Understanding Your Personal Computer

PC 300GL

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PC 300GL

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Overview

This book provides information about microprocessors, memory, bus architectures, input/output features, video, power management, ports, storage devices, security features, and software. Not all features and capabilities described in this book are available on all models.

For specific information on features of the PC 300GL and instructions on how to set up, operate, install options, program, or maintain your computer, refer to the *PC 300GL User Guide* that comes with your computer.

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Chapter 1. Microprocessors and Memory

The microprocessor-and-memory subsystem consists of components on the system board that perform logical operations and calculations, control memory, and manage data-transfer operations.

The devices and features that make up the microprocessor-and-memory subsystem are:

- Microprocessors and buses
- Memory and control logic

Microprocessors

The microprocessor controls most of the activity in your computer. Almost all information passes through it, whether it is a keyboard stroke, data from a disk drive, or information from a communication network. The microprocessor reads, changes, processes, and reroutes information as needed.

Your computer comes with an Intel™ microprocessor that has a 64-bit internal data path and integrated L2 cache. In addition, the microprocessor incorporates Intel MMX™ technology. MMX technology boosts the performance of the microprocessor in processing graphic, video, and audio data, thereby enhancing the performance of multimedia and communications software. For information about the type and speed of the microprocessor in your computer, view the *System Summary* screen displayed by the Configuration/Setup Utility Program.

Another key feature of the microprocessor is that it includes *system management mode (SMM)*, which enables the microprocessor to control power used by peripheral devices and other components. This makes processing more energy efficient and allows the system to run cooler.

Microprocessor Speed

The microprocessor operating speed is referred to as *clock speed* and is measured in *megahertz (MHz)*[1]. The design of the microprocessor determines the maximum clock speed at which it can operate. A quartz crystal on the system board generates a pulse to the microprocessor, causing the microprocessor to operate at a specific speed. A *clock cycle* is the time that the microprocessor takes to perform instructions at a given clock speed. Clock cycles are measured in *nanoseconds (ns)*.

[1] MHz only denotes internal clock speed of the microprocessor, not application performance; many factors affect application performance.

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Microprocessors can operate at two clock speeds: an *internal speed* for operations within the microprocessor and an *external speed* for transferring data in and out of the microprocessor.

Microprocessor Cache

Both *level-1 (L1) cache* and *level-2 (L2) cache* are integrated with the microprocessor on the system board. Cache is high-speed memory that stores information most often used by the microprocessor. Integrated cache provides a performance increase over the external placement of cache on the system board. Refer to "Cache Memory" on page 4 for more information about cache memory.

Microprocessor Bus

The microprocessor has an external bus that connects it with main memory and control circuits. This pathway, which is also called the *processor bus* or *local bus*, has the same bus width as the microprocessor and operates at the same external speed.

Another computer bus, called the *I/O bus* or *expansion bus*, carries data and instructions between the microprocessor bus and the computer peripherals. The width of the I/O bus is 32 bits. With advanced bus technologies, the speed of the I/O bus might approach that of the microprocessor bus. With standard bus technology, however, the speed of the I/O bus is much slower than that of the microprocessor bus. Refer to Chapter 2, "Expansion-Bus" on page 8 for additional information.

Microprocessor Instructions

Data and instructions are necessary for each processing operation that the microprocessor performs. Data and instructions are copied from memory into *registers* within the microprocessor. Registers are also used to store the data that results from each processing operation until the data is returned to memory.

The set of instructions that the microprocessor can perform determines whether the computer can run a particular program. For example, programs written for 32-bit computers require a microprocessor capable of performing 32-bit instructions.

Memory

Your computer uses several types of memory to store information. This section explains memory concepts, types of memory, and how the types of memory are used.

Although a computer is a complex machine, the method it uses to store information is quite simple. All information (data and instructions) is stored in a coded format made up of 0's and 1's. Memory is a series of switches, with an open switch representing a 0 and a closed switch representing a 1. Each switch represents the smallest unit of computer storage, a *bit*; eight consecutive bits of storage equals a *byte*. Memory is allocated in *kilobytes (KB)*, *megabytes (MB)*, and *gigabytes* where 1 KB equals approximately 1000 bytes, 1 MB equals approximately 1000000 bytes, and 1 GB equals approximately 1000000000 bytes. In 1 MB

of memory, the computer can store over 1 000 000 characters of information. The computer organizes its memory by assigning an *address* to each byte as a point of reference. The first address is 0, and the addresses increase sequentially. When information is written to memory, the encoded character is placed at a specific address.

Main Memory

Main memory (or *system memory*) is a temporary workspace that is active only while your computer is on. Any information placed in main memory is lost when you turn off your computer. Therefore, if you create or modify information, you must save the data to permanent storage, such as a diskette or hard disk.

The main memory in your computer uses *synchronous dynamic random access memory (SDRAM)* modules for temporary storage of data and instructions. These SDRAM modules are also known as *dual inline memory modules (DIMMs)*. SDRAM is *volatile* memory, which means that it must be constantly refreshed by an electric current. While the computer is turned off, no current is supplied to the DIMMs, so no data is retained in SDRAM.

The DIMM connectors are located on the system board. For information about the type and amount of main memory (or *System Memory*) in your computer, view the *System Summary* screen displayed by the Configuration/Setup Utility Program.

CMOS Memory

Your computer also uses some *nonvolatile RAM (NVRAM)*, also called *complementary metal-oxide semiconductor (CMOS)* memory, for storing configuration and setup information. Powered by a small battery, CMOS retains its contents while your computer power is off. CMOS maintains information about:

- Date and time
- Security features
- Power-management settings
- Storage devices
- Keyboard and mouse
- ISA legacy configuration information
- Plug and Play configuration information
- Port assignments
- I/O addresses and interrupts
- Other selectable features

Flash Memory

To store programs for startup procedures and other internal operations, some computers use *read-only memory (ROM)*. These programs are encoded in ROM modules on the system board. ROM is *nonvolatile* memory, which means that it retains its contents when the computer is turned off. Generally, the contents of a ROM module cannot be modified. However, *electrically erasable programmable ROM (EEPROM)* modules (also referred to as *flash memory*) can be reprogrammed while they are in the computer.

Your computer stores various system programs and data in *flash memory* so that they can be updated whenever enhancements are made. Stored in flash memory are:

- Basic input/output system (BIOS)
- Power-on self-test (POST)
- Configuration/Setup Utility program
- Vital product data (VPD)
- Processor update code

Cache Memory

Microprocessors can be so fast that main memory cannot respond to read and write requests as quickly as the microprocessor can send them. In some cases, main memory imposes one or more *wait states* on the microprocessor when it reads data from or writes data to memory.

A wait state is a period of time (one microprocessor clock cycle) during which the microprocessor suspends processing and waits for memory to respond to a read or write operation (a *memory I/O operation*). The speed of a memory I/O operation is measured in microprocessor clock cycles, so the microprocessor clock speed determines the minimum time required for a memory I/O operation. Wait states cause the computer to operate less efficiently than if the microprocessor were able to continue processing data during memory I/O operations.

A method of reducing the need for wait states is by using *cache memory*, which improves system performance by temporarily storing frequently used data and instructions in a *cache*. A cache is a buffer between the microprocessor and main memory.

For information about the cache memory in your computer, view the *System Summary* screen displayed by the Configuration/Setup Utility Program.

Level-1 Cache

Level-1 (L1) cache is determined by the type of microprocessor installed in your computer. The L1 cache for the Intel microprocessors contain high-speed memory, known as *static random access memory (SRAM)*, that can respond to memory I/O operations without imposing wait states on the microprocessor.

L1 cache memory is used to store the information most often used by the microprocessor. This allows a microprocessor to handle information faster than if it had to use the system memory each time it needed new information. During processing, the cache controller copies other data and instructions into the cache, replacing data and instructions that are no longer needed.

Performance is improved each time the microprocessor finds what it needs in the cache (a *cache hit*). If it does not find what it needs (a *cache miss*), the cache controller must locate the data or instruction in memory and copy it into the cache, while one or more wait states are

imposed on the microprocessor. 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

Your computer has *level-2 (L2)* cache memory integrated into the microprocessor. L2 cache complements L1 cache to increase the probability of cache hits. If the microprocessor cannot find what it needs in L1 cache, it searches L2 cache. If the data or instruction is not in either cache, the cache controller locates it in main memory and copies it into both caches.

Cache Mode

The microprocessor frequently updates cache memory with changed data. Caches, in turn, pass these changes to main memory.

When updating cache memory, your computer uses the *write-back mode*. In write-back mode, the microprocessor updates the cache, then goes on to perform other functions while the cache controller updates main memory.

Write-back mode provides better performance than *write-through mode*, which is a type of cache architecture used in some other computers. In write-through mode, a microprocessor updates main memory directly. Write-through mode is slower because the microprocessor interacts directly with main memory, which is slower than cache memory.

Memory Organization

Operating systems are responsible for allocating memory space, assigning addresses, and performing many other tasks associated with memory management.

DOS Memory Management

DOS organizes memory into the following types:

- Conventional
- Extended
- Expanded

Conventional memory is the first 1 MB of memory-address space. Of this, the first 640 KB is available for use by DOS and application programs. Memory from 640 KB through 1 MB is reserved as a work space for hardware devices and the BIOS.

Extended memory starts above the first 1 MB, appended to conventional memory. Use of this space is dependent on the operating system and application programs. Not all programs can use extended memory.

Expanded memory is controlled through an expanded memory specification (EMS) device driver, such as the one provided with DOS. The EMS device driver is commonly known as a *memory manager*. The EMS device driver uses part of the reserved area of conventional memory as a work space, and the memory above the first 1 MB as a storage area. The

memory above the first 1 MB is not written to or read from directly. It is broken into 16 KB pieces called *pages*, or 64 KB pieces called *frames*, and is moved in and out of the reserved area as needed. When a page or frame is moved into the reserved area, it can be read from and written to as any other address in conventional memory.

Other Types of Memory Management

Operating systems such as Microsoft Windows 95, Windows 98, and Windows NT have very sophisticated memory-management systems. These operating systems use a technique called *disk swapping* or *disk paging*. If your computer does not have enough memory to meet the needs of your active programs, these operating systems transfer the least-used information from memory to the hard disk to make more memory available. When the information on the hard disk is needed, it is exchanged with other information in memory.

