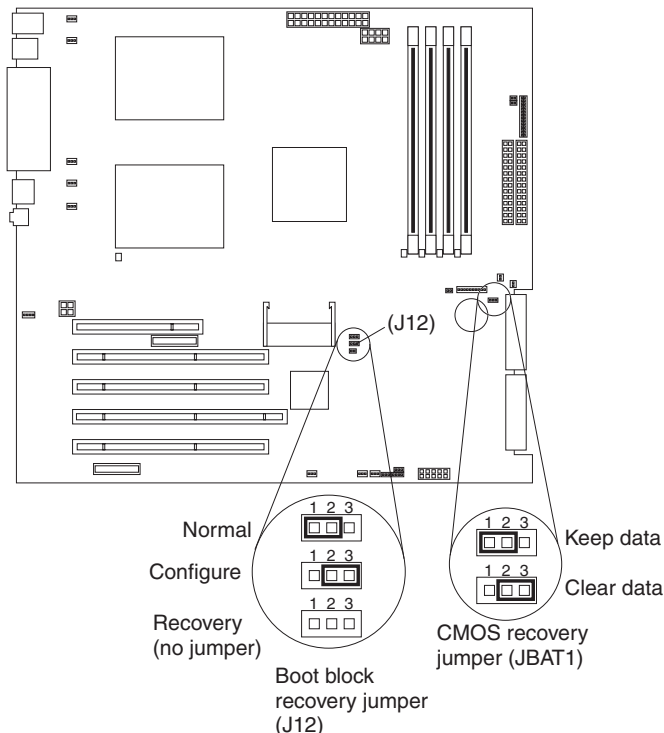
6. Remove the boot block recovery jumper from pins 1 and 2.
7. Replace any adapters that were removed; then, replace the support bracket and replace the side cover. (See "Removing and installing the support bracket" on page 33 and "Replacing the side cover" on page 53.)
8. Connect the computer to a power source, keyboard, monitor, and mouse.

9. Insert the POST/BIOS update (flash) diskette into the diskette drive. You can download a file to create this diskette from http://www.ibm.com/pc/support on the World Wide Web. For more information, see Appendix A, "Getting help and technical assistance" on page 93.

10. Turn on the computer and the monitor.

11. After the update session completes, turn off the computer and monitor.

12. Remove the diskette from the diskette drive.

13. Disconnect all power cords; then, remove the computer cover.

14. Return the boot block recovery jumper to pins 1 and 2.

15. Reinstall the computer cover; then, reconnect all external cables and power cords and turn on the peripheral devices.

16. Turn on the computer to restart the operating system.

Erasing a lost or forgotten password (clearing CMOS)

This section applies to lost or forgotten passwords. For more information about lost or forgotten passwords, see "Using Access IBM" on page 13.

Complete the following steps to set the CMOS recovery jumper and erase a forgotten password:

1. Review the safety information beginning on page vii and "Handling static-sensitive devices" on page 28.

2. Turn off the computer and all attached devices.

3. Unplug the power cord.

4. Remove the side cover and support bracket. (See "Removing the side cover" on page 31 and "Removing and installing the support bracket" on page 33.)

5. Locate the CMOS recovery jumper (JBAT1) on the system board, removing any adapters that impede access to the jumper. The illustration on page 88 shows the location of the jumper on the system board.

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 support bracket and replace the side cover. (See "Removing and installing the support bracket" on page 33 and "Replacing the side cover" on page 53.)

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

9. Connect the computer to a power source, keyboard, monitor, and mouse.

10. Turn on the computer. The Configuration/Setup Utility program starts.

11. Follow the instructions to erase the existing password or create a new password.

12. Select **Save Settings** and press Enter.

Replacing the battery

When replacing the battery, you must replace it with a lithium battery of the same type from the same manufacturer. To avoid possible danger, read and follow the information in "Safety" on page vii.

To order replacement batteries, call 1-800-772-2227 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 reseller or IBM marketing representative.

Note: After you replace the battery, you must reconfigure your computer and reset the system date and time.

