



PC Server 315

User's Reference

Note

Before using this information and the product it supports, be sure to read the general information under Appendix, "Product Warranties and Notices" on page 89.

First Edition (April 1997)

The following paragraph does not apply to the United Kingdom or any country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This publication could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time.

This publication was developed for products and services offered in the United States of America. IBM may not offer the products, services, or features discussed in this document in other countries, and the information is subject to change without notice. Consult your local IBM representative for information on the products, services, and features available in your area.

Requests for technical information about IBM products should be made to your IBM reseller or IBM marketing representative.

© Copyright International Business Machines Corporation 1997. All rights reserved.

Note to U.S. Government Users — Documentation related to restricted rights — Use, duplication or disclosure is subject to restrictions set forth in GSA ADP Schedule Contract with IBM Corp.

Contents

About This Book	vii
How This Book is Organized	vii
Related Publications	ix
Ordering Publications	ix
Chapter 1. Introducing Your PC Server 315	1
Features at a Glance	2
What Your PC Server 315 Offers	3
Controls and Status Indicators	4
Expansion Bays	6
Expansion Slots	8
Input/Output Ports and Connectors	10
Plug and Play Adapters	12
International Capabilities	12
Reliability, Availability, and Serviceability	13
Operating System Support	13
Specifications	14
Chapter 2. Server Performance	15
Understanding Server Performance	16
Network Operating System	16
Application Programs	17
Network Adapter	17
System Memory	18
System Microprocessor	18
The Hard Disk Subsystem	18
Estimating Server Performance and Capacity	19
Improving Server Performance	20
Chapter 3. Microprocessors and Memory	21
Microprocessor	21
Microprocessor Clock	21
Microprocessor Performance	22
Microprocessor Registers and Interfaces	23
Real Mode and Protected Mode Operation	23
Numeric Computing	24
Memory Subsystem	25
Memory Controller	25
Random Access Memory and Read-Only Memory	26
Physical Memory	27

Virtual Memory	27
Cache Memory	28
Chapter 4. Bus Architecture	31
ISA Bus Overview	32
PCI Bus Overview	32
Interface	33
Performance	33
Peripheral Devices	33
Expansion Bus Features	34
Adapter Configuration	36
Chapter 5. Data Storage Devices	37
Direct Access Storage Devices	37
Diskette Drives	37
SCSI Hard Disk Drives	37
SCSI CD-ROM Drive	38
Tape Drives	38
IBM External SCSI Storage Enclosures	39
Chapter 6. The SCSI Subsystem	41
Advantages of the SCSI Subsystem	41
Types of Interfaces	43
Device-Level Interfaces	43
Bus-Level Interfaces	43
Physical Configuration	44
Device IDs	45
Logical Unit IDs	46
Cabling	46
Termination	47
Chapter 7. Configuration	49
Power-On Self-Test	49
Configuration Programs	50
Configuration/Setup Utility Program	51
SCSISelect Utility Program	52
Ethernet Configuration Diskettes	53
Configuration Process	53
Configuring SCSI Devices	53
Adapter Configuration	54

Chapter 8. Input/Output Ports and Connectors	57
Infrared Port	58
Keyboard and Mouse (Auxiliary-Device) Ports	59
Serial Ports	59
Universal Serial Bus Ports	62
Parallel Port	63
Parallel Port Assignments	64
Parallel Port Modes	65
Video Monitor Adapter Port	67
SCSI Adapter Ports	68
Ethernet Adapter Port	70
Chapter 9. Video Subsystem	71
How Monitors Operate	72
Resolution and Dot Pitch	72
Vertical-Refresh Rate	73
Selecting a Monitor	74
Using Your Monitor	75
Brightness and Contrast Controls	75
Screen-Saver Programs	75
Avoiding Fatigue	76
Chapter 10. Security Features	77
Hardware Security Features	77
Door Lock and Keys	77
U-Bolt Facility	78
Software Security Features	79
Power-On Password	79
Administrator Password	79
Keyboard Password	81
Selectable Drive-Startup Sequence	81
Securing Data	82
Protecting Data from Loss	83
Viruses	85
Backup Power Supply	87
Appendix. Product Warranties and Notices	89
Warranties	89
Notices	92
Trademarks	93

Important Notes	93
Electronic Emission Notices	95
Power Cords	96
Glossary	99
Index	115

About This Book

This *PC Server 315 User's Reference* provides an overview of the technologies and features that make up your server. It is intended for anyone who has an interest in learning more about the IBM PC Server 315.

This reference does not provide specific instructions for performing procedures. That information is on your *Setup and Installation* sheet and in your *PC Server 315 User's Handbook*.

How This Book is Organized

Chapter 1, "Introducing Your PC Server 315," contains an overview of the features and expansion capabilities of your server. This chapter also includes the PC Server 315 specifications.

Chapter 2, "Server Performance," contains information about server performance, the advantages of using a LAN, and tuning your server for optimal performance in your environment.

Chapter 3, "Microprocessors and Memory," contains general information about the microprocessors and types of memory in the PC Server 315 models.

Chapter 4, "Bus Architecture," describes the PC Server 315 and its usage of industry standard architecture (ISA) and peripheral component interconnect (PCI) architecture.

Chapter 5, "Data Storage Devices," explains PC Server 315 data storage capabilities and includes general information about the types of storage devices that you can install, such as diskette drives, hard disk drives, CD-ROM drives, and tape drives.

Chapter 6, “The SCSI Subsystem,” describes the SCSI (small computer system interface) subsystem that your server uses to communicate with SCSI devices such as hard disk drives, read-and-write optical drives, CD-ROM drives, tape drives, scanners, and printers.

Chapter 7, “Configuration,” contains information about the configuration process. It also contains a description of the configuration programs provided with your PC Server 315.

Chapter 8, “Input/Output Ports and Connectors,” contains information about ports and connectors on the PC Server 315 models, including the infrared, keyboard, mouse, serial, universal serial bus (USB), and parallel ports, and ports for the SVGA and SCSI adapters. Pin assignments for the I/O connectors are provided to help you determine if a device is compatible with your server.

Chapter 9, “Video Subsystem,” contains information about the super video graphics array (SVGA) controller and video device drivers. This chapter also includes detailed information about some of the monitors that you can attach to your server.

Chapter 10, “Security Features,” describes how to secure the server hardware and network data stored on the server, and describes the selectable drive-startup feature.

Appendix, “Product Warranties and Notices,” contains your product warranty and special notices, such as a list of trademarks used in this book.

If you find a term you're not familiar with, refer to the glossary located in the back of this book. An index follows the glossary.

Related Publications

In addition to this *PC Server 315 User's Reference*, the following publications come with your PC Server 315:

- The *Setup and Installation* sheet contains the instructions for installing your server.
- The *PC Server 315 User's Handbook* contains instructions for installing optional hardware, installing operating systems, and configuring your server. This book also describes how to troubleshoot the server and how to obtain service and technical assistance.
- The *PC Server Service and Support* pamphlet contains important information and phone numbers to call for different types of support for your PC Server.

The *IBM PC Server Hardware Maintenance Manual Supplement* is available for purchase. It contains error codes, advanced diagnostic procedures, and a parts catalog for PC Servers. This manual is intended for trained service technicians. Diagnostic diskettes are not included.

Ordering Publications

Additional publications are available for purchase from IBM. For a list of publications available in your country:

- In the U.S., Canada, and Puerto Rico, call 1-800-879-2755.
- In other countries, contact your IBM reseller or IBM marketing representative.

Chapter 1. Introducing Your PC Server 315

The PC Server 315 is designed to meet your needs today and provide expansion capabilities for the future. Your system is a high-performance server; microprocessor performance, memory, system expansion, flexibility, and large amounts of data storage are high priorities. Your PC Server 315 is designed for ease of use and reliability.

Your server is built around a powerful Intel® Pentium® Pro microprocessor. You can upgrade the microprocessor as faster models become available. Your server also supports advanced 32-bit operating systems, such as the IBM OS/2 operating system and Microsoft Windows NT.

As always, your PC Server 315 meets stringent worldwide certifications for power, EMC (electromagnetic compatibility), and safety.



Features at a Glance

<p>Microprocessor</p> <ul style="list-style-type: none"> • Intel Pentium Pro with: <p>Cache Memory</p> <ul style="list-style-type: none"> – Level-1 cache, 16 KB – Level-2 cache, 256 KB <p>Memory</p> <ul style="list-style-type: none"> • 32 MB minimum, expandable to 512 MB • 60 ns, EDO ECC • Four DIMM sockets <p>Diskette Drives</p> <ul style="list-style-type: none"> • Standard: 3.5-inch, 1.44 MB • Optional (internal): 3.5-inch, 1.44 MB <p>Hard Disk Drives</p> <ul style="list-style-type: none"> • Supports up to four internal hard disk drives • Number and capacities of drives vary by model <p>CD-ROM Drive</p> <ul style="list-style-type: none"> • Standard: SCSI <p>Keyboard and Mouse (Auxiliary-Device)</p> <ul style="list-style-type: none"> • IBM keyboard • Mouse 	<p>Expansion Bays</p> <ul style="list-style-type: none"> • One 3.5-inch diskette drive bay • One 5.25-inch CD-ROM drive bay • One 3.5-inch or 5.25-inch drive bay • Three 3.5-inch drive bays <p>Expansion Slots</p> <ul style="list-style-type: none"> • Four 32-bit PCI bus slots • Two 16-bit ISA bus slots • One shared PCI/ISA bus slot • The number of slots available for expansion varies by model <p>Video</p> <ul style="list-style-type: none"> • Super video graphics array (SVGA) PCI adapter • 1 MB VRAM, expandable to 2 MB • Compatibility: <ul style="list-style-type: none"> – Color graphics adapter (CGA) – Video graphics array (VGA) <p>Security Features</p> <ul style="list-style-type: none"> • Bolt-down capability • Door lock • Selectable drive-startup • Power-on and administrator passwords <p>Upgradable POST and BIOS</p> <ul style="list-style-type: none"> • Upgradable EEPROM on the system board • POST/BIOS upgrades (when available) 	<p>Input/Output Connectors</p> <ul style="list-style-type: none"> • One infrared port • One keyboard port • One mouse (auxiliary-device) port • Two serial ports • One universal serial bus (USB) port • One parallel port • One SVGA PCI adapter • One UltraSCSI adapter <ul style="list-style-type: none"> – One 8-bit internal port – One 16-bit internal port – One 16-bit external port • One Ethernet adapter 100BASE-TX (100/10 Mbps) installed on some models <p>Power Supply</p> <ul style="list-style-type: none"> • 250 Watts with switch (115–230 V ac) • Built-in overload and surge protection
---	---	---

What Your PC Server 315 Offers

The PC Server 315 offers impressive performance using the Pentium Pro microprocessor. Your server also provides large data-storage capabilities, enhanced system expandability, and super video graphics array (SVGA) capabilities. Ethernet networking is installed on some models. This system design provides a powerful, cost-effective server.

The PC Server 315 takes advantage of advancements in microprocessor speed, memory capacity, application programs, communication devices, and operating environments. It offers innovative, multiple-bus architecture. This bus architecture defines the size, physical arrangement, and logical relationships of the expansion slots.

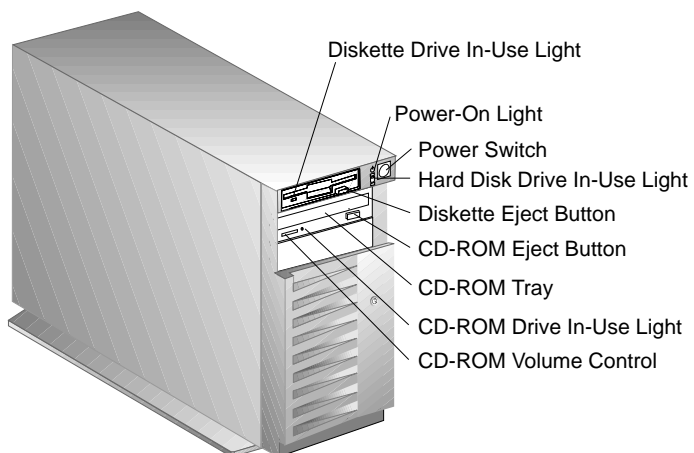
The four dedicated PCI and two dedicated ISA slots, and the one shared PCI/ISA slot are provided by a riser card connected to the ISA and PCI buses on the system board. You can use the shared PCI/ISA expansion slot to install a PCI adapter or an ISA adapter in the expansion slot, but not in both.

All models have a SVGA adapter and a SCSI adapter installed in two of the PCI expansion slots; some models also have an Ethernet adapter installed in one of the PCI slots.

The PCI bus architecture provides a high-performance local bus that supports high-throughput requirements, such as video adapters and mass storage adapters. The ISA bus offers a popular PC bus architecture, supported by thousands of adapters and applications.

Controls and Status Indicators

The following illustration shows the locations of the most commonly used controls and status indicators.



Diskette-Drive In-Use Light: This lights when the drive is accessing a diskette.

Power-On Light: This lights when you turn on your server.

Power Switch: Press this switch to turn on or turn off your server. Do not turn off your server if any of the drive in-use lights are on. This might damage the information stored on a hard disk or diskette.

Hard Disk Drive In-Use Light: This lights when your server is accessing a SCSI device.

Diskette Eject Button: Push this button to release a diskette from the drive.

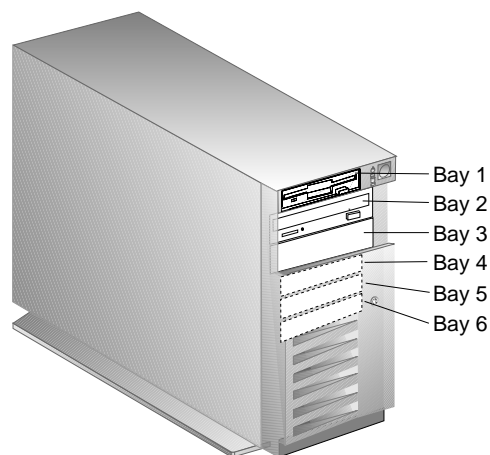
CD-ROM Eject Button: Push this button to release a CD-ROM from the drive.

CD-ROM Drive In-Use Light: This light is on whenever the CD-ROM drive is accessed.

CD-ROM Volume Control: Turn this knob to adjust the CD-ROM volume. You can turn this knob to increase or decrease the volume when you have an audio CD in the CD-ROM drive, and you have headphones or speakers plugged into the jacks on the CD-ROM drive.

Expansion Bays

The following illustration shows the locations of the expansion bays. Your server comes with a 3.5-inch, 1.44-MB diskette drive (installed in Bay 1) and a CD-ROM drive (installed in Bay 2). The number and capacities of hard disk drives that come with your server vary by model.



Diskette Drive: All models come with a 3.5-inch, 1.44 MB diskette drive in expansion bay 1 that uses 1 MB (unformatted) and 2 MB (unformatted) diskettes. For optimum use, format 1 MB diskettes to store 720 KB of data and 2 MB diskettes to store 1.44 MB of data.

CD-ROM Drive: All models come with a CD-ROM drive in expansion bay 2.

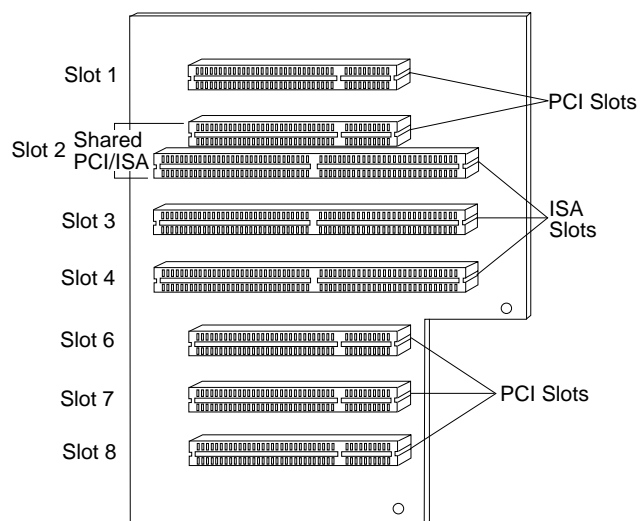
Open Bays: The open bays provide the flexibility to use combinations of 3.5-inch or 5.25-inch diskette, hard disk, tape, and rewritable optical drives in your server. For installation instructions and information about the types of drives that you can install in each bay, see your *PC Server 315 User's Handbook*.

Hard Disk Drive: The number of preinstalled drives and their capacities vary by model.

Note: See Chapter 5, "Data Storage Devices" on page 37, for more information about data storage devices you can install in your server. For the latest information about available options, contact your IBM marketing representative or your IBM reseller.

Expansion Slots

The following illustration shows the riser card that comes in the PC Server 315.



Note: Slot 5 is not available.