Microsoft Windows 95, Windows 98, and Windows NT also use memory in another way. These operating systems assign blocks of memory as *virtual DOS machines (VDM)*. Each VDM runs independently of the others, providing the same function as a separate computer running DOS. With very few exceptions, these operating systems are fully compatible with application programs written for DOS.

If you are using any of these operating systems, adding memory can increase the overall performance.

Physical and Virtual Memory

Physical memory consists of all the addressable memory locations in the computer. Physical memory is used to store such items as the operating system, video data, and instructions and data the computer uses to run programs.

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.

Virtual memory makes *multitasking* possible. In a multitasking session, the memory requirements of all the programs that might be running in the system at the same time can far exceed the amount of physical memory that is available. The operating system allocates virtual memory to meet the total memory requirements of each program and then manages the available physical memory to meet the actual requirements. Thus, the amount of virtual memory that is allocated can be much greater than the amount of physical memory installed in the computer.

Control Logic

The control logic consists of the modules on the system board that control access to main and cache memory by the microprocessor and I/O devices. Control logic includes the following devices and functions:

- Audio-port controller and interface (some models only)
- Bus-mastering IDE interface
- Counters and timers
- Direct memory access (DMA) controller
- Diskette-port controller and interface
- Interrupt controller
- Keyboard and mouse port controller and interface
- Memory (DRAM) controller
- Microprocessor-interface control
- Parallel-port controller and interface
- PCI-bus interface
- PCI-to-ISA interface
- Power-management controller
- Serial-port controller and interface
- USB-port controller and interface

Chapter 2. Expansion-Bus

This section gives an overview of the expansion-bus and explains how advanced buses can improve performance.

A computer *bus* is a pathway of wires and signals that carries (or transfers) information inside the computer; information includes data, addresses, instructions, and controls. The microprocessor has an external bus, called the *processor bus* or *local bus*, that carries information between the microprocessor and main memory. The processor bus has the same bus width (64 bits) as the microprocessor and operates at the same external speed.

Another computer bus, the *expansion-bus*, carries information between the microprocessor or memory and peripheral I/O devices. While processor-bus performance has improved rapidly, improvements in expansion-bus performance 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 expansion-bus.

Your computer has two expansion-buses: the *ISA-bus* and the *PCI-bus*. PCI is an advanced expansion-bus standard developed by the computer industry to keep up with performance improvements of processor buses and advanced peripheral devices. Although advanced designs can match the performance of the microprocessor bus only up to a point, they do achieve higher throughput by speeding up the expansion-bus and widening its data path. PCI is intended to add to the capability provided by the ISA-bus.

PCI-Bus

An answer to the need for a higher-performance expansion-bus is the *peripheral component interconnect (PCI)* bus. PCI architecture offers many features that improve expansion-bus performance such as:

- Microprocessor independence
- Industry-standard compatibility
- Wider data path (32 bits)
- Faster data-transfer rates
- More efficient data-transfer methods
- Enhanced peripheral-device performance
- Automatic configuration

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PCI Interface

The PCI-bus connects to the microprocessor 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 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. PCI can operate at speeds as fast as 33 MHz[1], slow down, or even stop if there is no activity on the bus, all independent of the microprocessor's operations. Microprocessor independence also makes PCI adaptable to various microprocessor speeds and families and allows consistency in the design and use of PCI peripheral devices across multiple computer families.

PCI Performance

One of the most significant features of PCI is its 32-bit data path, which is twice the width of the ISA data path. With a 32-bit data path, the PCI-bus can transfer more information per second than the ISA-bus, with its 16-bit data path. Also, PCI operates at higher speeds of up to 33 MHz. Depending on the mode of operation and computer components used, the PCI-bus can transfer data at speeds up to 132 MB per second. While many factors can reduce practical performance, achieving just half or a third of the PCI maximum theoretical throughput far exceeds the practical performance of the ISA-bus, which operates at 4 MB to 8 MB per second.

ISA-Bus

One of the most widely used and successful expansion-buses is the *industry standard architecture (ISA) bus*, also called the *AT 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 have been 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 requesters with moderate performance requirements.

Although the ISA-bus is widely used and is suitable for many applications, it 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 needed by video devices and applications with high resolution and high-color content. Also, ISA might not be capable of handling the throughput required by some fast hard disk drives, network controllers, or full-motion graphics controllers.

Expansion-Bus Slots

If you want to add new capabilities to your computer, you can do so by installing optional *adapters*. Your computer provides an ISA-bus expansion slot so you can take advantage of the wide availability of ISA peripheral devices and applications. Also, PCI-bus expansion slots allow you to connect high-performance devices to your computer, such as graphics, SCSI, or LAN adapters.

There are four expansion slots in your computer. Three are dedicated PCI slots and one is a dedicated ISA slot. These slots are grouped together on the system board.

The width of the expansion-bus determines the type of adapters the computer supports. The dedicated ISA slots accept only 8-bit or 16-bit ISA adapters, and the dedicated PCI slots accept only 32-bit PCI adapters. The width of the bus does not affect software compatibility.

Adapter Configuration

When adding adapters, you might need to manually set a variety of switches on the adapters. These switches control the assignment of computer resources such as interrupt request (IRQ) lines, direct memory access (DMA) channels, and memory address ranges. Determining how to set switches for (or *configuring*) these resources can be complex. A better method of configuring adapters and devices called *Plug and Play* is used on your computer to make expansion an easier task.

Plug and Play Adapters

Plug and Play is a configuration method that makes expanding your computer easier. Plug and Play adapters are easier to set up because they are auto-configuring. A Plug and Play adapter comes with built-in identification and configuration specifications set in memory on the adapter to provide installation information to the computer during startup. This information is interpreted by the computer's *basic input/output system (BIOS)*, which supports Plug and Play. The BIOS routines automatically configure the adapter as long as the required resources are not already in use.

Adapters designed for PCI slots are Plug and Play devices. Many adapters designed for ISA slots are not Plug and Play devices. If the adapter you are installing is not Plug and Play, you must configure it manually.

Legacy Adapters

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.

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

- Memory resources
- I/O port resources
- Direct memory access (DMA) resources
- Interrupt resources

From these screens you can select available resources for the adapter you are installing. Resources not currently being used by adapters already installed in your computer are set to **Available**. When you install an additional legacy adapter, set the resources used to **ISA Resource**. This enables the Plug and Play software to configure around legacy adapters, then you can make the appropriate jumper or switch settings on the adapter. Also, if you remove an ISA legacy adapter, set the resources it used back to **Available**. This frees up those resources for future configurations. Refer to the adapter documentation for information about required resources. Also, the refer to *PC 300GL User Guide* for more information about using the Configuration/Setup Utility Program.

Chapter 3. Video

This section describes the video features of your computer, including monitors, the graphics controller, video modes, and other video features.

Monitors

Although there are various types of monitors, the most common distinguishing characteristics are resolution, dot pitch, scanning rates, screen size, and color.

Resolution and Dot Pitch

The entire image on a monitor screen is made up of many tiny dots. These dots are called *picture elements* or *pels*. The monitor *resolution* is described by the number of pels that fill the screen in an array of horizontal rows and vertical columns. For example, the pels might be arranged in a horizontal-by-vertical array of 640 x 480 pels to make up a typical screen image. Higher resolutions, such as 800 x 600 or 1024 x 768 pels, mean more dots on the screen. The benefit of higher resolutions is either displaying more information at one time or displaying the same information with a sharper image.

Dot pitch refers to the space between the individual dots or pels. 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 consists of dots arranged in a red-green-blue pattern. The distance from the center of one phosphor dot to the center of the next phosphor dot of the same color is the dot pitch. Dot pitch is measured in millimeters, such as 0.28, 0.31, 0.39, 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.

Monitor characteristics can be very important. A computer 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. For some applications, a black-and-white (monochrome) monitor might work as well or better than a color monitor.

Scanning Characteristics

The phosphors on the inside of the monitor screen hold their brightness and color for a very short time. Therefore, the image has to be scanned (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 (or scanned). Refresh rates are specified in *hertz (Hz)*.

The image is redrawn from top to bottom (or vertically). By the time the bottom pel rows are drawn, the top rows are starting to fade. There are two ways of redrawing the image: *interlaced* scanning and *noninterlaced* scanning. The interlaced method draws every other

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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 that have a fast, noninterlaced refresh rate provide a very stable image with little or no detectable *flicker*. Monitors with slower refresh rates tend to have more noticeable flicker. Flicker can be particularly noticeable with white and other light-colored backgrounds. You can minimize flicker by changing the colors you work with. Many programs allow you to select colors.

Sensitivity to flicker varies from person to person. Noninterlaced flicker occurs when the screen is redrawn at a rate that is slow enough to be detected by the human eye. Interlaced flicker, or jitter, occurs when the pattern of pels in adjoining lines is very different, or when an object on the screen is made up of alternating bright and dim lines.

Some application programs cannot reproduce all colors and 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.

DDC Protocol

Potential problems with monitor flicker are reduced by operating a monitor at its highest refresh rate. To simplify the job of setting the refresh rate, some monitors offer Plug and Play capability using the *VESA Display Data Channel (DDC)* protocol. DDC is an industry standard for passing configuration information between a monitor and a computer. Both the monitor and the computer must have DDC capability.

Your computer supports the DDC2B protocol. With DDC, the computer can receive configuration information sent from a DDC monitor. When you turn on the computer with a DDC monitor connected, the monitor immediately starts sending its identification information to the computer. This information, called *Extended Display Identification Data (EDID)*, includes a description of the monitor and its operational limits and timings. The POST programs use the information from the monitor to automatically configure the video controls to operate the attached monitor in its optimum mode. Thus, when the monitor comes on, it is already set to the highest refresh rate that the monitor and graphics controller can support.

Power Management

Power management reduces the power consumption of your computer when you are not using it. A monitor with *VESA Display Power Management Signaling (DPMS)* support can save a significant amount of energy and have a longer useful life. DPMS-compliant monitors can be powered down in three modes: *Standby*, *Suspend*, and *Off*. The stages that can actually be used, however, depend on the power-management capabilities of your computer.