Complete the following steps to replace the battery:
1. Review the safety information beginning on page vii, "Installation guidelines" on page 27, and "Handling static-sensitive devices" on page 28.
2. Follow any special handling and installation instructions supplied with the replacement battery.
3. Turn off the computer and all attached devices.
4. Disconnect all power cords; then disconnect all external cables.
5. Remove the side cover and support bracket. (See "Removing the side cover" on page 31 and "Removing and installing the support bracket" on page 33.)
6. Removing any adapters that impede access to the battery.
7. Remove the battery:
   a. Use a fingernail to press the top of the battery clip away from the battery. The battery pops up when released.
   b. Use your thumb and index finger to lift the battery from the socket.
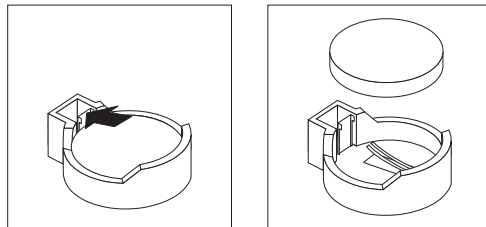
8. Insert the new battery:
   a. Tilt the battery so that you can insert it into the socket on the side opposite the battery clip.
   b. Press the battery down into the socket until it clicks into place. Make sure the battery clip holds the battery securely.
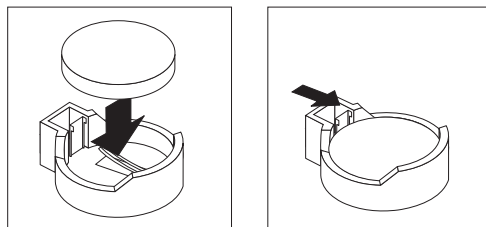
9. Replace any adapters that were removed; then, replace the support bracket and side cover. (See "Removing and installing the support bracket" on page 33 and "Replacing the side cover" on page 53.)

10. Connect all external cables; then, connect the power cords.
11. Turn on the computer.
12. Start the Configuration/Setup Utility program and set configuration parameters.
    - Set the system date and time.
    - Set passwords if necessary.
    - Save the configuration.

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 xSeries™ or IntelliStation system, and whom to call for service, if it is necessary.

Before you call

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

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Go to the IBM Support Web site at http://www.ibm.com/pc/support/ to check for technical information, hints, tips, and new device drivers.
- Use an IBM discussion forum on the IBM Web site to ask questions.

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

Using the documentation

Information about your IBM xSeries or IntelliStation system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation includes printed books, online books, 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/pc/support/ and follow the instructions. Also, you can order publications through the IBM Publications Ordering System at http://www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi.

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 xSeries and IntelliStation products, services, and support. The address for IBM xSeries information is http://www.ibm.com/eserver/xseries/. The address for IBM IntelliStation information is http://www.ibm.com/pc/intellistation/.

You can find service information for your IBM products, including supported options, at http://www.ibm.com/pc/support/. If you click **Profile** from the support page, you can create a customized support page. The support page has many sources of information and ways for you to solve problems, including:

- Diagnosing problems, using the IBM Online Assistant
- Downloading the latest device drivers and updates for your products
- Viewing Frequently Asked Questions (FAQ)
- Viewing hints and tips to help you solve problems
- Participating in IBM discussion forums
- Setting up e-mail notification of technical updates about your products

Software service and support

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

For more information about Support Line and other IBM services, go to http://www.ibm.com/services/, or go to http://www.ibm.com/planetwide/ for support telephone numbers.

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to http://www.ibm.com/planetwide/ for support telephone numbers.

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. Warranty information

This section contains information about your warranty period and the service and support that are provided by your warranty.

Warranty period

The warranty period varies by machine type and country or region.

Contact your place of purchase for warranty service information. Some IBM Machines are eligible for on-site warranty service depending on the country or region where service is performed.

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician.

This paragraph applies only to products with a warranty period of 3 years on parts and 1 year on labor. A warranty period of 3 years on parts and 1 year on labor means that IBM will provide warranty service without charge for:
1. parts and labor during the first year of the warranty period
2. parts only, on an exchange basis, in the second and third years of the warranty period. IBM will charge you for any labor it provides in performance of the repair or replacement.

The IBM Machine Warranties Web site at http://www.ibm.com/servers/support/machine_warranties/ contains a worldwide overview of the IBM Statement of Limited Warranty for IBM Machines, a glossary of terms used in the Statement of Limited Warranty, Frequently Asked Questions (FAQ), and links to Product Support Web pages. The IBM Statement of Limited Warranty is available from this Web site in 29 languages in Portable Document Format (PDF).

Machine - IBM IntelliStation Z Pro Type 6221

Country or region	Warranty period	Service delivery method
Worldwide	Parts - 3 years, labor - 3 years	On-site

Problem determination

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician. The service specialist will run diagnostic tests on the hardware and check the software.

Running diagnostics

The IBM service specialist will help you determine whether your equipment is functioning as specified. It might be necessary to isolate the failing xSeries, Netfinity®, or IntelliStation system; IBM component; or both from any active production environment to run diagnostics and perform defect-isolation programs. You are responsible for making the system, IBM component, or both available for running diagnostics and defect-isolation programs.

Checking software

The IBM service specialist will help you ensure that the correct BIOS code, firmware, device drivers, and other supporting IBM software are installed and

correctly configured. It might be necessary to manually gather information about the relevant software levels or run IBM-approved utility programs to gather this information. It might be necessary to isolate the failing system from any active production environment to gather this information. You are responsible, with assistance from the service specialist, for gathering this information. The IBM Statement of Limited Warranty does not include on-site assistance with this activity.

