WYSEpc 286
User's
Guide

WYSE

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User's
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WYSE

Overview

Computer Configuration

This powerful computer is based on the high-performance 16-bit Intel 80286 microprocessor. It is functionally compatible both in hardware and software with the IBM PC AT. The minimum configuration offers the following features:

- 640K RAM (random-access read-write memory)

- A 1.2MB half-height high-density diskette drive

- A disk-controller board with connections for two diskette drives and two hard-disk drives (for a maximum of three drives that can be installed at one time inside the system)

- Eight I/O (input/output) expansion slots

- A serial/parallel adapter board

- A battery-backed real-time clock

- Dual-speed processor board operation either at the standard IBM PC AT-compatible speed or a higher speed

- An international power supply with a choice of 115 or 230 volts

- Battery-backed CMOS, which holds your system configuration

- Choice of an 84-key or 102-key ergonomic keyboard

To these features, you can add any of several display adapter boards and monitors:

- A monochrome display adapter (with or without graphics) and a monochrome monitor

- A high-resolution monochrome display adapter (with graphics) and a high-resolution monochrome monitor

- A medium-resolution color display adapter and RGB color monitor

- An enhanced graphics display adapter (EGA) and high-resolution color monitor

- A graphics display adapter (GDA) that combines on one board the functions of several different video display adapters

Your computer plus the monitor and display adapter board of your choice make up your *system*. Figure 1 shows the minimum system.

Figure 1 Minimum Computer System

Figure 1 Minimum Computer System

Monitor of Your Choice

Computer

Keyboard
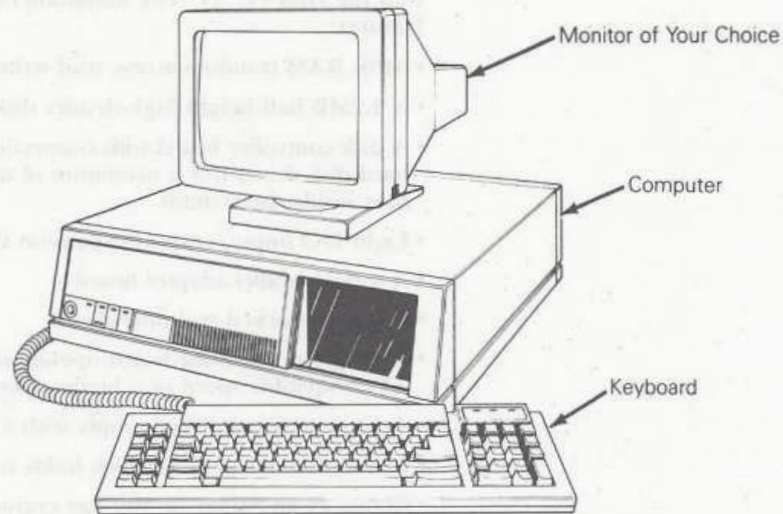
Among the many options that can be added to this minimum system are the following:

- One or two hard-disk drives of varying storage capacities
- A second diskette drive, either 1.2MB or 360K
- Memory expansion boards
- An 80287 math coprocessor
- A second serial/parallel board
- A floor stand

Operating System

The computer comes with the MS-DOS operating system, a standard operating system for microcomputers. The operating system controls what you can do with a computer and how you do it. You'll find the diskettes containing the operating system files in a packet with the manuals.

■ **Note**—Only MS-DOS and IBM DOS versions 3.0 or greater will run on this computer.

If you have a system with a hard disk, the operating system files are already installed on the hard disk. For more information about MS-DOS, refer to Chapter 6, "Getting Started with MS-DOS," and to the *MS-DOS Guide*.

Documentation Package Contents

Your computer was shipped with the following documentation and diskettes:

• *User's Guide*

• *MS-DOS Guide*

• *GW-BASIC Guide*

• One *Setup and Test Diskette*

• Two MS-DOS system diskettes

The following are brief descriptions of the manuals that come with your computer:

• *User's Guide* —Introduces you to all of the basic components of your new computer system. Chapters 1 through 8 comprise a tutorial that shows you how to assemble the components and get started with MS-DOS.

  The remainder of the manual serves as a reference guide for the computer hardware. It gives instructions on how to install options to make the computer more powerful, how to set up the system and run system tests, and how to install serial and parallel devices.

• *MS-DOS Guide* —Shows you how to get the most out of the operating system. It explains all the commands and utility programs in the operating system and has valuable information on the many special features of MS-DOS.

• *GW-BASIC Guide* —Contains information on all of the BASIC commands, statements, and functions, as well as some fundamental programming tips. If you are interested in programming, this reference guide for the GW-BASIC programming language will be very helpful.

The following are brief descriptions of the three diskettes that accompany your computer:

- *MS-DOS System Diskettes* —Contain the MS-DOS command files, the system utility programs, and the GW-BASIC programming language

- *Setup and Test Diskette* —Contains the SETUP program, which allows you to configure system options, and a series of tests for the computer system

Software Compatibility

Because your computer operates under MS-DOS, you have access to the rapidly growing library of MS-DOS-based IBM PC AT-compatible applications software programs, including popular spreadsheet, database, word-processing, and integrated packages. In addition, you can find many MS-DOS-based programs for accounting, communications, graphics, idea processing, time management, leisure-time, and much more. Your dealer can help you select the programs that fit your needs.

■ Note—If you run any operating system other than MS-DOS on your computer, refer to the documentation for that operating system for information about software compatiblity.

Hardware Compatibility

The expansion slots in your computer are IBM PC AT-compatible. This means that you can attach many different accessories that are available for the IBM PC AT. These include boards for networking communications and internal modems. Your dealer can help you choose the accessories that are best for your system.

How to Use This Manual

This *User's Guide* is intended to answer any fundamental questions you may have about your computer. It also touches on the subjects of operating systems in general and the MS-DOS operating system in particular. A detailed examination of these subjects is contained in the *MS-DOS Guide*.

The manual is divided into two parts, "Part 1—Getting Started: A Tutorial," and "Part 2—Reference Guide." The purpose of Part 1 is to guide you through getting your computer system up and running. Some of the things covered are

• The unpacking stage

• The connection of the various components into a complete computer system

• A general introduction to the MS-DOS operating system

When you finish Part 1, your system will be properly assembled, and you'll have enough knowledge about the computer and the MS-DOS operating system to run an MS-DOS-based applications software program.

Part 2 provides reference information about the computer hardware and getting the most out of your system.

Paths for Different Users

Different users with different needs will be seeking information from the pages of this *User's Guide*, so a Quick-Reference Table is included here to put them on the right path (Table 1). Regardless of your computer experience, this table will help you quickly access the parts of this manual that you specifically need. (It also refers you to the *MS-DOS Guide*.)

Nine categories of users are defined and addressed in three different divisions in this Quick-Reference Table. The three divisions are

• **Assembly**–The state of assembly in which you find the system

• **Drives**–The number and types of drives included in your system

• **Experience**–Your computer experience

You'll find yourself in at least two of these divisions; you may also find yourself in more than one category within a division.

Table 1 Quick-Reference Guide for Different Users

	If . . .	Read the chapters indicated in this *User's Guide* . . .								
		Part 1—Getting Started: A Tutorial								
		0v	1	2	3	4	5	6	7	8
ASSEMBLY	Your computer is still in its carton		■							
ASSEMBLY	Your system is unassembled and lacking a display adapter board*			■	■					
ASSEMBLY	Your system is unassembled, but has a monitor adapter board* already installed			■		■				
DRIVES	Your system has a hard-disk drive							■	■	
DRIVES	Your system has a single diskette drive									
DRIVES	Your system has dual diskette drives									
EXPERIENCE	You are approaching a personal computer for the first time	■		■		■	■	■	■	■
EXPERIENCE	You are familiar with computers but unfamiliar with MS-DOS							■	■	
EXPERIENCE	You are familiar with computers and MS-DOS, but unfamiliar with the IBM PC AT-compatible computers	■		■		■	■			

*The operation of the monitor is dependent on the presence of a *display adapter board* inside the computer.

Part 2—Reference Guide									Read the *MS-DOS Guide* as needed
R1	R2	R3	R4	R5	R6	R7	R8	R9	
				■				■	
				■					
	○		○		○				
		■	○						
		■	○						
■	○								○
									○
■	■					■			

■ = Read   ○ = Optional

Manual Conventions

You should be familiar with the conventions that are followed in this *User's Guide* before you start:

- References to keyboard keys are always shown in uppercase letters, though the actual keys may be labeled with both uppercase and lowercase letters and/or with a symbol. Examples: ESC for the *Esc* (or *escape*) key and BACKSPACE for the ← key.

- Although the text usually shows data that you enter from the keyboard in uppercase letters, you can type it in lowercase. MS-DOS does not distinguish between uppercase and lowercase.

- In Part 1, you are directed to press the ENTER key when you want the computer to accept commands and other information that you have typed in. This step is usually necessary in MS-DOS.

- The tutorial uses the ENTER key as the most convenient key to press when a screen message refers to "any key."

- *Computer* refers to the main computer unit. Depending on the context, *system* refers to the computer together with the monitor of your choice, or to any operating system.

- The expression *disk drives* refers to *hard-disk drives* and *diskette drives* considered together.

- Disk drives are often referred to by the following *drive designations*: *Drive A* is the first or only diskette drive; *drive B* is the second diskette drive; *drive C* is the first or only hard-disk drive; *drive D* is the second hard-disk drive.

- Unless otherwise indicated, numbers can be entered from either the alphanumeric portion of the keyboard or the numeric keypad. However, for numbers to be entered from the numeric keypad, the NUM LOCK key must be engaged.

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Part 1–Getting Started: A Tutorial

1

1 Unpacking the Computer

Unpacking

You've now opened the carton your computer was shipped in, and you've followed the instructions found on the top of the packing materials, which have referred you to this chapter of the *User's Guide* to complete the unpacking procedure.

To finish unpacking:

1. Remove the keyboard.
2. Remove the plastic diskette holder and any accessory bags and/or envelopes.
3. Hold the top packing material firmly and pull it up and out of the carton, exposing the computer.
4. Turn over the top packing material and remove the cable guard.
5. Lift the computer out of the carton and set it on a flat stable surface.
   ● **Warning**—The computer weighs over 40 pounds. Use proper lifting techniques to avoid injury.
6. Hold the bottom packing material firmly and lift it up and out of the carton.
7. Turn over the bottom packing material and remove the computer power cord and keyboard cable.
8. Save all shipping materials—the carton, packing, plastic bags, tie wraps, etc.—to use when you repack the computer for any move.

Parts List

As shown in Figure 1-1, the minimum computer configuration consists of the following components:

☐ Computer with a diskette drive and installed disk controller and serial/parallel boards

☐ Keyboard

☐ Keyboard cable

☐ AC power cord for the computer

Figure 1-1 Minimum Computer Components

Computer

AC Power Cord

Keyboard Cable

Keyboard
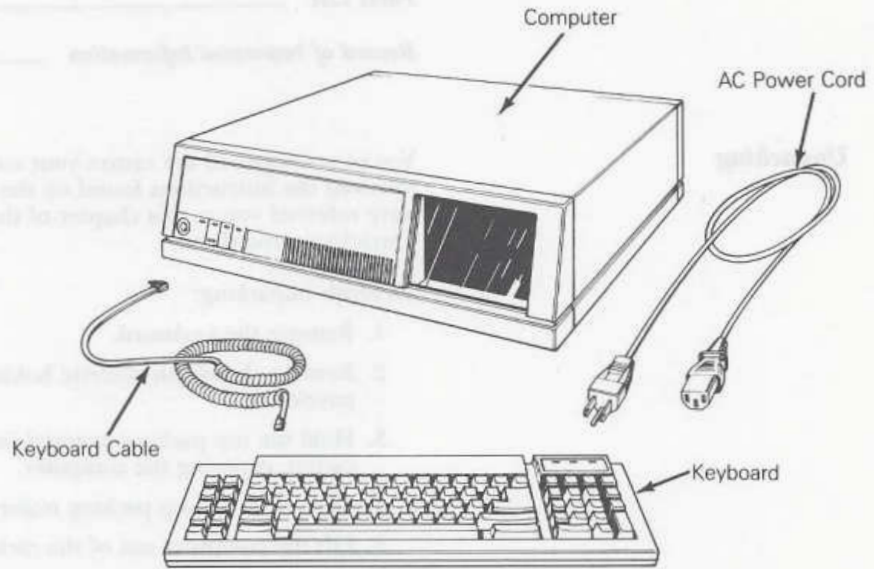
You will also find the following accessories:

• Manuals

• Two MS-DOS system diskettes

• One *Setup and Test Diskette*

• One diskette drive mounting clip with screw

• One plastic diskette holder (for optional mounting in drive B position)

• One coded cylindrical key (plus a spare)

• One serial-port adapter cable

Record of Important Information

For your convenience, we've included the following form on which you can record the model and serial numbers of your computer, as well as other vital technical and reference information. As you read the following chapters and set up your system, be sure to record information on this form.

IMPORTANT COMPUTER
SYSTEM INFORMATION

Computer Serial No. _____   Facility
                                            Inventory No. _____

Keyboard Serial No. _____   Facility
                                            Inventory No. _____

Keylock Key Serial No. _____

Monitor Brand _____   Facility
                                            Inventory No. _____
   Type _____

   Serial No. _____

Other _____   Facility
                                            Inventory No. _____
   Type _____

   Serial No. _____

Setup Information

Display Adapter Type _____

Memory Boards (number installed) _____

Serial Ports (number installed) _____

Parallel Ports (number installed) _____

Printer Brand _____

   Type _____

Diskette Drives

   Type _____   _____ K/MB

   Type _____   _____ K/MB

Hard Disk Drives

   Type _____   _____ MB

   Type _____   _____ MB

Hard-Disk Error Map
(Media Defects)

Drive C

Cylinder or Track No.	Head No.

Drive D

Cylinder or Track No.	Head No.

Drive C

Cylinder or Track No.	Head No.
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Drive D

Cylinder or Track No.	Head No.
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

2

2 Getting Familiar with the Computer

Overview

This chapter discusses each component of your computer in detail. Figure 2-1 shows the minimum computer with the keyboard attached.

Figure 2-1 Minimum Computer with Attached Keyboard

Computer

Keyboard
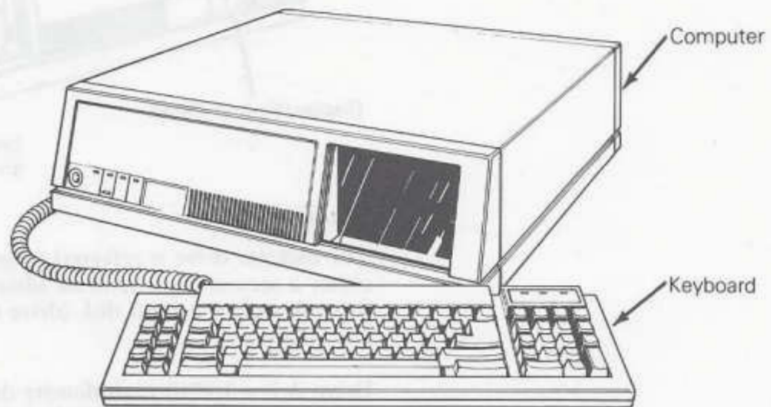
The Front of the Computer

Figure 2-2 shows the front of the computer. On the lower left is the display/keylock panel (shown in detail in Figure 2-3), which is divided into four sections. To the right is the sliding plastic door (seen in open position) that protects the diskette drive, and the diskette drive opening. (Every unit has at least one diskette drive. Your specific drive may differ slightly in appearance from the one shown in the figures in this *User's Guide.*) Simply slide the plastic door to open and close it.

Figure 2-2 The Front of the Computer

Display/Keylock Panel

Drive Door
(In Open Position)

Diskette Drive Opening
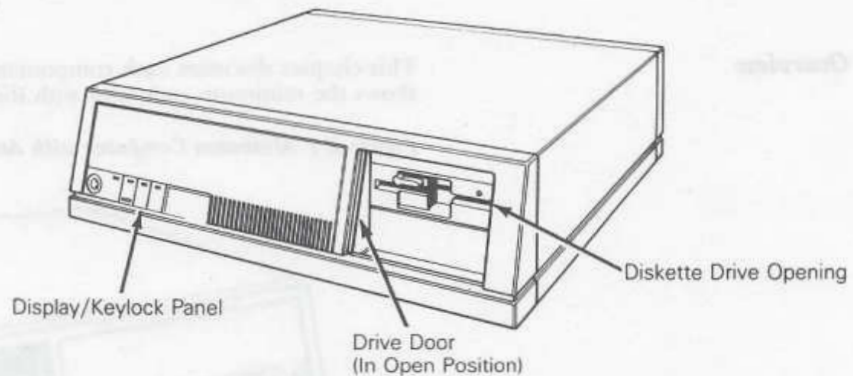
The Drive(s)

The diskette drive is referred to as *drive A*. Other configurations may include either a second diskette drive (drive B) or a hard disk (drive D) directly below drive A and/or a hard disk (drive C) concealed behind the front panel to the left of drive A.

Drive A is a 1.2MB high-density diskette drive. Although you can use both 1.2MB high-density and 360K double-density diskettes in this drive, we suggest that you primarily use high-density diskettes. (For a discussion of this very important subject, read Chapter 4, "Understanding Diskettes," and "Storage Media: Diskettes and Hard Disks" in the Reference Guide.)

The Display/Keylock Panel

The display/keylock panel (Figure 2-3) is divided into four sections, each of which contains a symbol and a small LED light. The LED lights indicate the current status of some fundamental computer functions. Descriptions of each of the panel sections follow.

Figure 2-3 The Display/Keylock Panel

Lock

LEDs

Keylock Indicators

Dual-Speed Button

Hard-Disk Indicator

Dual-Speed Indicator

Power Indicator
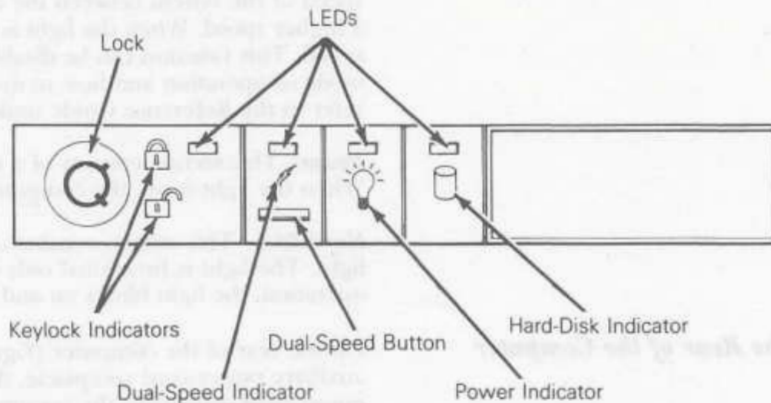
Keylock—This is the first section of the display/keylock panel. It consists of a small, tubular-style lock; symbols of two padlocks, one locked and the other unlocked; and a green LED light.

A uniquely coded key (and a spare) is provided as an accessory with each computer. When you insert the key into the lock and turn it counterclockwise so it points to the closed padlock, the light goes on, the cover is locked in place, and the keyboard is disabled (though the system can still run). When the lock is in this position, the computer cannot be operated from the keyboard and the cover cannot be removed.

When you turn the key clockwise so it points to the open padlock, the light goes off, indicating that the cover is unlocked and the keyboard is functioning. The key can be removed when it is in either the locked or unlocked position.

■ **Note**—The key is unique to your computer and has a serial number stamped on it; take care of the key and record its serial number in the "Record of Important Information" section in Chapter 1. You'll need this serial number to order a replacement key.

Dual-Speed—This section consists of a pushbutton, a symbol of a lightning bolt, and a green LED light. The pushbutton normally switches the operating speed of the system between the standard IBM PC AT-compatible speed and a higher speed. When the light is on, the computer is running at the higher speed. This function can be disabled. (For a discussion of the dual-speed mode of operation and how to disable and enable the front panel button, refer to the Reference Guide under "Dual-Speed Operation.")

Power—This section consists of a symbol of a lightbulb and a green LED light. When the light is on, the computer is on and operating within specifications.

Hard Disk—This section consists of a symbol of a cylinder and a green LED light. The light is functional only if your computer has a hard disk. In normal operation, the light blinks on and off when the system accesses the hard disk.

The Rear of the Computer

On the rear of the computer (Figure 2-4) are the power ON/OFF switch, the auxiliary power-cord receptacle, the 115/230-voltage selection switch, the AC power-cord connector, the opening for the fan, the standard 4-wire keyboard receptacle, the IBM PC AT-compatible 5-wire keyboard receptacle, the snap-on cable guard over the input/output (I/O) access openings, the I/O access area, the external device access opening, and the label area.

The listed elements are described in the following:

• The power ON/OFF switch is a rocker-type circuit breaker that turns the computer on and off and protects it from overload conditions. When the top of the switch (marked with a 1) is pressed in, the computer is on. When the bottom of the switch (marked with a zero—0) is pressed in, the computer is off.

• The slide-type voltage selection switch allows you to set the system to operate at either 115 volts AC, which is the standard in the U.S. and Canada, or 230 volts AC.

• The AC power-cord connector is a recessed male connector into which the main AC power cord is plugged.

• The female auxiliary power cord receptacle provides power for a monitor.

• Two female keyboard receptacles provide connections for the standard 4-wire keyboard that comes with the computer, and for any IBM PC AT-compatible 5-wire keyboard.

Figure 2-4 The Rear of the Computer

External Device
Access Opening

Fan Opening

Input/Output Access Area

Auxiliary Power Cord
Receptacle
(For Monitor)

Cable Guard

Label Area

Power ON/OFF Switch

115/230 Voltage
Selection Switch

Standard 4-Wire
Keyboard Receptacle

Serial/Parallel Adapter

AC Power Cord Connector

IBM PC AT-Compatible
5-Wire Receptacle
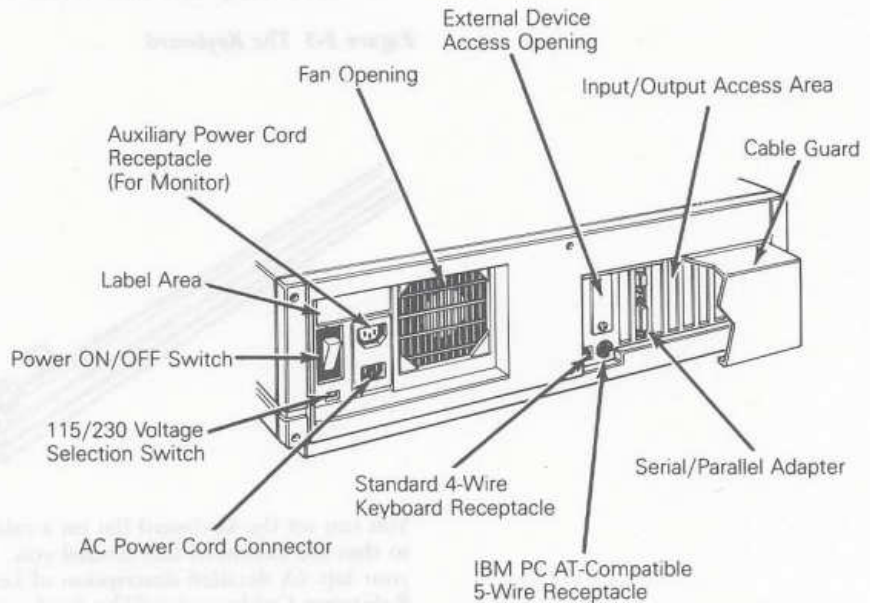
- The snap-on cable guard protects the I/O openings and connectors and maintains a 3-inch clearance between the rear of the computer and any obstacle.

- The I/O access area, which is under the snap-on cable guard, is a series of eight openings for I/O option boards that can be installed in the computer. (At the very least, you'll see the connector for the serial/parallel board that comes already installed in the unit.)

- The external device access opening is covered by a metal plate that is easily removed by unscrewing the screw that attaches it to the computer. This opening allows cable access to adapter boards that you install for certain external devices, e.g., a light pen.

- The external opening of the system fan allows air to be exhausted from inside the computer.

- The label area contains standard product identification and specification information, the serial number, and agency compliance statements.

The Keyboard

The keyboard's coiled cable and adjustable elevation feet (Figure 2-5) let you work with the keyboard in different ways.

Figure 2-5 The Keyboard
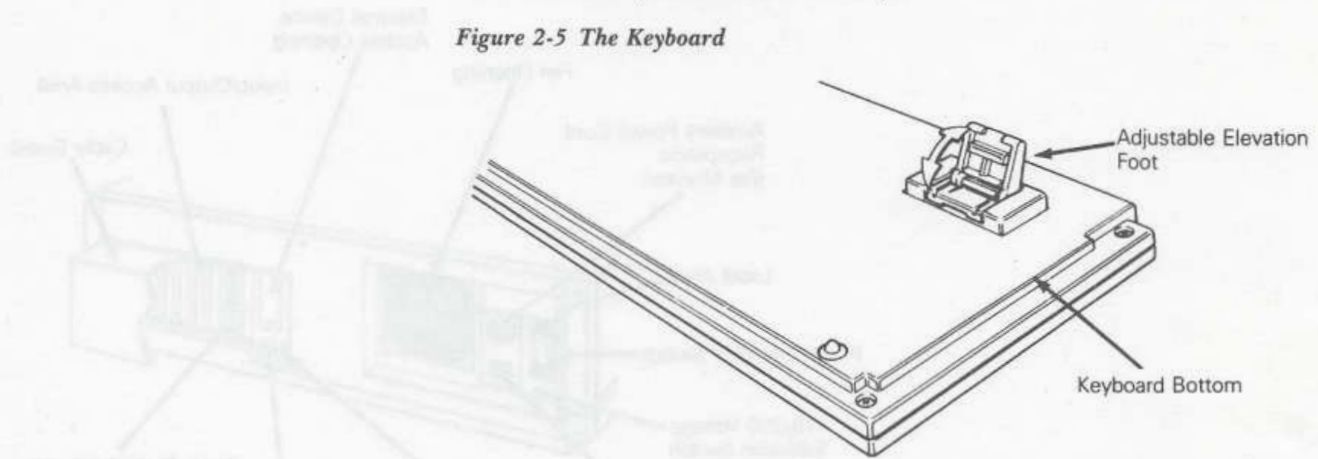
You can set the keyboard flat on a table, or you can extend the adjustable feet so that the keyboard tilts toward you. You can also work with the keyboard in your lap. (A detailed description of keyboard functions is presented in the Reference Guide under "The Keyboard.")

3

3
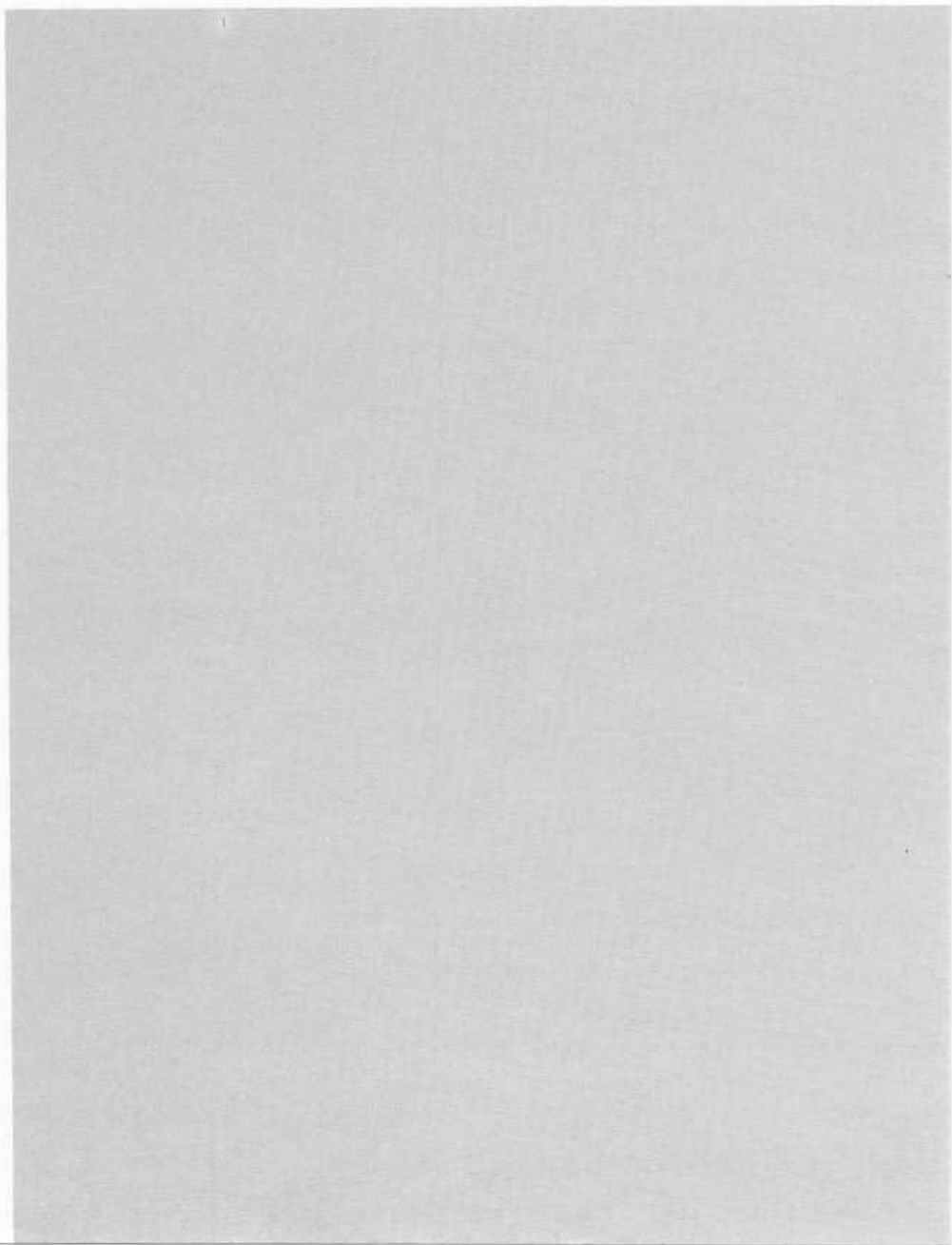
3 Assembling the System

Before You Start

This chapter guides you through the assembly of your computer system. The following items should be taken into account before you begin.

Space

Decide where you want to set up your computer. The room should be clean, cool, and dry. Choose a place where the computer will never be in direct sunlight. You'll need a flat surface and at least three inches of clearance around the system. It's important to leave this space behind the fan so that the computer can remain cool during operation. The extra space is also necessary for external cabling.

■ **Note**—The computer comes with a plastic snap-on cable guard. When it's installed, it automatically allows enough clearance behind the computer for air circulation and external cabling and prevents the fan exhaust air from being blocked.

Additionally, if you plan to install any peripheral devices, such as a printer or an external modem, be sure to leave extra room to the left or right of the computer for these devices.

Power

The computer runs on 115 or 230 volt alternating current (AC). Be sure you know what voltage is available at your installation site. The standard voltage in the U.S. and Canada is 115 volts AC.

• Make sure you have a grounded power outlet that accommodates a 3-pronged plug.

• Make sure that all extension and power cords used with your computer are grounded and that they have three prongs, including the ground pin.

• Make sure that the power outlet is grounded to prevent electrical shock. Other units attached to the system should also be grounded.

Assembling the System

Now you're ready to assemble your computer system. The only tool you'll need is a small flat-blade screwdriver.

The Display Adapter Board

You will need both a monitor and a display adapter board to operate your system. Because your monitor should meet your specific needs, and because there is such a wide range of monitor types, the computer doesn't come equipped with a monitor. Different monitors are designed to display color/graphics, enhanced color, monochrome only, high-resolution monochrome, and other possiblities.

All monitors need a display adapter board. This board must be installed in the computer for the monitor to work.

■ **Note—**If your computer does not have a display adapter board already installed, you'll have to remove the computer cover to install the board before you go on to assemble the system. Instructions for this can be found in the Reference Guide under "Installing Internal Options." If you suspect that your computer doesn't include a display adapter board, turn to that section now and follow the instructions. (See Figure 3-1 for a typical location for an already-installed display adapter board.)