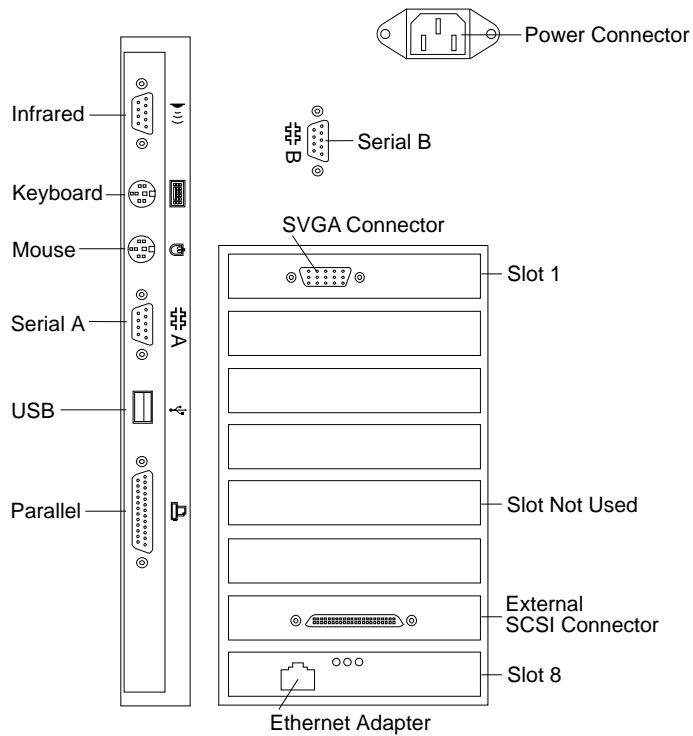
The riser card contains two industry standard architecture (ISA) expansion slots, four peripheral component interconnect (PCI) expansion slots, and one *shared expansion slot*. You can install either a PCI or an ISA adapter in the shared expansion slot, but not both.

A SVGA adapter is installed in one of the PCI expansion slots, a SCSI adapter is installed in a second PCI expansion slot, and an Ethernet adapter might be installed in one of the other PCI slots. You can add adapters to provide communications, specialized graphics, and sound using the remaining expansion slots.

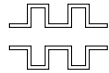
Input/Output Ports and Connectors

The following illustration shows the location and type of input/output ports (connectors) on your PC Server 315.

For pin assignments and other information about these connectors, see Chapter 8, “Input/Output Ports and Connectors” on page 57.



Power Connector: The server power cable attaches here.



Serial Connectors: The server has two 9-pin, universal asynchronous receiver/transmitter (UART) serial connectors (A and B). Serial signal cables for modems or other serial devices attach here. To attach 25-pin signal cables, you must use a 9-pin-to-25-pin adapter cable. For information about displaying and changing port assignments, see the *PC Server 315 User's Handbook*.

SVGA Connector: The monitor signal cable attaches here. You can install other graphics adapters in your server. If your server has an adapter other than the one shown here, refer to the instructions that come with your adapter or monitor.

SCSI Connector: External SCSI devices attach here.

Ethernet Connector: The external connector for the Ethernet network attaches here.



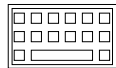
Parallel Connector: The server has one 25-pin parallel port. The signal cable for a parallel device, such as a printer, attaches here.



Universal Serial Bus (USB) Connector: You can use a 4-pin USB cable to attach I/O devices to the USB connector.



Mouse (Auxiliary-Device) Connector: The mouse (auxiliary-device) cable attaches here.



Keyboard Connector: The keyboard cable attaches here.



Infrared Connector: An optional infrared (IR) transceiver module can attach here.

Plug and Play Adapters

Plug and Play is a technology designed to make PCI/ISA servers more convenient to expand and operate. Your server automatically recognizes PCI and ISA Plug and Play adapters and configures the server accordingly. Your server automatically assigns system resources, such as memory and interrupt levels.

International Capabilities

The PC Server 315 is suitable for use worldwide. Electric power can vary from country to country; however, a switch enables you to set the PC Server 315 voltage to the standard power available in your country. See your *Setup and Installation* sheet for information about switching voltages.

Language is another factor to consider. You can use your system with editions of operating systems that enable the system and keyboard to operate in other languages. With the appropriate adapter, those same operating systems also enable the display of some *ideographic characters* on your monitor. Now you can use one system to communicate in many languages.



Reliability, Availability, and Serviceability

Three of the most important factors in server design are reliability, availability, and serviceability (RAS). These factors help to ensure:

- The integrity of the data stored on your server
- That your server is available when you want to use it
- That, should a failure occur, you can easily diagnose and repair the failure with minimal inconvenience

The following is a list of some of the RAS features of your PC Server 315. Many of these features are described in later chapters of this book, or in your *PC Server 315 User's Handbook*.

- Menu-driven configuration programs
- Power-on self-test (POST) and Fast POST
- 24-hour customer support center¹
- Menu-driven diagnostic programs
- Error codes and messages
- Upgradable POST and BIOS
- EDO ECC memory
- Parity checking on the:
 - SCSI bus
 - Keyboard interface
 - Serial ports

Operating System Support

You can use the PC Server 315 in a variety of environments to do many different tasks. To meet the requirements of these environments, your server supports several operating systems. Some operating systems, such as OS/2 2.1 or later, support more than 16 MB of memory. For more information, refer to your operating-system documentation or contact your IBM marketing representative or your IBM reseller.

¹ Response time may vary, depending on the number and nature of the calls received.

Specifications

<p>Size</p> <ul style="list-style-type: none"> • With pedestal: <ul style="list-style-type: none"> - Depth: 455 mm (17.9 in.) - Height: 450 mm (17.7 in.) - Width: 260 mm (10.2 in.) • Without pedestal: <ul style="list-style-type: none"> - Depth: 455 mm (17.9 in.) - Height: 420 mm (16.5 in.) - Width: 155 mm (6.1 in.) <p>Weight</p> <ul style="list-style-type: none"> • Typical configuration as shipped: 14.2 kg (31.2 lb) <p>Heat Output</p> <ul style="list-style-type: none"> • Approximate heat output in British thermal units (Btu) per hour: <ul style="list-style-type: none"> - Minimum configuration: 150 Btu (44 watts) - Maximum configuration: 1434 Btu (420 watts) 	<p>Environment</p> <ul style="list-style-type: none"> • Air temperature: <ul style="list-style-type: none"> - System on: 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft) - System on: 10° to 32° C (50° to 90° F) Altitude: 914 m to 2133 m (3000 ft to 7000 ft) - System off: 10° to 43° C (50° to 110° F) Maximum Altitude: 2133 m (7000 ft) • Humidity: <ul style="list-style-type: none"> - System on: 8% to 80% - System off: 8% to 80% • Maximum altitude: 2133 m (7000 ft) 	<p>Electrical Input</p> <ul style="list-style-type: none"> • Sine-wave input (50 to 60 Hz) is required • Input voltage: <ul style="list-style-type: none"> - Low range: <ul style="list-style-type: none"> - Minimum: 90 V ac - Maximum: 137 V ac - High range: <ul style="list-style-type: none"> - Minimum: 180 V ac - Maximum: 265 V ac - Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> - Minimum configuration as shipped: 0.08 kVA - Maximum configuration: 0.52 kVA <p>Total Power Available for Drives</p> <ul style="list-style-type: none"> • Nominal Operating Current allowed: <ul style="list-style-type: none"> - +5 V dc line: 9.3 A - +12 V dc line: 6.0 A
---	--	---

Chapter 2. Server Performance

Your productivity and satisfaction, as well as that of everyone on your network, depend upon server performance. Several factors influence the performance of your server, such as the configuration of the server hardware, application workloads, server operating-system configuration parameters, and the server operating environment.

This chapter provides information to help you avoid potential performance bottlenecks and includes suggestions for improving server performance.

One of the main capabilities of a local area network (LAN) is sharing of resources, such as data and expensive peripheral devices. The ability to share resources can mean a decrease in the cost of an individual workstation, because every workstation might not need its own software, printer, or hard disk. Also, sharing resources can improve work flow, work quality, and productivity.

Some reasons for this are:

- Centralized databases are easily shared.
- Security of information is more easily ensured.
- Using electronic mail, you can send meeting notices, notes, messages, letters, and text files to multiple users simultaneously.

Understanding Server Performance

You can optimize the performance of your server by balancing the performance of its main components. These components include the:

- Network operating system
- Application programs
- Network adapter
- System memory
- System microprocessor
- Hard disk subsystem (SCSI adapter and drives)

Network Operating System

Always check the documentation that comes with the network operating system to determine which parameters affect performance and which, if any, parameters you can change to increase performance. If you have a large network or increase the size of a network, you will probably need to adjust some settings to achieve optimum performance.

It is good practice to record the original settings before making any changes. If performance decreases, you can return the settings to their original values. It is also good practice to document a change by adding remarks, such as the date and the reason for the change, above or below the values that you change. If you need to make additional changes, such information can save you valuable time.

Application Programs

To improve performance in a network environment, you can use complex programs that let you change specific parameters. To determine which parameters you can change, and when to change them, use the instructions that come with your program.

For the reasons mentioned in “Network Operating System” on page 16, it is good practice to record the original settings before you make any changes. If possible, document your changes by adding remarks near the values that you change.

Network Adapter

Some models of the PC Server 315 come with a full-duplex Ethernet adapter. This bus-master adapter can be run at selectable speeds. Bus-master network adapters provide higher throughput rates because they handle most of the network processing and leave the system microprocessor free for other tasks.

Adding a faster network adapter provides additional throughput. Therefore, the total number of transactions that the server processes per second increases and the application response time decreases. However, as you add more users, the effects of the faster network adapter are offset by the increase in data space access and write-data processing.

IBM and other companies offer baseband, broadband, token-ring, and Ethernet adapters for peripheral component interconnect (PCI) and industry standard architecture (ISA) systems.

For a current list of the network adapters that are available for your model, contact your IBM marketing representative or your IBM reseller.

System Memory

When you have a large network or you increase the size of a small network, you might need to install additional memory to maintain adequate performance. Additional memory might be needed to support additional application programs, buffers, or control blocks.

System Microprocessor

You can optimize performance of your server by installing a faster microprocessor than the one shipped with the server. The Pentium Pro microprocessor in your server has an integrated cache controller, a level-1 cache of 16 KB, a level-2 cache of 256 KB, and an advanced programmable interrupt controller (APIC).

Integrating the cache controller, level-2 cache, and APIC into the Pentium Pro microprocessor improves performance and alleviates some of the performance bottlenecks experienced with earlier microprocessor designs.

Another way to improve system microprocessor performance is to lighten the load on the microprocessor by using bus-master adapters. Bus-master adapters handle tasks, such as network processing or data transfers, with minimal system-microprocessor involvement.

The Hard Disk Subsystem

Your server has an UltraSCSI adapter that significantly increases performance by handling the processing of SCSI commands and data transfers, leaving the system microprocessor free to handle other tasks. Depending on your particular configuration, you might need to install additional SCSI adapters when attaching external SCSI devices.

Estimating Server Performance and Capacity

There are no simple methods for evaluating your server performance in all environments. The hardware, software, applications, workloads, and number of users all affect server performance.

When you are ready to do a performance evaluation, always use a systematic approach. A good example of this approach follows:

1. Define the functional requirements of your server for your working environment.
2. Define what you consider to be adequate performance, such as response times and transaction rates.
3. Understand what factors affect server performance.
4. Decide what an approximate configuration of applications for your work environment would be.
5. Measure the current performance of your server by using a variety of application configurations.
6. Use the performance results to determine:
 - The location of performance bottlenecks
 - Which configuration provides sufficient performance today
 - Which configuration allows room for growth
7. Ensure that the performance of the server will still be acceptable if a component fails.

Improving Server Performance

Before you begin to experiment with applying upgrades or enhancements to improve performance, remember that the subsystem that causes a bottleneck depends largely on your applications.

Try to determine which applications most closely resemble your environment; concentrate on obtaining improvements for those applications. It is possible that some changes might improve the performance of an application, but degrade the performance for other applications. If this occurs, you will need to assess the trade-offs.

When you understand the factors that affect server performance, you can then use a methodical approach to improving it. A good example of this type of approach is:

1. Measure the current server performance.
2. Identify the performance bottlenecks.
3. Upgrade components that cause the bottlenecks.
4. Measure the new performance of the server.

For example, if the bottleneck is memory, you could install additional memory; if the bottleneck is the hard disk subsystem, you could install an additional drive or create a disk array. You can replace slow network adapters with faster ones, or you can install additional adapters.

Chapter 3. Microprocessors and Memory

The processing center of your server contains devices that run programs and store data used by programs. These devices include the microprocessor and the components of the memory subsystem.

Microprocessor

The microprocessor is an integrated circuit that performs most of the control and computing functions of your server. Your server comes with an Intel Pentium Pro microprocessor.

Microprocessor Clock

The rate at which the microprocessor performs its basic operations is called the *clock speed*. Examples of basic operations include fetching an instruction from memory, decoding it, executing it, writing the result to memory, and so on. The process of executing an instruction always consists of several basic operations. The design of the microprocessor determines the maximum clock speed at which it can operate reliably, and the design of the server determines the optimal clock speed for the server. Clock speed is measured in megahertz (MHz).

A *clock cycle* is the time unit that measures how long the microprocessor takes to perform a basic operation at a given clock speed. Clock cycles are measured in nanoseconds (ns) and are inversely related to the clock speed. For example, at a clock speed of 25 MHz, one clock cycle takes 40 ns; at a clock speed of 100 MHz, one clock cycle takes 10 ns. The microprocessor in your server operates at two different clock speeds; one speed for transferring data into and out of the microprocessor, and a faster speed for operations within the microprocessor.

Microprocessor Performance

The Pentium Pro microprocessor gains its high performance through its innovative design. *Dynamic Execution* is the term given to the design of the Pentium Pro microprocessor. This dynamic design enables the Pentium Pro microprocessor to speculatively execute instructions in any order, but always complete the instructions in their original program order. Looking 20 to 30 instructions ahead of the instruction pointer, the Pentium Pro microprocessor predicts program flow, and then analyzes the program data flow to determine the best order in which to execute the program's instructions. This approach eliminates the constraint for linear instruction processing and enables the microprocessor to schedule up to five instructions per clock cycle, although a sustained rate of three instructions per clock cycle is more typical.

One of the design features that helps the Pentium Pro achieve its higher clock rate is its *pipeline* implementation. In a pipeline, multiple instructions are in various stages of execution. For example, while one instruction is fetched, two are decoded, another is executed, and the results of another are written to memory. This parallelism speeds up instruction execution significantly when compared to a microprocessor that runs at the same speed and does not use pipelining.

The Pentium Pro microprocessor has a 12-stage, *superpipelined* implementation. This superpipelined implementation trades some work per pipe stage for more stages. The Pentium Pro microprocessor also has a pipe-stage time that is 33 percent less than the pipe-stage time of a standard Pentium microprocessor.

Another design feature that enables the Pentium Pro to achieve its higher clock rate is the integration of several system components. The Pentium Pro microprocessor in your server contains a level-2 *cache* of at least 256 KB, a cache controller, and an advanced programmable interrupt controller (APIC). In earlier personal computers, these system components were not contained within the microprocessor. Instead, they were separate components on the system board, processor board, or memory board.

This added level of integration improves performance by alleviating some of the performance bottlenecks experienced with earlier system designs. This integration also results in a microprocessor bus that more closely resembles a symmetric multiprocessing (SMP) system bus, rather than resembling a previous generation processor-to-cache bus.

Microprocessor Registers and Interfaces

The microprocessor needs data, instructions, or both for each basic operation. The set of instructions that the microprocessor can perform determines whether a particular program will run in the server. Instructions and data are copied from memory into data-storage locations, known as registers, in the microprocessor. The microprocessor can read from and write to its registers very quickly. Registers also store the results of processing operations, until the results are needed for other operations or are written to memory.

The connection between the microprocessor and the *data bus* is the microprocessor *data interface*. Programs written for a 32-bit interface require only that the microprocessor be capable of decoding and performing 32-bit instructions. The width of the data bus does not affect software compatibility.

The connection between the microprocessor and the *address bus* is the microprocessor *address interface*. The size of the address interface determines the width of the address bus and the amount of physical memory the microprocessor can address.

Real Mode and Protected Mode Operation

The microprocessor has a real mode with a 1 MB address space. The real mode is the default condition for the microprocessor; the microprocessor is always in the real mode after the server is turned on and before any operating system is started.

The microprocessor also has a protected mode that allows the microprocessor to address more than 1 MB of memory. In protected mode in a multitasking environment, the microprocessor manages the memory so that each program is protected from interference from other programs running at the same time.

The operating system you install determines whether the microprocessor stays in the real mode or is switched to the protected mode. For example, when the server runs DOS, the microprocessor stays in the real mode. DOS does not use the capabilities provided by the protected mode. When a multitasking operating system starts, it switches the microprocessor to the protected mode and uses the multitasking capabilities provided by the protected mode of the microprocessor.

Numeric Computing

The microprocessor in your server has an *execution unit* that performs only floating-point arithmetic and mathematical instructions. This execution unit, called the floating-point unit (FPU), executes the types of instructions previously executed by the separate math coprocessors used in earlier personal computers. These instructions, generally called numeric instructions, perform basic floating-point arithmetic and a variety of mathematical functions.

The control circuits within the microprocessor pass data and instructions to the FPU, which then performs the mathematical operations. Other units, such as the *integer units*, can execute instructions concurrently with the FPU. The FPU is pipelined, so several floating-point instructions can be in various stages of execution simultaneously.

Programs that require extensive mathematical calculations run much faster when the FPU performs the calculations, because the FPU is designed specifically for that purpose. A program that is intended to use the FPU must contain specific instructions that are recognized by the microprocessor. Otherwise, the microprocessor will not assign the operation to the FPU, and the integer units will perform the calculations.

Memory Subsystem

The memory subsystem consists of the memory controller, random access memory, read-only memory, physical memory, virtual memory, and cache memory.

Memory Controller

The memory controller is a device that controls access to system memory by the microprocessor and I/O devices. *Registers* in the memory controller contain information about the amount and type of memory that is installed in the server. During a system reset, the POST routine writes this information into the registers.

Your PC Server 315 has a 32-bit, direct-memory-access (DMA) controller. This DMA controller is a *bus master* that manages all DMA *data transfers* between system memory and I/O devices.