Warranty service and support

With the original purchase of an IBM xSeries or IntelliStation system, you have access to extensive service and support. During the IBM Machine warranty period, you may call IBM or your reseller for problem-determination assistance under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:
- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service, either on-site or at an IBM service center as determined by IBM.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been shipped from IBM. In those instances, IBM will make Engineering Changes (ECs) available that apply to your hardware.
- **Customer replaceable units (CRUs)** - Some parts of IBM xSeries and IntelliStation systems are designated as customer replaceable units. IBM ships CRUs to you for replacement by you. CRUs include keyboards, monitors, memory, diskette drives, hard disk drives, and mice (this list is not inclusive of all CRUs).

The following items are not covered under warranty service:
- Replacement or use of non-IBM parts. All IBM parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Installation of customer replaceable units (CRUs).
- Installation and configuration of BIOS code, firmware, or device drivers that are designated as customer installable.

See the IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

Please have the following information ready when you call:
- The machine type and model of your IBM hardware product (if available)
- Serial numbers of your IBM hardware products
- A description of the problem
- The exact wording of any error messages
- Hardware and software configuration information

International Warranty Service

If you travel with your xSeries or IntelliStation system or relocate it to a country or region where your system is sold and serviced by IBM or IBM resellers authorized

to perform warranty service, International Warranty Service (IWS) is available during the warranty period. Eligible IBM systems are identified by their four-digit machine types.

You can obtain IWS through the service delivery method (such as depot, carry-in, or on-site) provided in the servicing country or region. Service methods and procedures vary by country or region, and some service or parts might not be available in all countries and regions. Service centers in certain countries or regions might not be able to service all models of a particular machine type. In addition, some countries or regions might have fees and restrictions that apply at the time of service.

To determine whether your system is eligible for IWS, go to http://www.ibm.com/pc/support/ and click **Warranty lookup**.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these services, contact your IBM marketing representative.

IBM Statement of Limited Warranty Z125-4753-06 8/2000

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. The terms of Part 2 replace or modify those of Part 1. The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.

The IBM Warranty for Machines: IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications ("Specifications"). The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded.

Extent of Warranty: The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty: IBM does not warrant uninterrupted or error-free operation of a Machine. Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service: To obtain warranty service for a Machine, contact IBM or your reseller. If you do not register your Machine with IBM, you may be required to present proof of purchase.

During the warranty period, IBM or your reseller, if approved by IBM to provide warranty service, provides without charge certain types of repair and exchange service to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. At its discretion, IBM or your reseller will 1) either repair or exchange the failing Machine and 2) provide the service either at your location or a service center. IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Some parts of IBM Machines are designated as Customer Replaceable Units (called "CRUs"), e.g., keyboards, memory, or hard disk drives. IBM ships CRUs to you for replacement by you. You must return all defective CRUs to IBM within 30 days of your receipt of the replacement CRU. You are responsible for downloading designated Machine Code and Licensed Internal Code updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to
1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided:
    a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides;
    b. secure all programs, data, and funds contained in a Machine;
    c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations; and
    d. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Limitation of Liability: Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other

contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and

2. the amount of any other actual direct damages, up to the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

   This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST SAVINGS, EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Governing Law: Both you and IBM consent to the application of the laws of the country in which you acquired the Machine to govern, interpret, and enforce all of your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Part 2 - Country-unique Terms

AMERICAS

BRAZIL

Governing Law: *The following is added after the first sentence:*Any litigation arising from this Agreement will be settled exclusively by the court of Rio de Janeiro.

NORTH AMERICA

Warranty Service: *The following is added to this Section:* To obtain warranty service from IBM in Canada or the United States, call 1-800-IBM-SERV (426-7378).

CANADA

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws in the Province of Ontario.

UNITED STATES

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of the State of New York.

ASIA PACIFIC

AUSTRALIA

The IBM Warranty for Machines: *The following paragraph is added to this Section:* The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other similar legislation and are only limited to the extent permitted by the applicable legislation.

Limitation of Liability: *The following is added to this Section:* Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974 or other similar legislation, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of the State or Territory.

CAMBODIA, LAOS, AND VIETNAM

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*laws of the State of New York.

The following is added to this Section: Disputes and differences arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Singapore in accordance with the rules of the International Chamber of Commerce (ICC). The arbitrator or arbitrators designated in conformity with those rules shall have the power to rule on their own competence and on the validity of the Agreement to submit to arbitration. The arbitration award shall be final and binding for the parties without appeal and the arbitral award shall be in writing and set forth the findings of fact and the conclusions of law.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator.

The two arbitrators appointed by the parties shall appoint a third arbitrator before proceeding upon the reference. The third arbitrator shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the ICC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

The English language version of this Agreement prevails over any other language version.