Figure 3-1 Typical Location for a Display Adapter Connector

Typical Display
Adapter Connector

Video Signal Connector
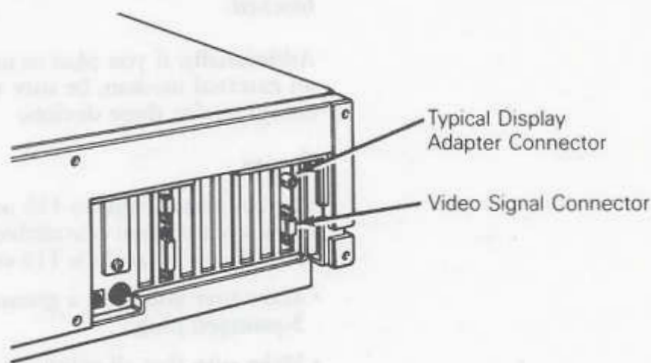
Assembly

If you know that a display adapter board is installed in your computer, you can continue with the steps that follow.

To assemble your system:

1. **CHECK POWER SWITCH.** Be sure the computer's power ON/OFF switch on the rear of the computer is in the OFF position (with the bottom of the switch—marked with a 0—pressed in).

2. **SET VOLTAGE SELECTION SWITCH.** Look at the voltage selection switch (Figure 3-2), which is under the power switch. Make sure the switch reading conforms to the voltage standard in your area.

Figure 3-2 The Voltage Selection Switch

230 Volts AC

115 Volts AC
(U.S. Standard)

Power ON/OFF Switch

115/230 Voltage
Selection Switch
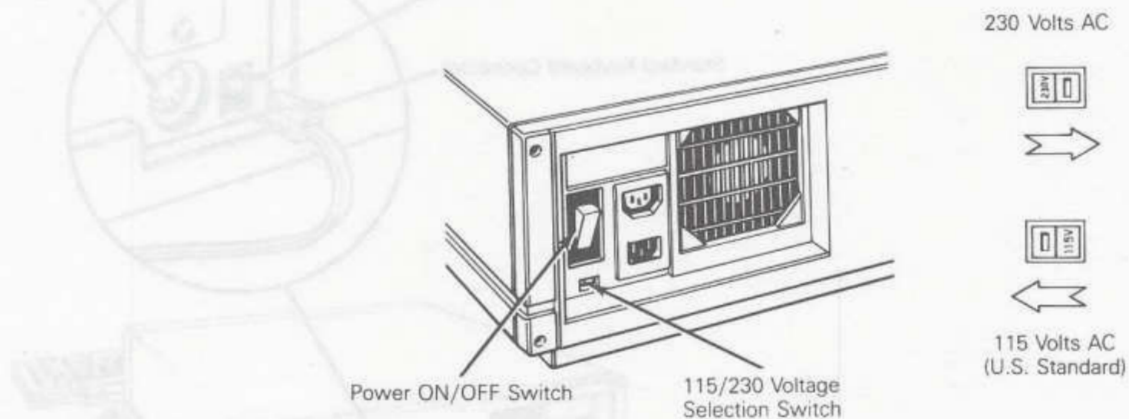
3. **CONNECT KEYBOARD.** Attach to the keyboard the end of the keyboard cable that's closest to the coiled part of the cord. Attach the other end to the computer (Figure 3-3). (The illustration shows the standard keyboard being attached to the computer. If you are using an IBM PC AT-compatible keyboard, you will need to connect it to the 5-wire receptacle on the rear of the computer. In this case, disconnect the standard keyboard cable.)

Figure 3-3 Keyboard Connections

IBM PC AT-Compatible 5-Wire
Keyboard Receptacle

Standard 4-Wire
Keyboard Receptacle

Standard Keyboard Connector
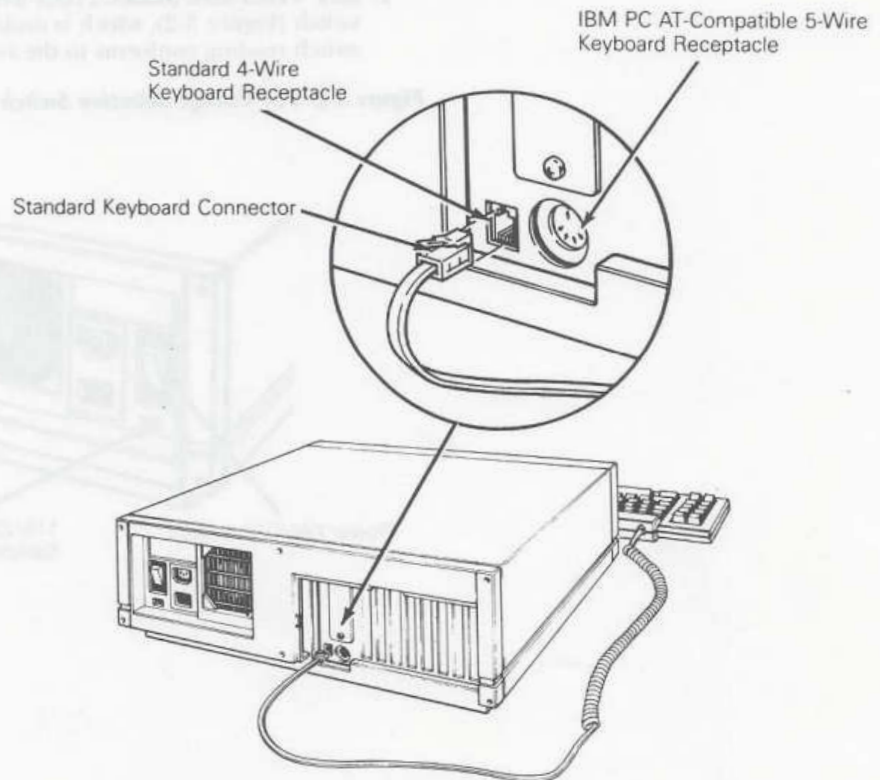
4. **CONNECT MONITOR.** Plug the monitor's attached video signal cable into the I/O connector on the display adapter board (Figure 3-4). Tighten the connector's two screws with a small flat-blade screwdriver.

Figure 3-4 Monitor Connections

Video Signal Cable

Typical Display Adapter Board

Video Cable Connector
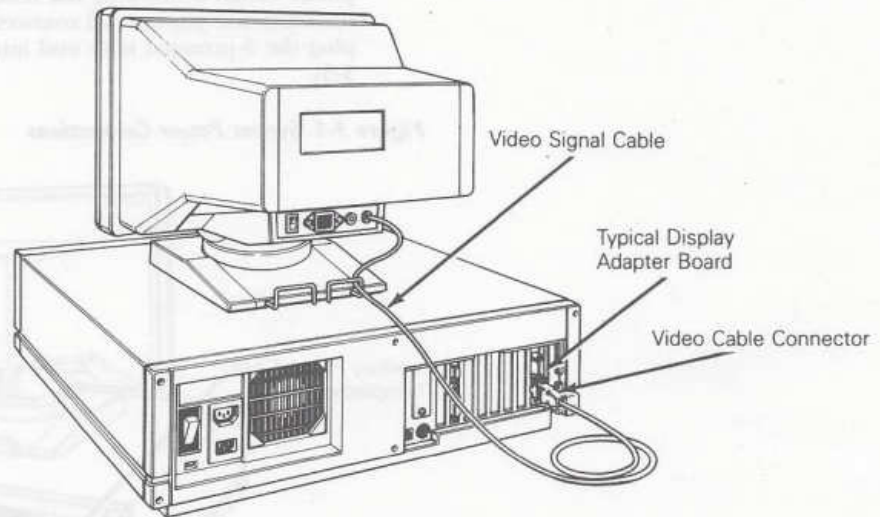
5. **CONNECT MONITOR POWER CORD.** Plug the monitor power cord into the female auxiliary power cord receptacle on the rear of the computer (Figure 3-5). This automatically provides power to the monitor when you turn on the computer.

6. **CONNECT SYSTEM POWER PLUG.** Being sure that the computer's power switch is off, plug the female end of the computer AC power cord into the power cord connector on the rear of the computer. Then plug the 3-pronged male end into a grounded electrical outlet (Figure 3-5).

Figure 3-5 System Power Connections
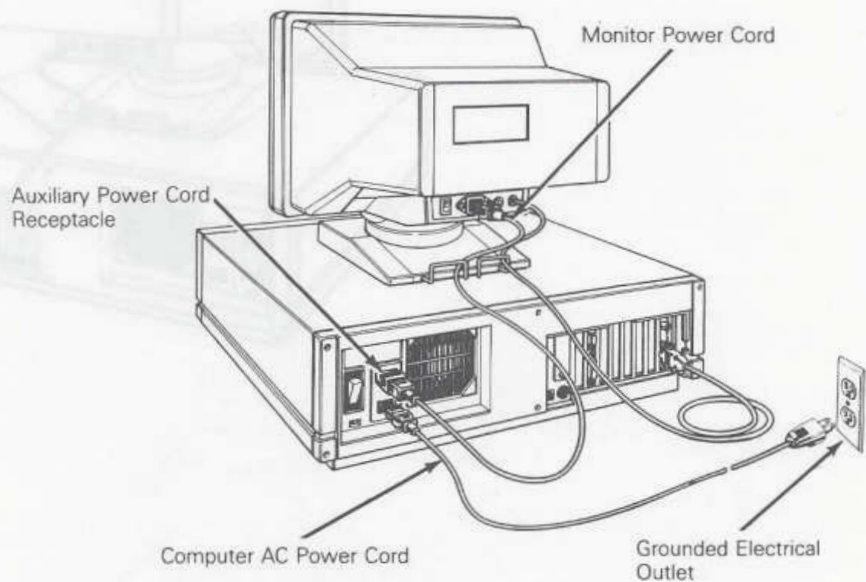
That completes the system assembly. If you've properly connected all of the system's components, your computer is ready to operate. However, do not turn on your computer yet. This is covered in Chapter 5, "Starting the System."

4

4

4 *Understanding Diskettes*

Diskettes and the Personal Computer

When you work with personal computers, you often need to store information on diskettes. The diskette drive of your computer stores programs and data on 5¼-inch diskettes. A diskette, or *floppy disk*, is a circular piece of mylar coated with magnetic material and packaged in a permanent protective jacket. The diskette drive(s) of your computer can *write* information onto the magnetic surface of a diskette and can *read* back and change the information later.

High-Density Format Versus Double-Density Format

The minimum computer system configuration is equipped with a 1.2MB, *high-density* diskette drive. This drive, defined as *drive A*, is able to both record and access data equivalent to 700 pages of single-spaced typed text onto and from compatible high-density diskettes.

■ **Note**–Always use high-quality diskettes in your diskette drives. Although diskettes of a lower quality will work in the drives, the failure rate of these diskettes is considerably greater.

An optional diskette drive for the system is the *360K double-density* drive. This drive uses double-density diskettes, which store only about 180 pages of single-spaced text. Most software programs are still distributed on double-density (48 tpi) rather than high-density diskettes. (The MS-DOS system diskettes and the *Setup and Test Diskette* that accompany your computer are all double-density.)

The high-density drive in your system can access, or *read*, data from both double-density and high-density diskettes. To read either diskette format, just insert the diskette into the high-density drive. The drive automatically determines which type of diskette is present and reads data accordingly.

▼ **Caution**—Once a high-density diskette drive has written or copied to a double-density diskette, that diskette may no longer be readable in a 360K double-density drive. It will only be readable in a high-density drive. To avoid problems with double-density diskettes in high-density diskette drives,

• Always write-protect a double-density diskette before you insert it into a high-density drive (see "Write-Protecting Diskettes" elsewhere in this chapter).

• Study Figure 4-1.

Figure 4-1 Using a Double-Density Diskette in a High-Density Drive

Do Not Write

Read OK

High-Density Drive

Double-Density Diskette
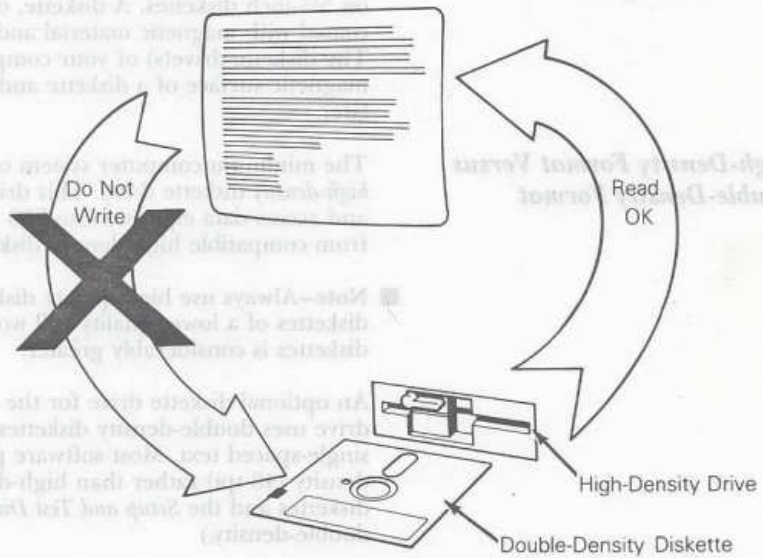
Backing Up Diskettes

Diskettes are a relatively fragile recording medium. The information you save on a diskette can be lost by physical damage to the diskette, exposure to a magnetic field, problems in erasing or saving, or by any number of other means. (See the Reference Guide under "Storage Media: Diskettes and Hard Disks" for complete diskette care information.)

Therefore, it's important to always make backup copies of your important diskettes and to store the originals in a safe place. As a general rule, make it a habit to back up all your files and diskettes, especially all the master diskettes of your applications software programs. Then use the backup copies in your daily routines instead of the originals. Backup procedures are detailed in Chapter 7, "Backing Up with MS-DOS," and in the Reference Guide under "Formatting and Copying with Alternative Configurations."

Write-Protecting Diskettes

Most diskettes have a small notch on one edge; this is the *write-protect notch*, and when it is covered, the drive cannot write information onto the diskette. Diskettes are packaged with a number of small stick-on write-protect tabs. To write-protect a diskette, fold the tab over the edge of the diskette so it covers the write-protect notch (Figure 4-2).

Figure 4-2 Write-Protecting a Diskette

Write Enabled Write Protected Write Protect Tab
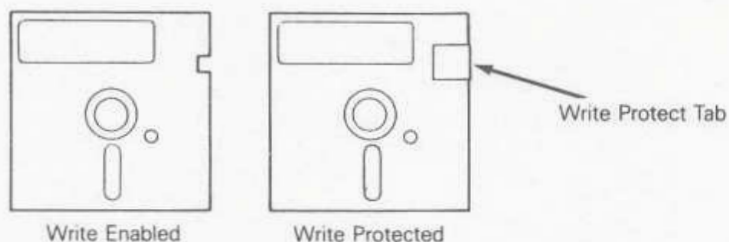
Write-protecting a diskette prevents anyone from accidentally erasing programs or data from the diskette. You should write-protect all diskettes that contain information you can't afford to lose.

■ **Note**—If you try to write to a write-protected diskette in drive A, the message

```
Write protect error writing drive A
Abort, Retry, Ignore?
```

will appear. If you want to write to the diskette, simply remove the write-protect tab from the diskette, put the diskette back in the drive, and press the R key for retry. Otherwise, press the A key to abort the write request.

5

5 *Starting the System*

Starting with the SETUP Program

■ **Note**–For the purposes of this step-by-step tutorial, please don't turn on the computer until instructed to do so.

The sections that follow explain how you can start, or *boot up*, the computer with the SETUP program. The SETUP program allows you to *configure your system*, that is, to record what options are installed in the computer. This information is then stored in a special chip in the computer where it remains until you run the SETUP program again to change it. You need to run the SETUP program to configure your system the first time that you assemble it and anytime thereafter that you change the original configuration.

One of the diskettes provided with your computer is the *Setup and Test Diskette*. In addition to the SETUP program, this diskette contains a series of programs that test various aspects of the computer and monitor.

Inserting a Diskette in a Drive

The procedure outlined below for inserting the *Setup and Test Diskette* into the diskette drive pertains to all diskettes.

To insert a diskette into the diskette drive:

1. **OPEN THE LEVER ON DRIVE A.** If you have one diskette drive, it is designated as *drive A*. If necessary, gently turn the lever on drive A counterclockwise, from a vertical to a horizontal position. Note the position of the lever in Figure 5-1.

2. **REMOVE CARDBOARD INSERT.** If there is a square cardboard insert in the diskette drive, remove it. It was placed there in the factory to protect the drive from damage in transit. Keep the insert because you'll want to put it back into the drive whenever you move the computer.

3. **INSERT DISKETTE INTO DRIVE.** Hold the *Setup and Test Diskette* with the label side up and towards you (Figure 5-1). Slide the diskette all the way into the slot until it stops.

Figure 5-1 Inserting a Diskette

Lever in Horizontal Position

Drive-Active Light

Drive A

Label
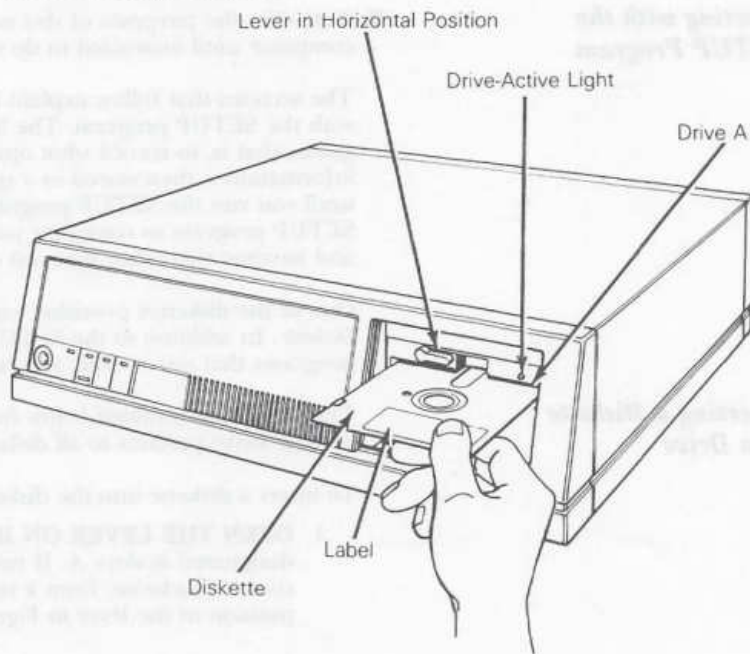
Diskette

4. **CLOSE LEVER ON DRIVE A.** Turn the lever clockwise one-quarter turn until it locks into place. (The computer cannot read or write to the diskette unless the diskette drive lever is closed, that is, in the vertical position.)

Turning on the Computer

Now you're ready to turn on the computer system:

1. **SET MONITOR POWER SWITCH ON.** If your monitor has a separate power switch, turn that switch to the ON position. (The monitor's documentation will have instructions on how to turn on the power.)

2. **TURN ON COMPUTER.** Turn on the computer power (Figure 5-2) by pressing in the top of the power switch (marked with a 1). (The monitor receives its power through the computer, so turning on the computer turns on the monitor as well.)

Figure 5-2 Turning on System Power

Power Switch
in On Position
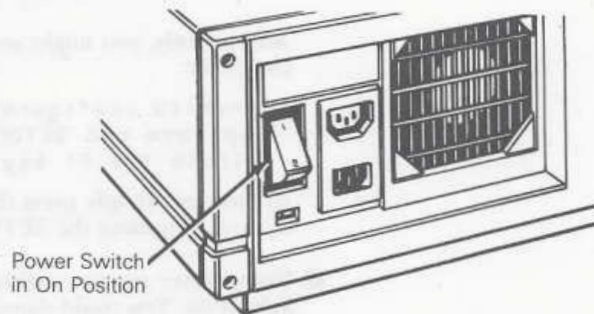
Whenever you turn on the computer, it goes through an automatic test that ensures that all components are operating properly. This is the *Power On Test.* A series of characters appears and disappears in the upper-lefthand corner of your monitor during the test procedure (indicating that the system memory is being checked). Wait for the test to finish before you do anything with the computer.

Several possibilities present themselves at this time. The system may immediately boot up in the System Diagnostics Main menu. However, if the computer was locked when you turned it on, the keylock LED in the display/keylock panel will go on, and the message

```
Keyboard is locked—please unlock
Strike the F1 key to continue
```

will appear. To unlock the keyboard, insert the cylindrical key that was provided with your computer into the lock in the display/keylock panel and turn it clockwise so it points to the open padlock symbol. When the key is in this unlocked position (Figure 5-3), the keylock LED will be off. When you press the F1 key on the keyboard, the system will complete the Power On Test and then boot up.

Figure 5-3 Unlocking the Computer

Cylindrical Key   Locked Position   Unlocked Position
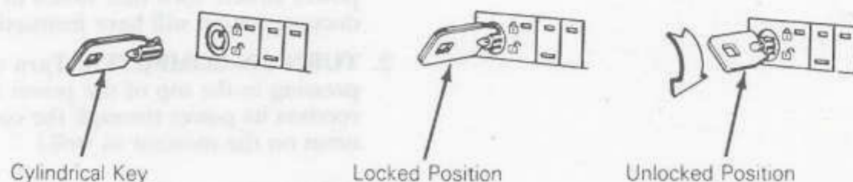
Alternatively, you might see another message when you turn on the computer:

```
Invalid configuration information
—please run SETUP program
Strike the F1 key to continue.
```

In this case, simply press the F1 key and proceed as described in the following section, "Running the SETUP Program."

■ **Note**—Never remove a diskette from a diskette drive while the drive-active light is on. You could damage the diskette and/or lose information that is stored on it. The drive-active light indicates that the disk drive is in the process of reading or writing to the diskette.

If the computer completes the Power On Test without detecting any problems, the following *menu* will appear on the screen of the monitor:

```
SYSTEM DIAGNOSTICS MAIN MENU

Enter 0 Run SETUP
       1 System checkout
       2 Diskette drive test
       3 Hard disk drive test
       4 Hard disk preparation
       5 Display Errors

Enter your selection >_

Press ESC to exit and reboot the system
```

A menu is a list of options that are available to you in the program you are running. Typically, you select an option from a menu by typing a number or a letter and then pressing the ENTER key.

Running the SETUP Program

In this section you'll get a general idea of how to run the SETUP program by going through four options on the SETUP Main menu: "0 Set date and time," "6 Review current configuration," "5 Set primary display type," and "7 Exit SETUP and save new configuration."

To get to the SETUP program from the System Diagnostics Main menu, you will select option "0 Run SETUP." (The other options in this menu are explained in the Reference Guide under "System Tests.")

■ **Note**–You can correct your typing errors by erasing the incorrect entries with the BACKSPACE key, the key with the left-facing arrow above the ENTER key.

To define your system configuration with the SETUP program:

1. **SELECT THE SETUP PROGRAM.** Type a zero

   0

The SETUP Main menu is displayed.

```
SETUP Main Menu

Enter 0 Set date and time
      1 Set diskette drive type
      2 Set hard disk type
      3 Set system speed
      4 Set expansion memory size
      5 Set primary display type
      6 Review current configuration
      7 Exit SETUP and save new configuration

Enter selection >_

Press Esc to return to Diagnostic Main Menu
```

2. **PREPARE TO SET DATE AND TIME.** Select option "0 Set date and time" from the SETUP Main menu, by typing zero

   0

and pressing the ENTER key.

3. **ESTABLISH CURRENT DATE.** Check the current date against the date displayed. If the date is correct, press the ENTER key. If it is incorrect, change it by entering the correct date with month first, followed by a hyphen and the day, another hyphen and the year, e.g., 04-07-86. Press the ENTER key to record the new date.

4. **ESTABLISH CURRENT TIME.** Check the current time against the time displayed, then follow the same procedure outlined in step 3. Time is entered in the 24-hour format with the hour entered first followed by a colon and the minutes, e.g., 21:22 represents 9:22 p.m. Press the ENTER key to record the new time.

5. **VERIFY DATE AND TIME.** You're shown the date and time you've set, and are asked if they're correct. If you entered the date and/or time incorrectly, you're given the chance to press the N key and ENTER to go back and correct them. When they're correct, press the Y key and ENTER and you'll be returned to the SETUP menu.

6. **CHECK CURRENT CONFIGURATION.** Before you configure your system, you can check its present configuration. To do this, select option "6 Review current configuration" from the SETUP menu. Type

   6

   and press the ENTER key. For now simply familiarize yourself with the items displayed in the list and then return to the SETUP menu by pressing the ESC key.

7. **PREPARE TO SET PRIMARY DISPLAY TYPE.** You need to tell the computer what display to boot with. Select option "5 Set primary display type" from the SETUP menu, by typing

   5

   and pressing the ENTER key.

8. **RESPOND TO GDA QUERY.** You're then asked

   Is the GDA card installed?

   The GDA card is a special multifunction adapter that you can connect to either a color or a monochrome monitor. If your computer has one of these special display adapters installed, respond to the question by pressing the Y key. Otherwise, answer by pressing the N key.

9. **SELECT PRIMARY DISPLAY TYPE.** Next, you are shown information about the primary display type. For example, you might see

```
Color or monochrome graphics monitor adapter
in 80-column mode
```

At the bottom of the screen you are asked

```
Is this correct (Y/N)?
Press Esc to return to the SETUP menu
```

(At this point, you might want to check the "Record of Important Information" form in Chapter 1 for verification.) If the information is correct, press Y and you'll see the SETUP menu again. If it's incorrect, press N. If you have a color monitor, you'll be given a form with which you can set the display width to either 80 columns or 40 columns. If you have a monochrome monitor, you'll see the message

```
The display adapter switch is set for a
Monochrome display adapter.
For information about the display adapter switch,
refer to the User's Guide for the computer.

Press Enter to continue...?

When you press Enter, you will be returned to
the SETUP menu.
```

■ **Note**—The information about the type of monitor is dependent on the positioning of the display adapter switch inside the computer. If there is a discrepancy between the type of monitor you have and the display type the computer indicates you have, you may need to check that switch. (For information on the display adapter switch, see the section on adapter boards under "Installing Internal Options" in the Reference Guide.) *R9-5*

Once you have selected the primary display type, you are automatically returned to the SETUP Main menu.

10. **REVIEW NEW CONFIGURATION.** Select option "7 Exit SETUP and save new configuration" from the SETUP Main menu by typing

```
7
```

and pressing the ENTER key. You now see essentially the same configuration list that was displayed in step 6 above. However, the list now includes any changes you may have made in setting the primary display type.

■ **Note**—If your system has a hard disk or a second diskette drive, you must enter that information in the appropriate part of the SETUP program. If you do not, the system will be unable to access these drives. For instructions, refer to "The SETUP Program" in the Reference Guide.

11. **EXIT SETUP.** When you determine that the configuration being displayed is correct, press Y and the system will reboot and return you to the System Diagnostics Main menu.

■ **Note**—Whenever you run the SETUP program, you must leave the program through option 7 for your new configuration to be saved. If you exit the program in some other way (for example, with ESC) your changes to the configuration will not be recorded in the special CMOS memory chip and your system will remain configured as it was before you ran the SETUP program.

When the system reboots, it is possible that, once again, the message

```
Invalid configuration information
—please run SETUP program
Strike the F1 key to continue.
```

may appear. Press the F1 key to be returned to the System Diagnostics Main menu and run the SETUP program again. Then select option 6 from the SETUP menu and check the displayed list for any errors. If the list appears to be correct, the following possiblities should be considered:

• Your system may include a memory expansion board

• Your display adapter switch may be set incorrectly

For information about configuring your system for a memory board, refer to "The SETUP Program" in the Reference Guide before you proceed. And for information about the display adapter switch, refer to the section on adapter boards in "Installing Internal Options" in the Reference Guide.

12. **EXIT SYSTEM DIAGNOSTICS.** To leave the System Diagnostics menu, press

```
ESC
```

You will see the message

```
Insert system diskette into drive A:
Press Enter to reboot
```

For now, only remove the *Setup and Test Diskette* from drive A.

You have now configured your computer system. At this point, you can begin to work with the operating system of your choice. In the next chapter, you will learn something about operating systems in general and the MS-DOS operating system in particular.

6
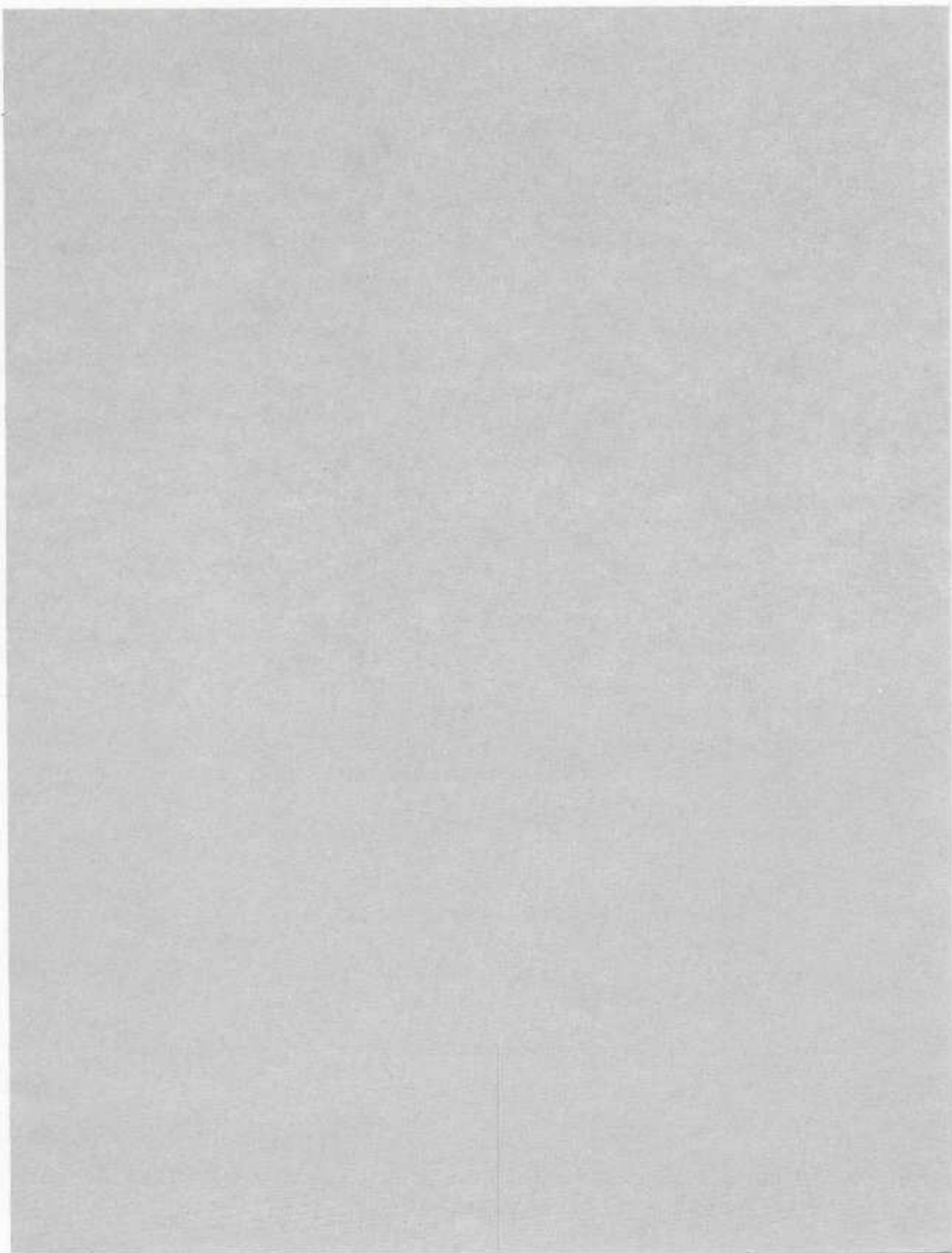
6 *Getting Started with MS-DOS*

Operating Systems

An *operating system* is a master set of programs that governs the way in which a computer system performs certain fundamental tasks. In most cases, you must load an operating system into the computer's random-access memory (RAM) before you can really start working with the computer.

A number of operating systems are available for your computer. Among them are Xenix, IBM DOS, and the one that we will be covering in this *User's Guide*, MS-DOS.

Starting MS-DOS

The MS-DOS operating system was included with your computer. The two diskettes containing the operating system were packed with the *Setup and Test Diskette*. One of the diskettes is labeled *MS-DOS System Diskette* and the other is labeled *MS-DOS Supplemental Diskette*.

To start MS-DOS:

1. **INSERT SYSTEM DISKETTE IN DRIVE A.** Put the *MS-DOS System Diskette* in drive A and turn the lever to close the drive.