DMA is a method used to transfer large amounts of data between system memory and I/O devices without the assistance of the microprocessor. This is more efficient than *programmed I/O*, in which the microprocessor reads the data from the sending device, and then writes it to the receiving device.

With DMA data transfers, data bypasses the system microprocessor as it moves between system memory and I/O devices. This improves server performance because the microprocessor does not need to interrupt its processing activities to manage data transfers.

Transferring data between system memory and an I/O device requires two steps. First, the microprocessor gives the DMA controller the location, destination, and amount of data that is to be transferred. Then, the DMA controller transfers the data, allowing the microprocessor to continue with other processing tasks.

When a device needs to use the bus to send or receive data, it competes with all the other devices that are trying to gain control of the bus, in a process known as arbitration. The DMA controller does not arbitrate for control of the bus; instead, the I/O device that is sending or receiving data (the DMA subordinate) participates in arbitration. The DMA controller takes control of the bus when the central-arbitration-control point grants the request of the DMA subordinate.

Random Access Memory and Read-Only Memory

Random access memory (RAM) is used for temporary storage of data and instructions during processing. RAM, or system memory, is contained in memory components known as dual inline memory modules (DIMMs). It is *volatile memory*, which means that to retain its contents, it must be constantly refreshed by an electrical current. If the power cord is detached, the battery provides power to the memory modules, preserving the data in RAM.

Your server supports up to 512 KB of 60 ns, unbuffered, extended data output (EDO), error correcting code (ECC) system memory. You can increase system memory by installing DIMMs on the system board.

In addition to volatile RAM, the system board has a small area of nonvolatile RAM (NVRAM). Using a small current from the *system battery*, NVRAM retains its contents while the server is unplugged. Your passwords, the time and date, and the system configuration information are stored in NVRAM.

Read-only memory (ROM) stores programs that the server uses for startup procedures and other internal operations. ROM is *nonvolatile memory*, and retains its contents when the server is turned off. Generally, the contents of ROM modules cannot be modified. However, your server contains electrically erasable programmable ROM (EEPROM) modules (or *flash memory*) that can be modified. For example, the power-on self-test (POST) and basic input/output system (BIOS) in your server are stored in flash memory, so they can be updated (modified) whenever enhancements are made.

Physical Memory

Physical memory consists of all the writable memory locations in the server, most of which are in dual inline memory modules (DIMMs).

Portions of the physical memory are reserved for:

- Operating system
- Power-on self-test
- Video data being displayed
- Adapter ROM data, which is copied into memory

The part of physical memory available for instructions and data that the server uses to run programs is *system memory*.

Refer to the *PC Server 315 User's Handbook* that comes with your server for more information about installing additional memory.

Virtual Memory

Virtual memory is memory that appears to be allocated to application programs. The operating system uses a portion of the hard disk as virtual memory, swapping data and instructions between the hard disk and physical memory. The portion of the hard disk used for virtual memory is often called *swap space*. The amount of swap space on the disk determines the amount of available virtual memory, which is typically much larger than the actual amount of installed physical memory.

Virtual memory supports very large programs and *multitasking*. In multitasking, multiple programs run simultaneously. The memory requirements of these programs can exceed the amount of available physical memory. The operating system allocates the memory required by each program as virtual memory and manages the available physical memory, swapping portions of each program's address space to the hard disk as required.

Cache Memory

Cache memory is high-speed memory, known as static random access memory (SRAM). To reduce the time that the microprocessor spends waiting for system memory to respond, your server uses cache memory. Cache memory improves server performance by temporarily storing frequently used data and instructions in a cache, a small buffer between the microprocessor and system memory.

The Pentium Pro microprocessor in your server contains a cache controller for its level-1 and level-2 caches. Cache performance depends on the size of the cache and the application programs you are running on your server.

Level-1 Cache

Level-1 cache, which is part of the microprocessor, consists of very fast RAM. This type of cache memory is also referred to as an internal cache. The Pentium Pro microprocessor provides 16 KB of internal level-1 cache. 1 KB equals approximately 1000 bytes.

Level-1 cache stores the data and instructions most frequently used by the microprocessor in the current execution context. The *execution context* is the instructions and associated data used by the program running on the microprocessor. Storing these instructions and data enable the microprocessor to execute programs much faster because the microprocessor does not have to access system memory for each read or write request. When the execution context changes, the cache controller writes out the current contents of level-1 cache to level-2 cache. Then, it copies the new data and instructions into level-1 cache, replacing the data and instructions that are no longer needed.

Server performance improves each time the microprocessor finds what it needs in the cache (a *cache hit*). The microprocessor is designed so that the cache hit rate is very high, and the penalty for a *cache miss* is minimized. A cache miss occurs when the information needed by the microprocessor is not available in the cache. In case of a cache miss, the integrated cache controller quickly locates the needed information from level-2 cache or system memory, and then copies the information into level-1 cache. The

cache controller manages the use of the cache so that the number of cache hits far exceeds the number of cache misses.

Level-2 Cache

The Pentium Pro microprocessor in your server also contains a level-2 cache of at least 256 KB. Level-2 cache provides an intermediate level of storage between level-1 cache and system memory. Although level-2 cache accesses are slower than level-1 cache accesses, level-2 cache accesses are still much faster than system memory accesses.

In the case of a level-1 cache miss, the microprocessor can access level-2 cache relatively quickly. If the microprocessor does not find what it needs in level-2 cache (a *second-level cache miss*), the cache controller locates the data or instruction in system memory and copies it into both of the caches.

Write Modes

The microprocessor cache memory in your server has two write modes (*write-back* and *write-through*).

In the write-back mode, the microprocessor updates level-1 cache, and the cache controller updates level-2 cache and system memory as needed. This leaves the microprocessor free to perform other operations. For maximum performance, your PC Server 315 cache memory is set to the write-back mode.

In the write-through mode, the microprocessor updates level-1 cache, the cache controller updates level-2 cache, and then the cache controller updates system memory. This is done automatically for each write operation. While the cache controller is updating system memory, which is a relatively lengthy task, the microprocessor might be idle with an outstanding memory request.

Chapter 4. Bus Architecture

This section contains an overview of input/output (I/O) buses and explains how advanced I/O buses can improve performance.

A computer bus is a pathway of wires and signals that carries (or transfers) information inside the server; information includes data, addresses, instructions, and controls. The microprocessor has an external bus, called the *microprocessor bus* or *local bus*, that carries information among various PC Server 315 subsystems. The local bus has the same bus width (64 bits) as the microprocessor and operates at the same external speed.

Another computer bus (I/O bus or expansion bus) carries information between the microprocessor or memory, and the I/O peripheral devices. The performance of the microprocessor bus has improved rapidly, but improvements in the performance of I/O buses have not equalled those of microprocessors and some peripheral devices, such as video and disk controllers. Regardless of how fast the microprocessor and other components are, data transfers between them must pass through the I/O bus.

Your server has two I/O buses: the industry standard architecture (ISA) bus and the peripheral component interconnect (PCI) bus.

ISA Bus Overview

One of the most widely used and successful I/O buses is the industry standard architecture (ISA) bus. The ISA bus is a 16-bit bus that operates at a *speed* of 8 MHz. It can transfer up to 8 MB of data per second between the microprocessor and an I/O device. Practical performance ranges between 4 MB and 8 MB per second.

The ISA bus continues to be popular because so many adapters, devices, and applications are designed and marketed for it. Peripheral devices that do not require faster throughput, such as fax modems, can use ISA. Also, ISA is adequate for users of DOS applications in a stand-alone environment, or for DOS network requestors with moderate performance requirements.

ISA buses are suitable for many applications, but they cannot transfer data fast enough for today's high-speed microprocessors and I/O devices. For example, the ISA bus might not provide the performance requirements of an application with high resolution and high-color content, or the requirements of a video device. Also, ISA might not be capable of handling the throughput required by some fast hard disk drives, network controllers, or full-motion video adapters.

PCI Bus Overview

PCI is an advanced I/O-bus standard developed by the computer industry to keep up with performance improvements of microprocessor buses and advanced peripheral devices. Although advanced designs can match microprocessor bus performance only up to a point, they do achieve higher throughput by speeding up the I/O bus and widening its data path. PCI is intended to add to, but not replace, the capability provided by the ISA bus.

The peripheral component interconnect (PCI) bus is an answer to the need for a higher-performance I/O bus. PCI architecture offers many features that improve I/O-bus performance such as:

- Industry-standard compatibility
- Wider data path
- Faster data-transfer rates

- More efficient data-transfer methods
- Enhanced peripheral-device performance
- Automatic configuration

Interface

The PCI bus connects to the microprocessor local bus through a buffered *bridge controller*. A bridge translates signals from one bus architecture to another. PCI and ISA devices get all their data and control information through the PCI controller. The PCI controller looks at all signals from the microprocessor local bus and then passes them to the ISA controller, or to peripheral devices connected to the PCI bus. However, the PCI bus is not governed by the speed of the microprocessor bus. The PCI bus can operate at speeds as fast as 33 MHz, slow down, or even stop if there is no activity, all independent of the microprocessor's operations. This independence is a distinguishing feature of the PCI bus that allows the microprocessor to do other work while the I/O bus is busy. Microprocessor independence also makes the PCI bus adaptable to various microprocessor speeds and allows consistency in the design and use of PCI peripheral devices.

Performance

One of the most significant features of the PCI bus is its 32-bit data path, which is twice the width of the ISA 16-bit data path. With the 32-bit data path and a higher *speed* of up to 33 MHz, the PCI bus can transfer information much faster than the ISA bus. Based on the mode of operation and the components used, the PCI bus can transfer data at speeds of up to 132 MB per second.

Peripheral Devices

The wider data path and higher throughput make the PCI bus a more suitable bus for today's high-speed microprocessors and I/O devices. Higher throughput translates into higher performance of peripheral devices, such as higher video resolutions, more colors, and quicker screen refreshes. The use of PCI architecture in your server enhances the performance of the monitor and the storage devices. Thus, the peripheral devices that have the greatest demand for higher performance can benefit from the faster PCI bus architecture.

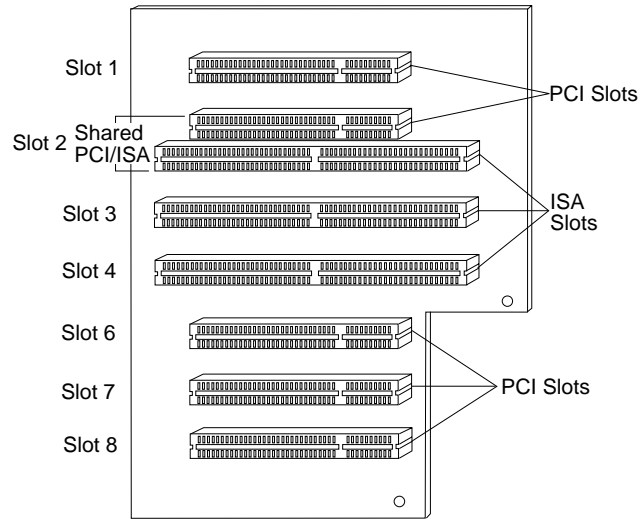
Expansion Bus Features

If you want to add new capabilities, such as communication, specialized graphics, or audio to your server, you can do so by installing *optional adapters*. Your server provides ISA expansion features so you can take advantage of the wide availability of ISA peripheral devices and applications. PCI expansion features allow you to add high-performance devices to your server, such as SCSI adapters.

You can install adapters into expansion slots in your server. These slots are grouped together on a *riser card* that is connected to the ISA and PCI buses on the system board.

The riser card provides one *shared PCI/ISA slot*, four dedicated PCI slots, and two dedicated ISA slots. The shared PCI and ISA slot have a common opening at the back of the server. You can install an adapter in either the PCI or the adjacent ISA expansion slot, but not in both.

The width of the I/O bus determines the types of adapters the server supports. The shared slot supports 16-bit ISA adapters and 32-bit PCI adapters. The dedicated ISA slots support only 16-bit ISA adapters. The width of the I/O bus does not affect software compatibility. The following illustration shows the PCI/ISA riser card.



Note: Slot 5 is not available.

The PCI bus operates at up to 33 MHz with a 32-bit data path. PCI connectors support both 3.3-volt and 5-volt adapters. A separate *power cable* connects to the back of the riser card to supply 3.3-volt power.

Adapter Configuration

PCI adapters configure automatically. When you install ISA adapters, you must configure them.

Plug and Play is a configuration method that makes expanding your PC Server 315 easier. Plug and Play adapters are easier to install and set up because they configure automatically.

ISA adapters that are not Plug and Play are referred to as *legacy adapters*. The Configuration/Setup Utility program can help you manually configure legacy adapters.

For more information, see “Adapter Configuration” on page 54.

Chapter 5. Data Storage Devices

You can install the IBM storage devices described in this chapter, along with a wide variety of industry-standard storage devices, to expand the data storage capacity of your server.

Direct Access Storage Devices

In a direct access storage device (DASD), the time required to access data does not depend on the location of the data on the storage medium. These devices include diskette drives, hard disk drives, CD-ROM drives, and rewritable optical drives.

Diskette Drives

A 3.5-inch, 1.44 MB diskette drive comes as standard equipment on the PC Server 315. The drive uses diskettes with a *formatted capacity* of 720 KB or 1.44 MB of data. You can purchase an additional diskette drive as an option.

To prevent loss of data, always format 1 MB diskettes to store 720 KB of data and 2 MB diskettes to store 1.44 MB of data.

SCSI Hard Disk Drives

IBM offers a variety of hard disk drives of various capacities and performance capabilities. The number of hard disk drives that your server can support is determined by your operating system. Refer to your operating-system documentation to determine the number of hard disk drives that your operating system supports.

Your server has an Adaptec UltraSCSI adapter that supports SCSI devices, such as hard disk drives, CD-ROM drives, optical drives, tape drives, scanners, and printers. For more information about the SCSI subsystem and the devices it supports, see Chapter 6, "The SCSI Subsystem" on page 41.

The PC Server 315 supports drives that comply with ANSI SCSI Standards X3.131-1986 (SCSI), X3.131-1994 (SCSI-2), X3.277-1996 (SCSI-3 Fast-20 parallel interface), and X3.253-1995 (SCSI-3 parallel interface).

SCSI CD-ROM Drive

All models come with a SCSI CD-ROM drive. Compact disc-read only memory (CD-ROM) drives use discs that contain information that can only be viewed. The information cannot be changed or updated. While diskette drives, hard disk drives, and tape drives use a magnetic recording technique, CD-ROM drives use an optical technique that reads data at a much higher density than magnetic recording can achieve. All IBM CD-ROM drives use industry-standard, 5.25-inch CDs with formatted capacities of approximately 680 MB of data.

IBM CD-ROM drives comply with ANSI SCSI Standards X3.131-1986 (SCSI) and X3.131-1994 (SCSI-2). They support CD-ROM Extended Architecture (XA), a standard for interleaving different types of data, such as video, audio, and text. This provides you with the option of expanding your system to work with advanced multimedia applications.

Tape Drives

Tape drives are sequential-access devices that provide an excellent, cost-effective way to *back up* the important data on your server. In a sequential-access (or serial-access) device, data is stored in the same order as it is entered. For more information about the tape drives available for the PC Server 315, contact your IBM marketing representative or your IBM reseller.

IBM External SCSI Storage Enclosures

You can use a SCSI storage enclosure to increase the data-storage capacity of any server that has a SCSI controller. The IBM PC Server Enterprise Expansion Enclosure shown in the following illustration is one of several enclosures that you can attach to the external SCSI connector on your server.



The publication that is provided with the external enclosure includes information about setting it up, installing drives, removing drives, and attaching the enclosure to the server.

Chapter 6. The SCSI Subsystem

Your PC Server 315 comes with an UltraSCSI adapter (referred to as the SCSI adapter). The SCSI adapter is used to communicate with SCSI devices such as hard disk drives, read-and-write optical drives, CD-ROM drives, tape drives, scanners, and printers.

The SCSI subsystem in your server consists of the UltraSCSI adapter, cabling, and connectors that allow the attachment of SCSI devices to your server. The SCSI adapter serves as the controller, sending commands to installed SCSI devices. The cabling provides a bus to carry the commands and data to and from the SCSI devices.

Advantages of the SCSI Subsystem

Before the SCSI standards were developed, many physical devices required controllers (usually adapters) that could support only one or a few devices of the same type. Because each device required support from the system microprocessor, every device added to the system increased the workload on the microprocessor. Also, because almost every device required its own adapter in a separate expansion slot, flexibility and growth were limited by the number of expansion slots in the system.

The SCSI standards define the interface through which the system communicates with different types of devices. Each SCSI device has a built-in *device controller* that interprets SCSI commands. The SCSI standards define the commands and messages that are used in the interface.

Several SCSI devices can operate concurrently and share the interface, achieving significantly higher overall data-transfer rates. You can realize faster, more efficient I/O management for network file servers by using the SCSI subsystem. The SCSI subsystem produces significant improvements in system performance and flexibility over other I/O interfaces.

In the PC Server 315, the *maximum number* of internal SCSI devices is five. One of the devices is a CD-ROM drive and the other four devices are hard disk drives or other SCSI devices. The number and capacity of hard disk drives varies by model. Depending on your particular configuration, you might need to install an additional SCSI adapter when attaching external SCSI devices.

The SCSI adapter supports:

- SCSI devices that conform to ANSI SCSI Standards:
 - X3.131-1986 (SCSI)
 - X3.131-1994 (SCSI-2)
 - X3.277-1996 (SCSI-3 Fast-20 parallel interface)
 - X3.253-1995 (SCSI-3 parallel interface).
- Devices compatible with the SCSI Common Command Set
- Functions that are unique to a particular SCSI device, when they are supported by a specific device driver provided by the device manufacturer

Types of Interfaces

The two most common types of interfaces for attaching devices to a server are device-level interfaces and bus-level interfaces. The SCSI subsystem is a bus-level interface.