In *Standby* mode, the monitor (and other devices) are switched to a reduced-power state if you do not use your mouse or keyboard for a specified period. The devices remain in a state of readiness and return to full power if you press a key or move the mouse. *Suspend* further decreases monitor power, and *Off* reduces monitor power to its lowest level. Refer to "Advanced Power Management" on page 42 for more information on power management.

Check the documentation that comes with your monitor to see if your monitor is enabled for power management. If you find no information about power management, your monitor probably does not support this feature. If your monitor does not have DPMS support, deactivate it in the power-management features of your software or use the Configuration/Setup Utility Program to disable *Display* in all three levels of power management. Even if you deactivate the display for power-management purposes, you can still take advantage of screen savers. Refer to "Using Screen Savers" on page 15 for more information.

Selecting a Monitor

The graphics controller installed in your computer is a high-performance, high-resolution graphics accelerator and includes many performance-enhancing features for your operating system environment. It has a built-in monitor connector. See "Video Control" on page 15 for more information. The graphics controller supports various SVGA monitor resolutions. If you connect an SVGA monitor to your computer, you can take advantage of SVGA resolutions such as 1024 x 768. However, the default resolution might be different for certain software packages, especially if they are not SVGA-ready. Also, you might have to install device drivers for certain software packages. Refer to the device-driver installation instructions that come with the software on the *IBM Software Selections CD* for a list of programs and the device drivers that they require.

To take full advantage of the video capabilities provided by your computer, use a noninterlaced monitor capable of supporting high resolution and a fast refresh rate. Also, the type of monitor you select depends on the software you use. Some applications are less demanding than others.

Using Monitor Controls

A monitor has brightness and contrast controls for adjusting the image on the monitor screen for maximum viewing comfort. On a new monitor, set the controls near their center positions. Setting these controls to their maximum positions can decrease the useful life of the monitor. As the monitor is used more, the image tends to become dimmer. You can adjust the brightness and contrast controls to compensate for this condition. Monitors also have additional controls for fine-tuning the screen image. Check the documentation that comes with your monitor for more information on controls.

Using Screen Savers

Leaving the monitor turned on for prolonged periods without changing the image can harm the monitor. Depending on what is on the screen, the image might be permanently burned into the phosphor coating or cause darkening of some areas of the screen.

With DPMS-enabled monitors, you can avoid this problem by using the power-management features of your computer. Also, you can use a *screen-saver* program, which turns off the video signal when the keyboard or mouse has not been used for a defined period. This action results in a dark, blank, or animated screen. When you are ready to work with the computer again, pressing a predefined key or a password restores the image to the screen. Several companies produce screen-saver programs. For more information, contact your IBM reseller or IBM marketing representative.

Video Control

Video control is the process of manipulating information into the desired format and sending it to the monitor screen. Video control can be handled by the microprocessor or a separate video or graphics controller. For graphics and window environments, video control involves operations that handle a high volume of data and computations. These typically require a high degree of speed. Moving a window from one location to another, dragging an icon across the screen, and scrolling through a document are examples of such operations.

AGP Video Controller

Your computer comes with an accelerated graphics port (AGP) video controller integrated on the system board. It has a PCI-like interface dedicated to high-performance and 3D graphical display applications. AGP provides a high bandwidth, direct connection to system memory allowing the graphics controller to work independently of the microprocessor and PCI adapters, resulting is in an increase in overall system performance.

Video Drivers

The graphics controller in your computer is supported by device drivers that are provided on the *IBM Software Selections CD* that comes with your computer. Instructions for installing the device drivers are also provided in README files on the *IBM Software Selections CD*. If your computer has IBM-preinstalled software, the video device drivers have already been installed on the hard disk. However, the information included in the device-driver installation instructions will be helpful if you ever need to reinstall or update the device drivers, or if you want to change the video resolution or color depth.

SVGA Mode

Super video graphics array (SVGA) is a video standard for displaying text and graphic images. Like other video standards, SVGA supports a variety of *video modes*. Video modes are different combinations of resolutions, refresh rates, and colors defined by a video standard for displaying text or graphics. SVGA provides higher-resolution graphics, faster refresh rates, and more colors than previous video standards, such as video graphics array (VGA). At the same time, SVGA video supports all standard VGA modes.

Your computer supports SVGA modes on a variety of monitors. Also, the SVGA modes on your computer are in accordance with the specifications of the *International Organization for Standardization (ISO) 9241 Part 3, Visual Display Requirements*. SVGA supports reduced-flicker operation when used with noninterlaced monitors that meet ISO standards.

Some application programs require video device drivers to use SVGA modes. The device drivers for your computer and instructions for installing them (README files) are provided on the *IBM Software Selections CD* that comes with your computer. If your computer has IBM-preinstalled software, the device drivers have already been installed on the hard disk of your computer.

Some application programs provide their own video device drivers to take advantage of SVGA modes. These device drivers are installed through a setup program built into the application program. Setting up these applications to operate in SVGA modes might be confusing because terminology for these modes is not consistent throughout the industry. If you are uncertain about the terminology used by your application program, refer to the documentation that comes with the application for additional information.

Special Characters and Languages

The video controller can display a variety of characters and languages. The language that is supported depends on the *code page* loaded by your operating system.

You can find additional information about code pages in the documentation that comes with your operating system.

Chapter 4. I/O Features

Input/output (I/O) devices provide you with many ways of getting information into and out of your computer. You can connect a variety of standard and optional devices to your computer, including a monitor, keyboard, mouse, and printer.

This section includes information about I/O device connectors and also explains the characteristics of some of the I/O devices.

Your computers system board includes connectors (or *ports*) for attaching I/O devices. An I/O *connector* refers to the physical connector on the computer that allows you to connect an external I/O device. These connectors are also called *ports* because they provide a communication pathway into the computer for an I/O device. Each port is identified by a number and an address that distinguishes it from other ports. No two ports can have the same address. The terms *I/O connector* and *I/O port* are often used to mean the same thing.

Note: Your computer model might not include all of the I/O devices or connectors described in this section. Refer to the *PC 300GL User Guide* for more specific information.

Following are the system board I/O connectors that are available on the PC 300GL:

- Audio: (some models only)
  Microphone in, Line out, Headphone out, and joystick/MIDI
- Serial
- Universal Serial Bus (USB)
- Parallel
- Keyboard
- Mouse
- Monitor

Audio Ports

The audio controller, integrated on the system board of some models, is SoundBlaster, SoundBlaster Pro, and Windows Sound System compatible. It has three audio ports and a joystick/Musical Instrument Digital Interface (MIDI) with 15-pin D-shell connector. Audio support can be enabled or disabled using the Configuration/Setup Utility Program. Audio ports provide you with the ability to play back and capture sound and music as well as the ability to enjoy sound with multimedia applications. The joystick/MIDI connectors allow attachment of a joystick or other Midi devices.

The ports are labelled:

Mic In	Connection for a microphone
Line Out	Connection for headphones or powered external speakers

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Headphone	Connection for headphones or powered external speakers
joystick/MIDI	Connection for a joystick or a MIDI device

Note: When either headphones or speakers are connected to the headphone jack, the internal computer speaker is disabled.

There might also be an internal speaker and connections on the system board for attaching it to the CD-ROM.

To take advantage of the audio feature, some computers come with *ViaVoice*. ViaVoice is continuous speech dictation and desktop navigation software available on CD-ROM. For more information, see the READ1ST.TXT file in the appropriate language folder on the ViaVoice CD-ROM.

Serial Port

Your computer comes with a serial port. The serial port is used to communicate with devices such as printers, plotters, and modems designed for the serial interface. Some modems are installed inside the computer; others are attached externally using the serial-port connector. For example, you can connect an external modem to a serial port in order to communicate with other computers over telephone lines.

The serial port transfers data one bit at a time at speeds ranging from 300 to 115000 bits per second (bps). The serial ports are 16550-UART (universal asynchronous receiver/transmitter) compatible so they can support high-speed modems.

You can increase the number of serial ports by installing a serial adapter in one of the expansion slots.

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 connected. 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.

The serial connector in your computer 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.

The four available port addresses are (in hex):

3F8
2F8
3E8

2E8

The available IRQs are:

IRQ 4
IRQ 3
IRQ 9
IRQ 10
IRQ 11
IRQ 14
IRQ 15

There is no direct relationship among the port connectors, the available port settings, and the COM numbers. When you start the computer, the power-on self-test (POST) 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.

You can view the port address and IRQ settings for serial ports using the Configuration/Setup Utility Program. You will not see the COM numbers on the setup screens. To see port settings and COM assignments for all serial ports, you can use one of the diagnostic programs available with the IBM-preinstalled software package.

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. If so, you can change the settings for the serial port using the Configuration/Setup Utility Program. Refer to the *PC 300GL User Guide* for more information about using the Configuration/Setup Utility Program.

To connect a device to your serial port, use a serial cable (purchased separately) to connect the device to the serial connector at the back of the computer. Refer to the documentation that comes with your I/O device for specific installation instructions.

Universal Serial Bus Ports

Universal serial bus (USB) is an emerging serial interface standard. The USB port is a connector for devices that previously used serial, parallel, keyboard, mouse, and game ports. USB technology uses Plug and Play features to determine what device has been connected to the port. Each USB device is accessed by a unique USB address. A device called a *hub* is used to convert a single USB connector into multiple attachment points. A hub has multiple ports where devices can be attached. USB operates up to 12 megabits-per-second (Mbps) and supports a maximum of 127 devices.

Parallel Port

Your computer has a parallel-port connector as a standard, built-in feature. The parallel port is most often used to communicate with a parallel printer, but it can also be used with a variety of other parallel devices.

The parallel port transfers data 8 bits at a time, compared to the serial port, which transfers data 1 bit at a time. The parallel port on the computer 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 connectors by installing a parallel adapter in one of the expansion slots.

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 connected. 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 connector or adapter on your computer 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.

The three available port addresses are (in hex)

378
278
3BC

The two available IRQs are:

IRQ 7
IRQ 5

There is no direct relationship among the three available port settings and the three LPT numbers. When you start the computer, the POST 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.