2. **REBOOT THE COMPUTER.** If you are coming directly from Chapter 5, follow the message on the screen and press the ENTER key to reboot the computer. Otherwise, turn on the computer to reboot it.

3. **CHECK THE DATE.** When you boot MS-DOS, the computer automatically displays a date and you're asked for the current date. If the date displayed is the current date (and it should be if you entered the correct date in the SETUP program) all you have to do now is press the ENTER key.

4. **CHECK THE TIME.** Next, a time is automatically displayed and you're asked for the current time. Again, if you entered the correct time in the SETUP program, the time displayed should be current and all you need to do is press the ENTER key.

Below the time, the Microsoft MS-DOS version number and copyright notice appear and below that is the MS-DOS *prompt*, A>. This particular prompt indicates that the current active (or *default*) drive is diskette drive A. The blinking *cursor* tells you that the computer is awaiting your command. (A cursor is a position indicator that shows the place on the screen where the text for your next keystroke will appear.)

Executing the MS-DOS DIR Command

It is not the intent of this guide to teach you the intricacies of the MS-DOS operating system. However, you'll be shown how to perform a few fundamental and frequently used MS-DOS functions. The *MS-DOS Guide* is your best source of information on MS-DOS, for it discusses in depth all of the commands and functions in that operating system.

Your initial command to the operating system will be one that you will employ often, the command *DIR*. DIR asks the computer to list on the screen the names of all the *files* in the *directory* of the currently active drive. A *file* is a discrete collection of information that is created and accessed as a unit and given a name. A *directory* is a table of contents of file names on a disk.

■ **Note**—DIR is an *internal* command; that is, it's loaded into the computer's memory with the operating system as part of the COMMAND.COM file. Some other internal commands are COPY, RENAME, and DEL. Once you've loaded the operating system, you don't need to have an MS-DOS system diskette in the drive in order to activate these commands. (These concepts are explained in more detail in your *MS-DOS Guide*.)

To execute the DIR command and then switch drives:

1. **DISPLAY DIRECTORY.** With the *MS-DOS System Diskette* in drive A, and with the A> prompt displayed, type

   D I R

   and press the ENTER key.

   What you see is part of the directory of files on the *MS-DOS System Diskette*. There are too many files for all of them to fit on the screen in a vertical column at the same time. But, with the following step, you can see them all at one time.

2. **DISPLAY WIDE DIRECTORY.** Type

    DIR /W

    and press the ENTER key.

    The /W added to the command asks the computer to list the directory in a wide format.

    Now you see all of the files on the *MS-DOS System Diskette*. Most of the other files are special utility programs that work with the operating system. Later in this chapter and in the next chapter, you'll run two of these utility programs to perform some very important activities.

3. **CHECK FOR A HARD DISK.** With DIR, you can determine if your system has a hard disk. Type

    DIR C:

    With the hard-disk models of the computer, the MS-DOS operating system may be already copied on the hard disk. If, when you type DIR C:, the MS-DOS directory is listed, your system includes a hard disk and you can continue working with MS-DOS by switching from the diskette drive (drive A) to the hard disk (drive C).

    If you don't have a hard disk, the message

    Invalid drive specification

    will appear and the A> prompt will return.

    ■ Note—The procedures that follow in this chapter and in Chapter 7 assume that your system has one high-density diskette drive and one hard disk. If your system is different from this, refer to the Reference Guide under "Formatting and Copying with Alternative Configurations."

4. **SWITCH DRIVES.** If you determined in step 3 that you have a hard disk, switch drives now by typing

    C:

    and pressing the ENTER key. From this point on, you will be working with the hard disk.

    ■ Note—You can boot up MS-DOS from the hard disk. Just be sure that all diskette drive levers are up (in the horizontal position) when you turn on the computer. If a lever is down (in the vertical position), the computer will attempt to access the diskette drive in search of the operating system instead of accessing the hard-disk drive from which you wish to boot up.

Formatting Diskettes

A blank, previously unused diskette must be *formatted* before it will be recognized by the operating system. The expression *formatting a diskette* means preparing the diskette for use by a particular operating system. The diskette is *blank* because the operating system can find no information on the diskette when it attempts to read it. To understand this better, remove the *MS-DOS System Diskette* from drive A and replace it with a blank, unformatted diskette. Then type

```
DIR A:
```

If the diskette was in fact an unformatted diskette, after a short pause during which the drive will attempt to read the diskette, you will get the response

```
Sector not found error reading drive A
Abort, Retry, Ignore?
```

This means that the drive cannot read the diskette because it has not yet been formatted for the MS-DOS operating system (it has nothing on it for the drive to read). Type

```
A
```

(for *abort*) to return to the MS-DOS prompt.

To Format High-Density Diskettes

In this section, you'll be using the MS-DOS utility program called FORMAT to format a high-density diskette with a hard disk.

To format a high-density diskette for use with MS-DOS:

1. **INSERT UNFORMATTED DISKETTE IN DRIVE A.** Insert an unused and unformatted high-density diskette in drive A.

2. **TYPE FORMAT COMMAND.** With the C> prompt displayed, type

```
FORMAT A:/S
```

and press the ENTER key. The message on the screen instructs you to

```
Insert new diskette for drive A
and strike ENTER when ready
```

Chapter 6

Since you already have a blank diskette in drive A, simply press the ENTER key. While the diskette is being formatted, the drive-active light on the diskette drive is on and the words

```
Formatting...
Verifying...
```

are displayed. When the format is completed, a message appears that includes the query

```
Format another (Y/N)?
```

3. **RESPOND TO QUERY.** You do not want to format another diskette at this time; therefore, type

```
N
```

(for *no*), and the C> prompt will reappear. Remove the diskette from the drive. You now have a formatted high-density diskette.
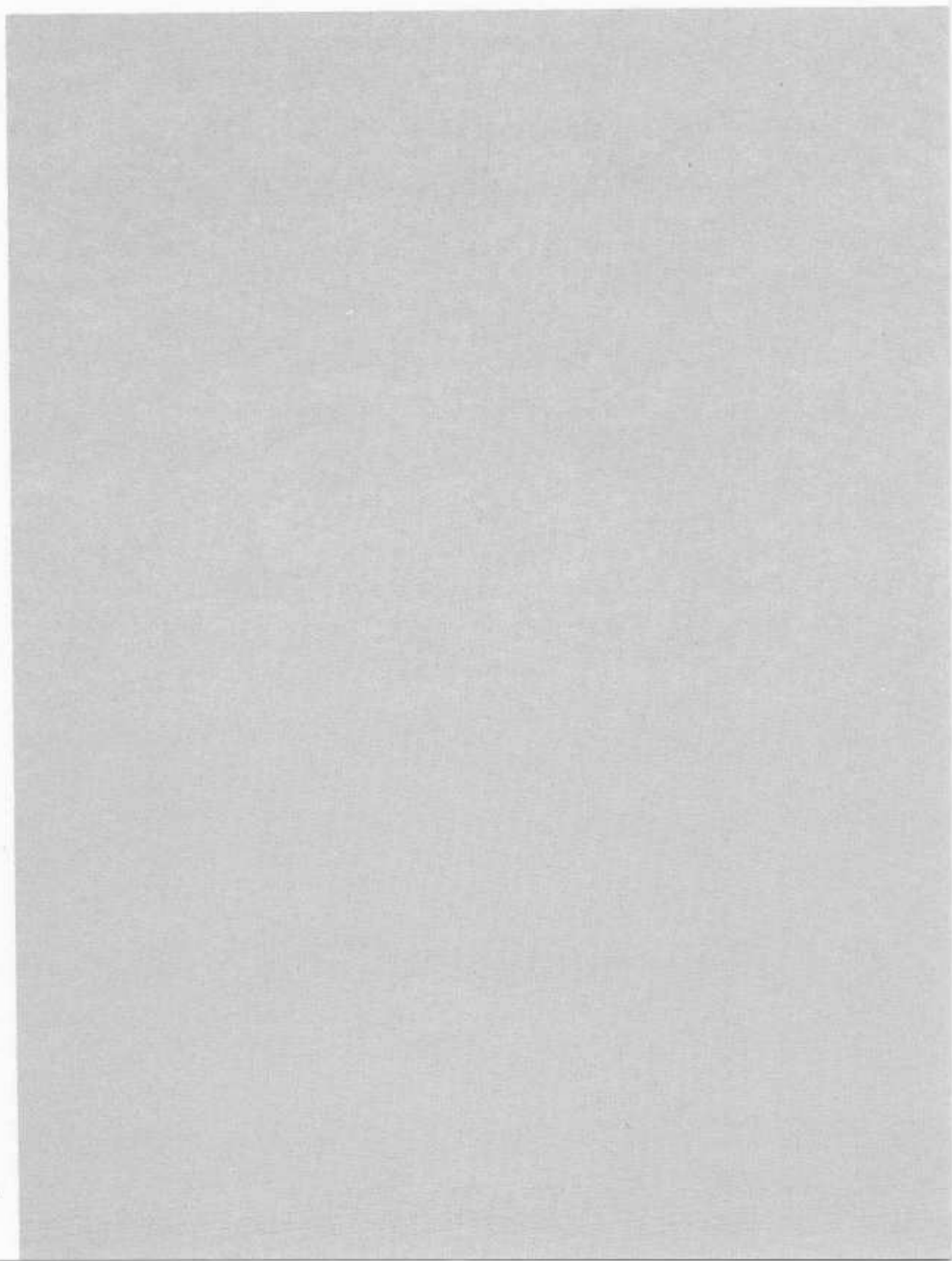
7

7 *Backing Up with MS-DOS*

Backing Up with the COPY Command

This chapter explains how to copy, or *back up*, your hard disk and diskettes with the MS-DOS command COPY. It is just as important to back up the MS-DOS operating-system files and other important hard-disk files as it is to back up diskettes because, just like diskettes, a hard disk is subject to damage and data loss.

First, you will back up the operating-system user files that are on your hard disk. Then you'll copy the main file from the *Setup and Test Diskette* to your hard disk and from there to a backup, or *working*, high-density diskette.

■ **Note–**Strictly speaking, since you already have all of the MS-DOS system files on two master (double-density) diskettes, you don't need to make a backup diskette copy of the files. However, Part 1 of this *User's Guide* will take you through the step-by-step procedure to back up those files for the following reasons:

• The procedure acquaints you with making diskette copies from a hard disk.

• When you're finished, in addition to your master copies on two double-density diskettes, you'll have an insurance copy of the MS-DOS system files on one convenient high-density diskette. This diskette, which will contain all of the operating system files, the SETUP program, and the system tests, will be your working diskette. To a great degree, you can be assured that no damage will come to the masters because you'll be using the working diskette at all times instead of the masters.

Backing Up MS-DOS User Files

This procedure assumes that your system includes one high-density diskette drive and one hard disk, and that you have come to this chapter directly from Chapter 6, where you formatted a high-density diskette. (The hard-disk model of the computer comes with all applicable MS-DOS operating-system files already copied on the hard disk. Therefore, you can copy directly from the hard disk to a high-density diskette in drive A, bypassing the two master MS-DOS diskettes.)

■ **Note**—If your system does not include a hard disk, you'll need to follow the appropriate alternative procedure for backing up double-density diskettes onto a high-density diskette; this procedure can be found in the Reference Guide under "Formatting and Copying with Alternative Configurations."

To make a diskette backup of the MS-DOS system files from your hard disk:

1. **TURN ON COMPUTER.** If your system is not already on, start up from drive C, the hard disk. To do this, simply make sure that the lever on drive A is in the open position and then turn on the computer. In a moment, the MS-DOS C> prompt will appear.

2. **ENTER COPY COMMAND.** Type

   ```
   COPY C:*.* A:
   ```

   and press the ENTER key. This message appears:

   ```
   Insert target diskette in drive A:
   Strike any key when ready
   ```

3. **INSERT FORMATTED DISKETTE INTO DRIVE A.** Insert the high-density diskette you formatted in Chapter 6 into drive A.

4. **BEGIN COPYING.** Turn the lever on drive A to the closed position and press the ENTER key. After a few seconds, the following will appear:

   ```
   C:COMMAND.COM
   ```

   This is the name of the first user file on the hard disk to be copied to the diskette. It will be followed quickly by a listing of approximately 50 user files. When all the files are copied, the following message appears:

   ```
   Copy complete

   Copy another (Y/N)?
   ```

5. **EXIT COPY PROGRAM.** Type

   ```
   N
   ```

   (for *no*) and press the ENTER key.

   From now on, whenever you need an MS-DOS system diskette, you should use this backup diskette. Keep the two master diskettes in a safe place.

Copying the SETUP and Test File

If you were to do a directory of the *Setup and Test Diskette,* you'd see three files listed—COMMAND.COM, TESTAT.EXE, and AUTOEXEC.BAT. The TESTAT.EXE file contains the SETUP program and the system tests. In the procedures outlined below, you'll be copying the TESTAT.EXE file to the hard disk and then onto the backup high-density diskette with your MS-DOS files.

To back up one file from a diskette onto a hard disk:

1. **TURN ON COMPUTER.** If necessary, boot up the computer from the hard disk.

2. **INSERT SOURCE DISKETTE INTO DRIVE A.** With the C> prompt displayed, insert the *Setup and Test Diskette* into drive A.

3. **ENTER COPY COMMAND.** Type

    COPY A:TESTAT.EXE C:

   and press the ENTER key. You'll know that the TESTAT.EXE file has been copied onto the hard disk when you see the message.

    1 File(s) copied

   and the MS-DOS C> prompt reappears. You now have the TESTAT.EXE file on the hard disk. Whenever you want to run the SETUP program or any of the system tests, simply type TESTAT at the C> prompt and the System Diagnostics Main menu will be displayed.

To back up one file from a hard disk onto a diskette:

1. **INSERT TARGET DISKETTE INTO DRIVE A.** Put the backup high-density diskette with the MS-DOS system files on it into drive A and turn the drive lever to the closed position.

2. **ENTER COPY COMMAND.** At the C> prompt, type

    COPY TESTAT.EXE A:

   and press the ENTER key. You'll know that the TESTAT.EXE file has been copied onto the diskette when you see the message

    1 File(s) copied

   and the MS-DOS C> prompt reappears. Your backup diskette now contains all your MS-DOS system files and the SETUP and test file. Label the backup diskette appropriately and put the three masters in a safe place. From now on, whenever you need any MS-DOS system files on diskette, you should use this backup diskette.

8

8 *Running Programs and GW-BASIC*

Applications Programs

Your computer runs MS-DOS and is IBM PC AT-compatible. For these reasons, you have access to the rapidly growing library of IBM PC AT-compatible applications software, including popular spreadsheet, database, and word-processing packages, as well as applications for accounting, communications, graphics, and much more.

Applications software is task-oriented; it is written to perform a specific task. A word-processing program is written to best meet the needs of those who write. An accounting program addresses the particular needs of the accounting profession. An *integrated* program brings together in a single program several different but related tasks, such as word-processing, spreadsheet, and database-processing capabilities. Much of what you accomplish with the computer will probably be a result of the applications software programs you run.

Following are some tips to keep in mind when you are buying software programs for and running them on your computer:

• Carefully read all the program requirements before you buy a program. Make sure it'll run on an IBM PC AT-compatible system under your version of MS-DOS. If you have any questions, ask your dealer and/or the program publisher.

• Always buy the latest version of a program; the program's publisher will be able to give you this information if the dealer can't.

• Only version 3.0 or later of MS-DOS and IBM DOS will run on your computer.

• You can start some programs without loading the operating system first; just start the computer with the program diskette in drive A and the program runs automatically.

• Some programs will not run in high speed on the computer. If you have a problem when running a program, confirm that the problem is occurring in standard speed before reaching for the phone to call customer support.

• Some programs will only run from BASIC. For those programs, start
MS-DOS first, then load BASIC (see the following section, "Running
GW-BASIC"); finally, insert the program diskette into the default drive
and type

　　RUN *program name*

with *program name* being the name of the program.

Running GW-BASIC

GW-BASIC is an easy-to-learn version of the BASIC programming language
from Microsoft Corporation.

To run GW-BASIC, first boot up MS-DOS. Your hard disk and the backup
diskette of the MS-DOS operating system that you made earlier in this tutorial
contain both the MS-DOS and the GW-BASIC files.

To start GW-BASIC from a hard disk, make sure the lever on drive A is open
and turn on your computer. To start in a system with a single diskette drive,
insert the backup MS-DOS system diskette in drive A and turn on the
computer.

When MS-DOS finishes booting, the MS-DOS prompt will appear. Type

　　GWBASIC

and press the ENTER key. The next thing displayed is the GW-BASIC screen.
(See the *GW-BASIC Guide* for further information about this programming
language.)

To exit GW-BASIC and return to the operating system, type

　　SYSTEM

and press the ENTER key. The screen is cleared and the MS-DOS prompt
reappears.
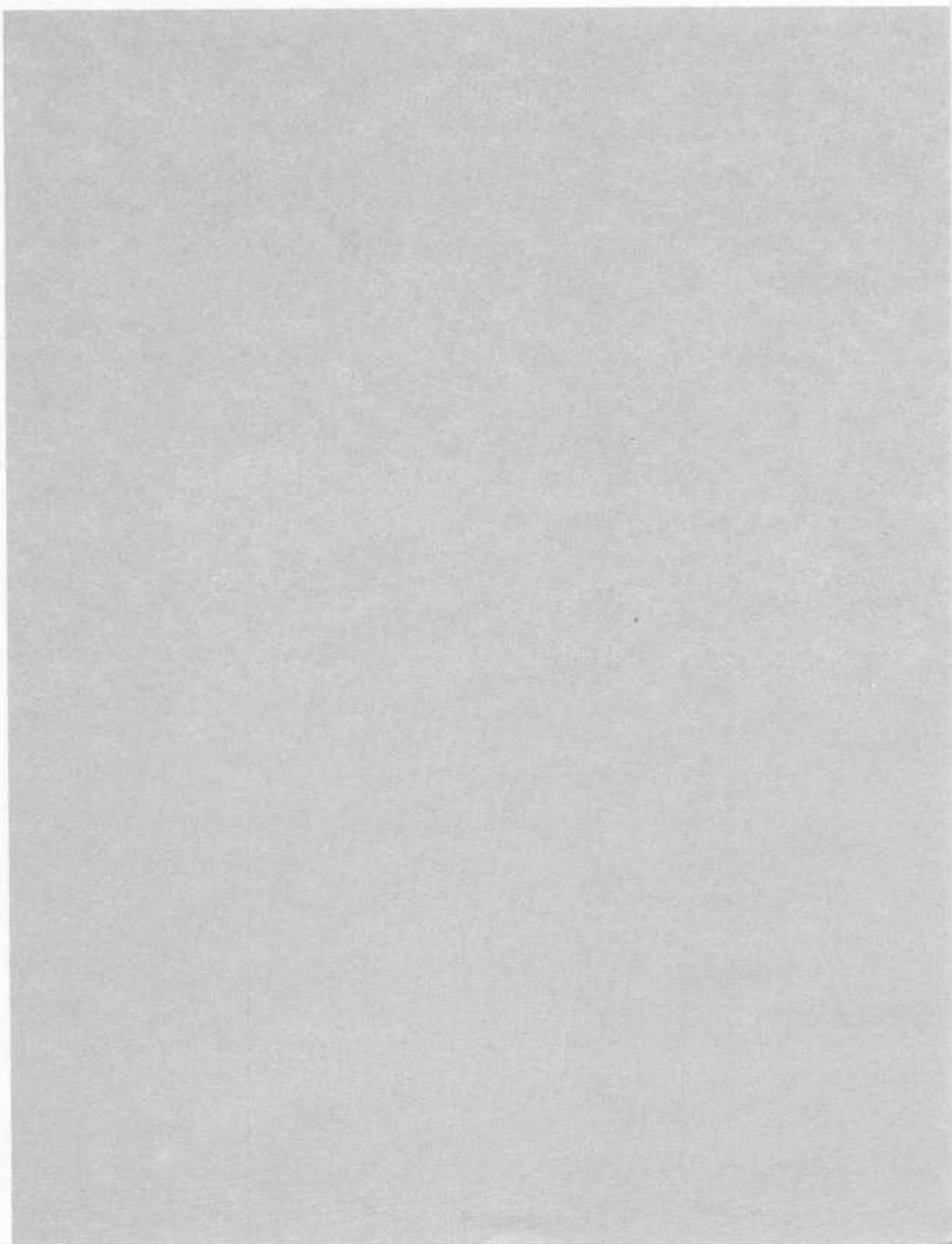
Part 2–Reference Guide

Reference 1—The Keyboard

Overview

Your computer is equipped with one of two styles of keyboards, either the 84-key, IBM PC AT-compatible keyboard layout, or the 102-key, IBM Enhanced Personal Computer keyboard layout. Each keyboard is low-profile and includes dual-position height-adjustable feet, sculpted keys, special function keys, and an accounting-style numeric keypad.

A number of the keys on the computer keyboard are not found on a normal typewriter keyboard. The major emphasis in this chapter is on some of the functions of those special keys.

■ Note—This reference section describes functions of specific keys using examples illustrated with the IBM PC AT-style layout. If your keyboard is the Enhanced Personal Computer keyboard layout, several keys are located in different positions. Although the positions have changed, the key functions have not changed. See Figures R1-1 and R1-2 for comparisons of the keyboards.

Figure R1-1 IBM Enhanced PC Style Keyboard

Figure R1-1 IBM Enhanced PC Style Keyboard

Figure R1-2 IBM PC AT Style Keyboard

Figure R1-2 IBM PC AT Style Keyboard
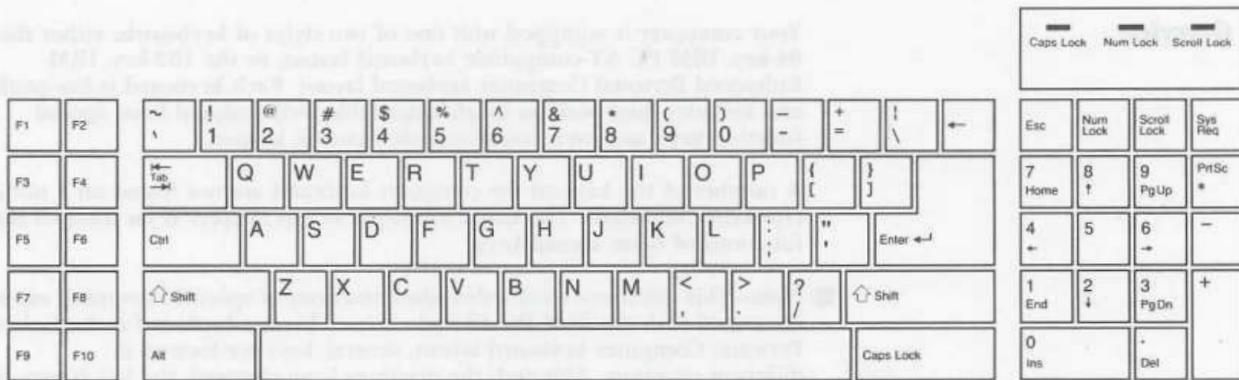
Command Keys

The keys highlighted in Figure R1-3 are the *command keys*. These keys perform many vital functions in various applications programs; these functions are usually unique to a program and are described in Table R1-1.

Figure R1-3 The Command Keys

Figure R1-3 The Command Keys
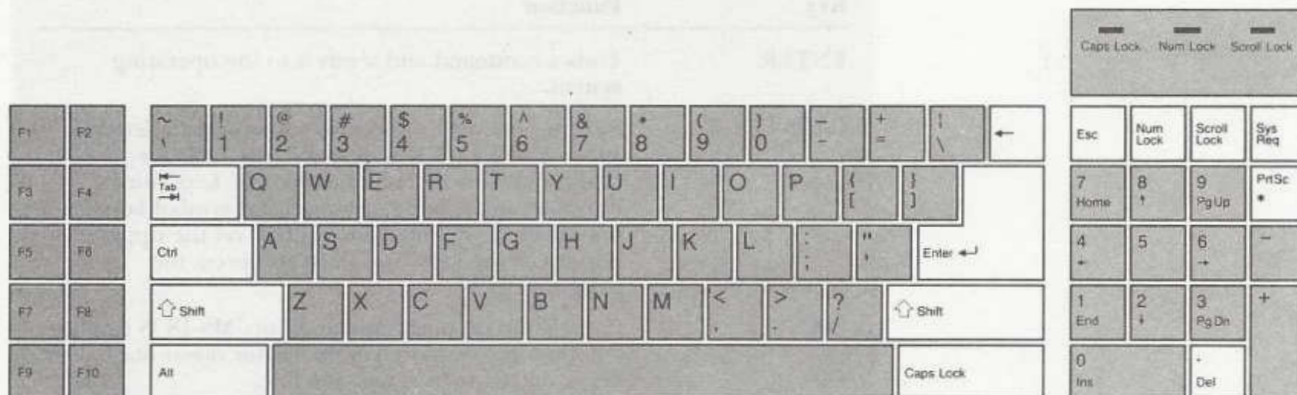
Table R1-1 Functions of Command Keys in MS-DOS

Key	Function
TAB	Moves the cursor to the next tab stop.
CTRL	Generates control key commands when pressed in conjunction with other keys. (For detailed description of the functions of CTRL, see "Control Key Commands" in this chapter.)
SHIFT	Changes lowercase letters to uppercase letters (or vice versa if the CAPS LOCK is engaged). The two SHIFT keys function identically.
ALT	Initiates a reboot of the system when pressed in conjunction with the CTRL and DEL keys. (See "Control Key Commands" in this chapter. For its many applications in GW-BASIC, see the *GW-BASIC Guide*.)
BACKSPACE	Moves the cursor to the left, deleting one character each time you press it.

Table R1-1 Continued

Key	Function
ENTER	Ends a command and sends it to the operating system.
CAPS LOCK	Switches between uppercase and lowercase letters. When CAPS LOCK is engaged, the LED for CAPS LOCK is lit and all alphabetic keys print in uppercase. Editing, number, and symbol keys are not affected. To enter the symbols on the upper portion of the keys, you must still press the SHIFT key.
ESC	Cancels the current command line. MS-DOS displays a backslash (\) and moves the cursor down one line. You can then retype the line.
NUM LOCK	Switches the functions of the numeric keypad between numeric entry and other functions (refer to "Keys on the Numeric Keypad" in this chapter). When NUM LOCK is engaged, the LED for NUM LOCK is lit.
SCROLL LOCK	Initiates the BREAK command when pressed with the CTRL key (see the "Control Key Commands" in this chapter). When SCROLL LOCK is engaged, the LED for SCROLL LOCK is lit.
SYS REQ	Functions with certain operating systems and applications programs; for these functions see the system or program documentation.
PRTSC	Prints what is displayed on the screen when pressed in conjunction with either the SHIFT or CTRL key (see "Print Screen Commands" in this chapter).
DEL	Initiates a reboot of the system when pressed in conjunction with the CTRL and ALT keys in the sequence CTRL ALT DEL.

Control Key Commands

The CTRL key is pressed with another key or keys to send a control code to the computer. MS-DOS uses control key commands for the important functions described in Table R1-2.

Pressing the CTRL key by itself has no effect on the computer. You need to hold down the CTRL key while simultaneously pressing another key (or keys) to send a control code to the computer. For example, to execute the CTRL BREAK command, first hold down the CTRL key, then press the SCROLL LOCK (BREAK) key.

Table R1-2 explains the functions of the MS-DOS control key commands.

Table R1-2 Functions of Control Key Commands in MS-DOS

Command	Function
CTRL BREAK	Terminates a program or command that is currently executing and returns to the system prompt. (CTRL BREAK clears the buffer first and then sends an ASCII Control-C character to the computer. Alternatively, if you enter the CTRL C command itself, the ASCII Control-C character is placed at the end of the buffer and won't be acted upon until all other commands before it have been executed.)
CTRL ALT DEL	Resets (reboots) the computer. For the system to successfully reload the operating system, the MS-DOS system files must be present in the default drive.
CTRL NUM LOCK	Suspends computer operation, halting scrolling so that you can read the display. (Press any key to resume operation.)
CTRL PRTSC	Sends everything displayed on the screen to the printer until the command CTRL PRTSC is entered again. (See "Print Screen Commands" in this chapter.)
CTRL ENTER	Moves the cursor to the next line without sending the command to MS-DOS, allowing you to continue entering a command line.

GW-BASIC uses control key commands for a wide range of editing functions. See the *GW-BASIC Guide* for details.

Many applications programs also have control key commands for particular functions; for particulars, refer to program documentation.

Function Keys

The ten keys on the left side of the keyboard marked F1 through F10 are called *function keys* (Figure R1-4). They allow you to send a command to the system with a single keystroke. The functions of these keys can be redefined by software. MS-DOS assigns them one set of commands, while GW-BASIC and applications programs send them quite different commands.

Figure R1-4 Function Keys

Whenever you enter an MS-DOS command, it is stored in a special storage area called the *template*. The function keys let you selectively retrieve what is stored in this template. For example,

• You can press a function key for the automatic reentry of the last command you entered

• You can press a sequence of keys that includes a function key to edit the last command you entered

If you are interested in learning more about these uses of the function keys in MS-DOS, look in your *MS-DOS Guide* under "MS-DOS Editing Keys."

For details on the specific functions of the function keys in GW-BASIC, refer to your *GW-BASIC Guide;* for applications programs, refer to program documentation.

Keys on the Numeric Keypad

The NUM LOCK key is a toggle key on the numeric keypad (Figure R1-5). When you press the NUM LOCK key, the LED for NUM LOCK lights up indicating that the keys on the numeric keypad have taken on their numeric functions. This means you can enter numbers and other mathematical symbols like the plus and minus signs and the decimal point from the numeric keypad. Pressing the NUM LOCK key a second time returns the keys to their original functions.

Figure R1-5 Numeric Keypad and LED Panel
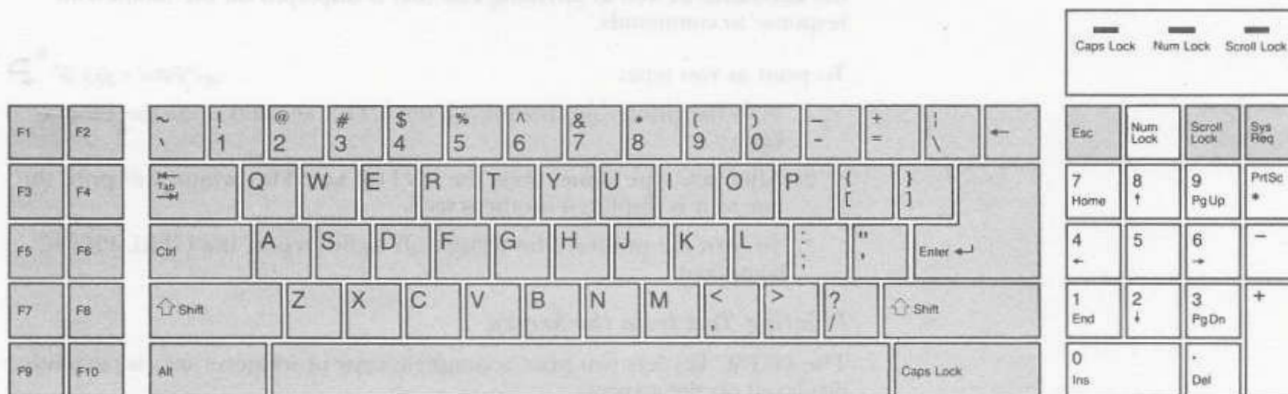
The original functions of the keys, i.e., their functions when NUM LOCK is not in effect, mostly involve cursor movement. However, most of the cursor keys are useful only in GW-BASIC and applications programs, but have no effect in MS-DOS. The keys with functions in MS-DOS are the following:

• The right cursor key (the 6 key) repeats keystroke-by-keystroke the last text that was entered at the MS-DOS prompt.

• The left cursor key (the 4 key) moves the cursor to the left deleting one character at a time.

• The plus and minus keys return the appropriate symbols.

• The */PRTSC key continues to return an asterisk.

LED Panel

In the upper right-hand corner of the keyboard is a panel with three LED lights (Figure R1-5). These lights indicate the status of three keys, the CAPS LOCK key, the NUM LOCK key, and the SCROLL LOCK key. When any of these keys is active, its light is on; when it's inactive, the light is off. For example, when the LED above the NUM LOCK label is on, you can enter numbers from the numeric keypad.

Print Screen Commands

If you have a printer connected to your computer system, it's easy to print what's on the screen.

Printing As You Type

The *printer echo* command can print lines of characters as you type them on the keyboard, as well as anything else that is displayed on the monitor in response to commands.