Device-Level Interfaces

Each device connected to a device-level interface has a controller that is mounted on a separate adapter, away from the physical device. Functions such as formatting, head selection, and error detection are directed by the controller and not by the device itself. The device is limited to performing the mechanical operations of reading and writing data, and it can do only what the controller allows it to do. There are limitations on the types of devices you can attach to the same controller.

Bus-Level Interfaces

Each device connected to a bus-level interface has a *device controller* that provides the details of how to accomplish the tasks performed by the device. A set of commands, the *Common Command Set*, specifies the tasks that devices are to perform. Each device controller determines how the tasks will be performed. The SCSI adapter imposes few restrictions on the number and types of devices that you can attach to it.

The SCSI standard allows great flexibility in the design of devices. Hardware manufacturers can develop SCSI devices to perform functions without requiring that the SCSI adapter supports those functions. Functions unique to a particular SCSI device are supported by the device driver provided by the device manufacturer. As new SCSI devices become available, there is no need to install new SCSI adapters. You can attach many different devices, such as hard disk drives, CD-ROM drives, optical drives, tape drives, scanners, and printers, to the same SCSI controller.

Physical Configuration

The following list describes a possible configuration of the SCSI subsystem in a PC Server 315:

- The UltraSCSI adapter is connected to the PCI bus.
- SCSI devices are attached by cable to one of the SCSI connectors on the UltraSCSI adapter. A cable attached to one of the adapter connectors inside the server provides connectors for internal SCSI devices. A cable (or series of cables) attached to the adapter connector on the back of the server provides connectors for external SCSI devices.
- The first external device is connected to an external SCSI cable, which connects to the external SCSI port. The external SCSI port is a 68-pin connector on the SCSI adapter. The connector is accessible on the rear panel of the PC Server 315. Additional external devices are connected to each other with SCSI *option-to-option* cables. The last external device must have a terminator; if there is only one external device, it must have a terminator. See “Termination” on page 47 for more information.

Note: Each device attached to the interface must conform to ANSI SCSI Standards X3.131-1986 (SCSI), X3.131-1994 (SCSI-2), X3.277-1996 (SCSI-3 Fast-20 parallel interface), and X3.253-1995 (SCSI-3 parallel interface). These standards specify the mechanical, electrical, and functional requirements and the command sets that must be used by devices in the SCSI subsystem.

Device IDs

The SCSI ID is also known as the *SCSI address* or *physical unit number* (PUN).

You must assign a unique SCSI ID to each SCSI device that you attach to the server. The unique ID prevents two devices from sending data to the same SCSI controller at the same time. SCSI devices use a variety of mechanisms to set the SCSI ID; such as jumpers, thumb wheels, or switches.

- ID 7 is reserved for the SCSI adapter (always preset to ID 7).
- The CD-ROM drive is preset to ID 6.
- Narrow (8-bit) SCSI devices use IDs 0 through 6.
- Wide (16-bit) SCSI devices use IDs 0 through 15.

When more than one physical device is connected to the same SCSI adapter, the devices compete for support from the SCSI adapter. Because the SCSI adapter communicates with only one device at a time, the priority of a device is based on its SCSI ID.

In summary, SCSI IDs perform two functions:

- They allow the SCSI controller to distinguish one device from another.
- They allow the SCSI controller to determine the priority of each device.

Logical Unit IDs

Each physical device has a physical unit number (PUN) and a *logical unit number* (LUN). If a physical device supports no logical devices, its LUN is 0. Most SCSI devices support only LUN 0. Certain types of physical SCSI devices (bridge controllers) can support more than one logical unit (device).

For example, a printer controller might support up to eight printers. The printer controller is a physical device, and each printer is a logical device. If the printer controller is assigned to ID 2, the ID of the first printer appears in the SCSI device configuration as PUN 2, LUN 0. The IDs of the other printers are PUN 2, LUN 1; PUN 2, LUN 2; up to PUN 2, LUN 7.

Cabling

The adapter and cabling in your server support:

- SCSI narrow devices that use a set of eight data lines, one data-parity line, and various control lines. The adapter has one 50-pin connector for narrow devices (internal only).
- SCSI wide devices that use a set of 16 data lines, two data-parity lines, and various control lines. The adapter has two 68-pin connectors for wide devices (one internal and one external). Because these connectors are a shared channel, only one of the two connectors can be used. For example, if you use the internal wide connector, you cannot use the external connector.

In all SCSI configurations, the interface must be terminated at both ends of the cable. When both an internal cable and an external cable are present, the entire configuration is seen as one long bus. In this case, there are only two termination points, at the far ends of the internal and external cables.

The interface uses *daisy-chain cabling*, where each device except the last one (internal or external) has one cable going into it and another coming out of it in a single connector. The last device has an incoming cable and is terminated.

Termination

SCSI devices are cabled to each other and to the SCSI adapter. The device at each end of the interface must be terminated.

If you have only internal SCSI devices connected to the internal connector on the SCSI adapter, the controller becomes the termination at one end of the cable.

If you use the internal connector and the external connector on the SCSI adapter, you must disable the termination of the adapter by using the SCSISelect Utility program included with the server. See your *PC Server 315 User's Handbook* for more information.

The following rules apply to SCSI-device termination:

Note: For specific information about termination, refer to the instructions supplied with the device.

- If you have more than one internal SCSI device, the device at the end of the SCSI cable must be terminated. Other internal devices connected to the same SCSI cable must not be terminated.
- If you have both internal SCSI devices and external SCSI devices, the devices at the ends of the internal and external cables must be terminated. The adapter must not be terminated.
- If you have only one external device, that device must be terminated.
- The CD-ROM drive that is installed in expansion bay 2 cannot be terminated.

Chapter 7. Configuration

You play a key role in how your server allocates resources to hardware devices and software programs. This resource-allocation process is referred to as configuration. The steps that are required to configure your server depend on the number of devices, the variety of devices, and the software programs you install.

Your server has the flexibility and power to support several types of adapters and devices. This flexibility lets you choose from among thousands of adapters and devices that comply with the following standards:

- Industry standard architecture (ISA)
- Peripheral component interconnect (PCI)
- Small computer system interface (SCSI)

In general, the greater the number and variety of hardware devices and software programs that you install, the more you will have to interact with your server and your devices to correctly configure your system.

Your PC Server 315 comes with the following:

- Configuration/Setup Utility program
- SCSISelect Utility program
- Ethernet configuration diskettes (provided with some models)

Power-On Self-Test

Each time you turn on your server, it performs a series of tests that check the operation of the server and some options. This series of tests is called the power-on self-test (POST). The POST is stored in an electrically erasable programmable ROM (EEPROM) module, along with the basic input/output system (BIOS) code and the Configuration/Setup Utility program. The functions of the POST are:

- Check the server hardware and subsystems
- Update the server configuration
- Load the BIOS into system memory
- Load the operating system into system memory
- Report problems

While the POST is running, the server displays an IBM screen with several messages and prompts. If you have set a password in the Configuration/Setup Utility program, a password prompt asks you for a password. Numbers cycle in the upper-left corner of the screen indicating memory checking is in progress. Other prompts allow you to access the Configuration/Setup Utility program or the SCSISelect Utility program, or to escape from the POST.

When the POST is successfully completed, the server proceeds to the first screen of your operating system or application program. If problems are found, the POST displays error codes and messages. Refer to the problem-solving section of your *PC Server 315 User's Handbook* for explanations of error messages and actions you can take to correct problems.

Configuration Programs

Most server devices (storage devices, ports, adapters, and other optional features) have programmable settings. Your PC Server 315 has a special type of nonvolatile memory (called CMOS) where it saves these settings. A battery is used to keep this memory active, so the settings are not lost when you turn off the server. Each time you turn on the server, the POST routine copies the configuration settings from CMOS to the various devices to get them ready for operation. If the battery fails, the settings in CMOS are lost, and the Configuration/Setup Utility program automatically restores the default (factory) settings.

When you add or change built-in devices or optional features in your PC Server 315, the configuration settings are updated. Your PC Server 315 either automatically reconfigures the settings it has saved, or you might have to help with reconfiguration. The Configuration/Setup Utility program is used for this process.

Configuration/Setup Utility Program

The Configuration/Setup Utility program automatically updates and saves configuration settings when you make changes to your server hardware. However, some changes require input from you. You can view the current settings, change the settings of various features, set passwords, change the date and time, and do other tasks using the Configuration/Setup Utility program.

The main menu of the Configuration/Setup Utility program lists the following categories of configuration screens:

- System summary
- Vital product data (VPD)
- Device and I/O ports
- Date and time
- System security
- Start options
- Advanced setup
- ISA legacy resources

Some items are in brackets on the Configuration/Setup Utility program screens. These brackets indicate an item that you can change. The items without brackets are filled in by the program. An arrow, pointing to an item on a screen, indicates a setting that has changed since the last time you ran the Configuration/Setup Utility program.

If the server finds a setup error during startup, it displays a message on the screen and gives you the option to access the Configuration/Setup Utility program. Also, you can access the Configuration/Setup Utility program any time you want to view or change settings. Refer to your *PC Server 315 User's Handbook* for information about using the Configuration/Setup Utility program.

SCSISelect Utility Program

The SCSISelect Utility program is a built-in, menu-driven configuration program that enables you to view or change SCSI settings. You can use this program to change default settings, locate configuration conflicts, correct configuration conflicts, and format a new SCSI hard disk.

The settings that you can view or change include:

- **Host Adapter SCSI ID**
You can change the SCSI ID of the SCSI adapter from its default value of 7.
- **SCSI Parity Checking**
You can enable or disable parity checking on the SCSI adapter. The default setting is enabled.
- **Host Adapter SCSI Termination**
You can change the SCSI adapter termination. The default setting is automatic.
- **SCSI Device Configuration**
You can configure SCSI device parameters. Before you can make updates, you must know the ID of the device whose parameters you want to configure.
- **Advanced Configuration Options**
These options include support for large hard disk drives and support for multiple disk drives with DOS Version 5.0 or later.

For additional information about the SCSISelect Utility program, refer to the documentation provided in the UltraSCSI adapter package that comes with your PC Server 315.

Ethernet Configuration Diskettes

If your PC Server 315 comes with an Ethernet adapter, the package contains a configuration diskette. For information about how to use this diskette, refer to the *PC Server 315 User's Handbook*.

Configuration Process

When you install a new device or change the position of an existing device, you might need to reconfigure your server. The steps required to reconfigure your server depend on the option you install.

Some options, such as memory and PCI adapters, are recognized and configured automatically by the system. However, other options, such as ISA adapters and SCSI devices, must be manually configured.

Configuring SCSI Devices

Preinstalled SCSI devices are already configured. To configure new SCSI devices, check the documentation that comes with the device for instructions to set the SCSI ID and termination for the device. See also "Termination" on page 47 for more information about termination.

Adapter Configuration

When you install ISA adapters, you must configure them.

Configuration is accomplished by manually setting jumpers or switches on the adapters. These switches control the assignment of server resources such as interrupt request (IRQ) lines, direct memory access (DMA) channels, and memory address ranges. New methods of configuring adapters and devices are now used on your server to make expansion an easier task.

Plug and Play Adapters

Plug and Play is a configuration method that makes expanding your PC Server 315 easier. Plug and Play adapters are easier to install and set up because they configure automatically. There are no jumpers or switches to set. A Plug and Play adapter comes with built-in identification and configuration specifications set in memory to provide installation information to the server during startup. This information is interpreted by the server's basic input/output system (BIOS). The BIOS routines automatically configure the adapter around the resources already in use by other devices.

PCI adapters are generally Plug and Play devices, while many ISA adapters are not. If the adapter you are installing is not Plug and Play, you must configure it manually.

Legacy Adapters

ISA adapters that are not Plug and Play devices are referred to as *legacy* devices. The Configuration/Setup Utility program can help you manually configure legacy adapters. Refer to your *PC Server 315 User's Handbook* for information about using the Configuration/Setup Utility program.

The screens of the Configuration/Setup Utility program show the legacy resources typically required by adapters:

- I/O port address
- Memory address
- Interrupt request (IRQ) line
- Direct memory access (DMA) channel

Resources that are not currently being used by adapters already installed in your PC Server 315 are highlighted. From these screens, you can select available resources for the adapter you are installing. Set the resources that are used by installed legacy adapters to **Not Available**. This enables the Plug and Play program to configure around legacy adapters, and then you can set the appropriate jumper or switch settings on the legacy adapter itself. Using this procedure helps prevent conflicts with other adapters. Refer to the adapter documentation for information about required resources. Also, if your PC Server 315 comes with preinstalled software, you can select the software by using the Plug and Play icon.

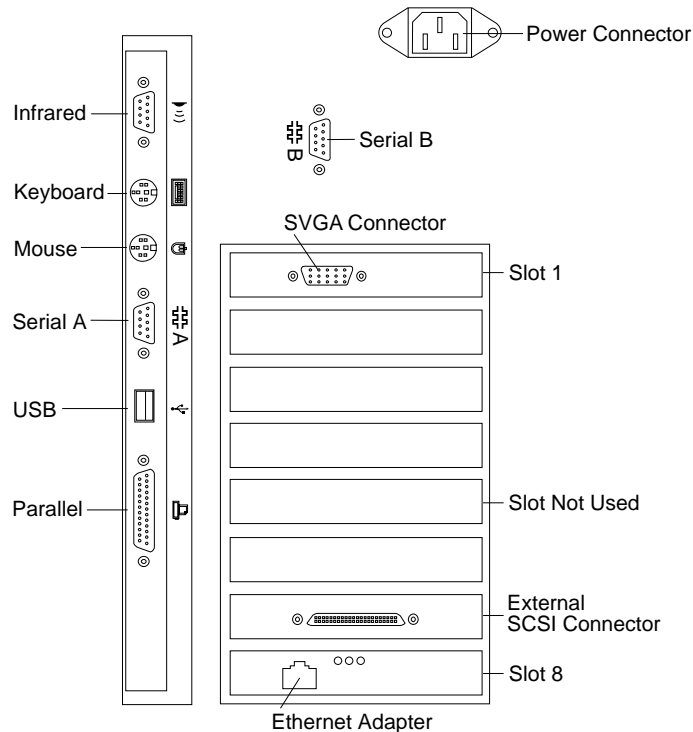
Note: The Plug and Play feature uses *memory addresses* ED00 to EFFF. If you install a legacy ISA adapter or use a memory manager program, do not use the addresses within this range.

Chapter 8. Input/Output Ports and Connectors

The input/output (I/O) connectors on the back of your server are for attaching devices to the following ports:

- Infrared
- Keyboard
- Mouse (auxiliary-device)
- Serial ports (16550-UART)
- Universal serial bus (USB)
- Parallel port
- SVGA adapter
- SCSI adapter
- Ethernet adapter

The location of each connector is shown in the following illustration.



Infrared Port

Your server provides one infrared port where you can attach an optional infrared transceiver module. The transceiver allows wireless communication between your PC Server 315 and other infrared-capable servers and printers.

The IBM Infrared (IR) Transceiver option includes TranXit software. During installation, when the TranXit Setup Connection dialog box appears, click on **National 306/334 Evaluation Board** to select the driver that supports your system.

The infrared port is a 9-pin, female, D-shell connector on the back of your PC Server 315. The infrared transceiver module plugs into this connector and provides a link of up to 1 m (39 in.) at a rate of 115 kilobits-per-second (Kbps). The infrared connector uses the same four port assignments as Serial Port B, but you cannot use the infrared connector if you are using the Serial B connector. Table 1 shows the pin-number assignments for the infrared connector.

Pin	Signal
1	Transmitted data (output)
2	Ground
3	Reserved
4	Ground
5	Ground
6	Received data (input)
7	Voltage (5 V dc)
8	Ground
9	Reserved

Table 1. Infrared Connector Pin-Number Assignments

Keyboard and Mouse (Auxiliary-Device) Ports

Your server provides one keyboard and one mouse (auxiliary-device) port.

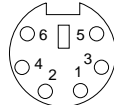


Table 2 shows the pin-number assignments for the keyboard connector and the mouse (auxiliary-device) connector.

Pin	Signal
1	Data
2	Reserved
3	Ground
4	+5 V dc
5	Clock
6	Reserved

Table 2. Keyboard Connector and Mouse (Auxiliary-Device) Connector Pin-Number Assignments

Serial Ports

Your server provides two serial ports that are used to communicate with devices such as printers, plotters, and modems. Some modems are installed inside the server; others are attached externally using a serial-port connector. For example, you can attach an external modem to a serial port to communicate with another server over telephone lines. The serial ports are 16550-UART (universal asynchronous receiver-transmitter) compatible, so they can support high-speed modems.

Serial ports transfer data asynchronously; they can transmit any number of bits with no restriction on the duration of the pauses between characters.

Serial ports transmit and receive data and commands at a rate of 300 bits-per-second (bps) up to 345 600 bps. The bits-per-second measurement is commonly referred to as the baud rate. To use a serial port at 345 600 bps, you need a shielded cable. For information about this cable, contact your IBM marketing representative or your IBM reseller.

You can increase the number of serial ports by installing a *serial adapter* in one of the expansion slots. For more information about installing adapters, refer to your *PC Server 315 User's Handbook*.

The serial ports on the back of the server are 9-pin, male, D-shell connectors that conform to the RS-232D industry standard.