You can view the port address and IRQ setting for the built-in parallel port using the Configuration/Setup Utility Program. However, you will not see the LPT number on the configuration screen. To see port settings and LPT assignments for all parallel ports, you

can use one of the diagnostic programs available with the IBM-preinstalled software package.

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 parallel-port setting. You can change the setting using the Configuration/Setup Utility Program. Refer to the *PC 300GL User Guide* for more information about using this program.

The parallel port can operate in five 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 the required device drivers.

Standard This AT-compatible mode 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.

Bidirectional This PS/2-compatible mode is a bidirectional mode used for data transfer to other computers 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 devices.

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 DMA. EPP supports the connection 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. These devices can be connected to each other in a *daisy-chain* arrangement, or they can be connected through an external multiplexer. 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 connected to the parallel port.

Note: ECP, EPP, and ECP/EPP modes are available only if the port address is hex 378 or hex 278.

You can set these modes of operation for the parallel port using the Configuration/Setup Utility Program. Refer to the *PC 300GL User Guide* for more information about using this program.

To connect a parallel I/O device, such as a printer, use a parallel cable (purchased separately) to connect the device to the parallel connector at the back of the computer. Refer to the documentation that comes with your I/O device for specific installation instructions.

Keyboard Port

The keyboard helps you communicate with your computer; the keyboard connects to the keyboard-port connector on the back of the computer. Use your keyboard for the following:

- Typing information
- Performing application functions
- Performing computer operations
- Entering numbers with the numeric keypad

104-Key Keyboard

Figure 1.

Keyboard Layout

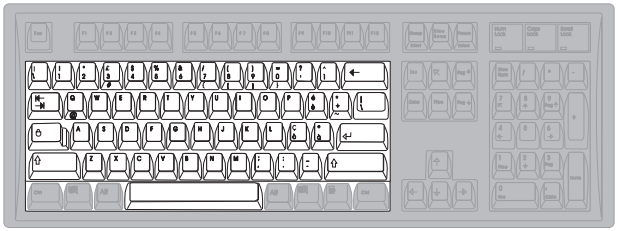
The illustrations in this section show the 104-key keyboard. The keyboard includes the following groups of keys:

- Standard typing keys
- Function keys
- Special computer keys
- Cursor keys
- Numeric keypad
- Function keys for Windows interface

Typing Keys

The layout of the typing keys is similar to that of a typewriter. The standard typing keys are *typematic*; that is, they repeat typing the character as long as you hold them down. The home row contains raised identifiers for the touch-typist. Unlike some typewriters, “1” (one) and “l” (lowercase L) are not interchangeable on this keyboard.

The Shift key is used with the typing keys to produce uppercase characters and symbols. When you press the Caps Lock key, a light turns on at the top right corner of your keyboard. When the Caps Lock light is on, the alphabet keys you type appear on the screen in capital letters. Caps Lock does not affect the number or punctuation keys.



Typing Keys

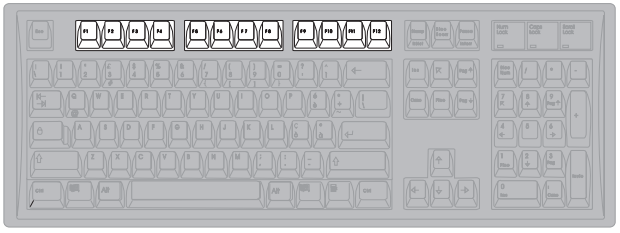
Figure 2.

The function of the Enter key is controlled by the program you are using. For example, a word-processing program uses the Enter key to move the cursor to the beginning of the next line. A spreadsheet program uses it to enter information into a specific cell or field. Your operating system uses it to accept a command.

Some programs use the Ctrl and Alt keys in combination with the typing keys to perform a specific operation. Refer to your application-program documentation for information about the key assignments.

Function Keys

Function keys are arranged across the top of your keyboard. Use them to send instructions to the software you are using. Think of them as shortcuts for doing routine tasks on your computer.



Function Keys

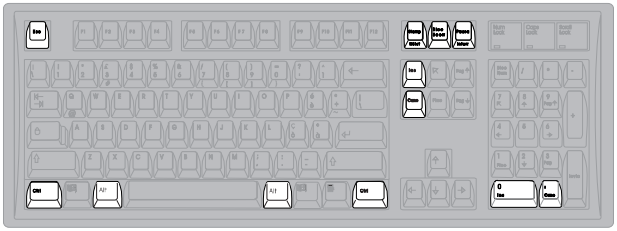
Figure 3.

Function-key tasks can vary from one application program to another. For example, you press the F1 key in some application programs to display a help message; you might press the same key in another program to display a list of files.

Some application programs use the Ctrl, Alt, and Shift keys in combination with the function keys to define additional operations. Many programs provide a template that you can place above the function keys. Refer to your operating-system and application-program documentation for the definition of the function keys.

Special Computer Keys

The keyboard has several other keys that are not on a typewriter. These are Escape (Esc), Control (Ctrl), Alternate (Alt), Insert (Ins), Delete (Del), Print Screen, Scroll Lock, and Pause/Break.



Special Computer Keys

Figure 4.

Your software controls these keys. It can disable them or modify their purpose. The following list describes the most common uses of these keys.

Esc — *Escapes* from an operation, window, message, or program and returns you to what you were doing previously.

Ctrl and Alt — Used with other keys to perform a specific operation defined by the program in use. When two or more keys are used together to perform a certain function, they are called *combination keys*. To use combination keys, you simply hold them down at the same time. For example, pressing Ctrl+Pause/Break stops the operation of most programs.

Combination keys might work differently, depending on your software.

Insert — Activates the insert mode, which allows you to *insert* information between two existing characters. When you press *insert* again, you return to the replace mode and write information over existing characters.

Delete — *Deletes* a character or field.

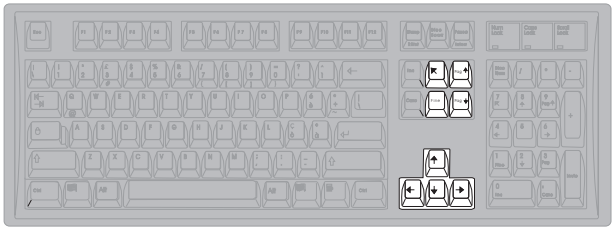
Print Screen — Prints information on your screen to a printer. If the screen contains graphic images, they might not be printed correctly.

Scroll Lock — Determines how you move through information. When you press the Scroll Lock key, a light turns on at the top right corner of the keyboard. With scroll locking on, the cursor can move through the information on the screen. With scroll locking off, the cursor remains stationary, and the information on the screen moves. Not many programs use this function.

Pause/Break — Allows you to stop a program temporarily.

Cursor Keys

The Cursor keys are used to move the *cursor* (a flashing short line or small box) to various positions on the screen.



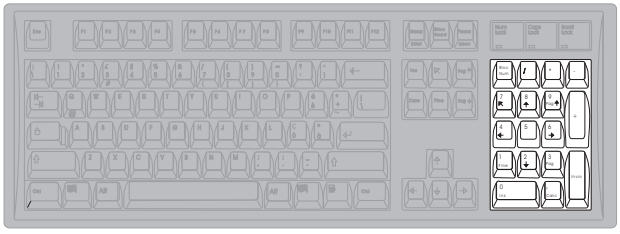
Cursor Keys

Figure 5.

Arrow keys	Moves the cursor up, down, right, or left on the screen, one space at a time. Like the standard typing keys, the arrow keys are *typematic*; that is, they keep repeating their function as long as you hold them down.
Home	Moves the cursor to the beginning of a line or document.
End	Moves the cursor to the end of a line or document.
Page Up	Moves the cursor up one screen of information.
Page Down	Moves the cursor down one screen of information.

Numeric Keypad

The numeric keypad is arranged like a calculator. It is useful for entering numeric information.



Numeric Keys

Figure 6.

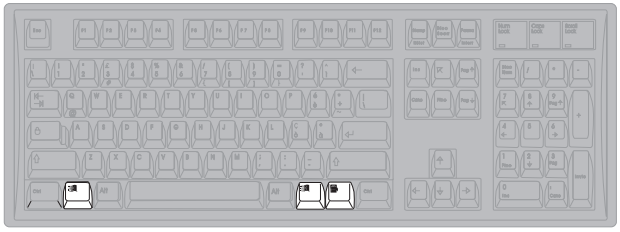
When the Num Lock light is on, the numbers marked on the keys are active. When the light is off, the symbols marked *below* the numbers are active.

You can use the numeric keypad to:

- Activate the Num Lock key to enter numeric information.
- Deactivate the Num Lock key to control cursor movement.
- Enter special characters when used in conjunction with the Alt key. This is done by holding down the Alt key while entering a numeric value on the keypad. The special characters are determined by the *code page* used by your operating system. Code pages vary by language.

Function Keys for Windows Interface

The 104-key keyboard provides three keys that are supported by Microsoft Windows NT, Windows 95, and Windows 98. In order to use these keys with earlier versions of Windows, you must use the appropriate device driver.



Windows Interface Keys

Figure 7.

The two keys with the Windows logo are supported by the operating system and provide system-level functionality. The third key, with an arrow pointing to a menu item, provides a context menu when pressed, although other functions might be available for different applications.

Languages

The operating system you use determines what characters can appear on your screen. Your operating system provides programs that allow you to use characters from other languages. Keyboard templates are also available to show you which keys on your keyboard correspond to the characters of another language. Refer to your operating-system documentation for additional information.

Mouse Port

Your computer has a mouse-port connector on the back panel for connecting a mouse. A mouse is a pointing device that provides an easy method of moving the cursor or pointer around the screen to make selections. Not all application programs support a mouse. Graphics or object-oriented application programs and operating systems, such as Microsoft Windows NT, Windows 95, and Windows 98 are much easier to use if you have a mouse.

Some mouse devices are designed for the round mouse connector on the back of your computer, while others are designed for the D-shaped serial connector. Either type of mouse will operate, provided you have the correct device driver installed.

Monitor Port

The monitor port allows you to connect a variety of *video graphics array (VGA)* or *super video graphics array (SVGA)* monitors to your computer. Refer to "Selecting a Monitor" on page 14 for information on monitors, and to "SVGA Mode" on page 16 for supported video modes.