To print as you type:

UPPER CASE "P"

1. With the printer on, hold down the CTRL key and press the ~~PRTSC~~ key.

2. After you type a line, press the ENTER key. The printer will print the line as it is displayed on the screen.

3. To turn the printer echo feature off again, repeat the CTRL PRTSC command.

Printing Text from the Screen

The PRTSC key lets you print a complete copy of whatever text is currently displayed on the screen.

To print text from the screen:

1. If the printer isn't already on, turn it on.

2. Hold down the SHIFT key and press the PRTSC key. The printer will print the complete contents of the screen.

Printing Graphics from the Screen

You can print the contents of a screen that includes graphics with the MS-DOS command GRAPHICS.COM. Refer to the chapter on MS-DOS commands in your *MS-DOS Guide* for an explanation of the procedure for using GRAPHICS.COM.

**Displaying Nonstandard
Characters**

With the following steps you can display nonstandard characters. Nonstandard characters are characters that are not directly available from the keyboard. Some of them are characters unique to particular languages; others are graphics characters.

■ **Note**–The three-number code referred to in step 2 is the decimal value for the character, which can be found in the ASCII character codes table in Appendix A.

1. Hold down the ALT key.

2. Type on the numeric keypad the three-number code for the desired character.

3. Release the ALT key.

· Notes on the Keyboard

Computers are literal about interpreting the keys you type. Remember the following points:

• **Look-alike characters**–The uppercase letter O and the number zero (0) may look alike when they're printed, but they are interpreted by the computer as different characters. Be sure to type the correct key in commands and file names. Also, don't press the lowercase letter l when you want the number one (1). These are separate characters.

• **Uppercase and lowercase**–MS-DOS commands can be entered in uppercase or lowercase or a mixture of both because MS-DOS does not recognize any difference in case. However, some applications programs do distinguish between upper and lower case.

• **The spacebar**–The spacebar creates new spaces or replaces text with spaces. Don't press the SPACEBAR when you want to move the cursor to the right, or you may erase existing text. Press the *cursor right* key instead.

• **The BACKSPACE key**–The BACKSPACE key functions as a delete key in MS-DOS. Although it moves the cursor to the left just as it does on a typewriter, it also deletes each character it backs over.

Reference 2–Storage Media: Diskettes and Hard Disks

Overview

The internal random-access memory of your computer, the *RAM*, retains information only as long as the computer is on, i.e., RAM is *temporary*. When you turn the computer off (or reboot it), the internal memory is erased. (RAM is, however, both dynamic and critical to your system, because each time you work with the computer, all of the actual program operations are conducted in RAM.) Therefore, any programs or information you wish to retain must be recorded someplace other than the internal memory óf the computer. The means most commonly employed are magnetic media, either flexible diskettes or hard disks, which can be thought of as the computer's external memory, a stable storage area.

How Disk Drives Work

Information is saved to diskettes and hard disks in special devices called *disk drives*. The term *disk drives* refers to the two types of drives, diskette (or *floppy disk*) and hard disk (or *fixed disk*), considered together.

Disk Drives

A disk drive is an electronic device that causes a disk to revolve so that selected information can be encoded on its surface by one or more magnetic heads. The magnetic heads of disk drives are called *read/write heads* because they can both *write* information onto the magnetic surface of the disk and *read* it back and change it later.

A disk drive can best be compared to a tape recorder. The latter machine records sounds onto, and replays them from, magnetic tape. The disk drive writes information on, and reads it from, a magnetic disk. The disk drive can record and access information more quickly than a tape recorder can because a drive usually has more than one head. Furthermore, the heads of a disk drive move radially across the surface of the revolving disk in a random search for data; the single head of the tape recorder remains stationary while the magnetic tape moves across it in a linear motion.

The operations of the disk drive are controlled by the operating system. When you enter an operating system command, the system first interprets the command and then directs the read/write heads to access the disk to carry out the command.

Disks

The surface of every disk is etched with a certain number of concentric circles called *tracks*. In the PC-compatible environment, each operating system has its own program for preparing or *formatting* disks. (Although there are some exceptions, in most cases, once a disk or a portion of a disk has been formatted under one operating system, it cannot be accessed by another operating system.)

Formatting electronically divides the physical tracks on the disk into segments called *sectors* (Figure R2-1). A disk can be formatted with eight or more sectors. The exact number of tracks and sectors on a disk depend on

• The number of tracks on the disk

• The capacity of the disk drive

• The version of the operating system being used to format the disk

The standard sector size dictated by the MS-DOS formatting program has consistently been 512 bytes but that size could become larger in future releases of the operating system.

Figure R2-1 Disk Tracks and Sectors
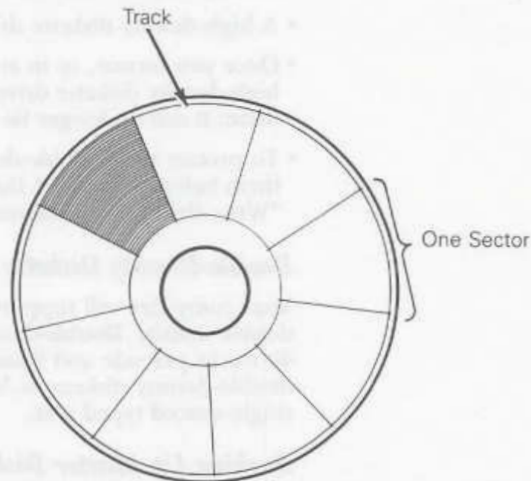
Disk formatting in the MS-DOS operating system is covered in detail in Chapter 6, "Getting Started with MS-DOS," and in this Reference Guide under "Formatting and Copying with Alternative Configurations."

Diskettes and Diskette Drives

You will be working with two types of diskette drives and diskettes in your computer—high-density and double-density. Both drives use double-sided diskettes. Depending on their density and the capabilities of the diskette drive, these diskettes can be formatted on both sides to contain a total of either 360K (kilobytes) or 1.2MB (megabytes) of data.

High-Density Diskette Drives

Your computer has a high-density diskette drive in the *drive A* slot. This drive uses 5¼-inch, high-density, double-sided, double-track, 96 track-per-inch (tpi) diskettes. A high-density drive formats a high-density diskette with 80 tracks per side and 15 sectors per track so that you can store as much as 1.2MB of data on it. That's more than 1.2 million bytes or the equivalent of approximately 700 pages of single-spaced typed text.

■ **Note**—Always use high-quality diskettes in your diskette drives. Although diskettes of a lower quality will work in the drives, the failure rate of these diskettes is considerably greater.

You can also use standard double-density diskettes in the high-density drive but keep in mind the following:

- A high-density diskette drive can read data from double-density diskettes.

- Once you format, or in any other way write to, a double-density diskette in a high-density diskette drive, that diskette can only be used in a high-density drive; it can no longer be used in a double-density drive.

- To protect your double-density diskettes, always put a write-protect tab on them before you insert them in a high-density drive. (See the section "Write-Protecting Diskettes" later in this chapter.)

Double-Density Diskette Drives

Your computer will support a second diskette drive, either high-density or double-density. Double-density drives format double-density diskettes with 40 tracks per side and 9 sectors per track. The most you can store on a double-density diskette is 360K of data, the equivalent of around 180 pages of single-spaced typed text.

Backing Up Master Diskettes

Most PC AT-compatible software programs are still distributed on double-density rather than high-density diskettes. Although you can read the program from the diskette, you should avoid writing data to the master. Therefore, now more than ever, it is important that you back up the master copy of all your original program diskettes and run the backups rather than the masters as your working diskettes. (See Chapter 7 and the Reference Guide under "Formatting and Copying with Alternative Configurations.")

Write-Protecting Diskettes

Most diskettes have a small notch on one edge; this is the write-protect notch (Figure R2-2). When this notch is covered, a drive can read the diskette but it cannot write information onto it. Most diskettes are packaged with a number of small stick-on write-protect tabs. To write-protect a diskette, simply cover the write-protect notch with one of these tabs.

Write-protect all your original program diskettes and any other diskettes containing information that you don't want to lose.

Write Enabled   Write Protected   Write Protect Tab

If you try to write to a write-protected diskette, the message

```
Write protect error writing drive <d>
Abort, Retry, Ignore?
```

will appear (where **<d>** is the active drive). If you want to write to the diskette, simply remove the write-protect tab from the diskette, put the diskette back in the drive, and press R (for *retry*).

Caring for Diskettes

By observing the following precautions, you'll reduce the risk of damaging diskettes and losing valuable data.

Be sure to . . .

Always store diskettes in their protective paper envelopes.
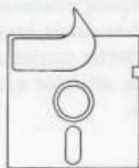
Label each diskette after you've stored information on it. Mark diskette labels with felt-tipped pens only.

Hold the diskette by its corners or the edges of its protective plastic cover.

Caution
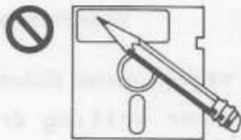
Never use a pencil or ballpoint pen to write on a label unless you write on the label before attaching it to the diskette.
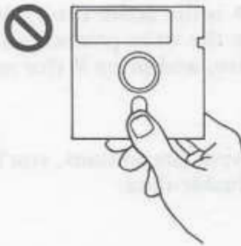
Never touch the exposed areas of the diskette.

Never bend diskettes.

Never expose diskettes to magnetic fields. Common magnetic sources include ringing telephones, electric motors, and magnetic paper clip holders. Magnetic fields can randomly alter or erase information that is recorded on diskettes.

Never use paper clips or clamps on diskettes.
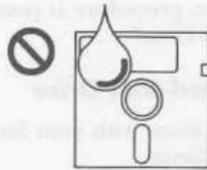
Never let diskettes get wet. Never use solvents or cleaners on diskettes.
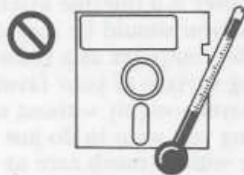
Never let diskettes get too hot or too cold. The temperature range for storing diskettes is from 50 to 115 degrees Fahrenheit (10 to 46 degrees Centigrade).

The Hard Disk

The hard-disk model of the computer is equipped with a Winchester hard-disk drive. Like diskettes, a hard disk (also called a *fixed* disk) stores information. Unlike diskettes, the hard disk cannot be removed from the computer because it is a permanent part of the hard-disk drive.

Access time with a Winchester hard-disk drive is much faster than with a diskette drive. In addition, the hard disk can store much more data than a diskette. A high-density diskette has a storage capacity of 1.2MB; hard disks have storage capacities of 10 to 40 times that and more.

Hard disks have greater storage capacities than diskettes because they are sealed in airtight compartments where minute particles can't contaminate disk surfaces. Therefore, hard-disk tracks can be written more densely on the surface of the disk. In addition, each airtight compartment can contain more than one disk (or *platter*) with several sets of heads for accessing the many surfaces. And finally, the disk itself is rigid and cannot warp with time or use.

Hard-Disk Preparation

Although the hard disk that comes in the hard-disk model of the computer may be already prepared at the time of purchase, you still should know how to prepare a hard disk for use. Any hard disk that you add to the system will need to be prepared and there may be instances when you'll want to totally erase the hard disk and start all over again.

The hard-disk preparation procedure is covered in this Reference Guide under "Preparing a Hard Disk."

Precautions with a Hard-Disk Drive

If you take certain precautions with your hard-disk drive system, you should never encounter any problems.

• Although your computer is a durable machine, the hard disk is extremely sensitive to shock and you should be very careful whenever you move the machine. Think of the computer as a record player with the stylus poised just above the playing surface of your favorite record. You might be able to handle the record player roughly without causing any damage to the record but it is not something you want to do just to see if it can be done. If you handle the computer with as much care as you would handle that record player, the hard disk should have a long life.

• Although information on the hard disk is maintained even when the computer is turned off, it is still possible to lose information. To prevent losing valuable programs and data files, you should regularly make backup copies of the hard disk on diskettes. In the MS-DOS operating system, two utility programs, BACKUP and RESTORE, facilitate the backup of hard disks. (For step-by-step instructions on using BACKUP and RESTORE, refer to the commands chapter in your *MS-DOS Guide*.)

Notes About Drives

There are several things that you should know about all drives:

• How to access different drives in the system

• How to protect drives when you move your computer

• The testing of drives

Accessing Different Drives in the System

When MS-DOS is ready to accept commands, the MS-DOS prompt indicates the current active drive. To change the current drive, simply type the letter of the new drive, followed by a colon (:), and press the ENTER key. For example, if you have booted from the MS-DOS diskette in drive A and you want to switch to the second diskette drive, drive B, type

    B:

and press the ENTER key. The B> prompt now appears on the screen, indicating that drive B is now the active drive. To switch back to drive A, type

    A:

and press ENTER. The A> prompt reappears.

If you want to access files or information on a drive other than the currently active drive, you must include the drive designator for the other drive in your command. For example, if your current drive is drive B and you want to read the directory of the diskette in drive A, at the B> prompt you would type

    DIR A:

Moving the Computer

The read/write heads of a disk drive can be damaged if the drive is handled roughly. You must be particularly careful when you move your computer.

To protect a diskette drive from undue shock during transport, insert the factory-provided cardboard insert into the drive.

Before you move your hard-disk, you should run a *head-parking* program. When you run this program, the heads of the hard-disk drive are moved to a place in the drive where they cannot be harmed and where they can't harm the surface of the disk.

The head-parking program in MS-DOS is called HDPARK. To run HDPARK, simply call up the program from your hard disk or from your backup MS-DOS system diskette by typing

```
HDPARK
```

You will see the message

```
You are about to park the hard disk head(s)
This should be done before computer shipment.

Are you sure you want to do this (Type 'Y' for yes)?
```

When you type Y, you are directed to

```
Press any key to park hard disk(s)
```

When the heads are parked, this message appears:

```
Heads parked.

Now turn off the power and re-pack computer
into the shipping carton.
```

The packing materials that came with the computer were designed to protect the computer in transit. For maximum protection, whenever you move the computer any distance, re-pack it in the shipping carton with the packing materials. If you no longer have the original packing materials, be sure to cushion the computer well before the move.

Testing Drives

On the *Setup and Test Diskette*, you'll find tests of both the diskette and the hard-disk drives. Explanations of the diskette drive test and the non-destructive test for a hard-disk drive can be found under "System Tests" in this Reference Guide. An explanation of the destructive test for the hard-disk drive can be found in the the hard-disk preparation procedure under "Preparing a Hard Disk" in this Reference Guide.

Reference 3 – Formatting and Copying with Alternative Configurations

Overview

Chapters 6 and 7 of this *User's Guide's* tutorial give instructions for formatting and copying files onto high-density diskettes with a computer system with one high-density diskette drive and one hard-disk drive. This chapter gives instructions for formatting and copying for systems with drive configurations different from that.

If You Are Working Through the Tutorial

If you are working through the tutorial (Part 1 of this manual), you've been directed to this chapter because your system lacks a hard-disk drive. To continue the tutorial, you'll need to format a high-density diskette and make a backup copy of your two MS-DOS system diskettes and the main file from the *Setup and Test Diskette*. This chapter is divided into two parts:

• The first part is for users who have a system with only one drive—a 1.2MB high-density diskette drive

• The second part is for users who have a system with one 1.2MB high-density diskette drive and one 360K double-density diskette drive

If your system is configured with one 1.2MB high-density diskette drive, continue reading below under "A Single Diskette Drive System."

If your system is configured with one 1.2MB high-density diskette drive and one 360K double-density diskette drive, skip ahead in this chapter to the section entitled, "A Dual Diskette Drive System."

A Single Diskette Drive System

You'll follow the step-by-step procedures outlined in this section if your system is configured with a single high-density diskette drive.

To Format High-Density Diskettes

In the following steps, you'll run the MS-DOS utility program called FORMAT to prepare a high-density diskette for use with MS-DOS.

To format a high-density diskette:

1. **TURN ON COMPUTER.** If your system is not already on, boot MS-DOS from your *MS-DOS System Diskette.* In a few seconds, the A> prompt will be displayed.

2. **ENTER FORMAT COMMAND.** Type

   FORMAT B:/S

   and press the ENTER key. The message on the screen instructs you to

   Insert new diskette for drive A:
   and strike ENTER when ready

   ■ Note—Your single diskette drive will serve as both drive A and drive B. The above command (FORMAT B:/S) causes your system to format a high-density diskette in the high-density format. (See Chapter 4, "Understanding Diskettes," and the Reference Guide under "Storage Media: Diskettes and Hard Disks" for detailed discussions of different formats.) The /S following the command causes the MS-DOS operating-system files to be written on the diskette during formatting. (For more about system files, refer to the SYS command in the *MS-DOS Guide.*)

3. **INSERT UNFORMATTED DISKETTE INTO DRIVE A.** Replace the
MS-DOS diskette in drive A with an unused, unformatted high-density
diskette and press the ENTER key. While the diskette is being
formatted, the drive-active light on the diskette drive is lit and the words

```
Formatting...
Verifying...
```

are displayed. When the format is completed, a message appears that
tells you the total number of bytes on the formatted diskette, the
number that were used to store the operating-system files (/S), and the
number that are now available for file storage on the diskette. You're
also asked if you want to

```
Format another (Y/N)?
```

4. **RETURN TO SYSTEM.** Type

```
N
```

(for *no*) and press the ENTER key. The A> prompt is redisplayed.
Remove the newly formatted diskette from the drive.

Now you have a formatted high-density diskette. You will use this as your
backup diskette in the procedure for backing up MS-DOS user files.

■ **Note**—If you need to format double-density diskettes in the high-density
drive, refer to the FORMAT command in the commands section of the
MS-DOS Guide. Remember that a double-density diskette formatted in a
high-density drive can only be used in high-density drives.

To Back Up the MS-DOS User Files

You must make backup copies of all your master program diskettes because if
the master diskette is ever damaged, you'll be forced to buy another copy of
the program. In the sections below, you'll be copying the two MS-DOS system
diskettes and the main file from the *Setup and Test Diskette* to a single
high-density diskette. This one diskette, which will contain all of the operating
system files, the SETUP program, and the system tests, will be your backup or
working diskette. To a great degree, you can be assured that no damage will
come to the masters because you'll be using the backup diskette at all times
instead of the masters.

■ **Note**—If you working through the tutorial, the following procedure is for users
with a single high-density diskette-drive system. This procedure substitutes for
the steps presented in Chapter 7 of the tutorial.

The following procedure can be performed on systems with a single high-density diskette drive. Remember, the two MS-DOS system diskettes contain about 50 files. This means that the process of exchanging diskettes in the diskette drive (as described in the following procedure) will continue until all of the files from the three diskettes have been copied onto the high-density backup diskette.

To back up the two double-density MS-DOS system diskettes onto the high-density diskette:

1. **INSERT SYSTEM DISKETTE INTO DRIVE A.** If your system is not already on, boot MS-DOS from the *MS-DOS System Diskette*.

2. **ENTER COPY COMMAND.** With the *MS-DOS System Diskette* in drive A and the A> prompt displayed, type

   ```
   COPY A:*.* B:
   ```

   and press the ENTER key. The file name COMMAND.COM appears, followed by the message

   ```
   Insert diskette for drive B:
   Strike any key when ready
   ```

   With the COPY A:*.* B: command, you have instructed the computer to copy all of the files (represented by the shorthand *.*) from the diskette in drive A, in this case, the *MS-DOS System Diskette*, to the diskette in drive B.

   ■ **Note—**In system configurations that include only one diskette drive, drive A serves as both drive A and drive B. The function of *reading* data from the source diskette in drive A alternates with *writing* that same data to the target diskette in drive B. (In systems with two physical diskette drives, the top drive is drive A and the lower drive is drive B.)

3. **INSERT BACKUP DISKETTE INTO DRIVE A.** Replace the *MS-DOS System Diskette* with your formatted high-density diskette and press the ENTER key. The first file is copied onto the backup diskette and you see the message

   ```
   Insert diskette for drive A:
   Strike any key when ready
   ```

4. **EXCHANGE DISKETTES.** Replace the high-density backup diskette in drive A with the *MS-DOS System Diskette* and press the ENTER key.

■ **Note**—This process of exchanging diskettes will continue until all of the files from the *MS-DOS System Diskette* have been copied onto your high-density diskette. You know this process is completed when the total number of files copied is listed and the A> prompt reappears.

5. **INSERT SECOND MS-DOS DISKETTE.** With the A> prompt displayed, insert the *MS-DOS Supplemental Diskette* into drive A, type

```
COPY A:*.* B:
```

and press the ENTER key. Once again, after a few seconds, a file name will appear, followed by the message

```
Insert diskette for drive B:
Strike any key when ready
```

6. **INSERT BACKUP DISKETTE INTO DRIVE A.** Replace the *MS-DOS Supplemental Diskette* with your high-density backup diskette and press the ENTER key. Once again, you'll see the message

```
Insert diskette for drive A:
Strike any key when ready
```

7. **EXCHANGE DISKETTES.** Replace the backup diskette with the *MS-DOS Supplemental Diskette* and press the ENTER key.

After exchanging diskettes a number of times, you'll know that the copying process is completed when the total number of files copied is listed and the MS-DOS prompt reappears. You now have a backup copy of your two MS-DOS system diskettes.

To Copy the SETUP and Test File

If you were to display the directory of the *Setup and Test Diskette*, you'd see three files listed, COMMAND.COM, TESTAT.EXE, and AUTOEXEC.BAT. The TESTAT.EXE file contains the SETUP program and the system tests. In the following procedure, you'll be copying this file from the double-density *Setup and Test Diskette* onto your high-density backup diskette.

To back up one file from a double-density diskette onto a high-density diskette:

1. **TURN ON COMPUTER.** If necessary, boot up the computer from the *MS-DOS System Diskette*.

2. **INSERT SETUP AND TEST DISKETTE INTO DRIVE A.** With the A> prompt displayed, insert the *Setup and Test Diskette* into drive A.

3. **ENTER COPY COMMAND.** Type

```
COPY TESTAT.EXE B:
```

and press the ENTER key. You'll see the message

```
Insert diskette for drive B:
Strike any key when ready
```

4. **INSERT BACKUP DISKETTE INTO DRIVE A.** Remove the *Setup and Test Diskette* from drive A and replace it with the high-density backup diskette. Press the ENTER key. Shortly, you'll be asked to

```
Insert diskette for drive A:
Strike any key when ready
```

5. **EXCHANGE DISKETTES.** Replace the backup diskette with the *Setup and Test Diskette* and press the ENTER key. Because TESTAT.EXE file is a large file, several diskette exchanges will be required before the whole file is copied. You'll know that the file has been copied when you see the message

```
1 File(s) copied
```

and the A> prompt reappears. Your backup diskette now contains all your MS-DOS system files and the TESTAT.EXE file. Label the backup and put the three masters in a safe place. From now on, whenever you need an MS-DOS system diskette, the SETUP program, or the system tests, you should use this backup diskette.

A Dual Diskette Drive System

If your system is configured with one high-density diskette drive and one double-density (360K) diskette drive, follow the step-by-step procedures outlined in this section.

To Format High-Density Diskettes

In the following steps you'll run the MS-DOS utility program called FORMAT to prepare a high-density diskette for use with MS-DOS.

To format a high-density diskette:

1. **TURN ON POWER.** If your system is not already on, boot MS-DOS from your *MS-DOS System Diskette*. In a few seconds, the MS-DOS A> prompt will be displayed.

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2. **REMOVE SYSTEM DISKETTE FROM DRIVE A.** Take the *MS-DOS System Diskette* out of drive A and put it into drive B. Then, change the MS-DOS prompt by typing

    B:

3. **ENTER FORMAT COMMAND.** At the B> prompt, type

    FORMAT A:/S

    and press the ENTER key. The message on the screen instructs you to

    Insert new diskette for drive A:
    and strike ENTER when ready

    ■ **Note–** The procedure outlined here causes your system to format a high-density diskette in the high-density format. (See Chapter 4, "Understanding Diskettes," and the Reference Guide under "Storage Media: Diskettes and Hard Disks" for detailed discussions of different formats.) The /S following the command causes the MS-DOS operating-system files to be written on the diskette during formatting. (For more about system files, refer to the SYS command in the *MS-DOS Guide.*)

4. **INSERT UNFORMATTED DISKETTE IN DRIVE A.** Place an unused, unformatted high-density diskette in drive A and press the ENTER key. While the diskette is being formatted, the drive-active light on drive A is lit and the words

    Formatting...
    Verifying...

    are displayed. When the format is completed, a message appears that tells you the total number of bytes there are on the formatted diskette, the number that were used to store the operating-system files (/S), and the number that are now available for file storage on the diskette. You're also asked if you want to

    Format another (Y/N)?

5. **RETURN TO SYSTEM.** Type

    N

    (for *no*) and press the ENTER key. The B> prompt is redisplayed.

    Now you have a formated high-density diskette. You will use this as your backup diskette in the procedure for backing up MS-DOS user files.

■ **Note—**If you need to format double-density diskettes in the high-density drive, refer to the FORMAT command in the commands section of the *MS-DOS Guide.* Remember that a double-density diskette formatted in a high-density drive can only be used in high-density drives.

To Back Up the MS-DOS User Files

You must make backup copies of all your master program diskettes because if the master diskette is ever damaged, you'll be forced to buy another copy of the program. In the sections below, you'll be copying the two MS-DOS system diskettes and the main file from the *Setup and Test Diskette* to a single high-density diskette. This one diskette, which will contain all of the operating system files, the SETUP program, and the system tests, will be your backup or working diskette. To a great degree, you can be assured that no damage will come to the masters because you'll be using the backup diskette at all times instead of the masters.

■ **Note—**If you're working through the tutorial, the following procedure is for users with a system with one high-density and one double-density diskette drive. This procedure substitutes for the steps presented in Chapter 7 of the tutorial.

To back up the two double-density MS-DOS system diskettes onto the high-density diskette:

1. **TURN ON COMPUTER.** If your system is not already on, boot MS-DOS from the *MS-DOS System Diskette.*

2. **INSERT SYSTEM DISKETTE INTO DRIVE B.** Take the *MS-DOS System Diskette* out of drive A and insert it into drive B.

3. **INSERT BACKUP DISKETTE INTO DRIVE A.** Insert the high-density diskette you formatted into drive A.

4. **ENTER COPY COMMAND.** The *MS-DOS System Diskette* in drive B will be your first source diskette. Type

   COPY B:*.* A:

   and press the ENTER key. After a few seconds, the system files will be listed on the screen one after the other as they are copied onto the target diskette in drive A. When all of the files have been copied, the total number of files copied will appear, followed by the A> prompt.

5. **INSERT SECOND MS-DOS DISKETTE INTO DRIVE B.** Remove the *MS-DOS System Diskette* from drive B and replace it with the *MS-DOS Supplemental Diskette.* Leave the high-density backup diskette in drive A.

6. **ENTER COPY COMMAND.** Type

```
COPY B:*.* A:
```

and press the ENTER key. After a few seconds, this diskette's files will be listed on the screen one after the other as they are copied onto the target diskette in drive A. When all of the files have been copied, the total number of files copied will appear, followed by the A> prompt.

Now all of the MS-DOS system files are copied onto your high-density backup diskette. You still have one more file that needs to be backed up.

To Copy the SETUP and Test File

If you were to display the directory of the *Setup and Test Diskette*, you'd see three files listed COMMAND.COM, TESTAT.EXE, and AUTOEXEC.BAT. The TESTAT.EXE file contains the SETUP program and the system tests. In the following procedure, you will be copying this file from the double-density *Setup and Test Diskette* onto your high-density backup diskette with your MS-DOS files.

To backup one file from a double-density diskette onto a high-density diskette:

1. **INSERT BACKUP DISKETTE INTO DRIVE A (IF NECESSARY).** If you haven't already done so, insert your high-density backup diskette into drive A.

2. **INSERT SETUP AND TEST DISKETTE INTO DRIVE B.** Remove the *MS-DOS Supplemental Diskette* from drive B and replace it with the *Setup and Test Diskette*.

3. **ENTER COPY COMMAND.** With the A> prompt displayed, type

```
COPY B:TESTAT.EXE A:
```

and press the ENTER key. Shortly, you'll see this message

```
1 File(s) copied
```

and the A> prompt will reappear.

Your high-density backup diskette now contains all your MS-DOS files and the TESTAT.EXE file. Label the backup and put the three masters in a safe place. From now on, whenever you need an MS-DOS system diskette, the SETUP program, or the system tests, you should use this backup diskette.

Reference 4–System Tests

Overview

In the packet with the MS-DOS diskettes, you'll find the *Setup and Test Diskette*. This diskette contains the SETUP program and a series of system tests that can isolate a problem to a specific piece of hardware. Most of the time you will run the system tests only if you have a problem with the system. You cannot run the system tests until you've run the SETUP program. (Details about the SETUP program are covered in this Reference Guide under "The SETUP Program.")

To run the system tests, boot up the system directly from the *Setup and Test Diskette*. Once the tests are loaded and the System Diagnostics Main menu is on the screen, the diskette is no longer needed in the diskette drive.

System Diagnostics Main Menu

When you boot up the system from the *Setup and Test Diskette*, you are shown the System Diagnostics Main menu. From this menu you can choose what you want to do next.

```
SYSTEM DIAGNOSTICS MAIN MENU

Enter    0    Run SETUP
         1    System checkout
         2    Diskette drive test
         3    Hard disk drive test
         4    Hard disk preparation
         5    Display errors

Enter your selection >_
```

The remainder of this chapter deals with options 1, 2, 3, and 5 from this menu. Options "0 Run SETUP" and "4 Hard disk preparation" are covered in this Reference Guide under "The SETUP Program" and "Preparing the Hard Disk" respectively.

Option 1: System Checkout

The system checkout initially lists some of the standard equipment that might be installed in your computer and, in parentheses, notes how many or how much is installed:

```
(x) On Board Memory
(x) Expansion Memory
(x) Monochrome Display Adaptor
(x) Graphics Display Adaptor
(x) Diskette Drives
(x) Hard Disk Drives
(x) Parallel Ports
(x) Serial Ports
(x) Math Coprocessor
```

If any of the numbers in the parentheses preceding the equipment notation is incorrect, enter an N. This calls up the message:

```
Error in system configuration
Run SETUP first before running diagnostics

Press ESC to return to main menu
```

If all of the information in the system checkout listing is correct, press Y and you are taken to the System Test menu.

```
System Test Menu

Press  0   Real Time Clock Test        ON OFF
       1   Display Test                ON OFF
       2   Keyboard Test               ON OFF
       3   Serial Port Test            ON OFF
       4   Parallel Printer Port Test  ON OFF
       5   Coprocessor Test            ON OFF
       6   Clock Speed Switch Test     ON OFF

Press 0 - 6 to switch tests ON or OFF

Enter  7   Start testing in Single Test Mode
       8   Start testing in Continuous Test Mode
       9   Display errors

Enter your selection >_
```

When the menu is first called up, all of the tests, options 0 through 6, are ON. You can switch back and forth between ON and OFF by pressing the number of the test. For example, to turn the Keyboard Test OFF, press 2; to turn it back ON again, press 2 again.

Not all of the tests will be applicable to all computer configurations. For example, if your computer doesn't have a math coprocessor installed, then you have no need to run the coprocessor test. However, if you do run the test, you'll be told that a coprocessor isn't installed. That fact will be recorded in the error history file.

An explanation of each of the seven tests and three options on the System Test menu follows:

Real Time Clock Test—The computer has a real-time clock; this clock stays on even when the system power is off. The real-time clock test tests the accuracy of the real-time clock by comparing it to the system clock. (The system clock is the clock that begins to run whenever you turn on the computer and runs until you change it from the operating system or reboot or turn the computer off.) The test sets both clocks to the same time and after a 30 second delay compares the two results.

■ **Note**—The real-time clock test alters the date and time settings. Therefore, if you run this test, when you leave the System Diagnostics Main menu to return to the operating system, a screen message will tell you

```
Real time clock has incorrect date and time.
Press Esc to run SETUP to set date and time.

or

Insert system diskette in Drive A:
Press Enter to reboot.
```

For accurate date and time settings, press ESC and follow the instructions.

Display Test—The display test tests your primary display and display adapter for the correct operation of the following:

• Character attributes, such as, normal, inverse, bright, blinking, and underscore

• Font display of all 256 characters

• Ripple patterns in an 80- and a 40-column by 25-line format

• A color bar chart if the system is configured in the color graphics mode

Keyboard Test – The keyboard test will run only in single test mode. In this test, you must press each of the keys on the keyboard in any sequence. The system scan code of the pressed key is compared to a predefined scan code table. If they match, then the representation of that key on the displayed keyboard is reversed from a highlighted to a normal display. When all of the keys have been tested, you will be asked

```
Is the keyboard OK? (Y/N)
```

If all of the keys now appear in normal display mode rather than the highlighted mode, the keyboard is all right and you can press Y.