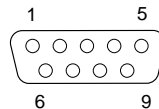


Table 3 shows the pin-number assignments for the serial port connectors.

Pin	Signal	Pin	Signal
1	Data carrier detect	6	Data set ready
2	Receive data	7	Request to send
3	Transmit data	8	Clear to send
4	Data terminal ready	9	Ring indicator
5	Signal ground		

Table 3. Serial Port Connector Pin-Number Assignments

Operating systems and application programs often designate serial ports with the name COM (communication). Many programs use COM1, COM2, COM3, and COM4 in their setup commands or menus to identify serial ports. When setting up your applications, you might have to identify the COM port to which a particular device is attached. Also, if you are adding a serial adapter or modem, you might have to configure the adapter or modem for a specific COM port. This might involve setting switches on the adapter or modem as well as changing settings in the Configuration/Setup Utility program.

Each serial port or adapter in your PC Server 315 can use any of four available port settings, provided that a different setting is used for each. The settings include the *port address* (in hexadecimal) and the IRQ (interrupt request) line, which determines how the microprocessor responds to an interrupt from the serial port. There is no direct relationship among the ports, the four available port settings, and the four COM numbers. The four available port settings, in sequential order, are 3F8-IRQ 4, 2F8-IRQ 3, 3E8-IRQ 4, and 2E8-IRQ 3. When you start the server, the power-on self-test (POST) program assigns COM numbers to the port addresses that are actually in use at the time. POST goes down the list of addresses sequentially to assign COM numbers to each address in use by a serial device. If an address is not in use, a COM number is not assigned to it. POST assigns the next available COM number to the next address in use, if any.

POST assigns COM1 to Serial A during startup. The port address and IRQ for Serial A are factory preset at 3F8-IRQ 4; the port address and IRQ for Serial B are factory preset at 2F8-IRQ 3. You can view the port address and IRQ settings for both serial ports using the Configuration/Setup Utility program.

Generally, you do not have to change serial-port settings. However, if you add a serial adapter or use special hardware or software that causes a configuration conflict, you might have to change port settings. You can change the settings for Serial A using the Configuration/Setup Utility program. For more information about using the Configuration/Setup Utility program, refer to your *PC Server 315 User's Handbook*.

Note: The Serial B and infrared ports use a common port address and IRQ setting.

Universal Serial Bus Ports

The universal serial bus (USB) is an emerging serial interface standard for telephony and multimedia devices. The USB port is a connector for devices that previously used serial, parallel, keyboard, mouse, and game ports. USB technology uses Plug and Play to determine what device is attached to the connector. Each USB device is accessed by a unique *USB address*. A device called a hub is used to convert the USB port into multiple attachment points. A hub has multiple ports where peripherals can be attached. USB provides 12 megabits-per-second (Mbps) bandwidth with a maximum of 63 peripherals and a maximum signal distance of 5 m (16 ft) per segment.

Note: If more than one USB device is to be attached, the device must be connected to a hub. Your PC Server 315 does not support a keyboard attached to the system USB port.

Table 4 shows the pin-number assignments for the USB connector.

Pin	Signal
1	VCC
2	-Data
3	+Data
4	Ground

Table 4. USB Connector Pin-Number Assignments

Parallel Port

Your server provides one parallel port that is most often used to communicate with a parallel printer, but you can use it to communicate with a variety of other parallel devices. The parallel port on the PC Server 315 supports extended, high-speed modes, which means that it can transfer data up to 10 times as fast as a standard parallel port.

You can increase the number of parallel ports by installing a parallel adapter in one of the expansion slots. For more information about installing adapters, refer to your *PC Server 315 User's Handbook*.

The parallel port on the back panel of the server is a 25-pin, female, D-shell connector.

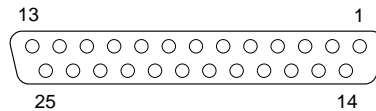


Table 5 shows the pin-number assignments for the parallel connector. The standard mode signal names are shown; some signals have different names for other modes.

Pin	Signal	Pin	Signal
1	-Strobe	14	-Auto Fd XT
2	Data 0	15	-Error
3	Data 1	16	-Init
4	Data 2	17	-Select (SLCT) In
5	Data 3	18	Ground
6	Data 4	19	Ground
7	Data 5	20	Ground
8	Data 6	21	Ground
9	Data 7	22	Ground
10	-Ack	23	Ground
11	Busy	24	Ground
12	PError	25	Ground
13	Select (SLCT)		

Table 5. Parallel Port Connector Pin-Number Assignments

Parallel Port Assignments

Operating systems and application programs often designate parallel ports with the name LPT (line printer). Many programs use LPT1, LPT2, and LPT3 in their setup commands or menus to identify parallel ports. When setting up your applications, you might have to identify the LPT port to which a particular device is attached. To provide automatic configuration, some operating systems use Plug and Play BIOS calls to query the LPT port. Also, if you are adding a parallel adapter, you might have to configure the adapter for a specific LPT port. This might involve setting switches on the adapter as well as changing settings in the Configuration/Setup Utility program.

Each parallel port or adapter on your PC Server 315 can use any of three available port settings, provided that a different setting is used for each. The settings include the *port address* (in hexadecimal) and the IRQ (interrupt request line), which determines how the microprocessor responds to an interrupt from the parallel port. There is no direct relationship among the three available port settings and the three LPT numbers. The three available port settings, in sequential order, are 3BC-IRQ 7, 378-IRQ 5, and 278-IRQ 5. When you start the server, the POST program assigns LPT numbers to the port addresses that are actually in use at the time. POST goes down the list of addresses sequentially to assign LPT numbers to each address in use by a parallel device. If an address is not in use, an LPT number is not assigned to it. POST assigns the next available LPT number to the next address in use, if any.

The port address and IRQ setting for the built-in parallel port is preset at the factory to 3BC-IRQ 7, and the POST assigns LPT1 to it during startup.

If you add another parallel adapter that uses the next sequential address (378-IRQ 5), POST assigns LPT2 to it. You can view the port address and IRQ setting for the built-in parallel port using the Configuration/Setup Utility program.

Generally, you do not have to change the parallel-port setting. However, if you add a parallel adapter or use special hardware or software that causes a configuration conflict, you might have to change the port setting. Also, you have to change the parallel-port setting if you use ECP, EPP, or ECP/EPP modes because 3BC-IRQ 7 cannot be used for these modes. You can change the setting using the Configuration/Setup Utility program. For more information about using the Configuration/Setup Utility program, refer to your *PC Server 315 User's Handbook*.

Parallel Port Modes

The parallel port can operate in five different modes. One is a standard, unidirectional mode; the other four are extended, bidirectional modes that provide additional function and higher performance. Refer to the documentation that comes with printers and other parallel devices to determine the appropriate parallel mode to use and required device drivers.

Standard, unidirectional: This is the default mode. In this mode, the parallel port is limited to writing information to the device attached to it. You can use this mode with most IBM-compatible parallel printers.

Extended, bidirectional: In this mode, the parallel port can transfer data to other PC Server systems and supported devices.

ECP: The *extended capabilities port* (ECP) mode is a high-performance, bidirectional mode, that uses direct memory access (DMA) for data transfer to a high-speed printer or other device.

EPP: The *enhanced parallel port* (EPP) mode is a high-performance, bidirectional mode, that has capabilities similar to ECP mode. The main difference is that EPP data transfers are processor-initiated instead of direct memory access (DMA). EPP supports the attachment of up to eight external devices such as hard disk drives, CD-ROM drives, tape drives, diskette drives, and a printer to the parallel port. You can connect these devices to each other in a daisy-chain arrangement, or you can connect them through an external multiplexor. The attachment of multiple devices requires device drivers supplied by the device manufacturers.

ECP/EPP: This mode combines the capabilities of the ECP and EPP modes. Select this mode if you have both ECP and EPP devices attached to the parallel port.

You can set these modes of operation for the parallel port using the Configuration/Setup Utility program. For more information about using the Configuration/Setup Utility program, refer to your *PC Server 315 User's Handbook*.

Video Monitor Adapter Port

Your server comes with an SVGA adapter. You can attach a variety of super video graphics array (SVGA) or video graphics array (VGA) monitors to the connector on this adapter. The SVGA adapter provides a 15-pin, female, D-shell connector.

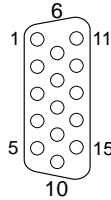


Table 6 shows the pin-number assignments for the video monitor connector.

Pin	Signal
1	Red
2	Green
3	Blue
4	Not used
5	Ground
6	Red ground
7	Green ground
8	Blue ground
9	+5V, used by DDC2B
10	Ground
11	Not used
12	DDC2B serial data
13	Horizontal synchronization (Hsync)
14	Vertical synchronization (Vsync)
15	DDC2B clock

Table 6. Video Monitor Connector Pin-Number Assignments

SCSI Adapter Ports

Your server comes with an UltraSCSI adapter. You can attach SCSI devices to the connectors on this adapter. The adapter provides the following shielded, high-density connectors:

- One internal 50-pin (2 × 25) for SCSI narrow devices
- One internal 68-pin (2 × 34) for SCSI wide devices
- One external 68-pin (2 × 34) for SCSI wide devices

Table 7 shows the pin-number assignments for the 50-pin (2 × 25) SCSI connector.

Pin	Signal	Pin	Signal
1	Ground	26	Terminator power
2	Data 0	27	Reserved
3	Ground	28	Reserved
4	Data 1	29	Ground
5	Ground	30	Ground
6	Data 2	31	Ground
7	Ground	32	-Attention
8	Data 3	33	Ground
9	Ground	34	Ground
10	Data 4	35	Ground
11	Ground	36	-Busy
12	Data 5	37	Ground
13	Ground	38	-Acknowledge
14	Data 6	39	Ground
15	Ground	40	-Reset
16	Data 7	41	Ground
17	Ground	42	-Message
18	Data P	43	Ground
19	Ground	44	-Select
20	Ground	45	Ground
21	Ground	46	-Control/data
22	Ground	47	Ground
23	Reserved	48	-Request
24	Reserved	49	Ground
25	Not connected	50	-Input/output

Table 7. Pin-Number Assignments for the SCSI 50-pin (2 × 25) Connector

Table 8 shows the pin-number assignments for the 68-pin (2 × 34) SCSI connectors.

Pin	Signal	Pin	Signal
1	Ground	35	Data 12
2	Ground	36	Data 13
3	Ground	37	Data 14
4	Ground	38	Data 15
5	Ground	39	Data P1
6	Ground	40	Data 0
7	Ground	41	Data 1
8	Ground	42	Data 2
9	Ground	43	Data 3
10	Ground	44	Data 4
11	Ground	45	Data 5
12	Ground	46	Data 6
13	Ground	47	Data 7
14	Ground	48	Data P0
15	Ground	49	Ground
16	Ground	50	Ground
17	+Term power	51	+Term power
18	+Term power	52	+Term power
19	Reserved	53	Reserved
20	Ground	54	Ground
21	Ground	55	-Attention
22	Ground	56	Ground
23	Ground	57	-Busy
24	Ground	58	-Acknowledge
25	Ground	59	-Reset
26	Ground	60	-Message
27	Ground	61	-Select
28	Ground	62	-Control/Data
29	Ground	63	-Request
30	Ground	64	-Input/Output
31	Ground	65	Data 8
32	Ground	66	Data 9
33	Ground	67	Data 10
34	Ground	68	Data 11

Table 8. Pin-Number Assignments for the SCSI 68-pin (2 × 34) Connector

Ethernet Adapter Port

The Ethernet adapter in some server models provides a standard Ethernet 100BASE-TX connector. This connector is used with a Category 5 cable that has RJ-45 connectors, allowing 10 or 100 Mbps transmission over two or four pairs of twisted-pair Ethernet cabling. In two-pair cabling, one pair of cables is used for transmission and the second pair is used for reception and collision detection. Because a 125 MHz frequency is used on the wiring, 100BASE-TX uses Category 5 cabling. Segment lengths are limited to 100 m (328 ft) for signal-timing restrictions.

Refer to the *PC Server 315 User's Handbook* for more information about Ethernet networks, cables, and connectors.

Chapter 9. Video Subsystem

Your PC Server 315 provides super video graphics array (SVGA) capability through an SVGA adapter. SVGA mode can provide a screen resolution of up to 1024×768 pels with up to 256 colors. A 15-pin connector on the adapter enables you to attach a video monitor to your server. For information about this connector, see “Video Monitor Adapter Port” on page 67.

The *video controller* on the SVGA adapter supports high-resolution graphics and fast refresh rates that exceed International Organization for Standardization (ISO) 9241 Part 3, Visual Display Requirements. It also provides reduced-flicker operation when used with noninterlaced monitors that meet ISO standards. For more information about noninterlaced monitors, see “Vertical-Refresh Rate” on page 73.

The video subsystem includes a video display buffer that contains 1 MB of video random access memory (VRAM). The buffer is expandable to 2 MB. (MB equals approximately 1 000 000 bytes.) The capabilities of the video driver and the amount of VRAM in your server determine the resolution and number of colors that are supported. Your server supports the following screen resolutions and numbers of colors for both 1 MB and 2 MB capacities:

- 640×480 pels with up to 16.8×10^6 colors (noninterlaced)
- 800×600 pels with up to 65 536 colors (noninterlaced)
- 1024×768 pels with up to 256 colors (noninterlaced)

Note: Monitors supporting 1280×1024 pels and up to 16 colors, and 1600×1200 pels and up to 16 colors may require operating-system support. See your operating-system documentation for more information.

Additional features of the video subsystem include:

- Integrated VGA emulation
- Support for the 132-column text mode
- Reduced-flicker operation for noninterlaced monitors that meet ISO standards

Monitors come in many sizes and types. The video controller supports a wide range of monochrome and color monitors having various capabilities.

How Monitors Operate

The most common distinguishing characteristics are resolution, dot pitch, vertical-refresh rate, screen size, and color.

Resolution and Dot Pitch

If you look closely at the screen, you can see that the entire image is made up of many tiny dots. These dots are called *pels*. Resolution is measured by the number of pels needed to fill the screen (horizontal-by-vertical).

Dot pitch is more difficult to visualize. The inside of the monitor screen is coated with light-emitting materials called *phosphors*. Color monitors use three phosphors: red, green, and blue. The phosphor coating is made up of dots arranged in a red-green-blue (RGB) pattern. The distance from the center of one phosphor dot to the center of the next phosphor dot of the same color is called the dot pitch. Dot pitch is measured in millimeters, such as 0.28, 0.31, and 0.41.

In general, the monitor with the highest resolution and finest dot pitch produces the sharpest image. A monitor with a fine dot pitch, such as 0.28, produces sharper, better-defined characters than a similar monitor that uses a coarser dot pitch, such as 0.41.

A system used extensively for detailed graphics might need a monitor that shows more colors, at a higher resolution and finer dot pitch, than one used exclusively for word processing. A black-and-white (monochrome) monitor can work as well as a color monitor for some applications.

Vertical-Refresh Rate

The phosphors on the inside of the monitor screen hold their brightness and color for a very short time. The image must be redrawn many times each second to refresh the phosphors. The vertical-refresh rate is the speed at which the image on the screen is redrawn.

The image is redrawn from top to bottom. By the time the bottom rows are drawn, the top rows are starting to fade. There are two ways of redrawing the image: *interlaced* and *noninterlaced*. The interlaced method draws every other row from top to bottom, then starts at the top to fill in the rows that were skipped on the first pass. The noninterlaced method draws the complete image on each pass.

The vertical-refresh rate affects the stability of the image on the screen. Monitors, such as the IBM G50 and P50 that have a fast, noninterlaced refresh rate, provide a very stable image with little or no visible flicker. Monitors with slower refresh rates tend to have more noticeable flicker. This is particularly evident with white and other light-colored backgrounds. You can often minimize flicker by changing the colors. Many programs allow you to select colors.

Sensitivity to flicker varies from person to person; young people are the most sensitive. Noninterlaced flicker occurs when the screen is redrawn at a rate that is slow enough to be detected by the human eye. Interlaced flicker occurs when an object on the screen is made up of alternating bright and dim lines, or when adjoining lines have very different pel (picture element) patterns.

Some application programs cannot reproduce all colors, so they use a technique called *dithering* to combine two colors. For example, light red might be produced by alternating lines of white and red. As the image is continually refreshed using the interlaced method, the red lines are drawn on one pass and the white lines on the next pass. As a result, the light-red object might appear to flicker while the rest of the image on the screen remains stable.

Selecting a Monitor

A monitor having a fast, noninterlaced refresh rate fully uses the video capabilities of your server. The IBM G50 and the IBM P50 are examples of monitors that use your server's video capabilities fully.

However, as mentioned earlier, some applications demand less video support than others. IBM provides many monitors that you can use with your system. The following is a partial list of monitors and their characteristics.

Type	Dot Pitch	Resolution (pels)	Maximum Vertical Refresh Rate
G40	0.28	1024 × 768	43 Hz interlaced
G40	0.28	800 × 600	60 Hz noninterlaced
G40	0.28	640 × 480	75 Hz noninterlaced
G50	0.28	1024 × 768	72 Hz noninterlaced
G50	0.28	800 × 600	85 Hz interlaced
G50	0.28	640 × 480	85 Hz noninterlaced
P50	0.26	1024 × 768	85 Hz noninterlaced
P50	0.26	800 × 600	85 Hz noninterlaced
P50	0.26	640 × 480	85 Hz noninterlaced

Table 9. Monitor Types and Characteristics

For more details, refer to the information supplied with your monitor. For the current list of IBM monitors, see your IBM marketing representative or your IBM reseller.

Using Your Monitor

The following information will help you use your monitor comfortably and correctly.