Chapter 5. Storage Devices

This section contains information about some of the data-storage devices available for your computer. These devices enable you to expand the capacity of your computer.

The common types of storage devices that can be used in the computer are:

- Diskette drives
- Hard disk drives
- CD-ROM drives
- Tape drives
- Zip drives

Each drive has a letter assigned to it. For example, if your computer has two diskette drives, one is called *drive A*, and the other is called *drive B*. If you have only one hard disk drive, it is called *drive C*. If you partition the drive, the partitions are named as if they were separate drives: *drive D*, *drive E*, and so on.

The type and number of devices that you can have in your computer vary by computer model. You can add internal storage devices if expansion bays are available. Refer to *PC 300GL User Guide* for more information on expansion space.

Diskette Drives

Your computer comes with a 1.44 MB diskette drive designed to use only 3.5-inch diskettes. Optional diskette drives that support different sizes and capacities of diskettes are available from your IBM marketing representative or IBM reseller.

Diskettes

You can use 3.5-inch diskettes in the diskette drive of your computer. If you want to use 5.25-inch diskettes, you must install a 5.25-inch diskette drive.

The information that follows will help you identify and use 3.5-inch diskettes.

Identifying Diskettes

The labeling on 3.5-inch diskettes is not consistent among manufacturers. Some diskettes are labeled with the letters *DD* or *HD* to identify the diskette type; other diskettes might not be labeled. However, the appearance of the lower-right corner of a 3.5-inch diskette always can be used to identify the diskette type, as shown in the following illustrations.

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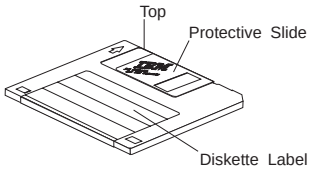
1 MB Double Density (DD)

2 MB High Density (HD)

Handling and Storing Diskettes

Inside the protective diskette case is a flexible disk with a magnetic-sensitive coating. This disk can be damaged by heat, dust, a magnetic field, or even a fingerprint. Use the following guidelines when handling and storing diskettes.

- Data is stored on the magnetic surface of the diskette. On 3.5-inch diskettes, this surface is protected by a plastic cover. If the cover is damaged, *do not* use the diskette. A damaged diskette might damage the diskette drive.
- A protective slide on the top of a 3.5-inch diskette covers part of the magnetic surface. The diskette drive moves this slide to read data from or write data to the diskette. *Do not* move this slide, because fingerprints and dust can cause loss of data.



- Never touch the magnetic disk itself.
- Keep diskettes away from magnets or devices that create a strong magnetic field, such as electric motors and generators. Diskettes are sensitive to magnets found in television sets, telephones, stereo speakers, and other such items. A magnetic field can erase the data on your diskettes. *Do not* set diskettes on the monitor or use magnets to attach notes to your computer.
- Do not store diskettes at high temperatures, low temperatures, or in direct sunlight. Temperatures ranging from 4° to 53°C (39° to 127°F) are acceptable for 3.5-inch diskettes. Keep diskettes away from heat. The plastic outer covering might warp, damaging the diskette.

Labeling Diskettes

Before using a diskette, label it so that you can identify the data stored on it. Labels usually come in the package with the diskettes. Diskette labels can become a problem if you do not apply them correctly. Loose edges or an excessive buildup of labels can prevent the diskette from being inserted or ejected.

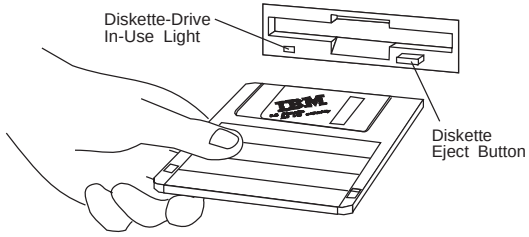
To prevent this problem, take the following precautions:

- Remove an old label before you apply a new one.
- Apply labels carefully to ensure that all edges are secure.
- Apply labels only to the front of diskettes. Do not place a label where it interferes with the protective slide or covers an opening in the protective diskette case.

Inserting and Removing Diskettes

To insert a 3.5-inch diskette, hold the diskette with the label facing up and insert the end with the protective slide first. Push the diskette into the diskette drive until the diskette clicks into place.

To remove the diskette, press the eject button and slide the diskette out of the drive. Do not remove the diskette while the in-use light is on.

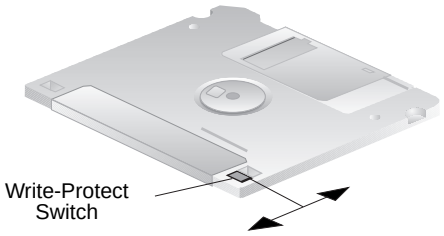


Write Protecting Diskettes

It is possible to accidentally format a diskette or unintentionally write data to it. Important information can be written over or lost. For this reason, it is a good idea to write protect important diskettes. You can read data from a write-protected diskette, but you cannot erase or change the data.

Most 3.5-inch diskettes have a write-protect switch that can be used to prevent data from being written to or erased from the diskette. If a 3.5-inch diskette does not have a write-protect switch, it is permanently write protected.

The write-protect switch is located on the back of 3.5-inch diskettes.



- To allow writing to the diskette, slide the switch so the write-protect window is covered.
- To prevent writing to the diskette, slide the switch so the write-protect window is open.

Formatting Diskettes

You can buy diskettes either formatted or unformatted. Formatted diskettes are ready to use; unformatted diskettes must be formatted by your operating system before you can use them. The format operation checks a diskette for defects and prepares it for storing data. If data is already stored on the diskette, the format operation writes over it, and the data is lost.

The operating system FORMAT command specifies how to format a specific type of diskette.

Attention: Always format diskettes to their correct capacity. Failing to do so might cause unreliable results. Differences such as magnetic coatings, the thickness of the diskette material, and the recording technique used all affect the formatting operation. Refer to your operating-system documentation for detailed information on formatting diskettes.

The following table shows diskette types, their formatted capacities, and the drive type that can be used with each diskette.

3.5-Inch Diskette Type	Formatted Capacity	Drive Type
1 MB (MF2DD)	720 KB	1.44 MB
2 MB (MF2HD)	1.44 MB	1.44 MB

Notes

1. MF2DD = Mini-floppy, two-sided, double density
2. MF2HD = Mini-floppy, two-sided, high density
3. If you are using DOS, use *FORMAT A: /F:720* to format a 1 MB diskette in a 1.44 MB drive.

Copying Diskettes

If you are using DOS, you can copy one or more files to or from a diskette using the COPY command. Groups of files can be copied faster using the XCOPY command. Both COPY and XCOPY can copy files to different types of diskettes. For duplicating a diskette, use the DISKCOPY command. DISKCOPY requires that both the source diskette (the diskette you copy from) and the target diskette (the diskette you copy to) be the same type.

Refer to your operating-system documentation for more information on copying diskettes.

Hard Disk Drives

Your computer comes with a hard disk drive preinstalled. The capacity of the drive varies by model. An expansion bay is provided for installing additional drives. For information about the hard disk drive in your computer, refer to the *PC 300GL User Guide.*

Hard disk drives have different types of interfaces, or controllers. The main function of the interface is to transmit data to and from the hard disk drive. The different interface types provide various degrees of performance and differ in the speed with which they can transfer data between the hard disk drive and other system components. The most common interface specifications used in IBM computers are discussed in the following sections.

IDE

Your computer has a PCI-to-IDE interface that complies with the AT-attachment interface. This interface includes the original IDE (ATA) interface with extensions for Ultra DMA-33. The original IDE interface specification refers to a hard disk drive with a built-in controller (as opposed to a hard disk drive with a separate controller). Two IDE connectors are provided on the system board. One connector is designated as primary and the other as secondary. Your computer system board can accommodate up to two IDE drives attached to each connector. However, the PC 300GL only supports a total of three IDE devices.

When you connect two hard disk drives to the same ribbon cable, the two drives could potentially send and receive data at the same time (because each drive has its own controller). To prevent the drives from competing for priority, you must designate one drive as the primary (master) drive, and the other as the secondary (subordinate) drive. This is determined by switch or jumper settings on each hard disk drive. If only one hard disk drive is attached to either the primary or secondary IDE connector, it must be designated as the master drive.

SCSI

Some computers have a *SCSI (small computer system interface)* hard disk drive connected to an optional SCSI adapter. SCSI can be faster than IDE, particularly when used with a multitasking operating system, such as Microsoft Windows 95, Windows 98, and Windows NT. With SCSI, instructions can be sent concurrently to every drive in the system, and the drives can then execute these instructions simultaneously. This is not possible with IDE. SCSI is well suited for computers in which expandability is important.

CD-ROM Drives

An *IDE compact disc-read only memory (CD-ROM)* drive uses a removable compact disc (CD) that stores various formats of audio and video information. A CD-ROM drive can play back or read from a CD, but it cannot write information to it. The information on the CD can be heard or viewed, but not changed or updated as it can on a diskette, hard disk, or tape.

CD-ROM technology offers quick access to enormous amounts of information. Diskettes, hard disks, and tapes are magnetically recorded. CDs are optically recorded at a much higher density. CD-ROM drives use industry-standard 12 cm (4.75 in) CDs with formatted capacities of approximately 650 MB of data. CDs are used for music, voice, animated graphics, multimedia, education, software distribution, and many other applications.

To hear music or voice from a CD, you can utilize the built in speaker or, if your model has an audio controller, connect headphones or powered speakers.

Some models come with an IBM-preinstalled CD-ROM drive.

Zip Drives

Some computers come with a preinstalled internal *Zip* drive. A Zip drive is a high-capacity disk drive that uses a removable disk that is slightly larger and about twice as thick as a conventional 3.5-inch floppy diskette. The Zip disk has a capacity of 100 MB of data. They have become very popular for backing up hard disk drives or transporting large files.

Chapter 6. Security

This section provides information about the security features of your computer.

Security is important for protecting your computer and the data stored in it. If you use your computer in a public environment, such as an office, you might want to protect the computer and data by using one or more of the security features available to you.