To leave this test and return to the System Test menu before the test is finished, press the CTRL key, the ALT key, and the DEL key simultaneously.

Serial Port Test – This test tests the functionality of the serial port on your computer. If two serial/parallel cards are installed in the system, both will be tested automatically. Three different tests are performed:

• Transmit/receive test

• Control line test

• Force error condition test

Parallel Printer Port Test – The parallel printer port test will run only in single test mode and then only if you have a parallel printer connected to the computer. When you select this test you are asked to

```
Enter desired character or Ctrl R for ripple
pattern to be printed >
```

At this point, if you enter one character, the screen will be filled with repetitions of that character. If you enter CTRL R, the ripple pattern (a series of all available characters) will fill the screen. To test the printer, press the SPACEBAR and the pattern on the screen should be printed out.

For test results, press ENTER at the end of the test.

Coprocessor Test – This test checks the reliability of an installed math coprocessor by running the following three tests:

• Register test—tests all eight registers with different data patterns

• Functional test—checks the results of mathematical operations for validity

• Interrupt test—generates an interrupt by performing a divide-by-zero operation

Clock Speed Switch Test—This test checks the functionality of the dual-speed button on the front of the computer. You select a speed, either standard or high, and then run the test. The system clock is reset to an initial value and is read again after executing a time delay routine. This value is compared to a predefined value to confirm the selected clock speed. To test the alternate speed, select that speed and run the test again.

Start Testing in Single Test Mode—Choose this option if you want to run the selected test(s) only once. (The keyboard test and the parallel printer port test can only be run in single test mode.)

Start Testing in Continuous Test Mode—This option runs the selected test(s) in a continuous loop, that is, over and over again. You can stop the continuous testing by pressing the ESC key. (With several of the tests, when you press ESC, the test will finish first and then return you to the tests menu.)

Display Errors—When you select this option, you'll see an error history file showing all of the errors that were found when the tests were run. (See Option 5 later in this chapter for some suggested remedies to errors.)

Option 2: Diskette Drive Test

The diskette drive test diagnoses any problems in the diskette drive subsystem.

▼ **Caution**—The test requires a formatted diskette; use only a diskette that contains no data. If you use a diskette with data on it, the data will be erased from the diskette during the testing.

A high-density drive should be tested with a formatted high-density diskette but you can also use a formatted double-density diskette. A double-density drive can only be tested with a formatted double-density diskette.

The test first *writes* a worst case data pattern on a test track and then *reads* that track back again. After the read it does a data comparison. It then proceeds to do the write/read operation sequentially for all the tracks on the diskette.

The test can be performed one time in single test mode or repeatedly for an indefinite number of times in continuous test mode.

■ **Note—**The following step-by-step procedure shows you how to test drive A. The same procedure applies to drive B. If drive B is a double-density drive, it must be tested with a double-density diskette.

To run the diskette drive test:

1. **SELECT OPTION 2.** From the System Diagnostics Main menu, select option "2 Diskette drive test." This takes you to the Diskette Drive Test menu.

```
Diskette Drive Test

0   Select drive
1   Select to run in single test mode
2   Select to run in continuous test mode
3   Start testing

No drive selected
Single test loop mode selected

Enter your selection >_
```

2. **BEGIN DRIVE SELECTION.** To initiate drive selection, type

```
0
```

3. **SELECT DRIVE TO BE TESTED.** To test drive A, enter the drive designator for that drive by typing

```
A
```

The menu display will change to read

```
Diskette drive A: selected
```

■ **Note—**The test will run in single test mode if you make no further selection at this point; the screen will continue to read

```
Single test loop mode selected
```

(To run in continuous test mode, you would select option 2.)

4. **START TESTING.** To start testing, type

```
3
```

The following message appears:

```
Insert formatted blank diskette into drive A:
Press Enter to start testing
```

5. **INSERT DISKETTE INTO DRIVE A.** Insert a formatted high-density diskette into drive A and press the ENTER key. This message appears:

```
Testing high-density diskette drive A: with
   high-density diskette.
It will take about 1 minute to complete.

Press Esc to end test before completion and
   return to menu
```

When the test is finished, you are returned to the Diskette Drive Test menu. If you want to leave the test before it is completed, press ESC at any time.

6. **DISPLAY ERRORS.** From the Diskette Drive Test menu, select

   6

for a display of any errors that were discovered in the test.

Option 3: Hard Disk Test

The hard-disk test diagnoses any problems in the hard-disk subsystem. You can choose a destructive or a nondestructive test. Both tests detect potentially bad areas on the hard disk.

The destructive test does a sequential write and read operation on the surface of the entire hard disk. It uses a worst-case pattern and does a data comparison after the read operation.

▼ **Caution—**The destructive test is *destructive* because it writes over any data that is already on the disk in the course of the test.

The nondestructive test performs in the same way except that it only reads the surface. Because it doesn't write to the disk, it is *nondestructive*.

To run a nondestructive test on drive C in single test mode:

1. **SELECT OPTION 2.** From the System Diagnostics Main menu, select option "2 Hard disk drive test." This takes you to the Hard Disk Drive Test menu.

```
Hard Disk Drive Test

0    Select drive
1    Select to run in single test mode
2    Select to run in continuous test mode
3    Select non-destructive test
4    Select destructive test
5    Start testing
6    Display current bad track list

No hard disk selected
Single test mode selected
Non-destructive test selected

Enter your selection >_
```

2. **BEGIN DRIVE SELECTION.** To initiate drive selection, type

   0

3. **SELECT DRIVE TO BE TESTED.** To test hard disk drive C, enter the drive designator for that drive by typing

   C

   The display will change to read

   ```
   Hard disk C: selected
   ```

4. **SELECT TEST MODE.** If you want to run the test in a continuous loop, select option 2. To run the test only once, do nothing and the screen will continue to read

   ```
   Single test mode selected
   ```

5. **SELECT TEST TYPE.** Since you are running a nondestructive test in this exercise, do nothing. The screen message will reflect your choice.

6. **BEGIN TESTING.** To start testing, type

    5

    When you make your selection, the test begins and the following message appears:

    Testing xxMB hard disk drive <d>
    It will take about xx minutes to complete

    with <d> representing the drive being tested. When the test is completed, you'll see

    Number of new bad tracks = xx

7. **SAVE BAD TRACK LIST.** Press the SPACEBAR. You are asked

    Do you want to save new bad track list? (Y/N)

    If you are running MS-DOS, you can save the bad track list on the hard disk now by typing

    Y

    This will return you to the Hard Disk Test menu. (If you are not running MS-DOS, see the note under step 8.)

    ■ **Note**—The actual marking of the bad tracks, so that data cannot be written to them, does not occur until you partition and format the hard disk with the FDISK and FORMAT programs of MS-DOS.

8. **DISPLAY BAD TRACK LIST.** Type

    6

    This will cause the bad track list to be displayed.

    ■ **Note**—The bad track list generated by the hard-disk test can be saved for any MS-DOS partition on a hard disk (see Step 7 above); it is not saved on non-MS-DOS partitions. If you are running a non-MS-DOS operating system, see if that operating system has a bad track sparing program. Then, with option 6 on the hard-disk test menu, make a copy of the displayed bad track list. The bad tracks from this list can be entered into the sparing program of your operating system.

Option 5: Display Errors

If you select option 5 from the System Diagnostics Main menu, you will see

```
                        ERROR HISTORY FILE

ERROR COUNT                            TEST MODULE
-----------                            -----------
```

Either there will be errors shown, or the message

```
No errors found
```

will be displayed in the Error History File.

If any errors are recorded, take note of the Test Module. Below are some suggested courses of action for each of the indicated tests. If you take these actions and the Test Module continues to record errors, contact your service representative.

Real Time Clock Test—Call your service representative.

Display Test—Check monitor controls and any switches on the display adapter board. Also check the display adapter switch on the main system board of the computer.

Keyboard Test—Make sure that the keyboard is plugged in properly. If the keyboard displayed on the screen in this test differs from the actual keyboard on your system, you may get errors in this test.

Serial Port Test—Call your service representative.

Parallel Printer Port Test—Check to see that

• The printer is turned on and is on line

• The printer is connected to the computer with the correct cable and that the cable is connected to the correct port

• Paper is correctly loaded in the printer

Coprocessor Test—Make sure that the coprocessor is installed correctly if you installed it yourself. All of the pins must fit into the connector and the notch on the top of the chip must be facing towards the rear of the computer.

Clock Speed Switch Test—Call your service representative.

Diskette Drive Test—Run the test again with a different diskette. It is possible that the diskette you used in the test was defective, not formatted, or not write-protected, and that the drive is not defective.

Hard Disk Drive Test—Hard-disk errors are normal because of the delicate nature of the hard disk. But all of the errors should be recorded in the bad track list on the disk. You can set these tracks aside for the MS-DOS operating system when you save the bad track list at the end of the Hard Disk Drive Test, and then run FDISK and FORMAT. Or, if you are running another operating system that has a spare program, you can record the results from the hard-disk drive test in the assigned place in that program.

Reference 5–The SETUP Program

Overview

If you are setting up the computer for the first time or if you have changed the base system configuration by adding any options to the system, you must run the SETUP program.

The SETUP program allows you to *configure your system,* that is, to record all of the options that your computer system has to work with. This must be done the first time you assemble the system and any time thereafter when you make changes to the system. The system configuration that you set with this program is saved in a special CMOS memory. This chip is battery-backed so the setup information is retained even when the computer is turned off.

■ **Note**–If you fail to run the SETUP program after you change the configuration of the system, the following message may appear when you boot up the operating system:

```
Invalid configuration information
—please run SETUP program
Strike the F1 key to continue
```

If you receive this message, run the SETUP program as described in the following sections.

Running the SETUP Program

To run the SETUP program, boot the computer from the *Setup and Test Diskette.* (If you have the file TESTAT.EXE on your hard disk or on your backup system diskette, then you can boot up by typing TESTAT at the MS-DOS prompt.)

Select option 0 from the System Diagnostics Main menu. The SETUP Main menu will be displayed.

```
SETUP Main Menu

Enter 0 Set date and time
      1 Set diskette drive type
      2 Set hard disk drive type
      3 Set system speed
      4 Set expansion memory size
      5 Set primary display type
      6 Review current configuration
      7 Exit SETUP and save new configuration

Enter selection > _

Press Esc to return to Diagnostics main menu
```

The options on this menu make it possible for you to internally configure or reconfigure your computer system. In essence, you are telling the computer what options to work with when it boots up. These instructions from software are retained in the CMOS chip and remain in effect until you change them again with the SETUP program.

■ Note—In Chapter 5 of Part 1, options 1, 5, 6, and 7 on the SETUP Main menu were covered in a step-by-step format. Refer to that chapter for information about those options. The remainder of this chapter concentrates on the SETUP menu options that were not covered in Chapter 5 and elaborates on a few that were.

The SETUP Options

To select an option from the SETUP menu, type the number of that option and press the ENTER key.

0   Set date and time

With this option you can set the correct date and time in a battery-backed real-time clock in the computer. This clock keeps time even when the computer is turned off; in other words, it maintains "real time."

1   Set diskette drive type

You are shown information about the two diskette drives: They can be "Not installed," "High-density," or "Double-density." (At the very least, the computer came with one high-density drive.) If the information concerning drives A and B is correct as shown, press Y and the ENTER key and you'll be returned to the SETUP Main menu.

If the entries are not correct, press N and the ENTER key. This will allow you to record the correct information about each diskette drive in turn. Once again you'll be asked to verify the settings and when you've done so, you'll be returned to the SETUP Main menu.

2   Set hard disk drive type

When you select this option, you're shown the present type settings for hard-disk drives C and D. A drive is either "Not installed" or it's one of a number of possible types. If the entry for either of the drives is incorrect, type N and press the ENTER key. A table is displayed with three columns with the headings "Type," "Cylinders," and "Heads." You will enter a drive type number based on the number of cylinders and heads in the drive.

If you installed the drive yourself following the instructions in this manual, you copied the drive type (found on a label on the front or top of the drive) into the "Record of Important Information" in Chapter 1 before you installed it. Enter that number here to set up the hard-disk drive.

Should the information not be recorded on that page, look at the specifications for the drive and find the number of cylinders and the number of read/write heads that it has and enter the corresponding drive type from the displayed table. For example, if the specifications tell you that the drive has 462 cylinders and 8 read/write heads, enter selection 7 from the table.

▼ **Caution**—It is important that you enter the correct drive type in the SETUP program. If you enter the incorrect type, you may not be able to access the drive at all; at best, you'll only be able to access a portion of it.

3 ·   Set system speed

When you select this option, you are shown the speed at which the system is set to run after booting and the boot-up status of the dual-speed front panel button. For example, you might see the following:

```
Set the system speed

The system speed is : Standard
The state of the front panel button is : Enabled

Entries correct (Y/N) ?
```

This means that your system is currently set to boot at the standard IBM PC AT-compatible speed and that the system speed can be changed by pressing the dual-speed button. To change the current status, press N and the ENTER key. First, you'll be given the chance to change the speed:

```
Set system speed to :

    Enter    0    Standard
             1    High

Enter selection (0,1) >
```

If you select 1 and press the ENTER key, the display then reads:

```
Set system speed to : High

    Enter    0    Standard
             1    High

Set the state of the front panel button to:

    Enter    0    Enabled
             1    Disabled

Enter selection (0,1) >
```

Again, if you select 1 and press the ENTER key, the display changes to read:

```
Set the state of the front panel button to : Disabled

    Enter    0    Enabled
             1    Disabled

Entries correct (Y/N) ?
Press Esc to return to SETUP menu
```

Changing a speed setting in the SETUP program does not immediately change the status of the dual-speed LED on the computer's front panel. Only after you've exited SETUP with option 7 from the SETUP Main menu, and the system has rebooted, will the status of the light change to reflect the new setting.

■ **Note**—The system speed you set in the SETUP program will be in effect whenever you boot up the computer. For example, if you set the system speed at "High" and the status of the dual-speed button to "Disabled," the system will boot up with those settings until you go back to the SETUP program and change them. You won't be able to change the speed with the front-panel button but, if you're running MS-DOS, you can change both the speed and the status of the button with the SPEED command. However, these changes will only last until the computer is turned off or rebooted. During a reboot, the settings from the SETUP program are reinstated.

4   Set expansion memory size

Expansion memory refers to the random access memory (RAM) available on expansion boards in the computer. It doesn't include the 640K of RAM available on the main system board. This option from the SETUP Main menu establishes the amount of expansion RAM that is available in the computer. When you select it, you'll see

```
Expansion memory size is : xxxxxxkb

Entry correct (Y/N) ?
```

If the number of kilobytes displayed (xxxxxxkb) represents your current expansion memory size, press Y and the ENTER key, and you'll be returned to the SETUP Main menu. If it does not, press N and the ENTER key. This will take you to a list of expansion memory sizes. You don't enter the actual number of kilobytes or megabytes of expansion memory that you've installed, but the number from this list that represents that amount.

■ **Note**—Expansion memory can only be accessed in the protected mode of the 80286 microprocessor. Only those MS-DOS applications that are programmed to access it can make use of the additional memory. One such program is the VDISK.SYS memory disk program on the *MS-DOS System Diskette*. For details about this program, refer to your *MS-DOS Guide*.

5   Set primary display type

Here you set your primary display type. The primary display is the display to which messages will be written during the system bootup.

First, you are asked if a GDA (graphics display adapter) is installed in your unit. GDA refers to a type of display adapter that combines the functions of several different video display adapters on a single board. If you have a special GDA like this, type Y and press the ENTER key. If a GDA is not installed, type N and press the ENTER key.

At this point, this message appears

    The primary display is attached to

followed by the type of adapter, for example,

    Monochrome display adapter

or

    GDA in the 80 column mode

If the information is correct, press Y and the ENTER key and you will be returned to the SETUP Main menu.

If it is incorrect, press the N key. If you are using a color display or a monochrome display in color-graphics emulation mode, you will be given the opportunity to select either the 80- or 40-column display mode. Otherwise, you will see a message referring you to the explanation of the display adapter switch under "Installing Internal Options" in this Reference Guide.

The information about the type of display adapter that is shown in this option is dependent on the status of the display adapter switch inside the computer and on your answer to the question about the GDA board. (The proper settings for a GDA can be found in the documentation that came with the board.)

6   Review current configuration

This option lets you view the current status of the options in the SETUP program. You'll see

```
The following options have been set:

    Current date :xx-xx-xxxx
    Current time :xx:xx:xx
    Diskette drive A : xxxxxxxxxxxx
    Diskette drive B : xxxxxxxxxxxx
    Hard drive C : Type x
    Hard drive D : Type x
    System speed is : xxxxxxxx - Front panel button
       xxxxxxx
    Expansion memory size : xxxxxxkb
    Primary display is attached to :
       xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Press Esc to return to SETUP menu
```

To leave this review and return to the SETUP menu, press ESC.

7   Exit setup and save new configuration

If you want the changes that you made to be saved in the battery-backed CMOS chip, you must exit the SETUP program with option 7. When you select option 7, you'll see the same list as in option 6 except now you're asked if the entries in the list are correct.

To change any of the entries in the list, press N and the ENTER key and you'll be returned to the SETUP Main menu to make any necessary changes.

When the entries are correct, you can leave the SETUP program. To reboot the operating system, make sure that the system files can be booted from drive A or the hard disk and press Y and the ENTER key to exit SETUP. The new configuration will be saved and the system will reboot.

Reference 6–Preparing a Hard Disk

Overview

Before you can begin storing information on a new or unformatted hard disk, you must go through several steps to prepare it to accept the information. The hard disk that comes in the hard-disk model of the system may be already prepared. You may not need to go through the procedures outlined in this chapter before you begin using that hard disk. However, if you've added a hard disk to the system, you'll have to prepare it before it can be used.

This chapter outlines the complete hard-disk preparation procedure for the MS-DOS operating system from the time the drive is installed in the unit to the time you can boot the operating system from the disk. The various steps of the procedure are represented in Figure R6-1.

Figure R6-1 The MS-DOS Hard-Disk Preparation Procedure
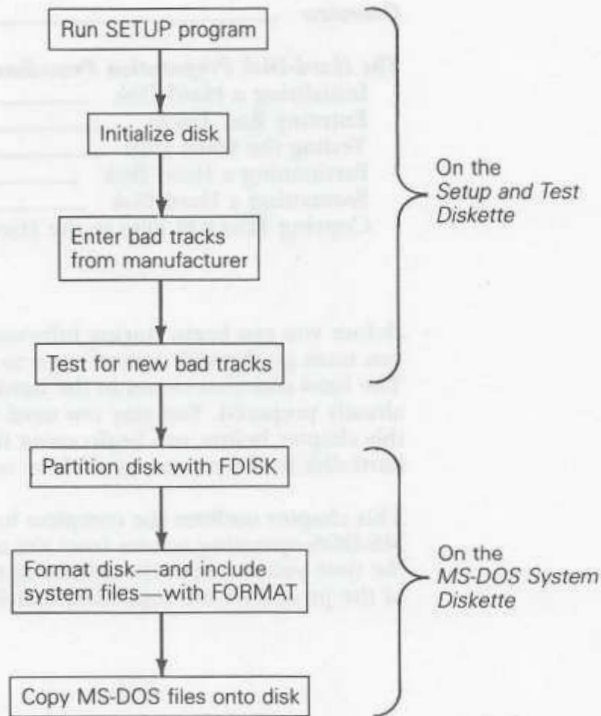
The Hard-Disk Preparation Procedure

No matter what operating system you're going to install on the hard disk, you must begin the preparation procedure by

• Running the SETUP program to identify the hard-disk type to the system

• Initializing the hard disk

The SETUP procedure is covered in this Reference Guide under "The SETUP Program." Instructions on initializing the hard disk are presented later in this chapter.

If you are planning to install an operating system other than MS-DOS on the hard disk, either as the only operating system or together with MS-DOS, be sure to read all pertinent installation instructions before you begin the preparation procedure. If MS-DOS is to be one of the operating systems installed, read the explanation of the FDISK command in the *MS-DOS Guide* for information on partitioning.

■ **Note**—The first hard-disk drive in the system, drive C, is being prepared in the following procedures. To prepare the second hard-disk drive, drive D, follow the same steps, but, whenever you are instructed to select a drive, select drive D instead of drive C.

Initializing a Hard Disk

For the hard disk to be properly initialized, you must have correctly identified it by type and have recorded that type in the SETUP program (see the chapter in this Reference Guide on "The SETUP Program"). If the drive has not been recorded, you'll be unable to proceed with initialization. If an incorrect type has been recorded, the whole procedure may fail or result in the initialization of only a portion of the hard disk. Therefore, make sure that you've set up the hard disk before you begin.

To initialize hard-disk drive C:

1. **TURN ON POWER.** Boot up the computer with the *Setup and Test Diskette*. (Alternatively, run the TESTAT program from your backup diskette.)

2. **SELECT HARD DISK PREPARATION.** Select option "4 Hard disk preparation" from the System Diagnostics Main menu. The Hard Disk Preparation menu will be displayed:

```
HARD DISK PREPARATION

Enter   0    Select drive
        1    Enter bad tracks
        2    Initialize hard disk
        3    Display current bad track list

No hard disk selected

Enter your selection >_

Press Esc to return the main menu }
```

3. **INITIATE DRIVE SELECTION.** Initiate the selection of a hard disk by typing zero

```
0
```

4. **SELECT HARD-DISK DRIVE.** To select hard-disk drive C for testing, enter the drive designator for that drive by typing

    C

The display will change to read

    Hard disk C: selected

5. **SELECT OPTION 2.** Select option "2 Initialize hard disk" by typing

    2

You'll see the message

    You are about to initialize hard disk C:
    This will destroy all data on that disk.

    Are you sure you want to do this? (Y/N)

6. **BEGIN INITIALIZING.** Press the Y key. You'll be directed to

    Press Enter to start initializing

If you were to change your mind at this point and decide that you didn't want to initialize the hard disk, you could return to the Hard Disk Preparation menu by pressing ESC.

7. **CONTINUE PROCEDURE.** To continue the initialization process, press the ENTER key. The procedure is finished when the message

    Initialization complete

is displayed.

8. **RETURN TO MENU.** Press the ESC key to return to the Hard Disk Preparation menu.

■ **Note**—From here on, if you plan to install an operating system other than MS-DOS, refer to the installation instructions for that operating system before proceeding.

Entering Bad Tracks

A great deal of information can be recorded on a hard disk because the tracks are very tightly packed on the surface of disk. Because of the large number of tracks, a hard disk can have proportionally more bad tracks than a diskette.

Reference Guide

For this reason, disk manufacturers pass each hard disk through rigorous tests that reveal potential bad areas on an otherwise faultless disk. It is normal for there to be a large number of these potential bad tracks.

On each drive you'll find a label (sometimes called a *Hard Error Map*) that lists the potential bad tracks the manufacturer found when testing the hard disk. One bad track is shown as a combination of a *cylinder*, or *track*, number and a *head* number.

■ **Note**—If no bad tracks are listed on the the label on the drive, then your disk was free of media defects when it was tested by the manufacturer. You can skip directly to the "Testing the Hard Disk" section in this chapter.

When you installed the new drive, you were directed to enter the numbers from the Hard Error Map in the "Record of Important Information" section of Chapter 1 of this manual. To protect your data and increase the reliability of the hard disk, you must copy those numbers to a *bad track list* on the disk itself.

The bad track list is saved on an area of the disk that is guaranteed to be good. When you format the disk, all of the tracks listed in the bad track list will be marked in such a way that no files can ever be written to them. As a result, you're assured that you won't be writing files to tracks that could eventually become unreadable.

■ **Note**—This specific procedure is for MS-DOS only. If you're running another operating system, refer to the documentation for that system for instructions on recording bad tracks or media defects.

To enter bad tracks from the manufacturer's list of hard errors:

1. **SELECT OPTION 1.** Select option "1 Enter bad tracks" from the Hard Disk Preparation menu. You're directed to

   ```
   Type cylinder number, comma, head number, and
   press ENTER >
   ```

2. **ENTER BAD TRACKS.** Enter the numbers from the hard-disk error list in the "Record of Important Information" section of Chapter 1. From your list, type the first

```
<cylinder number>,<head number>
```

and press the ENTER key. You're then asked

```
Is entry correct? Press 'Y' if OK or 'N' to cancel
```

Whether you answer Y or N, you're returned to

```
Type cylinder number, comma, head number, and
press ENTER >
```

3. **CHECK BAD TRACKS ENTERED.** When you've finished entering the bad tracks from your list, press the ESC key. If any tracks were entered, a table of bad tracks is displayed according to cylinder and head. (If you entered no bad tracks, a message to that effect is displayed.) Make sure that these readings conform to your list; you don't want to designate as bad more tracks than you need to.

4. **CONTINUE PROCEDURE.** To continue, press the ENTER key. If you entered any bad tracks, you're asked

```
Do you want to save new bad track list? (Y/N)
```

5. **SAVE BAD TRACK LIST.** To save the bad track list, respond to this question by typing

```
Y
```

and you'll be returned to the Hard Disk Preparation menu.

6. **RETURN TO DIAGNOSTICS MENU.** Press the ESC key to return to the System Diagnostics Main menu.

Testing the Hard Disk

Now you're going to test your hard disk. You can choose between a *destructive* test and a *nondestructive* test. Both tests examine the hard disk for potential bad tracks that may have occurred since it was tested at the factory.

The nondestructive test performs a sequential read of the disk. Any data already recorded on the disk is unaffected by the test. Run the nondestructive test on a disk with data recorded on it to find any potential bad tracks that might need to be marked.

▼ **Caution**–The destructive test finds bad tracks more effectively than the nondestructive test because, in addition to reading the disk, it also performs a sequential write to the disk. Thus, it will destroy any data already recorded on the disk except for the list of bad tracks that you entered and saved in the previous procedure. Only in this sense can this be thought of as a "destructive" test.

A destructive test can be run on a new and unused hard disk because there's no data recorded on it yet. Therefore, in the procedure that follows, you'll run a destructive test on drive C.

To run a hard-disk test on drive C:

1. **SELECT OPTION 2.** From the System Diagnostics Main menu, select option "2 hard disk drive test." The Hard Disk Drive Test menu is displayed.

```
HARD DISK DRIVE TEST

Enter    0    Select drive
         1    Select to run in single test mode
         2    Select to run in continuous test mode
         3    Select non-destructive test
         4    Select destructive test
         5    Start testing
         6    Display current bad track list

No hard disk selected
Single test mode selected
Non-destructive test selected

Enter your selection >_
```

2. **INITIATE HARD DISK SELECTION.** To initiate the selection of a hard disk, type

   0

3. **SELECT HARD DISK DRIVE.** To select hard-disk drive C for testing, enter the drive designator for that drive by typing

   C

   The display will change to read

   Hard disk C: selected

4. **RUN IN SINGLE TEST MODE.** To run the test a single time, do nothing; the program is in single test mode as the screen message indicates.

■ **Note**—In continuous test mode, the test is run over and over again until you stop it by pressing the ESC key. The more often the test is run, the better chance it has of finding bad tracks. Therefore, the continuous test mode is more effective at discovering bad areas than the single test mode. Should you wish to run a test in a continuous loop, you would select option 2 and the screen text would change to read

```
Continuous test mode selected
```

5. **SELECT DESTRUCTIVE TEST.** Select to run the destructive test by typing

```
4
```

6. **START TESTING.** To start testing, type

```
5
```

Because the test you're about to run is destructive, you're given the opportunity to retract your selection when the following message appears:

```
WARNING!!! All data on the hard disk C: will be
destroyed Enter 'Y' if OK or 'N' to abort the test
```

If you select N you'll be returned to the Hard Disk Drive Test menu. If you select Y, the test begins and the following message appears:

```
Testing xxMB hard disk drive C:
It will take about xx minutes to complete
```

The amount of time the test will take depends on the size of the hard disk. When the test is completed, this message is displayed:

```
Number of new bad tracks = xx
```

7. **CONTINUE PROCEDURE.** Press the SPACEBAR and you'll be asked

```
Do you want to save new bad track list? (Y/N)
```

8. **SAVE BAD TRACK LIST.** Type

```
Y
```

The new bad tracks will be saved in the bad track list.

Now the disk is initialized and a bad track list has been created on it. In the following section, you'll be telling the system how much of the disk should be reserved for the MS-DOS operating system.

Partitioning a Hard Disk

Before you can use the hard disk, or *fixed disk*, you set aside at least one area, or *partition*, of the disk for the installation of an operating system. In addition to its mass storage capacity and speed, another advantage of the hard disk is that you can divide its total storage area into a maximum of four separate partitions of differing sizes. Each partition can be formatted with and store a different operating system.

Every operating system has its own program for creating and deleting partitions and, in most cases, the programs are not compatible. If you install an MS-DOS partition on the hard disk with the FDISK utility and you want a Xenix partition on the same disk, you'll have to create it with the Xenix installation programs.

■ Note—The directions below explain how to partition the hard disk if you want to run only the one operating system, MS-DOS. If you'll be running more than one operating system, read the explanation of FDISK in the *MS-DOS Guide* and the documentation for the additional operating systems before proceeding.

To partition the whole hard disk for MS-DOS:

1. **TURN ON COMPUTER.** Boot the computer with an MS-DOS system diskette in drive A.

2. **ENTER FDISK COMMAND.** At the A> prompt, type the command

   FDISK

   and press ENTER. The FDISK Options menu appears:

   FDISK Options

   Current Fixed Disk Drive: x

   Choose one of the following:

       1. Create MS-DOS Partition
       2. Change Active Partition
       3. Delete MS-DOS Partition
       4. Display Partition Data
       5. Select Next Fixed Disk Drive

   Enter Choice:[1]

   The number 1 (the default option) is already displayed.

3. **SELECT DEFAULT OPTION.** Select option 1 by pressing the ENTER key. If the hard disk hasn't been partitioned previously, the display looks like this:

```
Create MS-DOS Partition

Do you wish to use the entire hard disk
for MS-DOS?........................? [Y]
```

The default answer is Y.

4. **CREATE MS-DOS PARTITION.** To make the whole hard disk one large MS-DOS partition, select the default answer by pressing the ENTER key. The MS-DOS partition is created and a table of information about the partition is displayed.

5. **LEAVE FDISK.** To leave the FDISK program, press the ESC key two times. The following message is displayed:

```
Please insert MS-DOS diskette into drive A:
Press any key when ready.................
```

6. **RETURN TO MS-DOS.** The *MS-DOS System Diskette* should already be in drive A. To return to the operating system level, press any key and the system will reboot.

After you add a new MS-DOS partition or change an existing MS-DOS partition, you must always reboot MS-DOS so that the system will recognize the new or altered partition.

Formatting a Hard Disk

As the final step in the actual hard-disk preparation procedure you must format the disk. (If you have installed more than one operating system on the disk, format each partition with the formatting program from its own operating system.) The MS-DOS formatting program is on the *MS-DOS System diskette.*

To format the hard disk with MS-DOS:

1. **ENTER FORMAT COMMAND.** With the *MS-DOS System Diskette* in drive A, type

   ```
   FORMAT C:/S/V
   ```

   and press the ENTER key. This tells MS-DOS to format the disk in drive C (the hard disk), to copy the MS-DOS *system* files onto the disk (/S), and to prompt you for a disk volume label (/V). The following message is displayed:

   ```
   You are about to format your hard disk.
   This will destroy all data in the MS-DOS
   partition.

   Are you sure you want to do this
   (Type 'Y' for yes)?
   ```

2. **CONTINUE PROCEDURE.** Press the Y key. You now see the message

   ```
   WARNING, ALL DATA ON THE NON-REMOVABLE DISK
   DRIVE C; WILL BE LOST!
   Proceed with Format (Y/N)?
   ```

   Because of the irreversible nature of this command (all data on the hard disk will be erased), you're being given another chance to change your mind about formatting. However, in the present situation, since there's no data on the hard disk, disregard the warning and proceed with the format.

3. **PROCEED WITH FORMAT.** Type

   ```
   Y
   ```

   and press the ENTER key to proceed with format. This message appears on the screen:

   ```
   Formatting...
   Verifying...
   ```

   During the formatting process, MS-DOS checks the entire disk. How long this takes depends on the capacity of the disk. Five minutes is an average.