Brightness and Contrast Controls

The Brightness and Contrast controls are used to adjust the image on the screen for maximum viewing comfort. On a new monitor, set the controls near their center position. Setting these controls to their maximum position can decrease the useful life of a monitor.

As the monitor gets older, the image tends to become dimmer. Adjust the Brightness and Contrast controls to compensate for this condition.

Screen-Saver Programs

Leaving the monitor turned on for prolonged periods of time without changing the information on the screen can adversely affect its ability to display information. Depending on what is on the screen, the image might burn into the phosphor coating (leaving a permanent image) or cause some areas of the screen to darken.

You can avoid this problem by using a screen-saver program. A screen-saver program turns off the video signal when the keyboard or mouse has not been used for a defined period of time. To restore the previous image and resume working with the monitor, you usually press any key or move the mouse. Several companies produce screen-saver programs. For details, contact your IBM marketing representative or your IBM reseller.

Avoiding Fatigue

The American Academy of Ophthalmology considers monitors safe for normal use. They state that monitors are not a hazard to vision and they do not damage the eye.

However, performing any visually demanding task for a long time, such as knitting, reading, or viewing a monitor screen, can cause eye fatigue. To avoid eye fatigue, reduce annoying glare and ensure that your vision is corrected for the task. If eye discomfort persists, consult your eye-care professional or physician.

Similarly, sore muscles and joints can result from any job or activity where you stay in a fixed position, or you repeat the same movement over a long period.

Modifying work practices can reduce muscle, joint, and eye fatigue. Taking breaks, rotating tasks, adjusting the monitor, adjusting lighting, and adjusting chair height all result in less fatigue.

Additional information is available by ordering the following publications from the nearest IBM branch office:

- *Comfort and You* (G360-2050)
- *The VDT Workstation and Vision* (SV04-0309)
- *Working with Displays* (G325-0620)

Chapter 10. Security Features

Security features deter unauthorized use of your system and data. If you use your server in a public environment, such as an office, you can implement the security features of your server to protect it and the data stored on it.

Before implementing any security features, evaluate your security requirements. Where will the system be located? Should it be secured to permanent furniture or fixtures? Should use of the system be limited? After you have identified your security needs, you can activate or implement the appropriate security features.

Hardware Security Features

One of the best methods for protecting your hardware from theft is to keep it under lock and key. For more protection, you can fasten your server to a stationary object (table, desk, or wall). Also, you can put critical resources, such as your server, behind locked doors in a limited-access area. This approach is particularly important. Anyone with the correct equipment and knowledge can gain access to the data on your hard disk and other storage devices through the connectors on the rear of your server. The hardware security features of your server include:

- Door lock and keys
- Optional U-bolt facility, which allows you to secure the system to a stationary object using a cable or chain

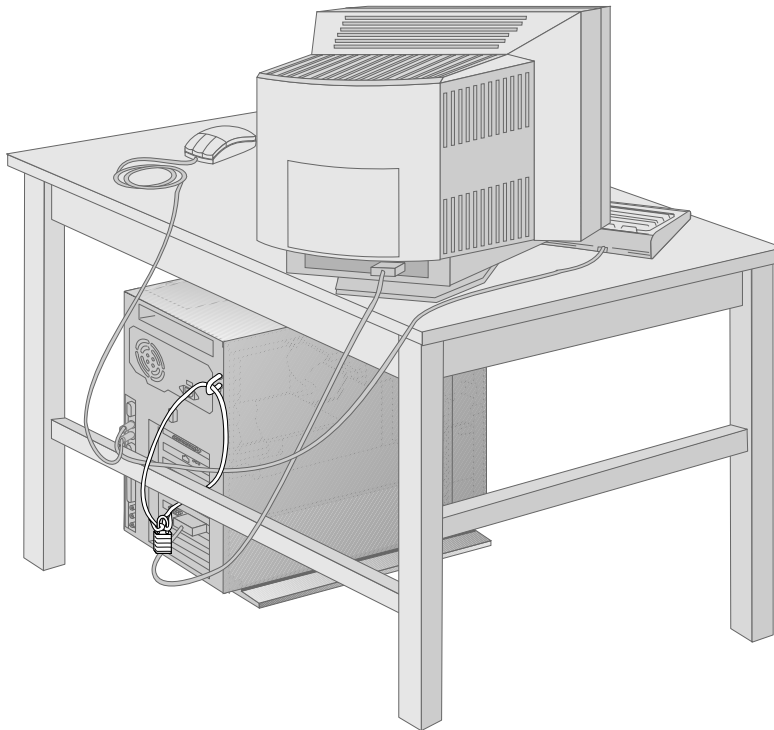
Door Lock and Keys

A door lock mechanically deters access to the drives. Two keys are provided with your PC Server. Always store the keys in a safe place. If you lose them, you must order a replacement lock mechanism and keys from IBM.

Note: Anyone who has the key serial number and manufacturer's address can order duplicate keys, so store the tag in a safe place.

U-Bolt Facility

If your server is in an accessible area, you might need a method of securing it to a desk, table, or other stationary object. Two holes in the rear panel of the server can accommodate a U-bolt. After a U-bolt is installed, you can use a cable or a chain to lock the server in place. This capability is referred to as a *cable-down* or a *bolt-down* feature. Your *PC Server 315 User's Handbook* contains step-by-step instructions for installing the U-bolt. The following illustration shows an example of how you can use the U-bolt to secure a server.



Software Security Features

This section contains information about the software security features provided with your PC Server 315.

- Power-on password
- Administrator password
- Keyboard password
- Selectable drive-startup sequence

Power-On Password

You do not need to set a power-on password to use your server, but a password helps to protect the information you store in it. The password can contain any combination of up to seven characters (A-Z, a-z, and 0-9). When a password is used, the keyboard and mouse (if attached to the mouse port) are locked to prevent unauthorized use of your server. The mouse remains active if it is attached to a serial port.

Keep a record of your power-on password in a secure place. If you forget it, but you remember the administrator password, you can enter the administrator password at the power-on password prompt to unlock the keyboard and mouse. You can then use the Configuration/Setup Utility program to set a new power-on password.

Administrator Password

Before setting an administrator password (also known as privileged-access or supervisor-level), it is a good idea to read this section completely. Using this security feature requires some planning and ongoing administration.

When the administrator password is set, you must use it to gain full access to the system Configuration/Setup Utility program. Also, you can use it to override the power-on password.

After an administrator password is set, only those who know the password can perform tasks such as:

- Altering settings or features controlled by the system programs
- Running diagnostic tests

How the Administrator Password Works

Use the administrator password to prevent unauthorized access to system settings and configuration.

You can use any combination of up to seven characters (A–Z, a–z, and 0–9) for your administrator password, just as you can with your power-on password. For additional security, do not make the two passwords the same.

The most important reason for setting an administrator password is that when one is set, only those who know the password can access the system programs, modify the hardware, or change any of the settings.

If the password you enter is incorrect, Incorrect password appears and you are prompted to enter the password again. After three incorrect attempts, The system is locked appears, and you must turn off the server and start again.

If the administrator password is forgotten, refer to the “Configuration” chapter in your *PC Server 315 User's Handbook* for the procedure to enter a new password.

Keyboard Password

You can set a keyboard password to lock the keyboard while the system is turned on. This is useful if you leave your system on and unattended.

The way you set the keyboard password depends on the operating system you are using. The OS/2 operating system provides keyboard-password protection as a standard feature.

If you forget your keyboard password, turn off the server for at least 5 seconds; then turn it on. The keyboard password is erased from memory when you turn off the server.

Selectable Drive-Startup Sequence

You can use selectable drive startup (sometimes referred to as selectable boot) to control the startup sequence of the drives in your server. Each time you turn on the server, it checks the drives as it looks for the operating system. The order in which the system checks the drives is the drive-startup sequence.

In most cases, you do not need to change the default drive-startup sequence. However, you may want to change your default drive-startup sequence if you set an administrator password, or you are working with multiple hard disk drives, multiple operating systems, or different-sized diskette drives.

The default drive-startup sequence checks the primary diskette drive for a *self-starting (bootable) diskette*. If one is present, the operating system or program is loaded from the diskette. If not, the system checks the primary hard disk for an operating system. If one is present, it is loaded from that hard disk. If no operating system is present on a start-up device, a screen prompting for a diskette appears.

If you start the system from a diskette, the drive containing the diskette becomes drive A, regardless of the defined sequence. The first hard disk selected in the startup sequence becomes drive C. You can choose a startup sequence of up to four drives.

You can customize the startup sequence by changing the order in which the system checks the drives. You decide which drive is the first to be checked and the order in which the system checks the remaining drives.

Note: When you change the startup sequence, the drive letters might change. The operating system assigns the drive letters when the system starts. The letters A and B are always assigned to diskette drives. You can assign subsequent drive letters to any type of drive based on your operating system or the device drivers you use.

Attention: If you change your startup sequence, you must be extremely careful when doing write operations (for example, copying, saving, or formatting). You can accidentally overwrite data or programs if you select the wrong drive.

Securing Data

It is very difficult to secure shared information from theft, but an effective method is to limit user access. Only users who need the software or data should be able to access it. This level of access control is provided as a standard feature of most network operating systems. Password protection is another common feature of network operating systems that helps secure data from theft. Passwords, which are easy to use and very effective, help prevent unauthorized users from accessing sensitive files.

System usage can be audited by some advanced network-management programs, based on names, adapter addresses, date, time, and unsuccessful attempts to access a file. Such information can help identify users who attempt to access restricted data.

To secure extremely sensitive data, you might want to consider using a commercially available *data-encryption tool*. These tools (software or hardware) encode the files so that they are unintelligible unless a special key is used. Software is usually less expensive than a hardware device, but software is slower.

Protecting Data from Loss

There are several methods you can use to prevent the loss of data. Consider these methods carefully, because some of them affect the performance, reliability, and hardware requirements of the server. There are primarily three ways that you can protect your data from loss:

- You can wait until the data accumulates on the server and then make backup copies of all the hard disks.
- You can configure a disk array to duplicate the data (create a redundant copy) as it is entered and then store the duplicate copy on a separate hard disk.
- You can configure a disk array to store the parity information about the data on the array as the data is being entered.

Backup Copies

A good method for preventing the loss of data is to make copies of the data. When a hardware failure occurs, you can always recover using the copies.

Backing up the entire contents of a hard disk to diskettes can be very time-consuming, and might require hundreds of diskettes when a network server has multiple hard disks. A faster and more efficient way to back up the data is to use a *tape-backup drive*. Using a tape-backup drive, you can copy large volumes of data from the hard disks to a single tape.

There are two problems with making backup copies. The first problem is someone has to remember to do it. The second problem is that you usually need to disconnect the server from the network to make the backup copies.

Redundant Copies

A convenient way to copy the contents of a hard disk is to duplicate all data as it is being entered. This duplicate copy is then stored on another hard disk. If one hard disk fails, you still have access to the data on the other. This method is more expensive than backing up to diskettes or tapes, because it doubles the amount of disk-storage space needed.

Parity Information

Storing parity information about the data as the data is being entered is an efficient, cost effective, and reliable method commonly used to guard against the loss of data. When a hard disk failure occurs, the parity information, and the data on the remaining functional disks, are used to reconstruct the data that was stored on the drive that failed.

Erased Files

Erasing a file from a diskette or hard disk does not destroy the file. With the right type of software, you can reclaim all or part of an erased file. This can cause a security risk if you sell a system or give someone a diskette that once contained classified or confidential information.

One way to help ensure that no readable information is left on a hard disk is to do a *low-level format*. An *operating-system format* operation does not remove all information from a hard disk.

The operating-system format operation works a little differently with diskettes. This format operation writes a repeated pattern over the entire surface. Any information that was on the diskette becomes unreadable.

Depending on the type of information stored, your company might require additional safeguards.

Viruses

A computer virus is a program (or set of instructions hidden within a program) that infects other programs by modifying them without your knowledge. Like any other program, the virus can do anything it is programmed to do. Some viruses are practical jokes and only cause unusual or erratic screen behavior. Others are destructive and erase or damage files, or overload memory and communication networks.

Viruses are generally spread unknowingly from computer to computer when programs are exchanged or shared. If you do not know where a program came from, be careful. Most reputable program distributors and bulletin-board services scan their files to guard against viruses and maintain records to identify program owners.

Viruses are difficult to detect. Many stay inactive until triggered by a specified event such as a date, command, or some other operation. Others are activated when an infected program is started a specified number of times. When the symptoms of a virus appear, they might appear to be hardware failure or a software problem.

Virus-detection programs examine files and look for patterns associated with these viruses, or look for changes in the size of files. These programs detect a virus before it becomes widespread or causes damage. Many computer users check for viruses on a regular basis.

Your server comes with a virus-detection program that examines files at system startup. You can use the system Configuration/Setup Utility program to enable or disable the virus-detection programs. Several other programs are available that can detect the presence of many known viruses.

When a virus is found, it must be removed. This might be as simple as replacing a file, or it might require the assistance of a trained technician. Some virus-detection programs can remove viruses and repair the damage caused by relatively benign viruses.

Here are a few tips to help you guard against computer viruses:

- Write-protect original program diskettes before using them. This ensures the diskettes will not be infected if a virus is already present in your system.
- Avoid using programs and diskettes from unknown sources.
- If you use programs that are provided from *public-domain software distributors* or *bulletin-board services* find out what precautions they take to guard against viruses.
- Back up all critical data and programs regularly.
- Watch out for changes in file sizes (when they shouldn't change).
- Use password protection to limit access to your system or network.

Remember not every problem is caused by a virus. If your system starts acting erratically, refer to your *PC Server 315 User's Handbook* for information about testing the system.

Backup Power Supply

To prevent the loss of data caused by a power fluctuation, you might consider installing a backup power supply. There are two basic types of commercially available backup power supplies: uninterruptible and standby.

Uninterruptible Power Supplies

An uninterruptible power supply provides power when the main power source is lost. An uninterruptible power supply connects directly to the main power source (electrical outlet), and then the server connects to the power supply. The power supply transfers the power from the main power source to its internal battery and its internal battery then provides power to the server. The advantages of uninterruptible power supplies are that they require no switching time (because they are always on), and they protect the server from power surges. A disadvantage is that they usually cost more than standby power supplies.

Standby Power Supplies

A standby power supply waits until it detects a drop in voltage; it then turns on and provides power to the server until its battery power is depleted. An advantage of a standby power supply is low cost. It is usually less expensive than an uninterruptible power supply. A disadvantage of a standby power supply is the amount of time that it needs to turn itself on; the more time it takes, the greater the chance of losing data.

Appendix. Product Warranties and Notices

Warranties

The following is the statement of limited warranty for the United States, Canada, and Puerto Rico.

International Business Machines Corporation

Armonk, New York, 10504

Statement of Limited Warranty

The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you originally 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. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. If you have any questions, contact IBM or your reseller.

Machine: IBM PC Server 315

Warranty Period*: Three Years

**Contact your place of purchase for warranty service information.*

Production Status

Each Machine is manufactured from new parts, or new and used parts. In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's warranty terms apply.

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. The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period IBM or your reseller, if authorized by IBM, will provide warranty service under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

For IBM or your reseller to provide warranty service for a feature, conversion, or upgrade, IBM or your reseller may require that the Machine on which it is installed be 1) for certain Machines, the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Many of these transactions involve the removal of parts and their return to IBM. You represent that all removed parts are genuine and unaltered. A part that replaces a removed part will assume the warranty service status of the replaced part.

If a Machine does not function as warranted during the warranty period, IBM or your reseller will repair it or replace it with one that is at least functionally

equivalent, without charge. The replacement may not be new, but will be in good working order. If IBM or your reseller is unable to repair or replace the Machine, you may return it to your place of purchase and your money will be refunded.

If you transfer a Machine to another user, warranty service is available to that user for the remainder of the warranty period. You should give your proof of purchase and this Statement to that user. However, for Machines which have a life-time warranty, this warranty is not transferable.

Warranty Service

To obtain warranty service for the Machine, you should contact your reseller or call IBM. In the United States, call IBM at **1-800-772-2227**. In Canada, call IBM at **1-800-565-3344**. You may be required to present proof of purchase.

IBM or your reseller will provide certain types of repair and exchange service, either at your location or at IBM's or your reseller's service center, to restore a Machine to good working order.

When a type of 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. 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 ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange.

You agree to:

1. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
2. where applicable, before service is provided —
 - a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provide,
 - b. secure all programs, data, and funds contained in a Machine, and
 - c. 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.

Extent of Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

The warranties may be voided by misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, removal or alteration of Machine or parts identification labels, or failure caused by a product for which IBM is not responsible.

THESE WARRANTIES 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.

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), IBM is liable only for:

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 or loss, up to the greater of U.S. \$100,000 or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR LOSSES OR 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 (INCLUDING LOST PROFITS OR SAVINGS), EVEN IF IBM 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 EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

Notices

References in this publication to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Subject to IBM's valid intellectual property or other legally protectable rights, any functionally equivalent product, program, or service may be used instead of the IBM product, program, or service. The evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM, are the responsibility of the user.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
500 Columbus Avenue
Thornwood, NY 10594
U.S.A.

Trademarks

The following terms are trademarks of the IBM Corporation in the United States or other countries or both:

IBM	OS/2
NetFinity	ServerGuide
XT	ESCON

The following terms are trademarks of other companies:

Adaptec	Adaptec, Inc.
SCSISelect	Adaptec, Inc.

Microsoft, Windows, and Windows NT are trademarks, or registered trademarks, of the Microsoft Corporation.

Intel and Pentium are trademarks or registered trademarks of Intel Corporation in the U.S. or other countries.