Some of the features include:

- A lockable cover using a customer supplied padlock to help secure computer hardware components
- A u-bolt and a lockable cable can be installed to secure the computer to a desk or table.
- A power-on password to help prevent unauthorized use of the computer
- An administrator password to authorize computer-setup changes
- An unattended start mode to enable the computer to operate without input from the keyboard or mouse
- A selectable startup sequence to prevent use of unauthorized programs to bypass security controls
- Selectable disabling of diskette and IDE drives to prevent unauthorized use
- I/O port control to disable input and output functions of the serial and parallel ports and their attached devices

The use of some features also depends on your operating system and network software. For detailed information about using these security features, see the *PC 300GL User Guide*.

While the security features can offer a good deal of protection for your computer and data, there are limitations, depending on the operating environment. For example, these features cannot authenticate or identify the adapter that attaches the computer to a LAN, and they cannot prevent outside persons or computers from gaining access to the computer, if it is equipped with a modem set to the automatic answering mode.

A major aspect of your security plan is protecting the information (data) stored in your computer. Some of the considerations of data security are:

- Backup and recovery
- Erased files
- Computer viruses

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Information Backup

Most of the information stored on a hard disk is contained in *data files*. Data files contain the information you put in the computer, such as letters and reports.

You can lose data files from your hard disk for a variety of reasons. Security violations, improper handling during a move, or computer viruses can destroy stored information. To avoid losing information, make copies of the data files using storage devices such as diskette drives, tape drives, or Zip drives. Also, if you are connected to a LAN, you might be able to back up information to another computer on the LAN. Backup copies can save you time and money recovering files accidentally erased from a hard disk or lost when a hard disk drive fails.

Back up your hard disks on a regular basis (daily, weekly, or monthly depending on how often the information changes). Also, back up the hard disk before moving the computer. Backup procedures differ from one operating system to another.

Erased Files

Erasing a file from a diskette or hard disk does not necessarily destroy the file. With the proper software tools, someone might be able to restore all or part of an erased file. An erased file, therefore, might be a security exposure if you sell your computer or give someone a diskette that once contained confidential information.

The standard operating-system format commands do not remove all information from a hard disk. Low-level format programs are used for this purpose and are available from a number of software manufacturers.

Diskettes are a little different. An operating-system format command writes a repeated pattern over the entire surface of the diskette. As a result, any information that was on the diskette becomes unreadable.

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

Computer Viruses

A computer virus is a program (or instructions hidden within a program) that can “infect” files and programs on your computer. Unlike most other programs, viruses are typically designed to spread themselves. Some viruses can display a message or cause erratic screen behavior. Others are destructive, erasing or damaging files, or overloading memory and communication networks.

Viruses are difficult to detect. Many stay inactive until triggered by a specified event such as a date, command, or some other operation. Some are activated when an infected program is started a specified number of times. When the symptoms of the virus appear, it

might be difficult to determine if the problem is a hardware failure, a software problem, or a virus in action.

Viruses are generally spread unknowingly from computer to computer when programs are copied or exchanged. If you don't know where a program came from, be careful. Most reputable bulletin-board owners and distributors of programs scan their files to guard against viruses and maintain records identifying program owners. You can take steps to protect your information by using a virus-scan program.

Chapter 7. Software

Software includes a variety of instructions, programs, utility programs, and tools that enable your computer to do what you want it to do.

Software Layers

Several layers of software work together to make your computer work.

System programs are the basic layer of software built into every computer. They include the POST, BIOS, and Configuration/Setup Utility programs. *Power-on self-test (POST)* is a set of tests and procedures performed every time you turn on your computer. *Basic input/output system (BIOS)* is a layer of software that translates instructions from other layers of software into electrical signals that the computer hardware can understand. Except for a short message on your screen when you turn your computer on, you rarely have much direct involvement with BIOS. You can use the Configuration/Setup Utility Program to set up your computer for different features and options.

Other software used by your computer includes: *device drivers*, which support a specific type of hardware device; and *Advanced Power Management (APM)*, which allows the computer to conserve energy, or allows the computer to turn on when it is unattended.

An *operating system* is the layer of software that manages all computer operations by directing the flow of information to and from the various parts of the computer. The operating system interprets instructions from you and your application programs and directs these instructions to the BIOS. Your computer needs an operating system to *run* application programs.

Application programs are the highest layer of software. An application program allows you to do specific work, such as word processing, desktop publishing, or financial accounting. These are the programs you use to get work done on your computer. Some application programs, called *tools* or *utility programs*, are designed for very specific tasks such as configuring the computer, using a feature, or testing the computer. And, of course, there are games to keep you entertained.

Your software might have been preinstalled for you, or you might have to install it yourself. If not preinstalled, your software package usually contains program diskettes, CDs, and instruction manuals. Refer to the information provided with your software for installation and operating instructions.

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POST

Each time you turn on your computer, *power-on self-test (POST)* is automatically run. POST programs are stored in flash memory along with the BIOS and the Configuration/Setup Utility Program. Functions of POST are:

- Test the computer hardware and subsystems
- Update the computer configuration
- Load the BIOS into system memory
- Load the operating system into system memory
- Report problems

While POST is running, the computer displays an IBM screen with several messages and prompts. A password prompt asks you for a password, if you have set a password with the Configuration/Setup Utility Program. Other prompts allow you to access the Configuration/Setup Utility Program or escape from POST. When POST is successfully completed, the computer proceeds to the first screen of your operating system or application program. If problems or configuration changes are found, POST displays error codes and messages. Refer to the problem-solving section of the *PC 300GL User Guide* for explanations of error messages and actions you can take to correct problems.

Configuration/Setup Utility Program

Most computer devices (storage devices, ports, adapters, and other optional features) have programmable settings. Your computer has a special type of nonvolatile memory (called *CMOS*) where it saves these settings. This memory is kept active by a battery so the settings are not lost when you turn off the computer. Each time you turn on the computer, a POST routine copies the configuration settings from memory to the various devices to get them ready for operation. If the battery fails, the settings in memory are lost, and the Configuration/Setup Utility Program automatically reconfigures built-in devices.

When you add or remove hardware from your computer and restart the computer, the configuration settings must be updated. In most cases, the BIOS detects the change in hardware and *automatically* updates the configuration. In other cases, you might need to use the Configuration/Setup Utility Program to *manually* update the configuration. Either way, the computer displays a configuration-error message on the screen and gives you the option of accessing the Configuration/Setup Utility Program. You must enter the Configuration/Setup Utility Program and either *save* the automatic update or manually change the new configuration settings. For more information on using the Configuration/Setup Utility Program and saving configuration changes, see the *PC 300GL User Guide*.

Operating Systems

An operating system is a complex collection of utility programs and device drivers that control what a computer does. It is the operating system that enables a computer to accept information from a keyboard, display it on a monitor, print it, and save it on a disk. The operating system has built-in routines for performing input and output operations, such as reading and writing disk files. When an application program gives a command to the operating system to save a file, the operating system communicates with the BIOS to transfer the file from memory to disk.

Just as the BIOS defines how the hardware works, the operating system defines how software works by establishing a set of rules all software must follow. For example, the operating system defines how files are named, what commands can be used, and how memory is organized. Your computer is designed to use a variety of operating systems to meet many different needs.

Device Drivers

Device drivers are programs that support a specific type of hardware device, such as a printer or high-resolution monitor. These programs provide instructions that allow the computer to interact with the device or take advantage of the special features of a device. Device drivers are necessary because the BIOS cannot be large enough or current enough to contain all the code needed to control every hardware device. If your computer has IBM-preinstalled software, the device drivers might be included with your operating system or application programs. Also, some device drivers are located on the *IBM Software Selections CD*. Hardware optional features also might include diskettes that contain the device drivers you need to make the optional features work.

Latest Level Device Drivers

The latest device drivers are always available on the World Wide Web or from the IBM Personal Systems Group Bulletin Board System (BBS). For more help information, refer to the *PC 300GL User Guide*.

The IBM PC Company Bulletin Board System (BBS) can be reached 24 hours a day, 7 days a week. Modem speeds of up to 14400 baud are supported. Long distance telephone charges might apply. To access the PC Company BBS:

- In the U.S., call 1-919-517-0001.
- In Canada:
  - In Halifax, call 902-420-0300.
  - In Montreal, call 514-938-3022.
  - In Toronto, call 905-316-4255 or 416-956-7877.
  - In Vancouver, call 604-664-6461 or 604-664-6464.

– In Winnipeg, call 204-934-2735.

For the latest device drivers, visit the following page:

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

Device-Driver Types

Device drivers fall into two general categories: application-specific and device-specific. Application programs load application-specific device drivers into memory. These device drivers stay in memory while the application is running, and generally are cleared from memory when you exit from the application.

Device-specific drivers are loaded into memory each time you turn on the computer. Some device drivers check for the presence of a device each time you turn on the computer. If the device it supports is not attached or is not turned on, the device driver is not loaded and might generate an error message. After they are loaded, device-specific drivers stay in memory. For more information about loading device drivers, refer to your operating-system documentation and the documentation that comes with your hardware or device drivers.

Video Device Drivers

Video device drivers are provided on the *IBM Software Selections CD* that comes with your computer. If your computer has IBM-preinstalled software, video device drivers are already installed on the hard disk of your computer. (However, note that DOS video device drivers might need to be installed.)

Advanced Power Management

Conserving energy is important for your computer and is also environmentally friendly. For both of these reasons, your computer provides energy-saving software, collectively called Advanced Power Management (APM).

The following are the APM features included with your computer:

- **APM BIOS** is important if your computer uses an operating system that supports APM-capable computers. When this setting is disabled, all APM BIOS support is disabled.
- **Automatic Hardware Power Management** allows you to reduce or suspend power to components of the computer after a preset time of inactivity is reached (a SCSI hard disk drive is unaffected by this feature). For more information on setting and using this feature, see the *PC 300GL User Guide*.
- **Activity Monitor** allows you to select which devices are monitored to determine if the system should enter or exit the low power state. Not all operating systems support this.

Refer to your operating system documentation to determine if the *Activity Monitor* is supported.