4. **ENTER VOLUME LABEL.** When the actual formatting is completed, you'll see the message

```
System transferred

Volume label (11 characters, RETURN or ENTER for
none)?
```

At this point, you can enter a disk volume label of no more than 11 characters. This label is optional; it identifies the disk volume by name or date or whatever you want as long as the label is limited to 11 characters.

5. **FINISH FORMATTING.** When you have entered a label (or nothing at all), press the ENTER key. The message

```
Format complete.
xxxxxxxx bytes total disk space
   xxxxx bytes used by system
xxxxxxxx bytes available on disk
```

indicates that the hard disk is now formatted.

Copying MS-DOS Files to the Hard Disk

If this is drive C (the first hard disk in your system), you should fix it so that you can boot directly from the hard disk and have all of the MS-DOS utility files and GW-BASIC files available on the disk.

■ **Note**—In the following procedure, you are directed to copy the MS-DOS files from the backup system diskette, which you created if you worked through Chapters 6 and 7 of the tutorial. You can also copy the files from the two MS-DOS system diskettes that came with the system.

To copy MS-DOS and GW-BASIC files to the hard disk:

1. **INSERT SYSTEM BACKUP DISKETTE INTO DRIVE A.** Put the high-density system backup diskette, which you created in the tutorial, in drive A.

2. **ENTER COPY COMMAND.** To copy all of the files from the diskette in drive A to the hard disk, type

   ```
   COPY A:*.* C:
   ```

   The files from the backup diskette are listed on the screen as they are copied from the diskette to the hard disk. When all of the files have been copied over, the message noting the number of files copied will appear and you'll be returned to the A> prompt.

3. **REBOOT COMPUTER.** To test that you have correctly completed the hard-disk preparation procedure, remove the system diskette from drive A and hold down the following three keys simultaneously:

   CTRL ALT DEL

   The system should reboot from the hard disk when you do this. If it doesn't, retrace your steps and make sure that you did everything that was required in the procedure.

Reference 7–Dual-Speed Operation

Overview

The computer features a front panel pushbutton that can change the processing speed of the computer between standard IBM PC AT speed and high speed (Figure R7-1). The difference between the two speeds is particularly noticeable for CPU-intensive activities, such as recalculating worksheets.

■ **Note**–Software programs that are sensitive to timing changes may run only at the standard speed. To determine, before you buy it, if a program can run at high speed, refer to the program documentation or ask your dealer. However, most programs will run correctly at high speed. (If a program doesn't run correctly at high speed, simply switch to standard speed.)

Figure R7-1 The Dual-Speed Indicator on the Display/Keylock Panel

Dual-Speed LED
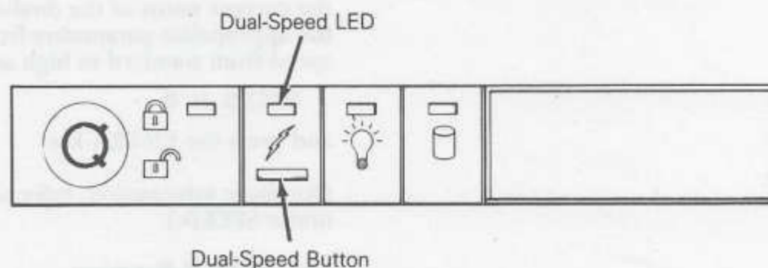
Dual-Speed Button

Managing the Dual-Speed Option

You can change the processing speed with

• The dual-speed button on the front of the computer

• The SPEED command in MS-DOS

• The SETUP program from the *Setup and Test Diskette*

The Dual-Speed Button

Pressing the dual-speed button changes the processing speed of the computer from its present speed to the alternate speed. The LED light above the button is on when the computer is running at the higher speed, and it's off when the computer is running at the standard speed.

The MS-DOS Speed Command

The SPEED command, an MS-DOS utility program on the *MS-DOS System Diskette*, also controls the dual-speed function. When you type

```
SPEED
```

at the MS-DOS prompt and press the ENTER key, the following information is displayed:

```
Allowable parameters for speed are
      D - Disable speed change
      E - Enable speed change
      S - Standard speed
      H - High speed
Current speed xxxxx
Dual Speed button xxxxx
```

The bottom two lines show the present speed and status of the dual-speed button. Speed is either *high* or *standard*; the button is either *enabled* or *disabled*. When the button is disabled, it cannot be used to switch speeds. To change the current status of the dual-speed function with the SPEED command, enter the appropriate parameters from the above list. For example, to change the speed from standard to high and the button from enabled to disabled, type

```
SPEED H D
```

and press the ENTER key.

(For more information, refer to the commands chapter in your *MS-DOS Guide* under SPEED.)

The SETUP Program

The power-on default speed and the default enable/disable function of the dual-speed button are set from the SETUP program on the *Setup and Test Diskette* or the TESTAT.EXE file on your hard disk and backup diskette. (For more about controlling the dual-speed option from this program, turn to "The SETUP Program" in this Reference Guide.)

Reference 8—Installing Serial and Parallel Devices

Overview

The serial/parallel board that comes as a standard component of your computer has connectors, or *ports*, for two optional peripherals:

• One parallel printer port (LPT1/LPT2)

• One RS-232C serial port for a printer, modem, mouse, or any other serial device (COM1/COM2)

These ports can be configured independently as (or given the *address* of) LPT1 or LPT2 for the parallel port, or as COM1 or COM2 for the serial port. The parallel port has a DB-25 connector, and the serial port has a DB-9 connector.

Figure R8-1 shows the location of the two connectors.

Figure R8-1 Standard Serial and Parallel Connectors
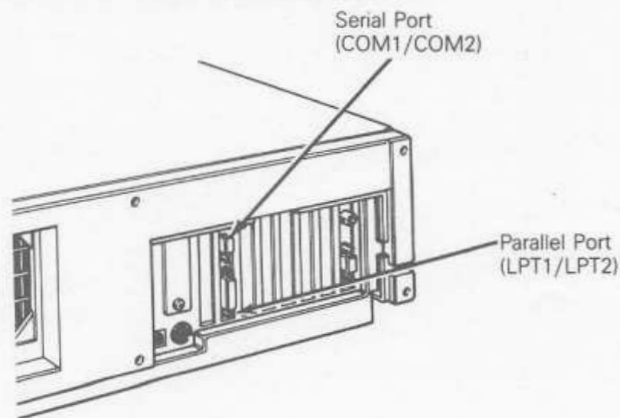
Connecting a Parallel Printer

You can connect any printer that uses a standard Centronics parallel communications interface connector to the parallel printer connector on the rear of the computer (Figure R8-2). The interface connector is fully compatible with the IBM PC AT; all cables made for the IBM PC AT will work on your system.

Figure R8-2 Parallel Printer Connector

Serial/Parallel Board

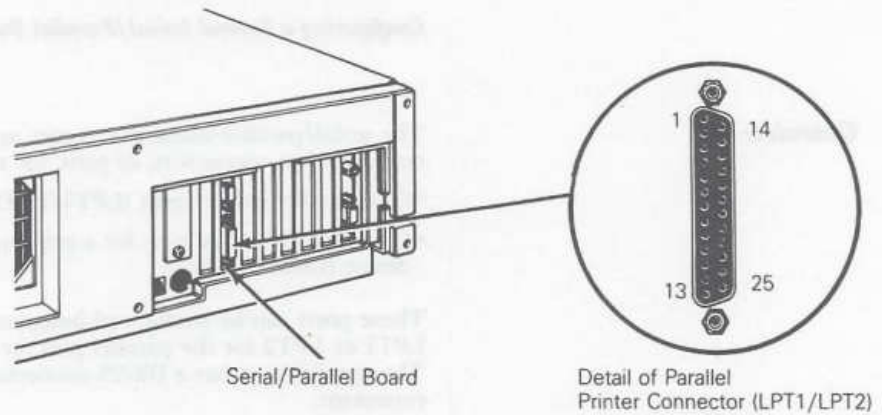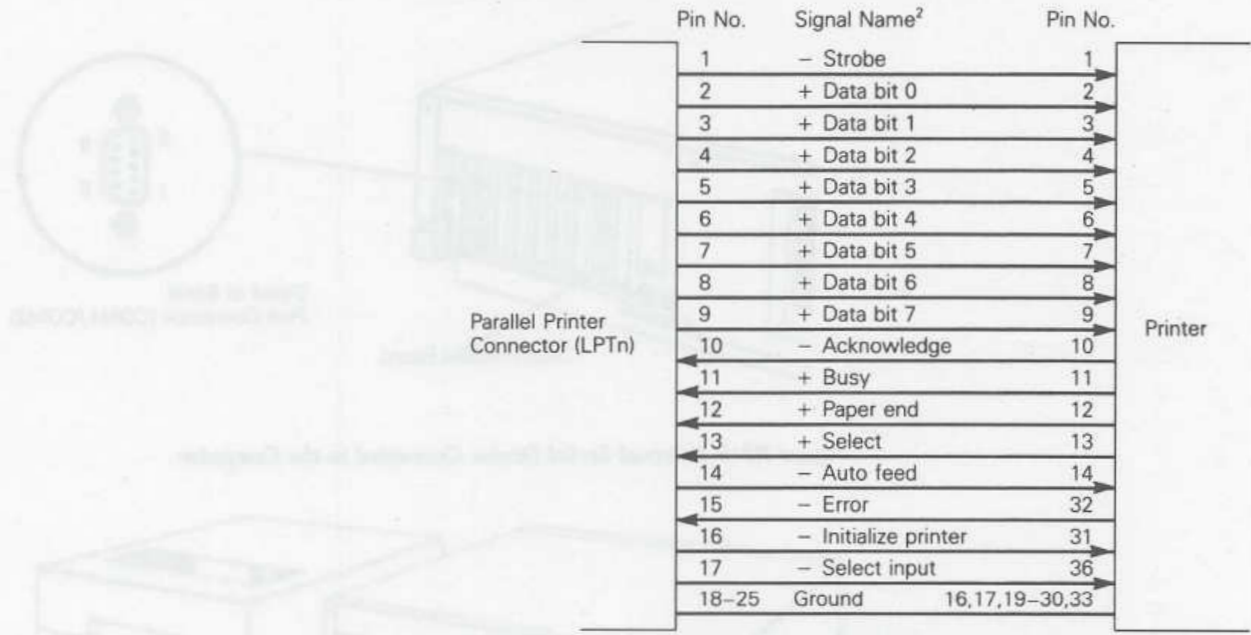Detail of Parallel
Printer Connector (LPT1/LPT2)

Figure R8-3 lists the pin assignments, signal names, and signal directions for the connectors on the interface cable between the computer and the parallel printer.

Figure R8-3 Pin Assignments for Parallel Printer Connector [1]

Pin No.	Signal Name[2]	Pin No.
1	– Strobe	1
2	+ Data bit 0	2
3	+ Data bit 1	3
4	+ Data bit 2	4
5	+ Data bit 3	5
6	+ Data bit 4	6
7	+ Data bit 5	7
8	+ Data bit 6	8
9	+ Data bit 7	9
10	– Acknowledge	10
11	+ Busy	11
12	+ Paper end	12
13	+ Select	13
14	– Auto feed	14
15	– Error	32
16	– Initialize printer	31
17	– Select input	36
18–25	Ground	16,17,19–30,33

Parallel Printer
Connector (LPTn)

Printer

1. All outputs are generated by software; all inputs are real-time (nonlatched) signals.
2. All Standard TTL Levels.

**Connecting an External
Serial Device**

In addition to the parallel port, the serial/parallel board has one serial port, which can be assigned to COM1 or COM2 by the user. This port is a 9-pin connector that conforms to the Electronics Industry Association (EIA) RS-232C standard (Figure R8-4). Most external modems, serial printers, and other serial devices are designed to connect to a serial communications connector that meets the RS-232C standard. Figure R8-5 shows an external serial device connected to the computer.

■ **Note**–Your computer can recognize only two serial ports. Therefore, if you install an internal modem board that includes a serial port, whichever configuration you assign to the modem serial port (COM1 or COM2), you must assign the remaining configuration to the serial port on the computer's serial/parallel board.
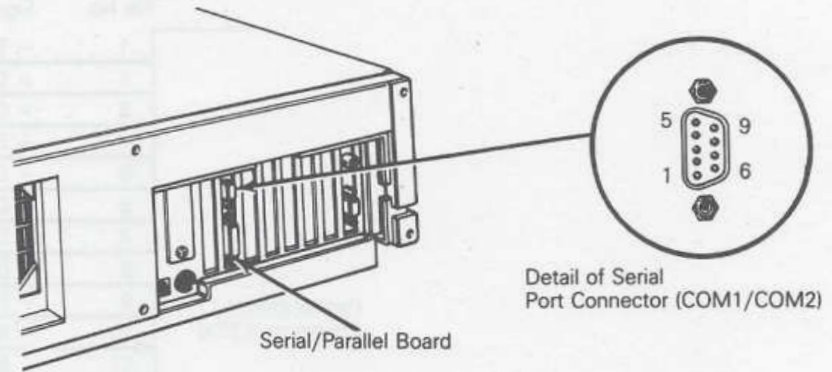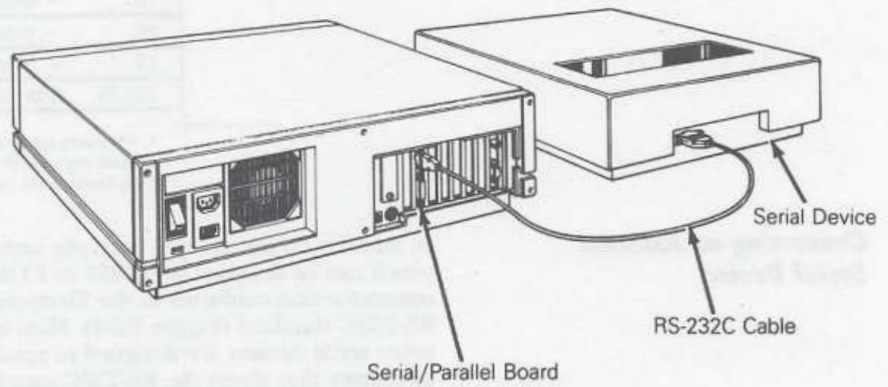
Figure R8-4 Serial Port Connector

Detail of Serial
Port Connector (COM1/COM2)

Serial/Parallel Board

Figure R8-5 External Serial Device Connected to the Computer

Serial Device

RS-232C Cable

Serial/Parallel Board

Reference Guide

To connect a serial device to the computer:

1. **ATTACH ADAPTER CABLE TO SERIAL DEVICE.** Attach the 25-pin connector of the adapter cable to the serial device connector.

■ Note—Serial devices are equipped with 25-pin connectors. For this reason, a 25-pin-to-9-pin adapter cable has been included with your computer accessories.

2. **ATTACH CABLE TO COMPUTER.** Attach the the 9-pin connector of the RS-232C cable to the serial port on the computer.

■ Note—Refer to the instructions that came with the serial device for any possible additional connections.

Figures R8-6 and R8-7 list the pin assignments, signal names, and signal directions (defined by the EIA RS-232C interface standard) for 9-pin connectors and for 25-pin-to-9-pin adapter cable connectors that attach to the computer.

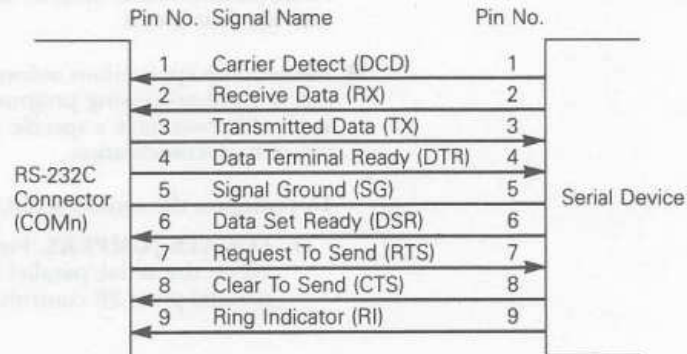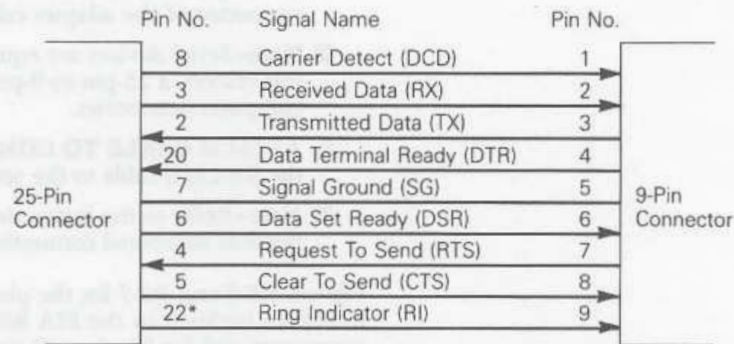*Figure R8-6 Pin Assignments for the RS-232C 9-Pin Connector*

Pin No.	Signal Name	Pin No.
1	Carrier Detect (DCD)	1
2	Receive Data (RX)	2
3	Transmitted Data (TX)	3
4	Data Terminal Ready (DTR)	4
5	Signal Ground (SG)	5
6	Data Set Ready (DSR)	6
7	Request To Send (RTS)	7
8	Clear To Send (CTS)	8
9	Ring Indicator (RI)	9

RS-232C Connector (COMn)

Serial Device

Figure R8-7 Pin Assignments for the RS-232C 25-Pin-to-9-Pin Connector

Pin No.	Signal Name	Pin No.
8	Carrier Detect (DCD)	1
3	Received Data (RX)	2
2	Transmitted Data (TX)	3
20	Data Terminal Ready (DTR)	4
7	Signal Ground (SG)	5
6	Data Set Ready (DSR)	6
4	Request To Send (RTS)	7
5	Clear To Send (CTS)	8
22*	Ring Indicator (RI)	9

25-Pin Connector

9-Pin Connector

*The remaining pins on the 25-pin connector are not used.

Configuring a Second Serial/Parallel Board

It is customary, but not necessary, to configure the ports on your first serial/parallel board as LPT1 and COM1. If you do so, the second serial/parallel board must be configured as LPT2 and COM2 to avoid conflicts with the first board.

■ **Note**—Some applications software programs that control serial/parallel devices, e.g., a word-processing program that enables a printer, require that the applicable port have a specific address. This information can be found in the program documentation.

To configure the second serial/parallel board:

1. **LOCATE JUMPERS.** Figure R8-8 shows the location of jumpers 2D and 2E on the serial/parallel board. Jumper 2D controls configuration of the parallel port; 2E controls the configuration of the serial port.

Figure R8-8 Jumpers on Serial/Parallel Board
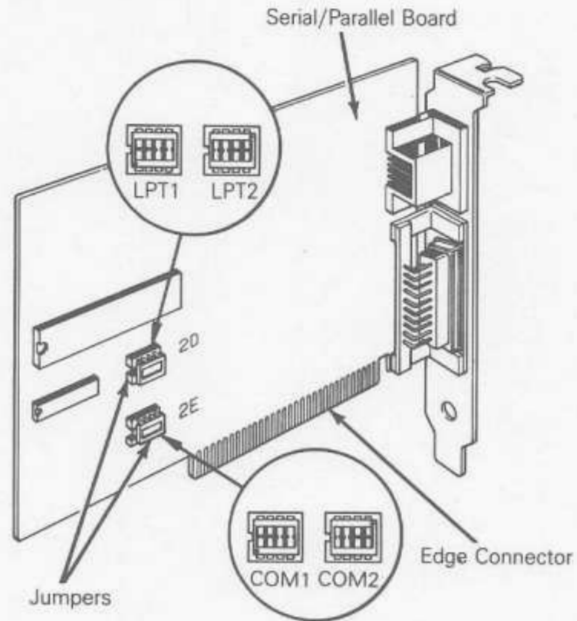
2. **CHOOSE PARALLEL PORT (LPT) CONFIGURATION.** If you want
   the parallel port to be identified as LPT2, position the 2D jumper
   sheath so the open contacts are closer to the connector edge of the
   board (Figure R8-8). If you want the port to be identified as LPT1,
   position the 2D jumper sheath so that the two open contacts of the
   jumper are farthest away from the connector edge of the board.

3. **CHOOSE SERIAL PORT (COM) ADDRESS.** Serial port identification
   is made in the same manner as above for the parallel port, using jumper
   2E.
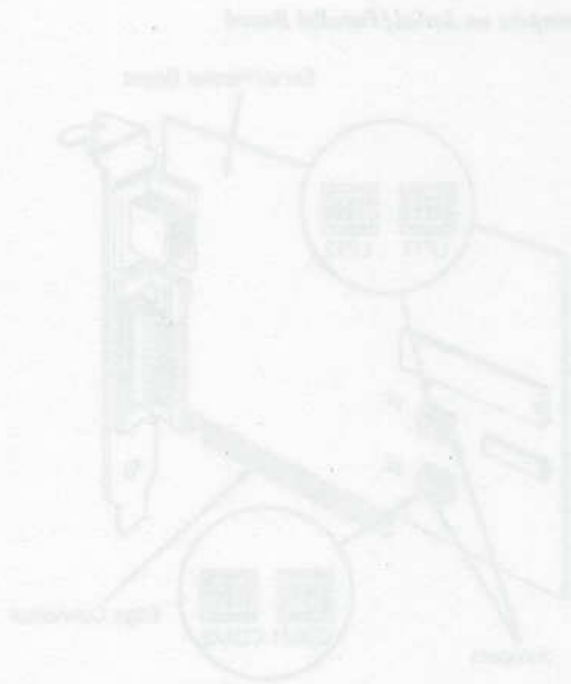
Reference 9–Installing Internal Options

Overview

You have many options available that expand the capabilities of your computer. Most options require the addition of a part inside the computer. Adapter boards are installed in the interior expansion slots; disk drives are installed in special openings inside the machine; and the 80287 math coprocessor is installed in a socket on the main processor board.

This chapter discusses the three types of available options and what you need to do to install them in the computer. Also included are generic installation instructions for each type.

To install any of these internal options, you must get inside the computer, and that means you will have to remove the cover.

■ **Note**–Unless stated otherwise, the only tool you will need to perform the work in this chapter is a No. 2 Phillips screwdriver.

Removing the Cover

● **Warning**–The computer contains high-voltage components that are extremely hazardous (even after you turn off the power) unless you take the proper precautions. No one other than a qualified service technician is authorized to open the computer case. If you choose to do it yourself, you void your warranty.

Removing the cover from the computer is simple. Make sure you have a large area in which to work.
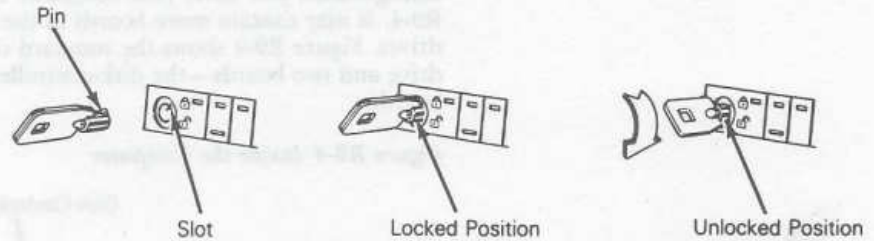
To remove the computer cover:

1. **TURN OFF POWER.** Any time you work inside the computer you must be absolutely certain that the system power is off. As a further precaution, unplug the AC power cord from the rear of the computer.

2. **REMOVE CABLE GUARD.** The cable guard is the rectangular plastic enclosure that covers the I/O access area on the rear of the computer. To remove it, press in the bottom half of both sides, then tilt it up and out (Figure R9-1).

Figure R9-1 Removing Plastic Cable Guard


Cable Guard
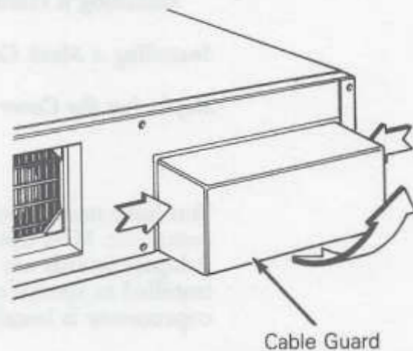
3. **DISCONNECT CABLES.** Disconnect all cables attached to the computer. Mark them so that you'll know where they go when you reconnect them.

4. **UNLOCK THE COMPUTER.** If the keylock is locked, you need to unlock it before you can remove the cover. Turn the key clockwise until it points to the open padlock symbol.

Figure R9-2 Unlocking the Computer

Pin

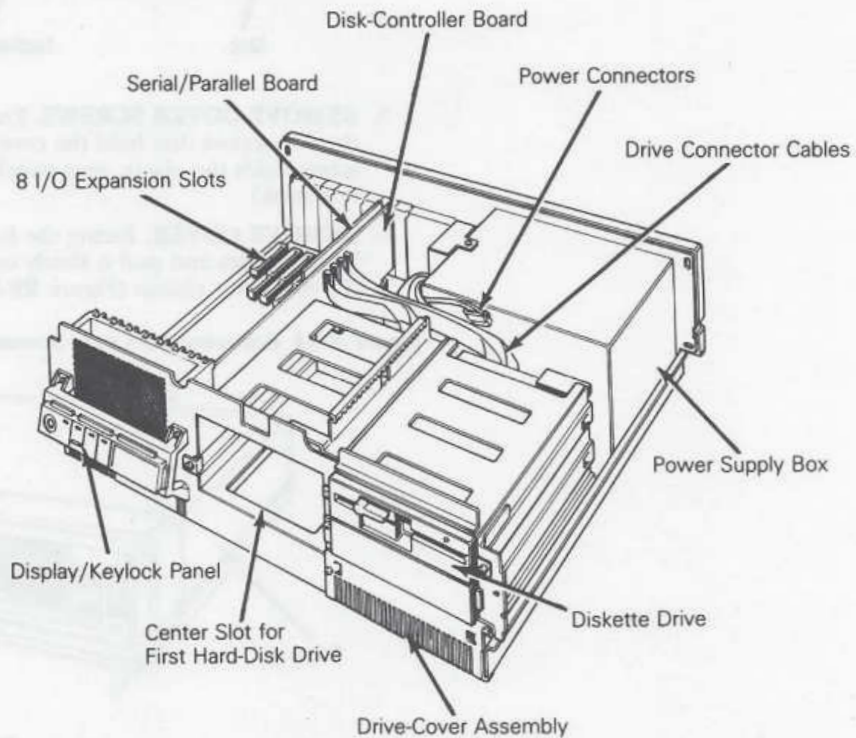Slot   Locked Position   Unlocked Position

5. **REMOVE COVER SCREWS.** From the rear of the computer remove the five screws that hold the cover in place (Figure R9-3). (The sixth screw holds the plastic rear panel in place and doesn't need to be removed.)

6. **REMOVE COVER.** Facing the front of the computer, grasp the cover by both sides and pull it slowly towards you until it is completely free of the computer chassis (Figure R9-3).

Figure R9-3 Removing the Cover Screws and Cover

Cover

Rear of Computer

Rear Panel Screw
(Do Not Remove)
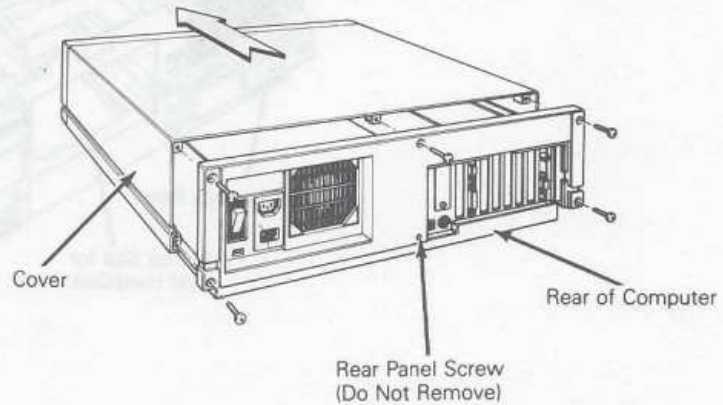
Before continuing, refer to Figure R9-4 to orient yourself to the location of the components inside the computer. (Depending on the model and configuration you have, your computer may differ in appearance from Figure R9-4. It may contain more boards in the expansion slots and/or more disk drives. Figure R9-4 shows the standard configuration with a single diskette drive and two boards—the disk-controller board and the serial/parallel board.)

Figure R9-4 Inside the Computer

Disk-Controller Board

Serial/Parallel Board

Power Connectors

Drive Connector Cables

8 I/O Expansion Slots

Power Supply Box

Display/Keylock Panel

Diskette Drive

Center Slot for
First Hard-Disk Drive

Drive-Cover Assembly

You are now ready to go on to the installation of any of the internal options. Installation instructions make up the remainder of this chapter in the following order:

• Adapter boards

• Disk drives

• A math coprocessor

Adapter Boards

The term *adapter board* (or *adapter card*) covers a wide range of printed circuit boards (PCBs) with a variety of functions. Some of them are required for the operation of the computer (e.g., a display adapter board or disk-controller board), while others are expansions of the basic capabilities of the computer (e.g., add-on memory boards). Adapter boards, no matter what their purpose, are installed in the eight expansion slots inside the computer.

Following is a list of some of the available adapter boards:

• Display adapters for a monochrome or a color monitor

• A second serial/parallel interface board

• Memory upgrade boards

• Combination boards that combine several different functions on a single board

• Network or communications adapters

• Internal modems

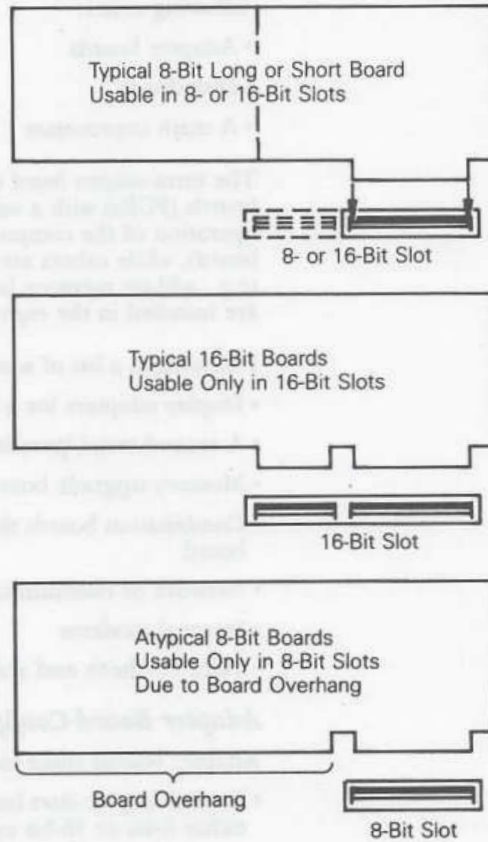• Voice synthesis and voice recognition boards

Adapter Board Configurations and Expansion Slots

Adapter boards come in four configurations (Figure R9-5):

• Typical *long* or *short* boards with 8-bit connectors that can be inserted into either 8-bit or 16-bit expansion slots

• Typical boards with 16-bit connectors that can be inserted only into 16-bit expansion slots

• Atypical 8-bit boards with a board overhang, which can be inserted only into 8-bit expansion slots

In order to accommodate these four configurations of adapter boards, the computer has six 16-bit slots (Nos. 2, 3, 4, 5, 6, and 8) and two 8-bit slots (Nos. 1 and 7).

Figure R9-5 Adapter Board Configurations and Expansion Slots

Typical 8-Bit Long or Short Board
Usable in 8- or 16-Bit Slots

8- or 16-Bit Slot

Typical 16-Bit Boards
Usable Only in 16-Bit Slots

16-Bit Slot

Atypical 8-Bit Boards
Usable Only in 8-Bit Slots
Due to Board Overhang

Board Overhang

8-Bit Slot

Installing an Adapter Board

■ **Note**–The steps in this section show the proper procedure for unwrapping and installing an adapter board. The particular board used in this example is a display adapter board, without which your monitor cannot function. With a few changes, you can follow the steps shown below to install any adapter board. The changes involve the setting of switches and jumpers as explained in the following:

• Display adapter boards and memory-expansion boards typically have switches on them that set the functionality of the boards.

• The display adapter switch on the main system board must be set in conformity with the display adapter board that is installed in the unit (Figure R9-6).

• The installation of a second serial/parallel board requires special jumper settings on that board (see "Installing Serial and Parallel Devices" in this Reference Guide).

Details about these switches and jumpers and any other installation instructions unique to the board that you are installing are included with the board.