HONG KONG AND MACAU

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of Hong Kong Special Administrative Region.

INDIA

Limitation of Liability: *The following replaces items 1 and 2 of this Section:*

1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Limited Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

JAPAN

Governing Law: *The following sentence is added to this Section:*Any doubts concerning this Agreement will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

NEW ZEALAND

The IBM Warranty for Machines: *The following paragraph is added to this Section:* The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: *The following is added to this Section:* Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

PEOPLE'S REPUBLIC OF CHINA (PRC)

Governing Law: *The following replaces this Section:* Both you and IBM consent to the application of the laws of the State of New York (except when local law requires otherwise) to govern, interpret, and enforce all your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Any disputes arising from or in connection with this Agreement will first be resolved by friendly negotiations, failing which either of us has the right to submit the dispute to the China International Economic and Trade Arbitration Commission in Beijing, the PRC, for arbitration in accordance with its arbitration rules in force at the time. The arbitration tribunal will consist of three arbitrators. The language to be used therein will be English and Chinese. An arbitral award will be final and binding on all the parties, and will be enforceable under the Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958).

The arbitration fee will be borne by the losing party unless otherwise determined by the arbitral award.

During the course of arbitration, this Agreement will continue to be performed except for the part which the parties are disputing and which is undergoing arbitration.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES: The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

Warranty Service: If you purchase an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM. If you purchase an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchase an IBM Machine in a Middle Eastern or African country, you may obtain warranty service for that Machine from the IBM entity within the country of purchase, if that IBM entity provides warranty service in that country, or from an IBM reseller, approved by IBM to perform warranty service on that Machine in that country. Warranty service in Africa is available within 50 kilometers of an IBM authorized service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM authorized service provider.

Governing Law: The applicable laws that govern, interpret and enforce rights, duties, and obligations of each of us arising from, or relating in any manner to, the subject matter of this Statement, without regard to conflict of laws principles, as well as Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided, except that in 1) Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Hungary, Former Yugoslav Republic of Macedonia, Romania, Slovakia, Slovenia, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, the laws of Austria apply; 2) Estonia, Latvia, and Lithuania, the laws of Finland apply; 3) Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Djibouti, Democratic Republic of Congo, Equatorial Guinea, France, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Mali, Mauritania, Morocco, Niger, Senegal, Togo, and Tunisia, this Agreement will be construed and the legal relations between the parties will be determined in accordance with the French laws and all disputes arising out of this Agreement or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 4) Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe, this Agreement will be governed by English Law and disputes relating to it will be submitted to the exclusive jurisdiction of the English courts; and 5) in Greece, Israel, Italy, Portugal, and Spain any legal claim arising out of this Statement will be brought before, and finally settled by, the competent court of Athens, Tel Aviv, Milan, Lisbon, and Madrid, respectively.

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA AND GERMANY

The IBM Warranty for Machines: *The following replaces the first sentence of the first paragraph of this Section:* The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this Section:

The minimum warranty period for Machines is six months. In case IBM or your reseller is unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: *The second paragraph does not apply.*

Warranty Service: *The following is added to this Section:* During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Limitation of Liability: *The following paragraph is added to this Section:* The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

The following sentence is added to the end of item 2: IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

EGYPT

Limitation of Liability: *The following replaces item 2 in this Section:* as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

Applicability of suppliers and resellers (unchanged).

FRANCE

Limitation of Liability: *The following replaces the second sentence of the first paragraph of this Section:*In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: *(items 1 and 2 unchanged).*

IRELAND

Extent of Warranty: *The following is added to this Section:* Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: *The following replaces items one and two of the first paragraph of this Section:*1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and 2. the amount of any other actual direct damages, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section: IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY

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

CD-ROM 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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Industry Canada Class A emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

Australia and New Zealand Class A statement

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

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

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

Taiwanese Class A warning statement

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這是甲類的資訊產品,在
居住的環境中使用時,可
能會造成射頻干擾,在這
種情況下,使用者會被要
求採取某些適當的對策。

Japanese Voluntary Control Council for Interference (VCCI) statement

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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
13F9940	Argentina, Australia, China (PRC), New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa
13F9979	Afghanistan, Algeria, Andorra, Angola, Austria, Belgium, Benin, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Rep., Chad, China (Macau S.A.R.), Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Senegal, Slovakia, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, former USSR, Vietnam, former Yugoslavia, Zaire, Zimbabwe
13F9997	Denmark
14F0015	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka

IBM power cord part number	Used in these countries and regions
14F0033	Antigua, Bahrain, Brunei, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Dubai, Fiji, Ghana, India, Iraq, Ireland, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Kingdom, Yemen, Zambia
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Ethiopia, Italy, Libya, Somalia
14F0087	Israel
1838574	Thailand
6952301	Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea (South), Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Suriname, Taiwan, Trinidad (West Indies), United States of America, Venezuela

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