- **Automatic Power On** enables the computer to turn on when it is unattended. Optional hardware and software is needed for some features of Automatic Power On. For more information about Automatic Power On, see the *PC 300GL User Guide*.

Attention: If a device, such as a monitor, does not have power-management capabilities, it might be damaged when exposed to a reduced-power state.

Advanced Configuration Power Interface (ACPI)

ACPI is a BIOS mode that allows the operating system to control the power management features of your computer. Not all operating systems support ACPI BIOS mode. Refer to your operating system documentation to determine if ACPI is supported.

Application Programs

Application programs provide the tools necessary to complete a specific type of job, such as editing text or preparing a spreadsheet. A variety of programs are available to aid you in generating reports, working with numbers, using graphics, and performing many other personal and business functions.

Many application programs are commercially available for your computer. After you determine the types of application programs you need, select programs that will work with your computer. Most program packages list the computer equipment you need to run the program. Read the package carefully and look for the following information:

Computer Type	Make sure the box is labeled for IBM or IBM-compatible computers.
Diskette Size	Your computer has a 3.5-inch diskette drive. Make sure the package contains 3.5-inch diskettes. If you installed an optional 5.25-inch diskette drive, you can use 5.25-inch diskettes also.
CD-ROM Support	If your computer has a CD-ROM drive, you can purchase application programs that are available on CDs.
Video Support	Your computer has an SVGA graphics controller that also supports video graphics array (VGA) standards.

Protecting Your Software

Under normal circumstances, there is little you can do to damage your software; however, accidents can happen. If you establish good habits when using your computer, you are less likely to experience problems.

Your computer might come with the operating system and other software already installed on the hard disk drive. The operating system might fail if you modify operating system files incorrectly or if you try to install software that is not designed to operate on your computer. Back up your operating system and other software so that you can more easily recover from an operating system or hard disk drive failure. For instructions on how to back up the operating system programs, refer to the documentation for your operating system.

Also, make backup copies of any original software diskettes. Using the backup copy can prevent damage to the original diskettes. Your operating-system documentation gives instructions for making backup copies.

Chapter 8. Networking and System Management Features

This section contains information about the networking features available on your computer.

A network consists of computers linked together so that they can share resources, such as files, programs, and peripherals. The simplest form of a network consists of two computers connected through their serial or parallel ports. This type of network might be used by an individual to transfer files between a laptop computer and a desktop computer.

Other networks are larger and typically consist of computers designated as *servers* and *workstations*. Servers provide shared resources (they store and retrieve shared data files) for computers linked to the network. They typically have fast processors and large, high-capacity disk drives that operate unattended. In contrast, workstations, often referred to as *clients*, are computers used by individuals and do not provide shared resources for an entire network.

Some computers come network-ready with a preinstalled Ethernet adapter. This adapter provides a high-performance network connection with an 8-conductor, Rj-45, unshielded twisted pair (UTP) connector. For computers with IBM-installed software, device drivers for this adapter are on the hard disk; for some adapters, device drivers are also provided on the *IBM Software Selections CD* that comes with your computer. For instructions on connecting a network cable to your computer, refer to the *PC 300GL User Guide*. For information on configuring your computer to work with a network, consult your network administrator.

When your computer is linked to a network, you can take advantage of the following features:

- Desktop Management Interface (DMI)
- Dynamic Host Configuration Protocol (DHCP) or Remote Program Load (RPL)
- Remote Administration
- Flash on LAN
- Wake on LAN
- Wake on Modem
- Wake on Ring

Desktop Management Interface (DMI)

DMI consists of software that enables network administrators to remotely monitor and control your computer in a network environment. DMI can be used to remotely track many types of information about computers, including serial numbers, memory attributes, product-specific characteristics of installed peripherals, temperature, and operating-system configuration information. This information can be accessed using a DMI browser. DMI

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browsers are provided by all major operating systems and all major LAN management packages (including Netfinity and LANClient Control Manager).

Remote Administration

When this feature is enabled and you are connected to a network, the system programs in your computer can be updated remotely by a network server. If you have set an administrator password for your computer, it does *not* have to be entered by the server. Consult your network administrator for information on setting up your network server to perform POST/BIOS updates.

DHCP and RPL

DHCP (Dynamic Host Configuration Protocol) and RPL (Remote Program Load) enable a network administrator to control your computer. The DHCP feature makes it possible for a DHCP server on your intranet[2] to assign an IP (internet protocol) address to your computer so that a startup image can be loaded from the server. The DHCP server must be one that supports BOOTP (Boot Protocol) on your intranet using software such as the Intel LAN Desk Configuration Manager. Your computer requires network management software, such as the LANClient Control Manager.

If you use RPL in conjunction with software such as LANClient Control Manager, you can use a feature called *Hybrid RPL*. Using LANClient Control Manager, you set up your computer by installing hybrid images (or files) on the hard disk. Then, each time the computer starts from the network, LANClient Control Manager recognizes your computer as a Hybrid RPL client and a *bootstrap* program is downloaded to your computer. This bootstrap program is small and helps prevent network congestion. Working from the hybrid images, the bootstrap program initiates the startup process from the hard disk of your computer. An advantage to Hybrid RPL is that the network load associated with standard RPL is avoided.

Wake on LAN

Some models of the PC 300GL have a LAN adapter installed that is designed to use Wake on LAN, an IBM-developed technology that allows your computer to be turned on remotely by a network server. When Wake on LAN is used in conjunction with network management software, such as Netfinity Version 4 (included on the *IBM Software Selections CD* that comes with your computer), functions such as data transfers and software and device driver updates can be performed remotely on your computer and all other computers on your network that are enabled for Wake on LAN. To avoid interruptions and

[2] An intranet is a private network that conforms to the same protocols as the internet, but is contained within an organization. The intranet contains one or more servers that provide services to the workstations on the private network. Some intranets are also connected to the Internet.

help increase productivity, these updates can be done after normal working hours or on weekends when LAN traffic is at a minimum.

Wake on Modem

Your computer might have an internal modem installed that is designed to use the Wake on Modem feature. This feature allows your computer to be turned on remotely when a modem ring is detected. In BIOS this is referred to as *Modem Ring Detect*. When Wake on Modem is used in conjunction with network management software, such as Netfinity Version 4 (included on the *IBM Software Selections CD* that comes with your computer), functions such as data transfers and software and device driver updates can be performed remotely on your computer. To avoid interruptions and help increase productivity, these updates can be done after normal working hours or on weekends when telecommunication traffic is at a minimum.

Wake on Ring

Your computer might have an external modem attached to the serial port. The Wake on Modem feature allows your computer to be turned on remotely when a modem ring is detected. In BIOS this is referred to as *Serial Port Ring Detect*. When Wake on Ring is used in conjunction with network management software, such as Netfinity Version 4 (included on the *IBM Software Selections CD* that comes with your computer), functions such as data transfers and software and device driver updates can be performed remotely on your computer. To avoid interruptions and help increase productivity, these updates can be done after normal working hours or on weekends when telecommunication traffic is at a minimum.

Appendix. Notices and Trademarks

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Glossary

This glossary includes terms and definitions from the *IBM Dictionary of Computing*, New York: McGraw-Hill, copyright 1994 by International Business Machines Corporation. Copies may be purchased from McGraw-Hill or in bookstores.

A

adapter. A printed circuit board that modifies the system unit to allow it to operate in a particular way.

address. (1) A value that identifies a register or a particular part of storage. The value is represented by one or more characters. (2) The location in the storage of a computer where data is stored. (3) To refer to a specific storage location by specifying the value that identifies the location.

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

AGP. accelerated graphics port

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

application program. (1) A program that is specific to the solution of an application problem. (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.

architecture. See computer architecture.

audio controller. An audio controller receives input from a microphone or input line, digitizes the signal, and stores it in the computer. The controller can play back the digitized signal to an external speaker or headphones.

auxiliary storage. Addressable storage, other than memory, that can be accessed by means of an input/output channel; for example, direct access storage devices or magnetic tape.

B

back up. To copy information, usually to diskette or tape, for safekeeping.

backup. Pertaining to a system, device, file, or facility that can be used in the event of a malfunction or loss of data.

baud rate. A number representing the speed at which information travels over a communication line. The higher the number, the faster communication occurs.

bay. An area within a personal computer that provides space and physical support for storage devices.

binary. Pertaining to a system of numbers to the base 2; binary digits are 0 and 1.

BIOS (basic input/output system). Code that controls basic hardware operations such as interactions with diskette drives, hard disk drives, and the keyboard.

bit. Either of the digits 0 or 1 when used in the binary numeration system.

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. (2) A portion of storage used to hold input or output data temporarily.

bus. One or more conductors used for transmitting signals, data, or power. See also address bus, data bus, and expansion bus.

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

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

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C

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

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

CD. Compact disc. A disc, usually 4.75 inches in diameter, from which data is read optically by means of a laser.

CD-ROM. Compact disc-read only memory. High-capacity read-only memory in the form of an optically read compact disc. See also CD and ROM.

central processing unit (CPU). (1) The section of the microprocessor where arithmetic and logical operations are performed, and instructions are decoded and executed. (2) The functional unit that controls the operation of the computer.

chip set. An integrated circuit or a set of integrated circuits that provide hardware support for a related set of functions, such as the generation of video.

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.

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

clock speed. For a microprocessor, the operating speed of the microprocessor. Clock speed is typically measured in megahertz (MHz).

CMOS. Complementary metal-oxide semiconductor. A technology that combines the electrical properties of n-type semiconductors and p-type semiconductors.

code. A collection of instructions that are in a form that can be read and processed by a computer.

code page. An assignment of graphic characters and control function meanings to all code points; for example, assignment of characters and meanings to 256 code points for an 8-bit code, assignment of characters and meanings to 128 code points for a 7-bit code.

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.

computer security. (1) Concepts, techniques, technical measures, and administrative measures used to protect the hardware, software, and data of an information processing system from deliberate or inadvertent unauthorized acquisition, damage, destruction, disclosure, manipulation, modification, use, or loss. (2) Protection resulting from the application of computer security.

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

configure. To set up a computer for operation by describing to the system the devices, optional features, and programs installed in the computer.

connector. An electrical part used to join two or more other electrical parts.

control. The determination of the time and order in which the parts of a computer 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.