IPX and Novell are trademarks or registered trademarks of Novell, Inc. in the U.S. or other countries.

Important Notes

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

When referring to hard drive capacity, MB stands for million bytes and GB stands for one thousand million 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.

Unless otherwise stated, IBM makes no representations or warranties with respect to non-IBM products. Support (if any) for the non-IBM products is provided by the third party, not IBM.

Applications included with IBM products may vary from retail versions and may not include all documentation or functions. Not all products sold separately.

Other company, product, and service names may be trademarks or service marks of others.

Electronic Emission Notices Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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

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

Industry Canada Class A Emission Compliance Statement

This Class A digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Community Directive Conformance Statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

Power Cords

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

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

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

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

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

IBM power cords for a specific country are usually available only in
 that country:

IBM Power Cord Part Number	Used in These Countries
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, Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Macau, 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
14F0033	Antigua, Bahrain, Brunei, Channel Islands, Cyprus, Dubai, Fiji, Ghana, Hong Kong, 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

IBM Power Cord Part Number	Used in These Countries
62X1045	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

This glossary includes terms and definitions from:

- The *American National Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies may be purchased from the American National Standards Institute, 11 West 42 Street, New York, New York 10036. Definitions are identified by the symbol (A) after the definition.
- The ANSI/EIA Standard—440-A: *Fiber Optic Terminology*. Copies may be purchased from the Electronic Industries Association, 2001 Pennsylvania Avenue, N.W., Washington DC 20006. Definitions are identified by the symbol (E) after the definition.
- The *Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions of published parts of this vocabulary are identified by the symbol (I) after the definition; definitions from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet

been reached among the participating National Bodies of SC1.

A

ac. Alternating current.

access time. The time interval between the instant at which a call for data is initiated and the instant at which the delivery of data is completed.

adapter. (1) In a LAN, within a communicating device, a circuit card that, with its associated software and/or microcode, enables the device to communicate over the network. (2) A part that electrically or physically connects a device to a computer or to another device.

address. (1) In data communication, the unique code assigned to each device, workstation, or user connected to a network. (2) The location in the storage of a computer where data is stored. Also, the numbers that identify such a location.

address bus. The path used for the transmission of address information in a computer.

analog. (1) Pertaining to data consisting of continuously variable physical quantities. (T) (2) Contrast with *digital*.

ANSI. American National Standards Institute. ANSI is an

organization consisting of producers, consumers, and general interest groups that establishes the procedures by which accredited organizations create and maintain voluntary standards in the United States.

APAR. Authorized program analysis report.

application. The use to which an information processing system is put; for example, a payroll application, an airline reservation application, a network application.

application program. (1) A program that is specific to the solution of an application problem. Synonymous with application software. (T) (2) A program written for or by a user that applies to the user's work, such as a program that does inventory control or payroll. (3) A program used to connect and communicate with stations on a network, enabling users to perform application-oriented activities.

arbitration. A process that determines which device or subsystem gains control of a bus when two or more devices or subsystems simultaneously compete for control.

architecture. See *computer architecture*.

attachment unit interface (AUI). In a local area network, the interface between the medium attachment unit and the data terminal

equipment within a data station. (I) (A)

ASCII. American National Standard Code for Information Interchange.

asynchronous. (1) Pertaining to two or more processes that do not depend upon the occurrence of specific events such as common timing signals. (T) (2) A class of data transmission service whereby all requests for service contend for a pool of dynamically allocated ring bandwidth and response time.

attenuation. A decrease in magnitude of current, voltage, or power of a signal in transmission between points.

B

baud rate. In remote communications, the transmission rate that is synonymous with signal events. The baud rate is usually expressed in bits per second.

BBS. Bulletin board system.

BIOS. Basic Input/Output System.

bit. Either of the digits 0 or 1 when used in the binary numeration system. Synonymous with *binary digit*. (T)

bridge. A functional unit that interconnects two local area networks that use the same logical link control protocol but may use

different medium access control protocols.

buffer. (1) A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to another. (A) (2) A portion of storage used to hold input or output data temporarily.

bus. One or more conductors used for transmitting signals or power.

bus master. A device or subsystem that controls data transfers between itself and a subordinate.

byte. A string that consists of a number of bits, usually 8, that are treated as a unit and represent a character.

C

cable. The physical medium for transmitting signals; it includes copper conductors and optical fibers.

cable segment. A section of cable between components or devices on a network. A segment may consist of a single patch cable, multiple patch cables connected together, or a combination of building cable and patch cables connected together. See *LAN segment*.

cache. A buffer storage that contains frequently accessed instructions and data; it is used to reduce access time.

carrier sense multiple access with collision detection (CSMA/CD). A network protocol in which the transmitting workstation detects data collisions and waits a random length of time before retrying the transmission.

client. A functional unit that receives shared services from a server. (T)

clock. A device that generates periodic, accurately spaced signals used for purposes such as timing, regulation of the operations of a processor, or generation of interrupts. (T)

clock cycle. For a microprocessor, the amount of time that the microprocessor takes to pe at a given clock speed. Clock cycles are measured in nanoseconds (ns).

coaxial (coax) cable. A cable consisting of one conductor, usually a small copper tube or wire, within and insulated from another conductor of a larger diameter, usually copper tubing or copper braid.

code. Instructions written for a computer.

collision. An unwanted condition that results from concurrent transmissions on a channel. (T)

collision detection. In carrier sense multiple access with collision detection (CSMA/CD), a signal

indicating that two or more stations are transmitting simultaneously.

compatibility. The capability of a hardware or software component to conform to the interface requirements of a given computer without adversely affecting its functions.

computer architecture. (1) The logical structure and functional characteristics of a computer, including the interrelationships among its hardware and software components. (2) The organizational structure of a computer system, including hardware and software.

configuration. The manner in which the hardware and software of an information processing system are organized and interconnected. (T)

configure. To describe the interconnected arrangement of the devices, optional features, and programs installed on a system.

control. The determination of the time and order in which the parts of a data-processing system and the devices that contain those parts perform the input, processing, storage, and output functions.

controller. A device that coordinates and controls the operation of one or more input/output devices, such as workstations, and synchronizes the operation of such devices with the operation of the system as a whole.

crossover cable. A type of 10BASE-T cable in which the transmit and receive data pairs are wired so that the transmit pair is terminated at the pin positions used by the receive pair at the opposite end of the cable. A crossover cable is used to connect the 10BASE-T port (on an Ethernet controller) to a 10BASE-T port (on a repeater) that does not perform the crossover function.

CSMA/CD. See *carrier sense multiple access with collision detection*.

cycle. (1) An interval of space or time in which one set of events or phenomena is completed. (A) (2) A complete vibration, electric oscillation, or alternation of current.

D

DASD. Direct access storage device.

data. (1) A re-interpretable representation of information in a formalized manner suitable for communication, interpretation, or processing. Operations can be performed upon data by humans or by automatic means. (T) (2) Any representations such as characters or analog quantities to which meaning is or might be assigned. (A)

data bus. A bus used to communicate data internally and externally to and from a processing unit, storage, and peripheral devices. (A)

dB. Decibel.

device. A piece of equipment that is used with the computer. A device does not generally interact directly with the system, but is controlled by a controller. Each device has a device description associated with it, and often also has a job associated with it. Devices can be workstations, printers, diskette units, tape units, or remote systems.

digital. (1) Pertaining to data in the form of digits. (A) (2) Contrast with *analog*.

DIMM. Dual inline memory module.

direct access storage device (DASD). A device in which the access time is effectively independent of the location of the data.

direct memory access (DMA). The transfer of data between memory and input/output devices without microprocessor intervention.

disk array. Two or more hard disks interconnected to increase security, performance, or reliability.

disk duplexing. A method of storing data whereby the data from one hard disk is duplicated on another, with each hard disk drive using its own hard-disk controller. Contrast with *disk mirroring*.

diskette. A small magnetic disk enclosed in a jacket. (T)

disk mirroring. A method of storing data whereby the data from one hard disk is duplicated on another, with both hard disk drives sharing a single hard-disk controller. Contrast with *disk duplexing*.

DLC. Data link control.

DMA. Direct memory access.

dot pitch. A measure of display resolution on a color display, expressed as the distance between phosphor dots of the same color.

duplex. Pertaining to communication in which data can be sent and received at the same time. Synonymous with *full-duplex (FDX)*. Contrast with *half-duplex (HDX)*.

Dynamic Execution. The term given to the micro-architecture design of the Pentium Pro microprocessor. This design enables the Pentium Pro microprocessor to speculatively execute instructions in any order, but always complete the instructions in their original program order.

E

ECC. Error correcting code.

EDO. Extended data output.

EEPROM. Electrically erasable programmable read-only memory.

electrically erasable programmable read-only memory (EEPROM). EPROM that can be reprogrammed while it is in the computer.

EPROM. Erasable programmable read-only memory.

erasable programmable read-only memory (EPROM). A PROM that can be erased by a special process and reused. (T)

execution unit. A logical unit of a microprocessor that performs the arithmetic and logical operations specified by the microprocessor instruction set.

extended industry standard architecture (EISA). A microcomputer bus standard that supports 32-bit data exchange as an extension to the 16-bit ISA architecture.

F

FDX. Full-duplex. Synonymous with *duplex*. Contrast with *HDX*.

file. A named set of records stored or processed as a unit. (T)

file server. A high-capacity disk storage device or a computer that each computer on a network can use to access and retrieve files that can be shared among the attached computers.

floating-point unit (FPU). In microprocessors, an execution unit

that executes floating-point arithmetic instructions. See also *integer unit*.

frame. (1) A data structure that consists of fields, predetermined by a protocol, for the transmission of user data and control data. The composition of a frame, especially the number and types of fields, may vary according to the type of protocol. (T)

frequency. The rate of signal oscillation, expressed in hertz.

FTP. File transfer protocol. FTP is an application protocol used for transferring files to and from host computers. FTP requires a user ID and sometimes a password to allow access to files on a remote host system.

G

gateway. A functional unit that interconnects two computer networks with different network architectures. A gateway connects networks or systems of different architectures. A bridge interconnects networks or systems with the same or similar architectures.

GB. Gigabyte.

gigabyte. A unit of measurement for storage capacity; 1 073 741 824 bytes.

H

half-duplex. In data communication, pertaining to transmission in only one direction at a time. Contrast with *duplex*.

hard disk. A rigid magnetic disk such as the internal disks used in the system units of personal computers and in external hard disk drives.

hard disk drive. A stand-alone disk drive that reads and writes data on rigid disks and can be attached to a port on the system unit. Synonymous with *fixed disk drive*, *hard drive*.

hardware. (1) All or part of the physical components of an information processing system, such as computers or peripheral devices. (T) (2) The equipment, as opposed to the programming, of a system. (3) Contrast with *software*.

HDX. Half-duplex.

hexadecimal. Pertaining to a system of numbers to the base 16; hexadecimal digits range from 0 through 9 and A through F, where A represents 10 and F represents 15.

hertz (Hz). Unit of frequency.

I

icon. A graphic symbol, displayed on a screen, that a user can point to with a device such as a mouse in order to select a particular function or software application. Synonymous with *pictogram*. (T)

ID. Identification, identifier.

IEEE. Institute of Electrical and Electronics Engineers.

initialization. Preparation of a system, device, or program for operation.

input/output. Pertaining to a data provided to or resulting from a computer process.

input/output device. A device in a data processing system by means of which data can be entered into the system, received from the system, or both. (I) (A)

instruction. A statement that specifies an operation to be performed by a microprocessor, and that identifies data involved in the operation.

integer unit. In microprocessors, an execution unit that executes logical and integer arithmetic instructions. See also *floating-point unit*.

Internet Packet Exchange (IPX).

The routing protocol used to connect Novell's servers or any workstation or router that implements IPX with other workstations. Although similar to TCP/IP, it uses different packet formats and terminology. See also *TCP/IP* and *Xerox Network Systems** (XNS**)*.

Internet Protocol (IP). A protocol used to route data from its source to its destination in an internet environment.

interrupt level. The means of identifying the source of an interrupt, the function requested by an interrupt, or the code or feature that provides a function or service.

I/O. Input/output.

IPX. Internet Packet Exchange.

IRQ. Interrupt request.

ISA. Industry Standard Architecture.

ISO. International Organization for Standardization. ISO is an organization of national standards bodies from various countries established to promote development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

J

jabber. A transmission by a data station beyond the time interval allowed by the protocol. (T)

jumper. A connector between two pins on a network adapter that enables or disables an adapter option, feature, or parameter value.

K

KB. Kilobyte.

kilobyte. 1024 bytes.

km. Kilometer.

L

LAPS. LAN Adapter Protocol Support.

LAN. Local area network.

LAN segment. Any portion of a LAN (for example, a single bus or ring) that can operate independently but is connected to other parts of the establishment network via bridges.

LED. Light-emitting diode.

link segment. In an ESCON environment, any portion of an optical cable between connectors, including passive components.

load. To bring all or part of a computer program into memory

from auxiliary storage so that the computer can run the program.

local area network (LAN). (1) A computer network located on a user's premises within a limited geographical area. Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation. (T) (2) A network in which a set of devices are connected to one another for communication and that can be connected to a larger network.

locally administered address. In a local area network, an adapter address that the user can assign to override the universally administered address. Contrast with *universally administered address*.

logical. (1) Pertaining to content or meaning as opposed to location or actual implementation. (A) (2) Pertaining to a view or description of data that does not depend on the characteristics of the computer system or the physical storage. (A) (3) Contrast with *physical*. (A)

M

m. (1) Milli; one thousandth part. (2) Meter.

MAC. Medium access control.

math coprocessor. In personal-computer systems, a microprocessor that supplements the

operations of the system microprocessor, enabling the computer to perform complex mathematical operations in parallel with other operations.

MAU. Medium attachment unit.

MB. Megabyte.

Mbps. One million bits per second.

MDI. Medium dependent interface.

medium. A physical material in or on which data may be represented.

megabyte. (1) For processor storage and real and virtual memory, 2^{20} or 1 048 576 bytes. (2) For disk storage capacity and transmission rates, 1 000 000 bytes.

megahertz (MHz). A unit of measure of frequency. One megahertz is equal to 1 000 000 hertz.

memory. Addressable storage space in the computer that is used for temporary storage of instructions and data while a program is running, or for permanent storage of microcode.

menu. A list of options displayed to the user by a data processing system, from which the user can select an action to be initiated. (T)

microprocessor. A processor whose elements have been miniaturized into one or a few integrated circuits. (T)

millimeter (mm). One thousandth of a meter.

millisecond (ms). One thousandth of a second.

milliwatt (mw). One thousandth of a watt.

modem (modulator/demodulator).
(1) A functional unit that modulates and demodulates signals. Frequently, a modem is used to enable digital signals to be transmitted over analog transmission facilities. (T) (A)
(2) A device that converts digital data from a computer to an analog signal that can be transmitted on a telecommunication line, and converts the analog signal received to data for the computer.

multiplexing. In data transmission, a function that permits two or more data sources to share a common transmission medium so that each data source has its own channel. (I) (A)

multitasking. A mode of operation that provides for concurrent performance, or interleaved execution of two or more tasks. (I) (A)

N

nanosecond (ns). One thousand millionth of a second.

NDIS. Network driver interface specification.

NetBEUI. NetBIOS Extended User Interface.

network. (1) An arrangement of nodes and connecting branches. (T)
(2) A configuration of data processing devices and software connected for information interchange.

NetBIOS. Network Basic Input/Output System. An operating system interface for application programs used on IBM personal computers that are attached to the IBM Token-Ring Network. See also *BIOS*.

node address. The address of an adapter on a LAN.

normalization. The process of restructuring a relation for the purpose of reducing it to its simplest form, so that each of its attributes is based on a simple domain that consists of single, noncomposite values. (A)

ns. nanosecond.

O

operating system. Software that controls the execution of programs and that might provide services such as resource allocation, scheduling, input/output control, and data management. Although operating systems are predominantly software, partial hardware implementations are possible. (T)

P

packet. In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole. The data, control signals, and possibly error control information are arranged in a specific format. (I)

parity bit. A check bit appended to an array of binary digits to make the sum of all the binary digits, including the check bit, always odd or always even. (A)

PCI. Peripheral component interconnect.

pel. Picture element.

performance. One of the two major factors, together with facility, on which the total productivity of a system depends. Performance is largely determined by a combination of throughput, response time, and availability.

physical. (1) Pertaining to actual implementation or location as opposed to conceptual content or meaning. (A) (2) Contrast with *logical*. (A)

pipeline. In microprocessors, a technique used to shorten the critical path of instruction execution by performing multiple execution stages simultaneously.

port. An access point for data entry or exit.

POST. Power-on self-test.

power-on self-test (POST). A series of diagnostic tests that are run automatically by a device when the power is switched on.

processing. The performance of logical operations and calculations on data, including temporary retention of data in microprocessor storage while the data is being operated on.

processor. A functional unit that interprets and executes instructions. A processor consists of at least an instruction control unit and an arithmetic and logic unit. (T)

program. (1) A sequence of instructions that a computer can interpret and execute. (2) To design, write, and test computer programs. (I) (A)

programmable read-only memory (PROM). A storage device that, after being written once, becomes read-only memory. (T) (A)

PROM. Programmable read-only memory.

prompt. A visual or audible message sent by a program to request the user's response. (T)

PUN. Physical unit number.

R

RAID. Redundant array of independent disks.

RAS. Reliability, availability, and serviceability.

random access memory (RAM).

(1) A storage device in which data can be written and read. (2) A storage device into which data is written and from which data is read in a nonsequential manner.

read. To acquire or interpret data from a storage device, from a data medium, or from another source.

read-only memory (ROM).