■ **Note**–Before installing the adapter board, record all pertinent information regarding type of board and serial number, etc., in the "Record of Important Information" section of Chapter 1.

To install a display adapter board for use with a monitor:

1. **SET DISPLAY ADAPTER SWITCH.** Inside the computer, you will find the display adapter switch (Figure R9-6).

   ■ **Note**–Although instructions with your display adapter board will detail how this switch should be set, in general you can follow these guidelines: for monochrome displays without graphics, set it to MONO; for any graphics, color or mono, set it to COLOR.

2. **FIND EXPANSION SLOTS.** Refer to Figure R9-6 for the location of the eight expansion slots.

   ■ **Note**–An expansion slot has three parts: the actual slot (or connector) into which the edge connector on an adapter board is inserted; the plastic support bracket, or board guide, which stabilizes the board once it is installed; and the expansion-slot cover, which seals the slot opening when a slot is not in use.

*Figure R9-6 Display Adapter Switch and Expansion Slots*

Reference Guide
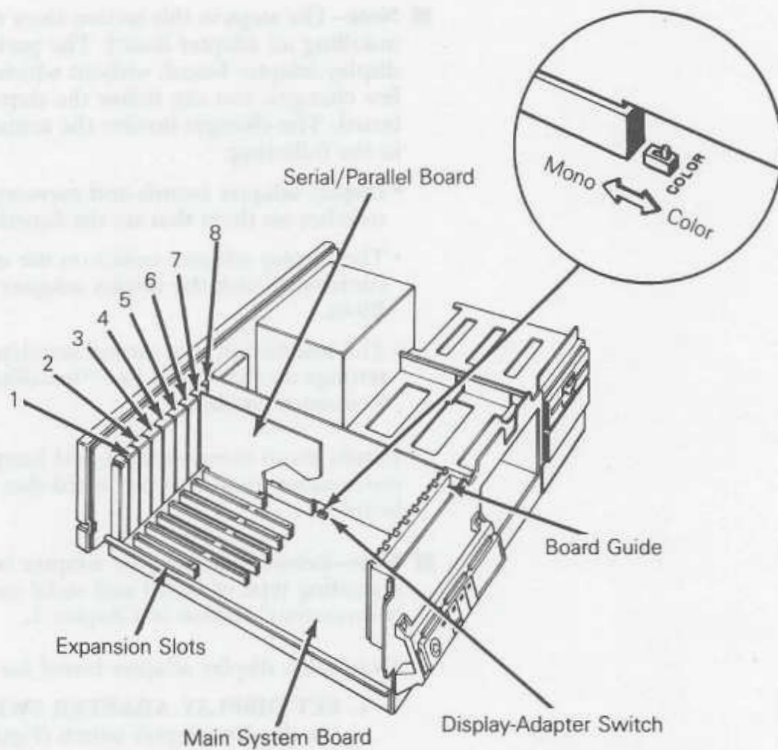
3. **REMOVE EXPANSION-SLOT COVER.** Choose a slot that conforms
with the type and configuration of your display board (see Figure R9-5).
Remove the cover from the slot by removing the screw that holds it in
place and lifting up on the cover (Figure R9-7). (You will need the screw
later in the installation, but not the cover.)

Figure R9-7 Removing the Slot Cover
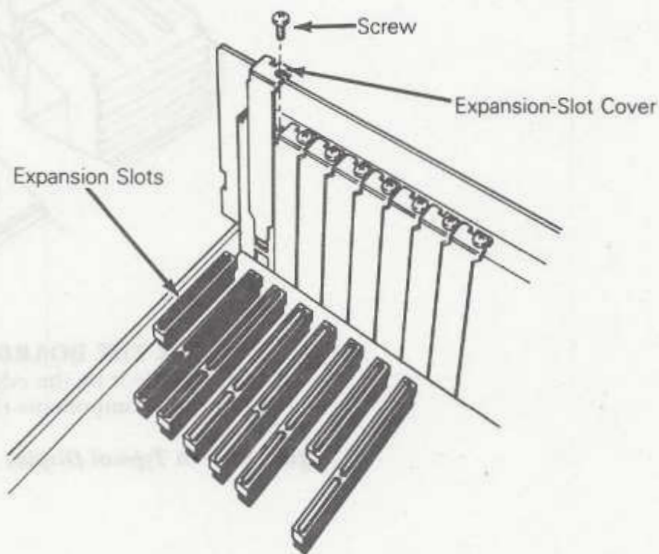
▼ **Caution**—Adapter boards are comprised of electrical components that are
sensitive to all kinds of electrical input, including static discharge.
Therefore, be very careful when you are handling them.

4. **DISCHARGE STATIC ELECTRICITY.** Adapter boards usually come
sealed in anti-static bags. To avoid the possibility of damaging the
adapter board, discharge any static electricity from your body before you
handle it by touching a metal portion of your computer with one hand,
while holding the adapter board in its bag in the other hand (Figure
R9-8).

Figure R9-8 Discharging Static Electricity

Metal Part

Adapter Board in
Anti-Static Bag
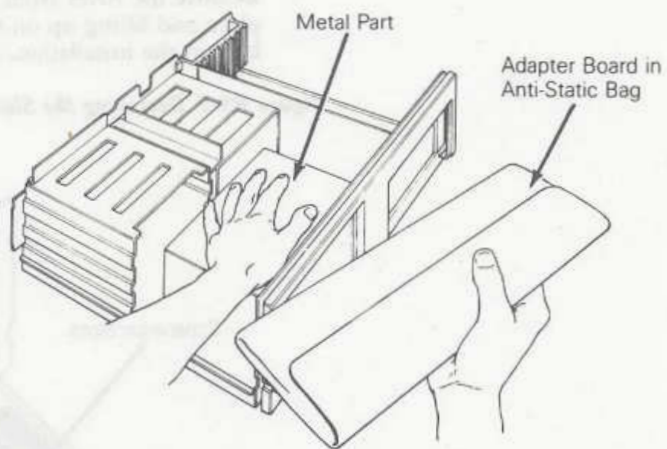
5. **REMOVE THE BOARD FROM THE BAG.** Take the board out of its
bag. Handle it by the edges and avoid touching the edge connectors or
any of the components (Figure R9-9).

Figure R9-9 A Typical Display Adapter Board

Jumpers

Adapter Cover Plate

I/O Connector
(To Monitor)

Components
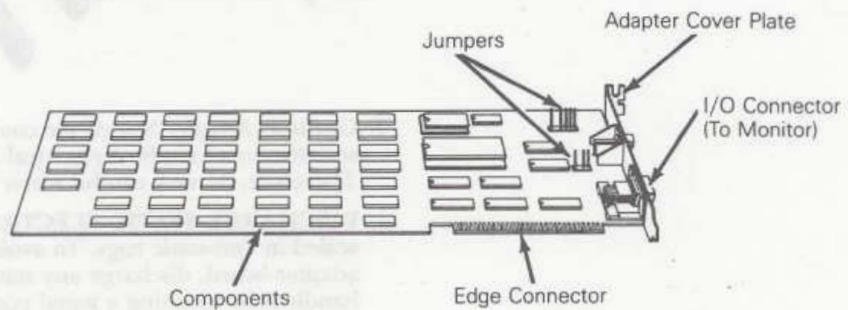
Edge Connector

6. **ALIGN THE BOARD IN PLACE.** Holding the board by the top edge or the two upper corners, align the board so that its edge connector is pointed down toward the expansion slot and the end of the board that's opposite the adapter cover plate is started into the plastic board guide.

7. **INSTALL THE BOARD.** Gently but firmly press the board down so that the edge connector on the board slides into the slot connector (Figure R9-10).

Figure R9-10 Installing the Board
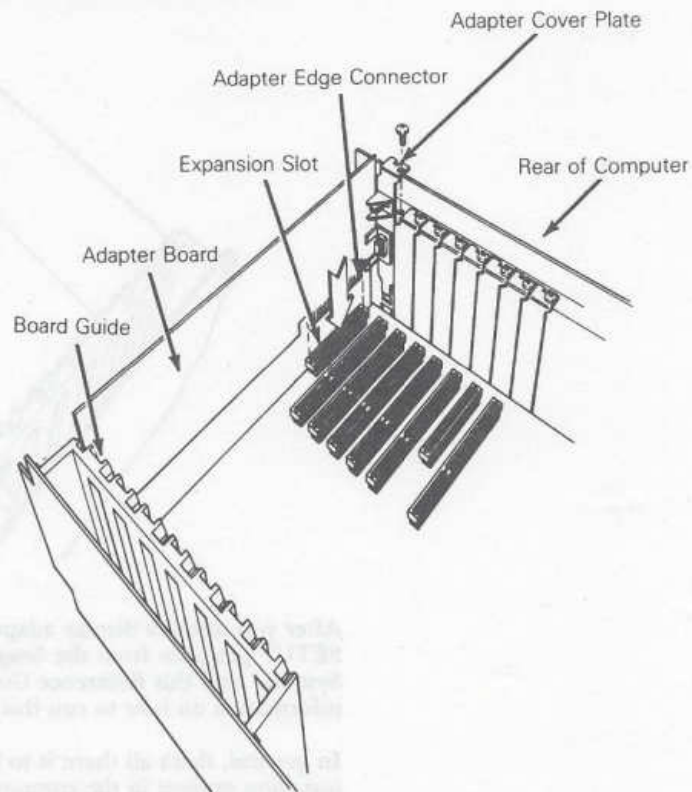
8. **STABILIZE THE BOARD.** Reinsert the screw you removed and saved in step 3 and tighten it until the board is stabilized (Figure R9-11).

Figure R9-11 Stabilizing the Board
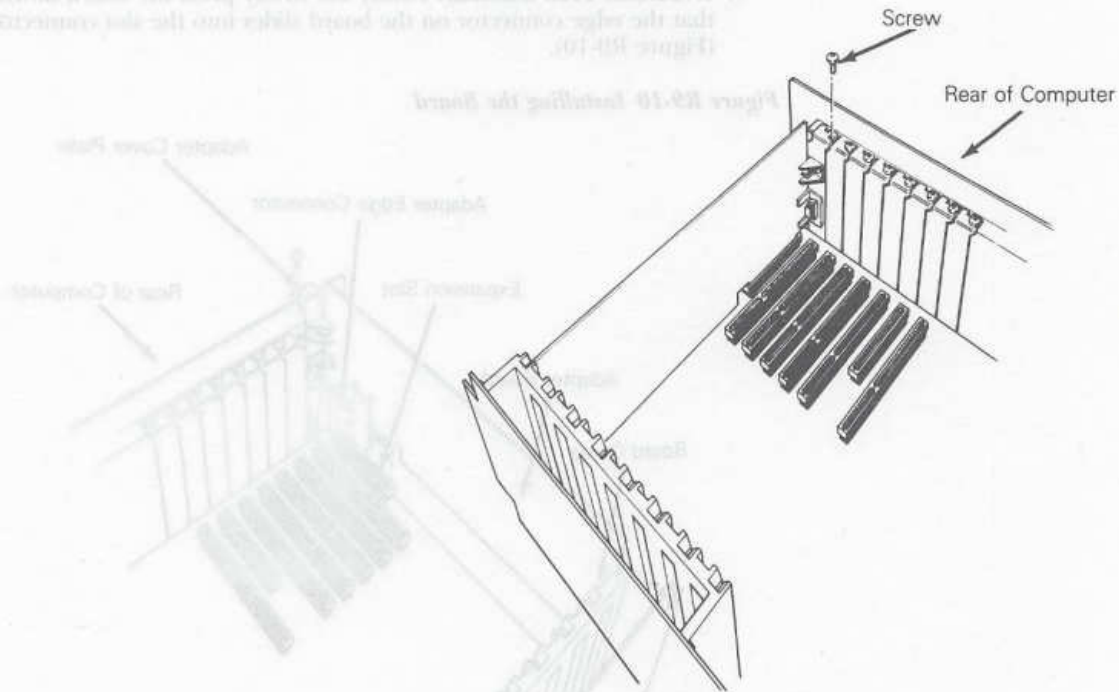
After you install a display adapter board in the computer, you must run the SETUP program from the *Setup and Test Diskette*. (See Chapter 5, "Starting the System," and this Reference Guide under "The SETUP Program" for information on how to run this program.)

In general, that's all there is to installing an adapter board. If you're finished installing options in the computer, follow the instructions that are included at the end of this chapter to replace the computer's cover.

■ **Note**—To complete the installation procedure, after you have replaced the cover, connect the monitor video cable to the appropriate connector on the new adapter board.

Disk Drives

In its minimum configuration, the computer features a single disk drive, the 1.2MB high-density diskette drive. With the existing disk-controller board and expansion capabilities of the computer, you can add to this configuration one or two additional drives of any available storage capacity in any one of the following combinations:

• A second half-height diskette drive (drive B)

• A full-height hard-disk drive (drive C)

• A second half-height diskette drive (drive B) plus a full-height hard-disk drive (drive C)

• Two full-height hard-disk drives (drives C and D)

With the sets of instructions that follow you will be able to configure your system in any of these combinations.

Disk-Controller Board

In order to operate, the disk drives in your computer must be connected by ribbon cables to the *disk-controller board*. These ribbon cables are the *drive-connector* and *data* cables. (The data cables are the narrower of the two.) This section includes step-by-step instructions on how to connect these cables to your drive(s).

■ **Note**—All four ribbon cables have been factory-installed and plug into the disk-controller board in the following configurations (Figure R9-12):

• Drive-connector cable for drives A and B connects to J1

• Drive-connector cable for drives C and D connects to J5

• Data cable for drive C connects to J4

• Data cable for drive D connects to J3

Figure R9-12 Drive-Connector and Data Ribbon Cables
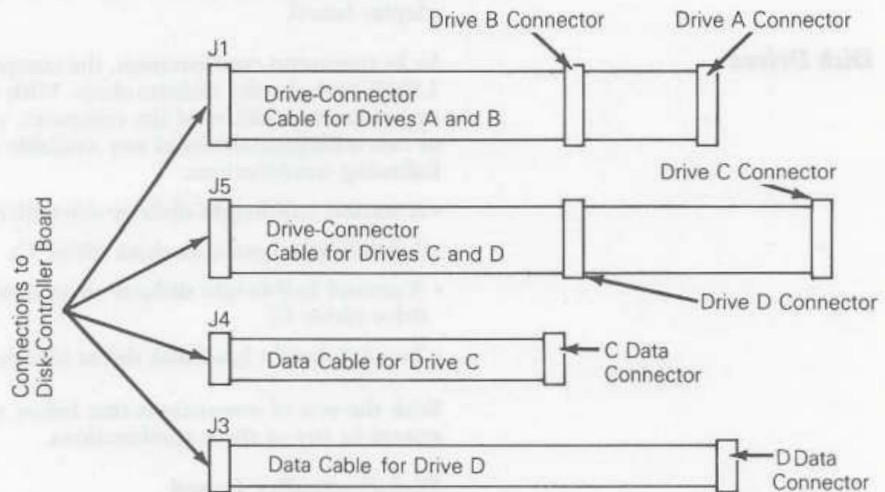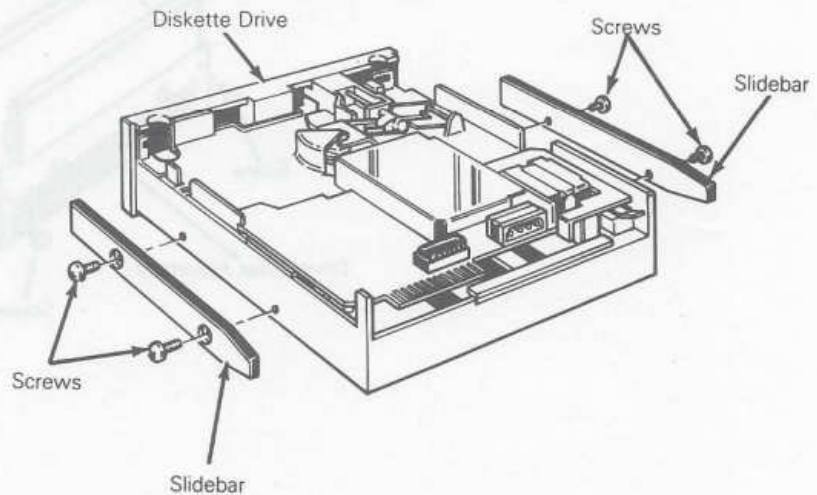

Installing the Second Diskette Drive

In this section you'll see how to install a second diskette drive below the existing diskette drive. But for one exception noted in the following steps, the installation procedure will be the same for any diskette drive that you choose to install in that slot.

▼ **Caution**—Before installing a second diskette drive, the following steps must be taken. Failure to perform them could result in the malfunctioning of and possible damage to your drive and computer.

• **CONFIRM DRIVE COMPATIBILITY AND SUPPORT.** Make sure the diskette drive you're going to install is IBM PC AT-compatible and that it is supported by this computer's manufacturer.

• **RECORD DRIVE TYPE.** Record the drive type and serial number in the "Record of Important Information" section of Chapter 1. (You'll need this number when you run the SETUP program to reconfigure the computer.)

• **REMOVE TERMINATING RESISTOR.** Diskette drives are shipped with a terminating resistor attached. If a drive is to be installed as a second diskette drive (drive B), the terminating resistor must be removed before installation. This resistor is usually a black, white, or blue chip, and it can be removed with a small flat-blade screwdriver. (Its location should be documented in the installation instructions that accompany the drive.)

• **SET JUMPERS.** The drive-select jumpers on the diskette drives must be set to DS2. This is done by removing the plastic jumper covers from all the select pins except pin DS2. (The location of these jumpers and any other jumpers unique to your drive should be documented in the installation instructions that accompany the drive.)

• **INSTALL SLIDEBARS.** If IBM PC AT-compatible slidebars are not installed on the drive, install them (Figure R9-13). The slidebars suspend the drive in place, preventing it from contacting the computer chassis. If the metal components of the drive and the computer come in contact, electrical damage to the drive may occur.

Figure R9-13 Installing Slidebars to Diskette Drive

To install a second diskette drive:

1. **REMOVE DRIVE-COVER ASSEMBLY.** With a No. 2 Phillips screwdriver, remove the two screws holding the drive-cover assembly in place (Figure R9-14). Save the screws because you will need them in step 10.

Figure R9-14 Removing the Drive-Cover Assembly
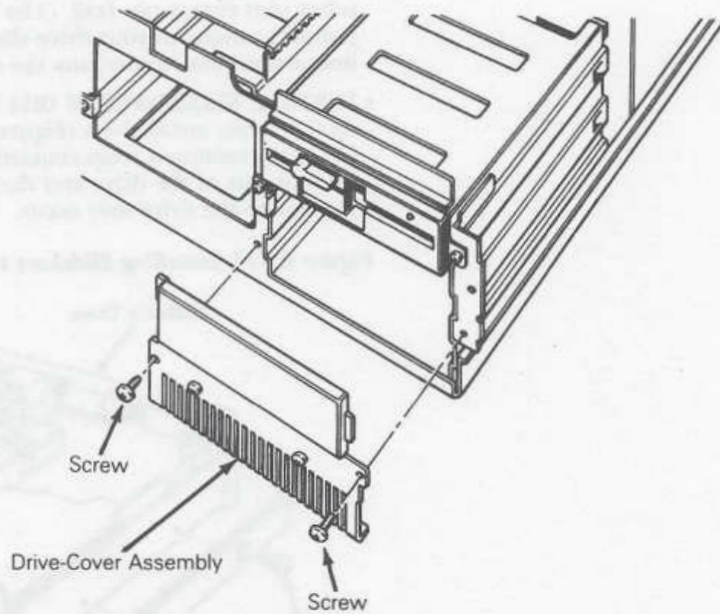
Screw

Drive-Cover Assembly

Screw

Reference Guide

2. **REMOVE SCREWS AND MOUNTING CLIPS.** Two screws and two mounting clips secure the existing diskette drive in place. Below the left-hand screw and mounting clip is a third screw and a double mounting clip. Remove all these screws and clips (Figure R9-15).

Figure R9-15 Removing Screws and Mounting Clips

Lefthand Screw and Clip

Third Screw and Double Clip

Righthand Screw and Clip

Diskette Drive (Drive A)
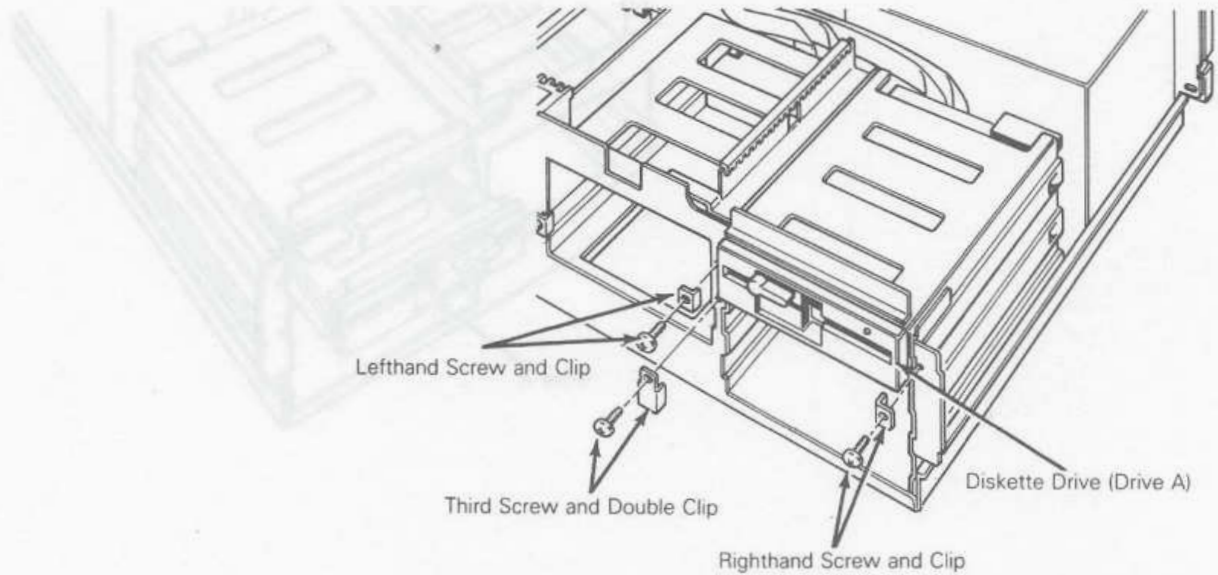
3. **PULL OUT DRIVE A.** Without unplugging any of its connectors, gently pull drive A one-third of the way out of its slot so that the area behind the drive slots is exposed (Figure R9-16). (With the mounting clips removed, it will pull out easily.)

Figure R9-16 Pulling Out Drive A

Drive A

Reference Guide
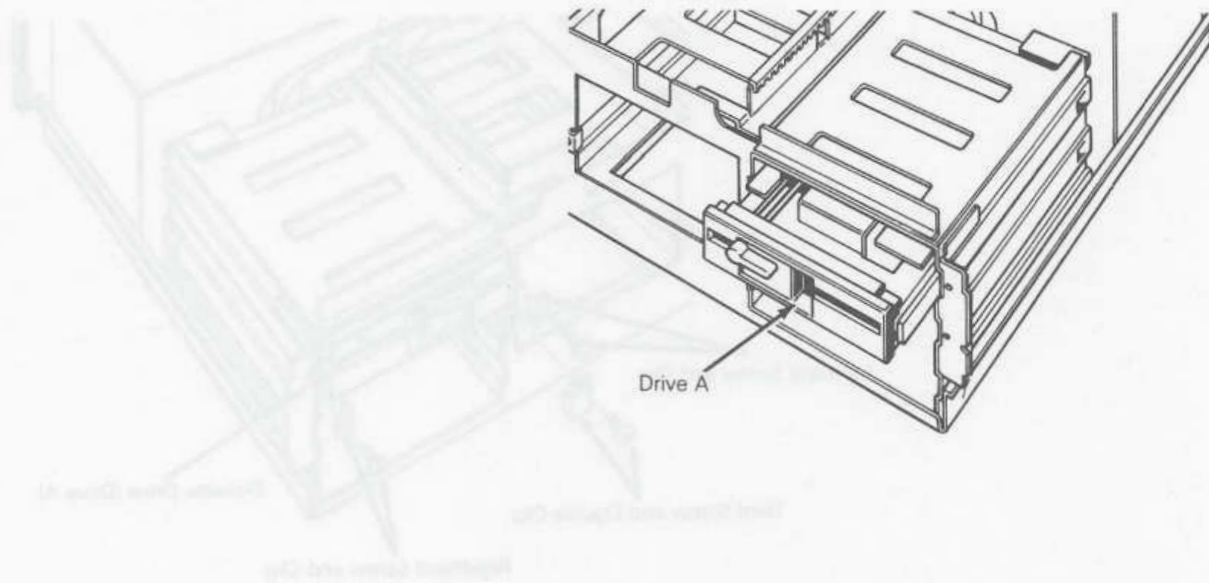
4. **SLIDE IN DRIVE B.** Align the slidebars on drive B with the appropriate pair of sliderails in the slot. (For a half-height drive, this would be the upper sliderails and for a full-height drive, the lower.) Slide the drive into the slot and arrange it relative to drive A so that you will have easy access to the connectors on its rear (Figure R9-17).

Figure R9-17 Putting Drive B in Place
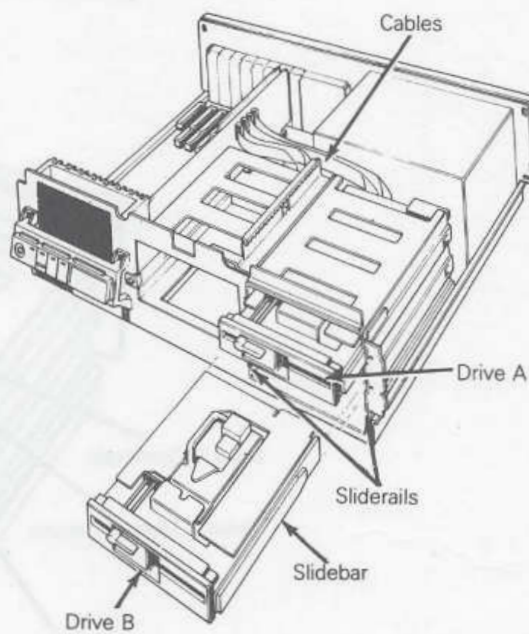
5. **ATTACH DRIVE CONNECTOR B.** In the space behind the drives are several ribbon cables with connectors attached to them. Find the connector labeled "B" and attach it to the male connector on the rear of drive B as shown in Figure R9-18. (This ribbon cable is connected to connector J1 on the disk-controller board.)

Figure R9-18 Drive B Cable Connection
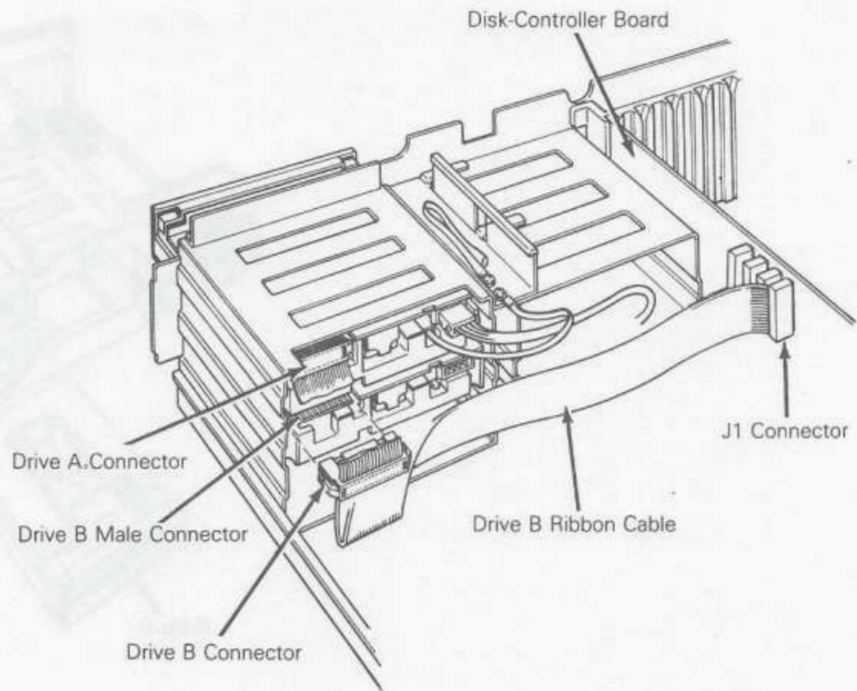
6. **ATTACH POWER CONNECTOR P32.** Several 4-wired connectors extend out of the power-supply box. Find the one marked P32 and connect it to drive B as shown in Figure R9-19. (Note that the connector is keyed so it can only be connected one way.)

7. **ATTACH GROUND WIRE.** You will find three ground wires attached to the frame on top of the computer. Connect an available ground wire onto drive B by pressing it firmly onto the small lug at the rear of the drive (Figure R9-19).

Figure R9-19 Electrical Connections

Ground Wires

Drive A

Drive B

Connector (P32) from Power Supply

Ground Lug
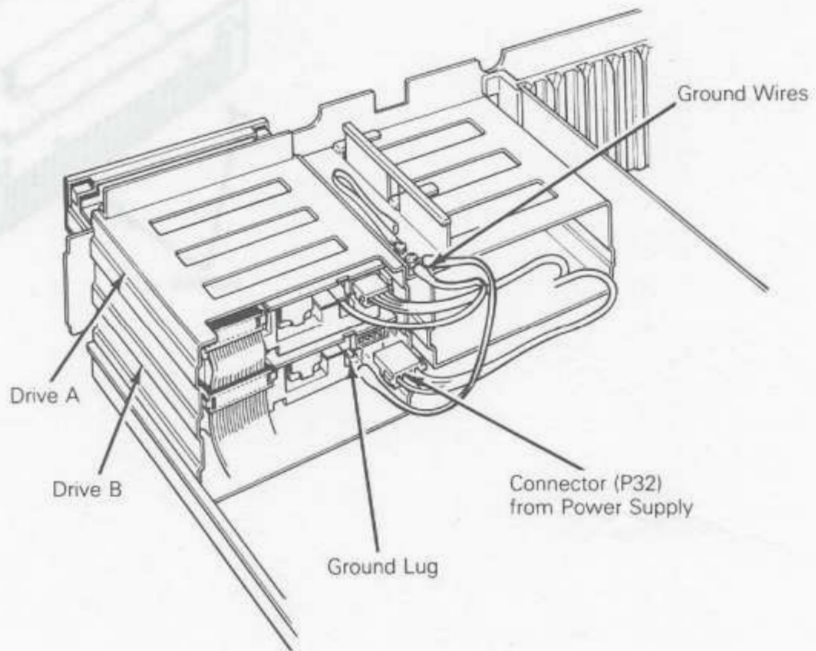
8. **SEPARATE DRIVE-COVER ASSEMBLY PANELS.** Separate the plastic drive-cover panel from the metal panel (Figure R9-20). You'll no longer need the two screws or the plastic drive-cover panel.

Figure R9-20 Separating the Drive-Cover Assembly Panels

Plastic Drive-Cover Panel

Metal Drive-Cover Panel
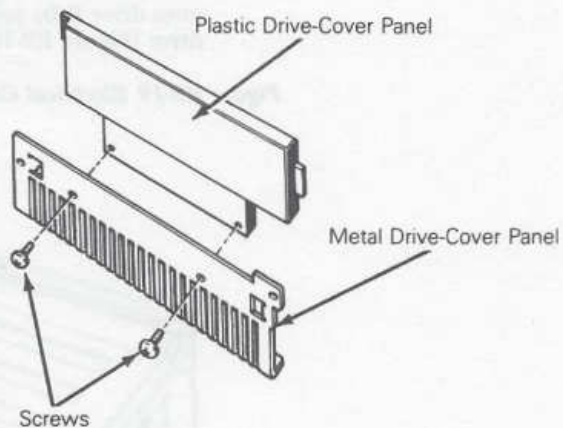
Screws

9. **REINSTALL MOUNTING CLIPS.** Slide the two drives into place and reinstall the mounting clips (noting the placement of the double clip). You will also need to install a fourth screw and mounting clip on the right-hand side of drive B (Figure R9-21). (The screw and clip were included in the accessory package that accompanied the computer.)

10. **REINSTALL METAL COVER PANEL.** Attach the metal panel portion of the drive-cover assembly to the front of the computer below the new drive (Figure R9-21), using the two screws you saved in step 1.