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.

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

D

daisy chain. A method of device interconnection for determining interrupt priority by connecting the interrupt sources.

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

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

DDC. Display Data Channel

decibel (dB). A unit that expresses the intensity of a sound.

decimal. Pertaining to a system of numbers to the base 10; decimal digits range from 0 through 9.

default. Pertaining to an attribute, condition, value, or option that is assumed when none is explicitly specified.

device. A mechanical, electrical, or electronic piece of equipment designed to serve a special purpose or perform a special function.

device driver. A file that contains the code needed to use an attached device.

diagnostic. Pertaining to the detection and isolation of errors in programs and faults in equipment.

diagnostic program. A computer program that is designed to detect, locate, and describe faults in equipment or errors in computer programs.

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

DIMM. Dual inline memory module

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

diskette. A small magnetic disk permanently enclosed in a rigid or semi-rigid protective jacket.

diskette drive. The mechanism used to seek, read, and write data on diskettes. It can be installed in, or attached to, a computer.

disk swapping. A form of memory management whereby if additional memory is needed for the active programs, the operating system transfers the least-used information from memory to the hard disk to make more memory available. When the transferred information is needed, it is exchanged with other information in memory.

Display Data Channel (DDC). An industry standard for passing monitor configuration information between a monitor and the attached personal computer. Plug and Play technology is used to provide automatic performance optimization for the monitor. A DDC-enabled computer can interpret configuration information from a DDC-enabled monitor and then set the display mode that best uses the capabilities of the monitor.

Display Power Management Signaling (DPMS). A monitor feature that makes it possible for the attached personal computer to safely lower and manage the power consumption level of the monitor, based on defined modes of inactivity of the keyboard and mouse. The power level can be progressively lowered each time the monitor is placed into the next mode—from On, to Standby, to Suspend, to Off. To take advantage of this feature, the monitor must be used with a computer and operating system that are hardware and software enabled for DPMS. If the monitor is attached to a video adapter, the adapter must also be DPMS enabled.

DMA. Direct memory access.

DMI. Desktop Management Interface

DPMS. Display Power Management Signaling

DRAM. Dynamic random-access memory.

Dual inline memory module. A small circuit board with memory-integrated circuits containing signal and power pins on both sides of the board.

dual processing. A process in which a personal computer uses the resources of two microprocessors, instead of one, to share the processing tasks. This architecture provides the capability of faster processing speed and faster throughput to input/output devices. Most operating systems that support dual processing use symmetric multiprocessing.

E

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). Programmable read-only memory that can be erased by a special process and reused; specifically, a PROM that must be removed from the computer to be reprogrammed.

expansion bus. An extension of the I/O bus that has connectors for attaching adapters to the bus.

expansion slot. In personal-computer systems, one of several receptacles in the rear panel of the system unit into which a user can install an adapter.

F

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

flash memory. A data storage device that is programmable, erasable, and does not require continuous power. The chief benefit of flash memory over other programmable and erasable data storage devices is that it can be reprogrammed without being removed from the circuit board.

format. To prepare a hard disk or diskette to hold information.

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

G

GB. Gigabyte.

gigabyte. (1) For processor storage and real and virtual memory, 2^{30} or 1073741824 bytes. (2) For disk storage capacity, 1000000 KB. (3) For transmission rates, 1000000000 bytes.

H

hard disk drive. A disk drive that reads and writes data on rigid disks and can be installed in or connected to a computer.

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

hertz (Hz). A unit of frequency equal to one cycle per second.

hex. See hexadecimal.

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.

I

input/output. Pertaining to a device, process, or channel involved in data input, data output, or both.

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.

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

instruction set. The set of instructions of a computer, of a programming language, or of the programming languages in a programming system.

interrupt. An instruction that directs the microprocessor to suspend what it is doing and run a specified routine. When the routine is complete, the microprocessor resumes its original work. See also routine.

I/O. Input/output.

ISA. Industry Standard Architecture.

ISO. International Organization for Standardization. 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

jack. A connecting device to which a wire or wires of a circuit can be attached and that is arranged for insertion of a plug.

jumper. A device, such as a short wire, used to open or close a circuit.

K

KB. Kilobyte.

kilobyte. Approximately 1000 bytes.

L

LAN. See local area network.

legacy device. A device that is not Plug and Play (automatic configuring) compatible. A legacy device must be manually configured by setting its switches or jumpers, and then manually assigned computer resources using the computer configuration/setup utility program. Contrast with Plug and Play device.

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. (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.

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

low-level format. A type of disk formatting that erases all readable information from a hard disk by writing zeros on all data sections of the disk to ensure that no readable information is left on the disk. Low-level formatting requires a low-level format program, which is available from a number of manufacturers.

M

MB. Megabyte.

megabyte. (1) For processor storage and real and virtual memory, 2^{20} or 1048576 bytes. (2) For disk storage capacity, 1000 KB. (3) For transmission rates, 1000000 bytes.

megahertz (MHz). A unit of measure of frequency equal to 1000000 cycles per second.

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. Contrast with auxiliary storage.

menu. A list of choices that gives users access to actions that can be applied to an object.

MHz. Megahertz.

microprocessor. An integrated circuit that contains the central processing unit (CPU) of a computer. See processor and central processing unit.

MIDI. Musical instrument digital interface

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. One of the functions of a modem is to enable digital data to be transmitted over analog transmission facilities. (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.

multiplexer. A device capable of transmitting several messages or signals simultaneously on the same circuit or channel.

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

N

nanosecond (ns). One thousandth of one millionth (10^{-9}) of a second.

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

network administrator. The person responsible for the installation, management, and control of a network. The network administrator gives authorization to users for accessing shared resources, and determines the type of access those users can have.

network server. See server.

nonvolatile. (1) Pertaining to a storage device whose contents are not lost when power is cut off. (2) Contrast with volatile.

ns. nanosecond.

O

operating system. Software that controls the execution of programs and that may provide services such as resource allocation, scheduling, input/output control, and data management.

P

parallel. Pertaining to a process in which all events occur within the same interval of time, each handled by a separate but similar functional unit.

parallel port. An access point through which a computer transmits or receives data that consists of several bits sent simultaneously on separate wires. Contrast with serial port.

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.

password. A string of characters known to the computer system and to a user, who must specify it to gain full or limited access to a system and to the data stored within it.

PC Card. A credit-card-sized adapter used to add memory, storage, or I/O capabilities to a personal computer, personal communicator, or other electronic device.

PCI. Peripheral component interconnect.

pel. (1) Picture element. (2) In computer graphics, the smallest element of a monitor surface that can be independently assigned color and intensity.

peripheral device. Any device that can communicate with a particular computer; for example, input/output units, auxiliary storage.

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

picture element (pel). In computer graphics, the smallest element of a monitor surface that can be independently assigned color and intensity.

pin. One of the conducting contacts of an electrical connector.

pipeline. A serial arrangement of processors or a serial arrangement of registers within a processor. Each processor or register performs part of a task and passes results to the next processor; several parts of different tasks can be performed at the same time.

plotter. An output unit that directly produces a hardcopy record of data on a removable medium, in the form of a two-dimensional graphic representation.

Plug and Play device. A device that is auto-configuring. A Plug and Play device comes with built-in identification and configuration specifications that enable the computer BIOS to automatically configure the device and assign it computer resources. Contrast with legacy device.

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 turned on.

priority. (1) A rank assigned to a task that determines its precedence in receiving system resources. (2) The relative significance of one job to other jobs in competing for allocation of resources.

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

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. See microprocessor and central processing unit.

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

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

PROM. Programmable read-only memory.

prompt. A visual or audible message sent by a program to request the user's response.

R

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 EEPROM, 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) In computer graphics, the process of repeatedly producing a monitor image on a monitor surface so that the image remains visible.

register. (1) An integrated circuit that contains 8, 16, or 32 storage locations, each of which can store 1 bit of binary data. See also binary. (2) An area that stores binary data while it is being processed by the computer.

resolution. In computer graphics, a measure of the sharpness of an image, expressed as the number of lines and columns on the monitor screen or the number of pels per unit of area.

resource. Any of the computer-system elements needed to perform required operations, including storage, input/output devices, processors, data, and programs.

riser card. A circuit card that connects to the system board and provides expansion slots for adding adapters.

routine. A program, or part of a program, that may have some general or frequent use.

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.

serial. Pertaining to the sequential or consecutive occurrence of two or more related activities in a single device or channel.

serial port. An access point through which a computer transmits or receives data, one bit at a time. Contrast with parallel port.

server. (1) A functional unit that provides shared services to workstations over a network. (2) In a network, a data station that provides facilities to other stations.

slot. (1) A position in a device used for removable storage media. (2) One of several receptacles in the rear panel of the system unit into which a user can install an adapter.

small computer system interface (SCSI). A standard input/output interface used by personal computers.

SMM. System management mode.

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

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.

subsystem. A secondary or subordinate system, usually capable of operating independently of a controlling system, and usually having a single purpose, such as displaying video or reading from and writing to hard disks. A subsystem can be integrated into the system board or on an adapter.

super video graphics array (SVGA). A video standard that supports high-resolution, 1024 x 768-pel graphic images.

SVGA. Super video graphics array.

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 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 management mode. A state controlled by the microprocessor that reduces the power consumed by components of the computer.

system programs. In personal-computer systems, startup routines, such as POST and BIOS code, and utility programs that are used to configure, test, and update the computer. See also POST, BIOS, and utility program.

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

U

UART (universal asynchronous receiver/transmitter). An electrical circuit that converts analog data to digital data and digital data to analog data; it is used in communications devices.

universal serial bus (USB). A serial interface standard for telephony and multimedia connections to personal computers.

universal serial bus port. On personal computers, a port that uses a single connector for devices that previously used serial, parallel, keyboard, mouse, and game ports. The USB port connector uses Plug and Play technology to determine what device is connected to the port. A hub device can be used to convert a single USB connector into multiple attachment points. Data is transmitted in asynchronous or isochronous mode.

USB. Universal serial bus

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

VGA. Video graphics array.

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

volatile. (1) Pertaining to a storage device whose contents are lost when power is cut off.
(2) Contrast with nonvolatile.

W

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

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

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