Memory in which stored data cannot be modified by the user except under special conditions. See also *EPROM* and *PROM*.

record. (1) A set of data treated as a unit. (2) A set of one or more related data items grouped for processing.

refresh. (1) To recharge a memory location in volatile memory with an electric current so that it retains a state or binary value. (2) The process of repeatedly producing a display image on a monitor surface so that the image remains visible.

register. A part of internal storage having a specified storage capacity and usually intended for a specific purpose.

repeater. A device used to amplify or reshape signals.

resolution. In computer graphics, a measure of the sharpness of an image, expressed as the number of lines per unit of length or the number of points per unit area discernible in that image.

S

SCSI. Small computer system interface.

seek time. The time required for the access arm of a direct access storage device to be positioned on the appropriate track.

segment. A section of cable between components or devices. A segment may consist of a single patch cable, several patch cables that are connected, or a combination of building cable and patch cables that are connected.

sequential. Pertaining to a process in which all events occur one after the other, without any time lapse between them.

sequential access. The capability to enter data into a storage device or a data medium in the same sequence as the data is ordered, or to obtain data in the same order as it has been entered.

server. (1) A functional unit that provides shared services to workstations over a network; for example, a file server, a print server,

a mail server. (2) In a local area network, a data station that provides services to other data stations.

small computer system interface (SCSI). A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

SMP. System Modification Program.

SNAP. Subnetwork Access Protocol.

socket. (1) A port on a specific host; a communications end point that is accessible through a protocol's family addressing mechanism. A socket is identified by a socket address. (2) An endpoint for communication between processes or applications.

software. (1) All or part of the programs, procedures, rules, and associated documentation of a data processing system. Software is an intellectual creation that is independent of the medium on which it is recorded. (2) Contrast with *hardware*.

SQL. Structured query language.

startup sequence. In personal-computer systems, the order that the computer uses to search the direct access storage devices for an operating system.

storage. A functional unit into which data can be placed, in which

it can be retained and from which it can be retrieved.

straight-through cable. A type of 10BASE-T cable in which the transmit and receive data pairs are wired so that each signal wire is terminated at the same pin position at each end of the cable. A straight-through cable is used to connect the 10BASE-T port (on an Ethernet controller) to a 10BASE-T port (on a repeater) that performs the crossover function.

Subnetwork Access Protocol (SNAP). A 5-byte protocol discriminator that identifies the non-IEEE standard protocol family to which it belongs.

subsystem. A secondary or subordinate system, usually capable of operating independently or asynchronously with, a controlling system. (T)

superscalar. In microprocessors, a technique in which multiple independent instructions are issued per clock cycle.

swap space. In virtual memory systems, external storage allocated to program and memory images.

symmetric multiprocessing. In personal computers, a multiprocessing design that enables two or more microprocessors to run concurrently and work independently, with each microprocessor capable of performing any application task.

system board. In a system unit, the main circuit board that supports a variety of basic system devices, such as a keyboard or a mouse, and provides other basic system functions.

system unit. In an IBM personal computer, the part of the computer that contains the processor circuitry, read-only memory (ROM), random access memory (RAM), and the I/O channel.

T

TB. Terabyte.

TCP. Transmission Control Protocol.

TCP/IP. Transmission Control Protocol/Internet Protocol.

telephone twisted pair. One or more twisted pairs of copper wire in the unshielded voice-grade cable commonly used to connect a telephone to its wall jack. Also referred to as *unshielded twisted pair* (UTP).

terabyte. 1 099 511 627 776 bytes for storage capacity.

throughput. A measure of the amount of work performed over a period of time, for example, number of jobs per day.

token. In a local area network, the symbol of authority passed successively from one data station to

another to indicate the station temporarily in control of the transmission medium. Each data station has an opportunity to acquire and use the token to control the medium. A token is a particular message or bit pattern that signifies permission to transmit.

transaction. An exchange between a workstation and another device that accomplishes a particular action or result.

transceiver. A physical device that connects a host interface to a local area network, such as Ethernet. Ethernet transceivers contain electronics that apply signals to the cable and sense collisions.

Transmission Control Protocol (TCP). A communications protocol used in Internet and in any network that follows the U.S. Department of Defense standards for inter-network protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It assumes that the Internet protocol is the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP). A set of protocols that allow cooperating computers to share resources across a heterogeneous network.

transmit. To send information from one place for reception elsewhere.
(A)

twisted pair. A transmission medium that consists of two insulated electrical conductors twisted together to reduce noise. (T)

U

universally administered address. In a local area network, the address permanently encoded in an adapter at the time of manufacture. All universally administered addresses are unique. Contrast with *locally administered address*.

unshielded twisted pair (UTP).
See *telephone twisted pair*.

utility program. (1) A computer program in general support of computer processes; for example, a diagnostic program, a trace program, a sort program. (2) A program designed to perform an everyday task such as copying data from one storage device to another.

V

virtual. Pertaining to a functional unit that appears to be real, but whose functions are accomplished by other means.

W

wait state. A period during which a microprocessor suspends processing while waiting for a response to a request for an unavailable resource.

workstation. (1) A functional unit at which a user works. A workstation often has some processing capability. (2) A terminal or microcomputer, usually one that is connected to a mainframe or to a network, at which a user can perform applications.

write. To make a permanent or transient recording of data in a storage device or on a data medium.

A

- about this book vii
- adapter
 - bus master 17, 18
 - configuration 36, 52, 54
 - Ethernet 70
 - expansion slot 8, 34
 - ISA 32, 34–36
 - legacy 55
 - network 17
 - parallel 63
 - PCI 32–36
 - Plug and Play 12, 54
 - riser card 34
 - SCSI 41–47, 68
 - serial 60
 - shared expansion slot 34
 - video 71–76
- address
 - interface and bus 23
 - parallel port 64
 - Plug and Play memory 55
 - SCSI 45
 - serial port 61
 - USB 62
- administrator password 79–80
- advantage, SCSI subsystem 41
- air temperature range 14
- altitude, maximum 14
- ANSI standards 37, 42
- APIC (advanced programmable interrupt controller) 22
- application program
 - performance 17
- architecture
 - bus 31–36
 - memory subsystem 25–29
 - SCSI subsystem 41–47
 - video subsystem 71–76

- auxiliary-device
 - See mouse
- avoiding fatigue 76

B

- backup
 - copy 83
 - power supply 87
 - tape drive 38, 83
- basic input/output system (BIOS) 26
- battery, system 26
- bay, expansion 6
- BIOS 54
- BIOS (basic input/output system) 26
- bolt-down facility 78
- bootable diskette 81
- bridge controller 33
- brightness and contrast control 75
- bulletin-board service 86
- bus
 - architecture 31–36
 - SCSI 41–47
 - USB 62
- bus master 25
- bus master adapter 17, 18
- bus-level interface 43

C

- cable
 - 9-pin-to-25-pin adapter 11
 - connector 57–70
 - connectors 10
 - daisy chaining 46
 - option-to-option 44
 - power cord 96
 - riser power 36
 - SCSI 46

- cable (*continued*)
 - termination 47
- cable-down facility 78
- capacity
 - diskette 37
 - estimating 19
- CD-ROM drive
 - controls 5
 - in-use light 5
 - location 6
 - overview 38
 - SCSI ID 45
- chapter description vii
- characteristics, monitor 74
- clock, microprocessor 21
- CMOS (complementary metal oxide semiconductor) 50
- COM (communication port)
 - assignment 60
- Common Command Set 43
- compact disc-read only memory
 - See* CD-ROM drive
- computer virus 85
- computing, numeric 24
- configuration
 - adapter 36
 - overview 49—55
- Configuration/Setup Utility
 - program 51
- connector
 - I/O port 57—70
 - location, I/O ports 10
 - riser card 34
- context, execution 28
- contrast and brightness control 75
- controller
 - APIC (advanced programmable interrupt controller) 22
 - bridge 33
 - bus master 25
 - controller (continued)*
 - cache memory 28—29
 - DMA (direct memory access) 25
 - memory 25
 - SCSI device 43
 - video 71
- controls, location 4
- copy, backup 83
- cord, power 96
- CPU
 - See* microprocessor
- customer assistance ix
 - See also* the *PC Server 315 User's Handbook*
- cycle, microprocessor clock 21

D

- daisy-chain cabling 46
- DASD (direct access storage device) 37—38
- data
 - parity information 84
 - protecting from loss 83
 - security 82
 - storage device 37—39
- description, PC Server 315 3
- device
 - configuration 49—55
 - I/O port and connector 57—70
 - SCSI 41—47
 - storage 37—39
- device-level interface 43
- DIMM (dual inline memory module) 26
- direct access storage device (DASD) 37—38
- direct memory access (DMA) 25, 55

- diskette drive
 - controls 5
 - formatting a diskette 84
 - in-use light 5
 - location 6
 - overview 37
 - startup sequence 81
- display
 - See monitor
- dithering 73
- DMA (direct memory access) 25, 55
- door lock 77
- DOS, real mode 24
- dot pitch 72
- drive
 - See CD-ROM drive
 - See diskette drive
 - See hard disk drive
 - See tape drive
- dual inline memory module (DIMM) 26
- duplicating data 84
- dynamic execution 22

E

- ECP (extended capabilities port) 66
- EEPROM (electrically erasable programmable ROM) 26
- eject-button 5
- electrical input 14
- electrically erasable programmable ROM (EEPROM) 26
- electronic emission notice 95
- encryption, data tool 83
- enhanced parallel port (EPP) 66
- environmental specifications 14
- EPP (enhanced parallel port) 66

- erased file 84
- estimating server performance and capacity 19
- Ethernet adapter
 - configuration 53
 - connector 70
 - location, connector 10
- expansion
 - bay 6
 - bus 34
 - slot 8, 34
- extended bidirectional mode 66
- extended capabilities port (ECP) 66
- external storage enclosure, SCSI 39

F

- fatigue, avoiding 76
- features at a glance 2
- first-level cache 28
- flash memory (EEPROM) 26
- format, diskette or hard disk 84
- formatting 37
- FPU (floating-point unit) 24

G

- glossary 99

H

- hard disk drive
 - external storage enclosure 39
 - formatting 84
 - in-use light 5
 - location 6
 - overview 37
 - startup sequence 81
 - subsystem 18
- hardware specifications 14

- hardware, securing 77
- heat output 14
- hit, level-1 cache 28
- how monitors operate 72
- humidity range 14

I

- I/O (input/output) port
 - connector 57—70
 - location, connector 10
- I/O bus 31—36
- ideographic character 12
- improving server performance 20
- in-use light 4
- indicators, status 4
- infrared
 - connector 58
 - location, connector 10
- integer unit 24
- interface
 - address 23
 - bus-level 43
 - data 23
 - device-level 43
 - microprocessor 23
 - PCI bus 33
- interlaced image 73
- international capability 12
- International Organization for Standardization (ISO) 71
- introduction, PC Server 315 1
- IRQ (interrupt request)
 - line, adapter 55
 - parallel port 64
 - serial port 61
- ISA bus 32, 34—36
- ISO (International Organization for Standardization) 71

K

- key, door lock 77
- keyboard
 - connector 59
 - international support 12
 - location, connector 10
 - locking 79
 - password 81

L

- legacy adapter 36, 55
- light, status indicator 4
- line, adapter IRQ 55
- local bus 31
- location
 - controls and status lights 4
 - drives (CD-ROM, diskette, hard disk) 6
 - expansion bays 6
 - expansion slots 8
 - I/O ports and connectors 10
- lock, door 77
- locking the keyboard 79
- logical unit number (LUN) 46
- low-level format 84
- LPT (line printer) 64
- LUN (logical unit number) 46

M

- maximum number, SCSI devices 42
- memory
 - CMOS 50
 - subsystem overview 25—29
 - system 18
 - VRAM 71
- microprocessor
 - system 18

miss, cache level 28—29

mode

cache memory 29

microprocessor 23

operating system 24

parallel port 65—66

monitor

connector 67

international support 12

location, connector 10

video subsystem 71—76

mouse

connector 59

location, connector 10

multitasking 27

N

network

adapter 17

Ethernet 70

operating system 16

security 82—87

nominal operating current 14

noninterlaced image 73

nonvolatile memory 26

notices 92

numeric computing 24

NVRAM (nonvolatile RAM) 26

O

operating system

international support 12

mode 24

network 16

securing data 82

selectable drive-startup

sequence 81

support 13

virtual memory 27

option-to-option cable 44

ordering a publication ix

See also the PC Server 315 User's Handbook

overview

cache memory 28—29

CD-ROM drive 38

configuration 49—55

diskette drive 37

features 2

hard disk drive 37

I/O port and connector 57—70

ISA bus 32, 34—36

memory subsystem 25—29

microprocessor 21—24

parallel port 63—66

PCI bus 32—36

performance 15—20

POST 49

register 23

SCSI subsystem 41—47

security features 77—87

serial port 59—61

storage device 37—39

tape drive 38

video subsystem 71—76

P

parallel port

connector 63

location, connector 10

overview 63—66

parity information 84

password 79—81

PCI bus 32—36

pels 72

Pentium 21

performance

cache memory 28—29

- performance (*continued*)
 - microprocessor 22
 - overview 15—20
 - PCI bus 33
- peripheral device, PCI 33
- phone, warranty service 89
- phosphors 72
- physical
 - configuration, SCSI 44
 - memory 27
 - unit number (PUN) 45
- pin-number assignment, I/O
 - connector 57—70
- pipeline 22
- Plug and Play adapter 12, 54
- pointing device
 - See* mouse
- port
 - See* I/O (input/output) port
- POST (power-on self-test)
 - COM assignment 61
 - EEPROM (flash memory) 26
 - LPT assignment 64
 - memory controller 25
 - overview 49
- power
 - cord 96
 - supply 87
 - switch and status light 5
- power-on password 79
- preface vii
- processor
 - See* microprocessor
- processor bus 31
- program
 - application 17
 - computer virus 85
 - configuration 50—52
 - Configuration/Setup Utility program 51

- program (*continued*)
 - screen-saver 75
 - SCSISelect Utility 52
- programmed I/O 25
- protected mode 23
- protecting data from loss 83
- public-domain software 86
- publications ix
 - See also* the *PC Server 315 User's Handbook*
- publications, ordering ix
- PUN (physical unit number) 45

R

- RAM (random access memory) 26
- RAS feature 13
- read-only memory (ROM) 26
- real mode 23
- redundant copy, data 84
- refresh rate, vertical 73
- register
 - memory controller 25
 - overview 23
- related publications ix
- resolution 72
- riser card 34
- ROM (read-only memory) 26
- RS-232D 60

S

- screen-saver program 75
- SCSI
 - 50-pin connector 68
 - 68-pin connector 69
 - ANSI standards 42
 - configuration 53
 - DASD 37—38
 - external device port 68
 - external storage enclosure 39

- SCSI (*continued*)
 - hard disk subsystem 18
 - internal device port 68
 - location, connector 10
 - location, drive 6
 - maximum number, devices 42
 - selectable drive-startup sequence 81
 - subsystem overview 41—47
 - SCSISelect Utility 52
 - second-level cache 29
 - security features 77—87
 - selectable drive-startup sequence 81
 - selecting a monitor 74
 - self-starting diskette 81
 - sequential access storage device 38
 - serial port
 - connector 60
 - location, connector 10
 - overview 59—61
 - shared expansion slot 8, 34
 - sine-wave input 14
 - size of server 14
 - slot, expansion 8, 34
 - small computer system interface
 - See* SCSI
 - SMP (symmetric multiprocessing) 21
 - specifications 14
 - speed
 - clock, microprocessor 21
 - ISA bus 32
 - PCI bus 33
 - SRAM (static random access memory) 28
 - standard unidirectional mode 66
 - standby power supply 87
 - startup sequence, drive 81
 - static random access memory (SRAM) 28
 - status indicators 4
 - storage
 - cache memory 28—29
 - data storage device 37—39
 - EEPROM (flash memory) 26
 - memory subsystem 25—29
 - RAM 26
 - register 23
 - ROM 26
 - subsystem
 - hard disk 18
 - memory 25—29
 - SCSI 41—47
 - video 71—76
 - superpipelined 22
 - supply, power 87
 - support, operating system 13
 - SVGA controller 71
 - swap space 27
 - switch, power 5
 - symmetric multiprocessing (SMP) 21
 - system
 - battery 26
 - configuration 49—55
 - memory 18, 25—29
 - microprocessor 18, 21—24
- T**
- tape drive
 - backup copy 83
 - overview 38
 - telephone number ix
 - See also* the *PC Server 315 User's Handbook*
 - termination, SCSI 47

- terms, glossary 99
 - defining terms, glossary 99
- theft, deterring 77
- tool, data-encryption 83
- trademarks 93
- types, monitor 74

U

- u-bolt facility 78
- UART (universal asynchronous receiver/transmitter) 59
- UltraSCSI adapter 37, 41, 68
- understanding server
 - performance 16
- uninterruptible power supply 87
- unit, execution 24
- USB (universal serial bus)
 - connector 62
 - location, connector 10
- user operated control 4
- using your monitor 75

V

- vertical-refresh rate 73
- video
 - connector 67
 - location, connector 10
 - subsystem overview 71—76
- virtual memory 27
- virus, computer 85
- volatile memory 26
- voltage
 - I/O port and connector 57—70
 - PCI bus 36
 - power supply 87
 - specification 14
- VRAM (video RAM) 71

W

- wait state 28
- warranty service 89
- weight of server 14
- what your PC Server 315 offers 3
- write modes, cache 29



Part Number: 84H5976

Printed in U.S.A.

April 1997

84H5976