Figure R9-21 Replacing the Mounting Clips and Cover Panel
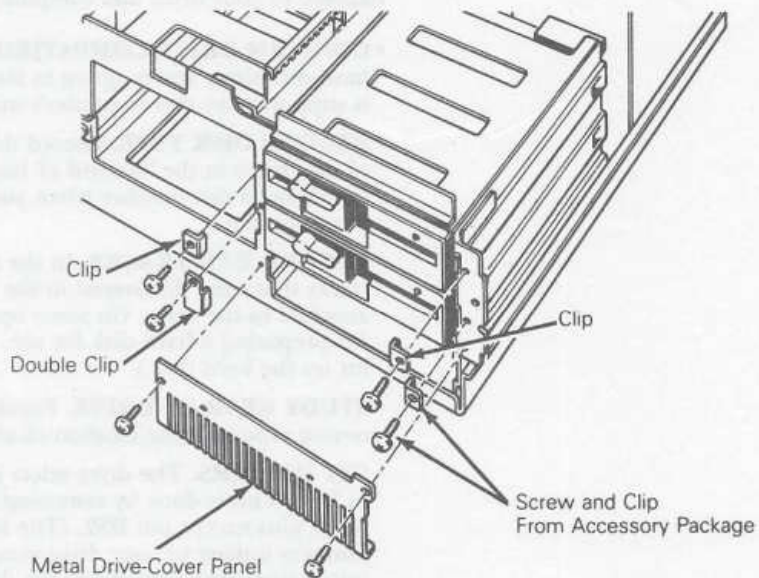
Clip

Clip

Double Clip

Screw and Clip From Accessory Package

Metal Drive-Cover Panel

If you're finished installing options in the computer, follow the instructions that are included at the end of this chapter to replace the computer cover.

■ **Note**–To complete the installation, after you have replaced the computer cover, run the SETUP program from the *Setup and Test Diskette*, entering the information relative to the new drive that you copied in the "Record of Important Information" section of Chapter 1.

Installing a Hard-Disk Drive in the Center Slot

Not only do you have a choice of hard-disk drives with different storage capacities, but the computer includes two places where they can be installed. One hard disk can be concealed behind the front panel in the center of the machine, a location that is standard for the first hard-disk drive (drive C). Another hard disk can go in the space just below the diskette drive (in place of drive B). This second drive is designated drive D. In this section, we will cover the installation of a hard-disk drive in the standard drive C location.

▼ **Caution**—The following steps must be taken before you install a hard-disk drive. Failure to perform these steps could result in the malfunction of and possible damage to your drive and computer.

- **CONFIRM DRIVE COMPATIBILITY AND SUPPORT.** Make sure the hard-disk drive you're going to install is IBM PC AT-compatible and that it is supported by this computer's manufacturer.

- **RECORD DISK TYPE.** Record the drive's type number (found on the front of the drive) in the "Record of Important Information" section of Chapter 1. (You'll need this number when you run the SETUP program to reconfigure the computer.)

- **RECORD BAD TRACKS.** In the same section, record the listing of bad tracks that were discovered in the factory. This can be be found on a label attached to the drive. (In some operating systems, as part of the procedure for preparing a hard disk for use, you'll enter these bad tracks in a bad-track list on the hard disk.)

- **STUDY REAR OF DRIVE.** Familiarize yourself with the rear of the drive, noting especially the location of all the connectors (Figure R9-22).

- **SET JUMPERS.** The drive-select jumpers on the hard-disk drive must be set to DS2. This is done by removing the plastic jumper covers from all the select pins except pin DS2. (The location of these jumpers and any other jumpers unique to your drive should be documented in the installation instructions that accompany the drive.)

- **INSTALL SLIDEBARS.** If IBM PC AT-compatible slidebars are not installed on the drive, install them (Figure R9-23). The slidebars suspend the drive in place, preventing it from contacting the computer chassis. If the metal components of the drive and the computer come in contact, electrical damage to the drive may occur.

- **REMOVE FRONT DRIVE PANEL.** If the drive you're going to install has a cosmetic front panel (an example is shown in Figure R9-23), remove that panel. It's not needed because the drive is internal.

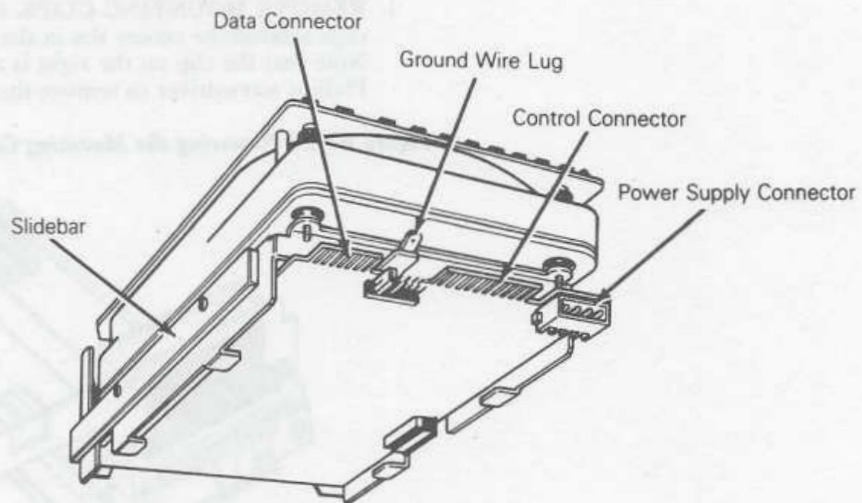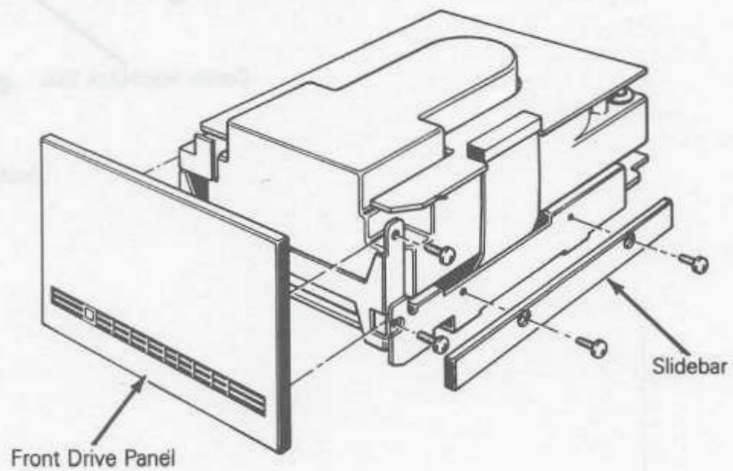**Figure R9-22 Rear of a Typical Hard-Disk Drive**

Figure R9-23 Hard-Disk Drive Front Panel and Slidebars

To install the first hard-disk drive:

1. **REMOVE MOUNTING CLIPS.** Remove the two screws and mounting
   clips around the center slot in the front of the computer (Figure R9-24).
   Note that the clip on the right is a double clip. (You may need a #1
   Phillips screwdriver to remove the screw on the left.)

Figure R9-24 Removing the Mounting Clips

Clip

Center Hard-Disk Slot

Double Clip
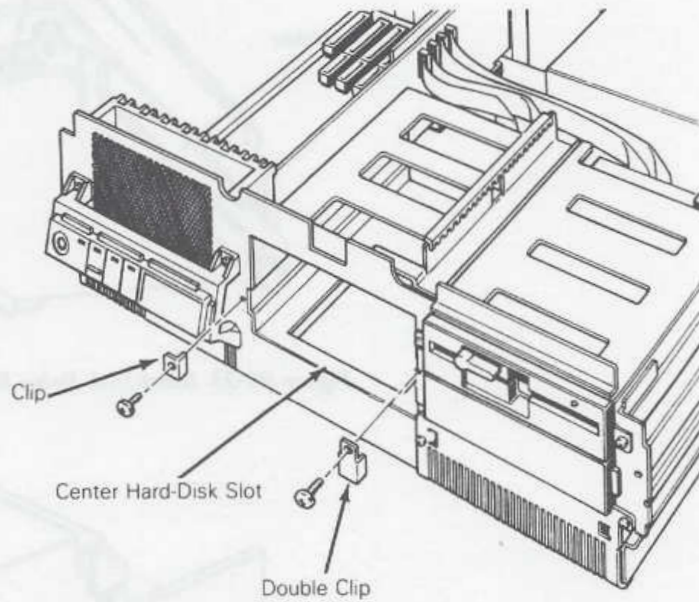
2. **SLIDE DRIVE INTO OPENING.** Align the slidebars on the drive with the sliderails in the opening in the computer and slide the drive into the opening until only 2 to 3 inches protrude from the front of the computer (Figure R9-25).

Figure R9-25 Installing the Hard-Disk Drive

First Hard-Disk Drive

Slidebars
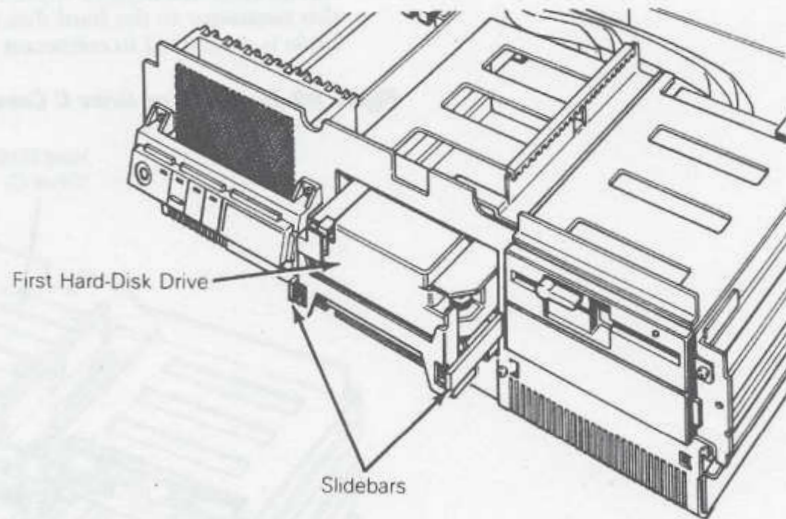
3. **ATTACH DRIVE CONNECTOR C.** In the space behind the drives are some ribbon cables with connectors attached. Two of these connecters are labeled "C." Find the wider of the two connectors and attach it to the hard disk as shown in Figure R9-26. (This ribbon cable is connected to connector J5 on the disk-controller board.)

4. **CONNECT DATA-CABLE CONNECTOR.** The narrower of the two ribbon-cable connectors labeled "C" is the data-cable connector. Attach this connector to the hard disk as shown in Figure R9-26. (This ribbon cable is connected to connector J4 on the disk-controller board.)

Figure R9-26 Attaching Drive C Connectors
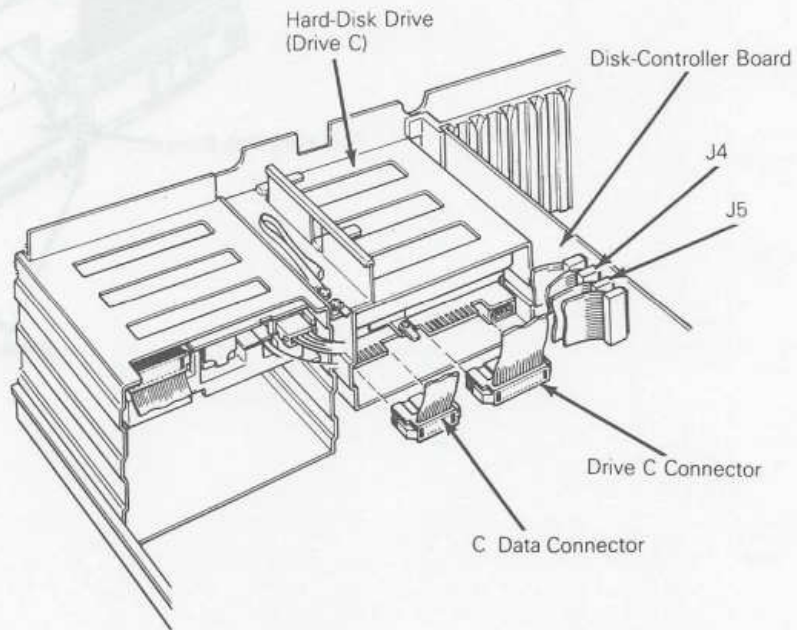
5. **ATTACH POWER CONNECTOR P30.** Several 4-wire connectors protrude from the power supply box. Find the one marked P30 and connect it to drive C as shown in Figure 6-27. (Note that the connector is keyed so it can only be connected in one way.)

6. **ATTACH GROUND WIRE.** Attached to the frame on top of the computer are three ground wires. Connect an available one to the ground lug on drive C (Figure R9-27).

Figure R9-27 Electrical Connections

Hard Disk Drive
(Drive C)

Ground Wires

Connector (P30)
from Power Supply

Drive A

Ground Lug
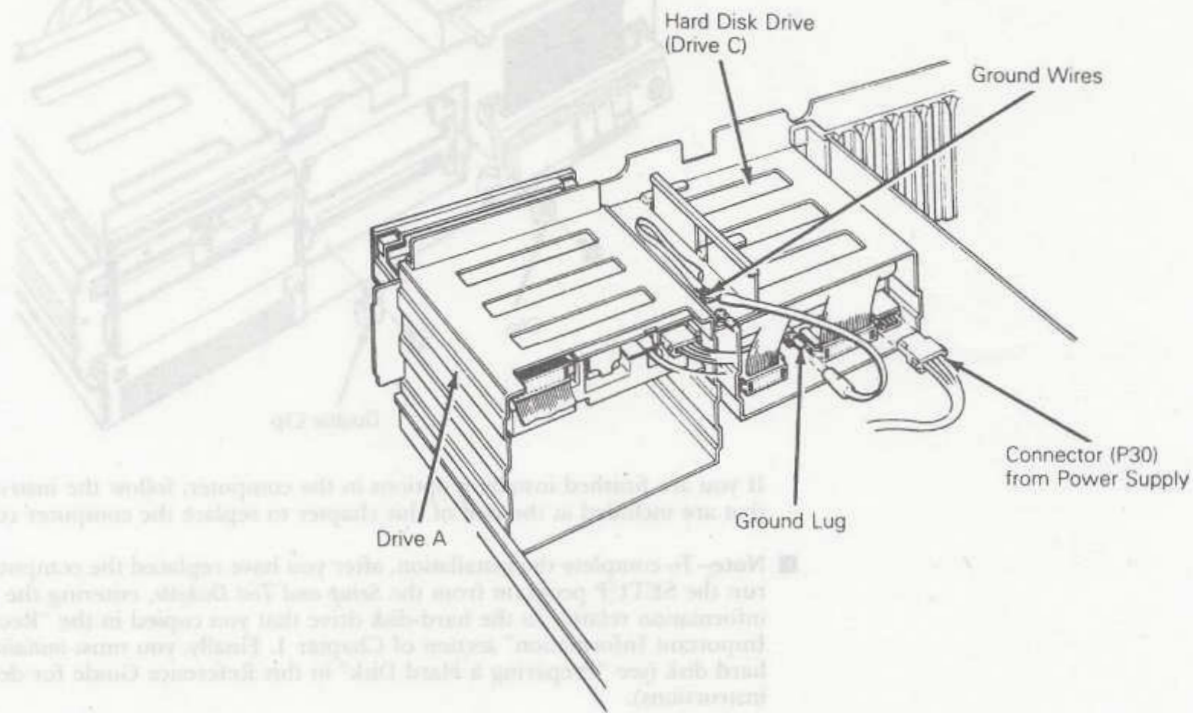
7. **REINSTALL MOUNTING CLIPS.** Slide the drive into place in the computer and reinstall the mounting clips (Figure R9-28). (Be sure that the double clip is in the correct place.)

Figure R9-28 Reinstalling Mounting Clips
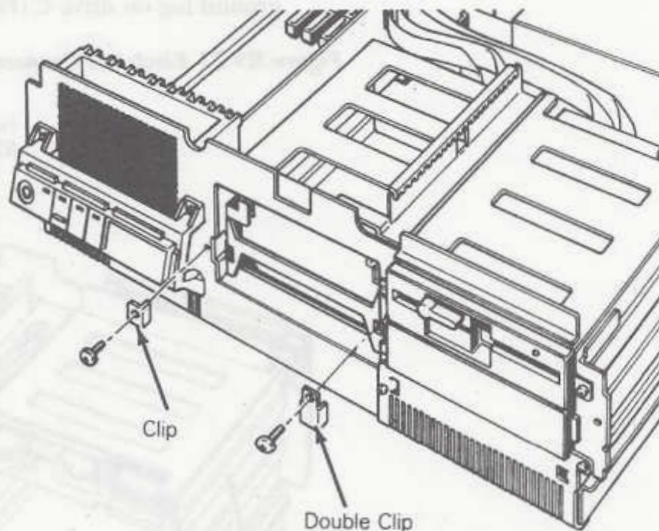
Clip

Double Clip

If you are finished installing options in the computer, follow the instructions that are included at the end of this chapter to replace the computer cover.

■ **Note**—To complete the installation, after you have replaced the computer cover, run the SETUP program from the *Setup and Test Diskette*, entering the information relative to the hard-disk drive that you copied in the "Record of Important Information" section of Chapter 1. Finally, you must *initialize* the hard disk (see "Preparing a Hard Disk" in this Reference Guide for detailed instructions).

Installing a Hard-Disk Drive in the Right-Hand Slot

The computer can support two hard-disk drives. The previous section covered the installation of the first hard-disk drive. In this section you will see how to install a second hard-disk drive in the space below the diskette drive in the standard configuration. In standard system configurations, the hard-disk drive hidden behind the computer front panel is drive C; the hard-disk drive below the diskette drive is drive D.

▼ **Caution**—The following steps must be taken before you install a second hard-disk drive. Failure to perform these steps could result in the malfunction of and possible damage to your drive and computer.

- **CONFIRM DRIVE COMPATIBILITY AND SUPPORT.** Make sure the hard-disk drive you're going to install is IBM PC AT-compatible and that it is supported by this computer's manufacturer.

- **RECORD DISK TYPE.** Record the drive's type number (found on the front of the drive) in the "Record of Important Information" section of Chapter 1. (You will need this number when you run the SETUP program to reconfigure the computer.)

- **RECORD BAD TRACKS.** In the same section, record the listing of bad tracks that were discovered in the factory. This can be be found on a label attached to the drive. (In some operating systems, as part of the procedure for preparing a hard disk for use, you'll enter these bad tracks in a bad-track list on the hard disk.)

- **STUDY REAR OF DRIVE.** Familiarize yourself with the rear of the drive, noting especially the location of all connectors (Figure R9-29).

Data Connector

Ground Wire Lug

Control Connector

Power Supply Connector

Slidebar
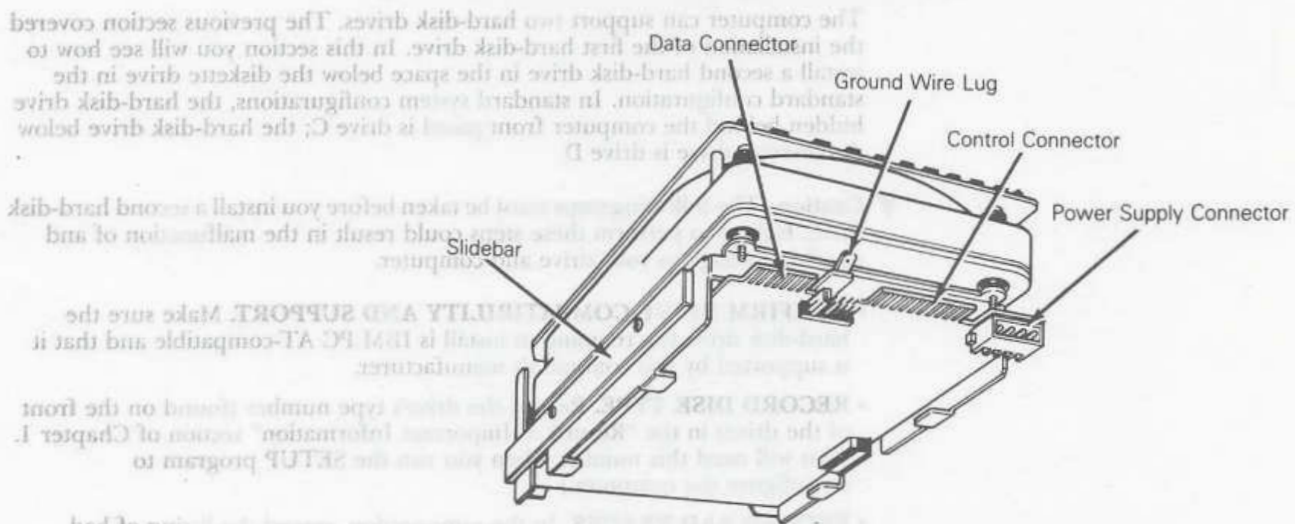
• **REMOVE TERMINATING RESISTOR.** Hard-disk drives are shipped with a terminating resistor attached. If a drive is to be installed as a second hard-disk drive (drive D), the terminating resistor must be removed before installation. This resistor is usually a black, white, or blue chip, and it can be removed with a small flat-blade screwdriver. (Its location should be documented in the installation instructions that accompany the drive.)

• **SET JUMPERS.** The drive-select jumpers on the hard-disk drives must be set to DS2. This is done by removing the plastic jumper covers from all the select pins except pin DS2. (The location of these jumpers and any other jumpers unique to your drive should be documented in the installation instructions that accompany the drive.) Failure to set the drive-select jumpers correctly may result in the loss of data on drive C during the initialization of drive D.

• **INSTALL SLIDEBARS.** If IBM PC AT-compatible slidebars are not installed on the drive, install them (Figure R9-30). The slidebars suspend the drive in place, preventing it from contacting the computer chassis. If the metal components of the drive and the computer come in contact, electrical damage to the drive may occur.

• **REMOVE FRONT DRIVE PANEL.** If the drive has a cosmetic front panel (an example is shown in Figure R9-30), remove that panel. It's not needed because the drive is internal.

Figure R9-30 Hard-Disk Drive Front Panel and Slidebars

Slidebar

Front Drive Panel
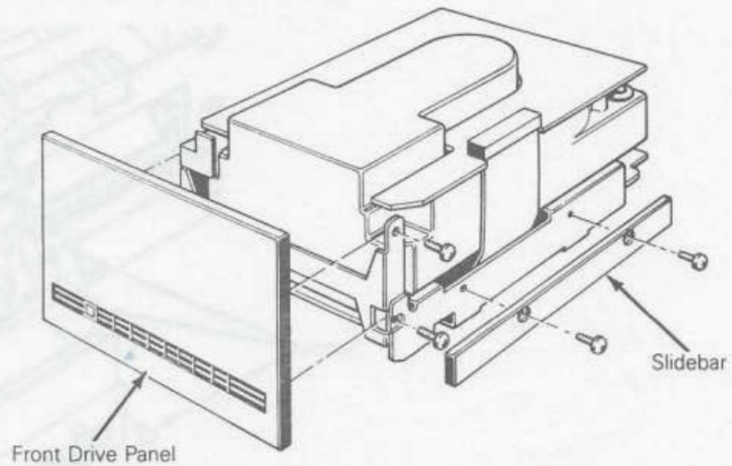
To install a second hard-disk drive:

1. **REMOVE DRIVE-COVER ASSEMBLY.** With a No. 2 Phillips screwdriver, remove the two screws holding the drive-cover assembly in place (Figure R9-31). Save the screws because you will need them in step 10.

2. **REMOVE SCREWS AND MOUNTING CLIPS.** Two screws and two mounting clips secure the existing diskette drive in place. Below the left-hand screw and mounting clip is a third screw and a double mounting clip. Remove all these screws and clips (Figure R9-31).

Figure R9-31 Removing the Drive-Cover Assembly, Screws, and Mounting Clips
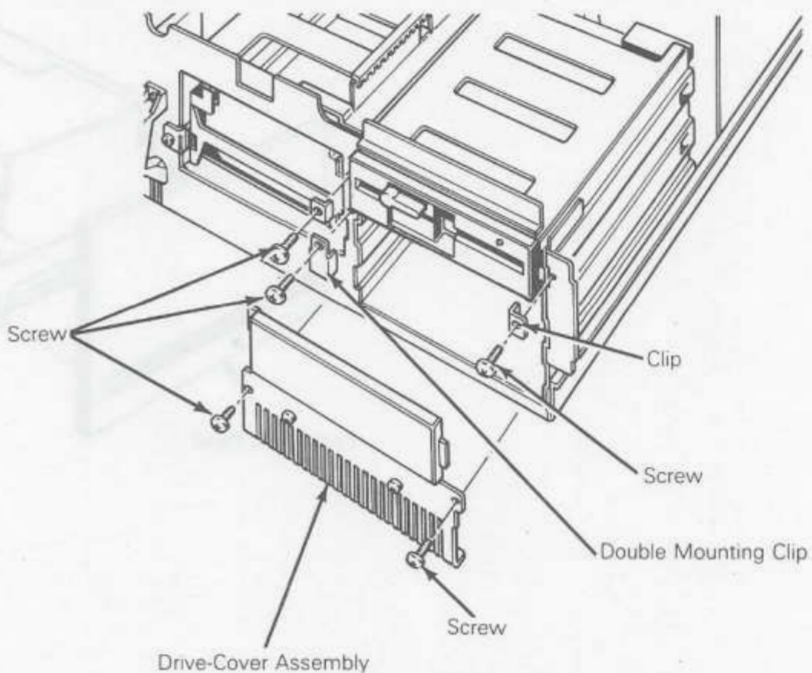
3. **PULL OUT DRIVE A.** Without unplugging any of its connectors, gently pull drive A a third of the way out of its slot so that the area behind the drive slots is exposed (Figure R9-32). (With the mounting clips removed, it will pull out easily.)

Figure R9-32 Pulling Out Drive A
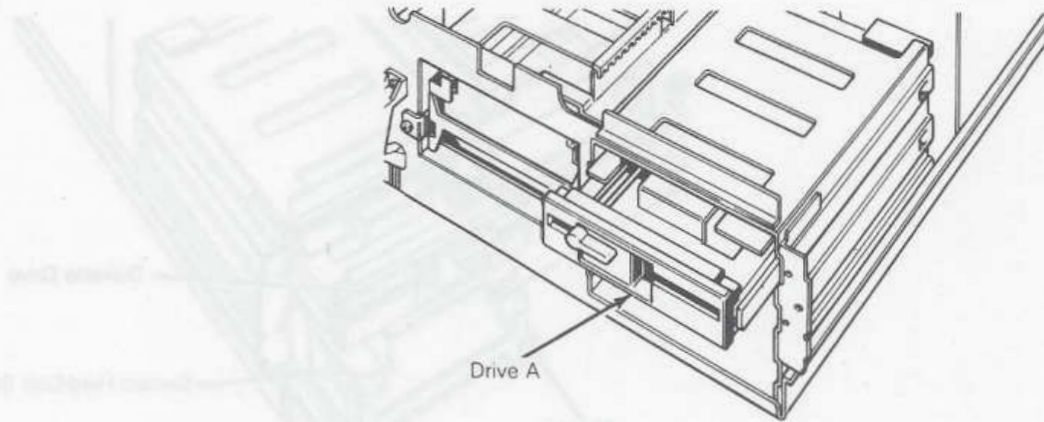
Drive A

4. **SLIDE IN THE HARD-DISK DRIVE.** Align the slidebars on the hard-disk drive with the appropriate pair of sliderails in the slot. Slide the drive into the slot and arrange it relative to drive A so that you will have easy access to the connectors behind it (Figure R9-32).

Figure R9-33 Putting the Second Hard-Disk Drive in Place

Diskette Drive

Second Hard-Disk Drive

Slidebar

Slidebar

Reference Guide
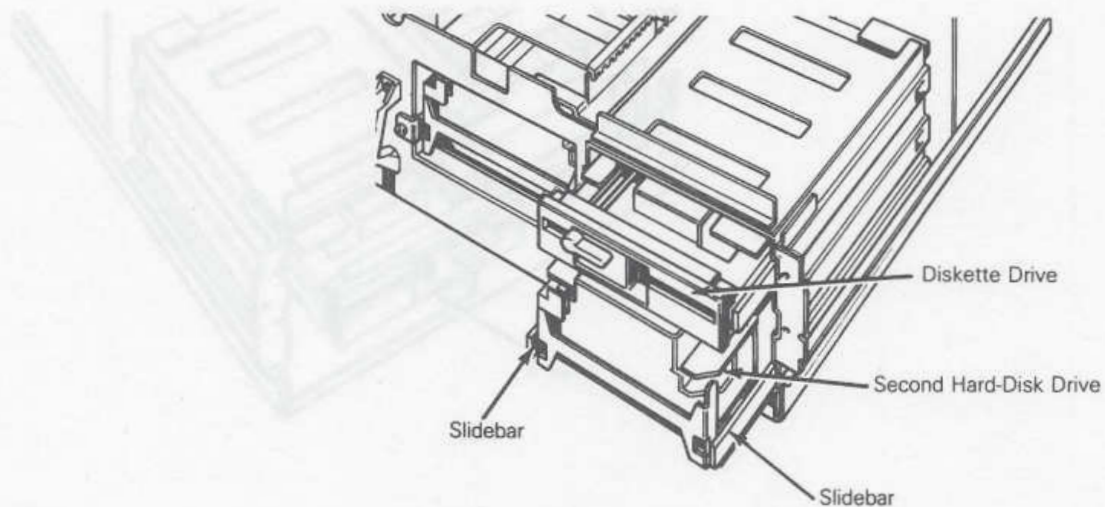
5. **ATTACH DRIVE CONNECTOR D.** In the space behind the drives are some ribbon cables with connectors attached. Two of these connecters are labeled "D." Find the wider of the two connectors and attach it to the hard disk as shown in Figure R4-34. (This ribbon cable is connected to connector J5 on the drive-controller board.)

6. **CONNECT DATA-CABLE CONNECTOR.** The narrower of the two ribbon-cable connectors labeled "D" is the data-cable connector. Attach this connector to the hard disk as shown in Figure R9-34. (This ribbon cable is connected to connector J3 on the disk-controller board.)

Figure R9-34 Attaching Drive D Connectors
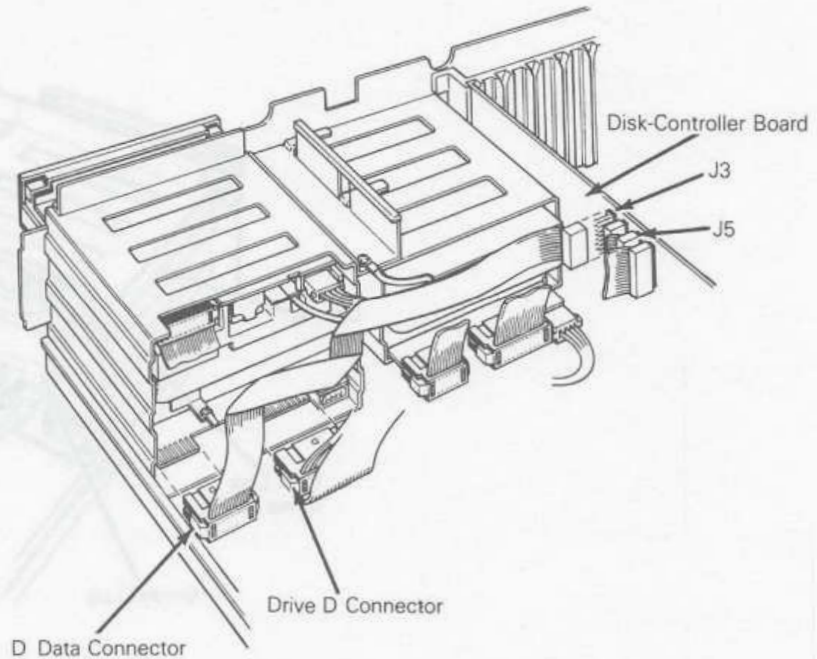
7. **ATTACH POWER CONNECTOR P32.** Several 4-wire connectors protrude from the power supply box. Find the one marked P32 and connect it to drive D as shown in Figure 6-35. (Note that the connector is keyed so it can only be connected in one way.

8. **ATTACH GROUND WIRE.** Attached to the frame on top of the computer are three ground wires. Connect an available one to the ground lug on drive D (Figure R9-35).

Figure R9-35 Electrical Connections

Drive A

Hard Disk
(Drive D)

Ground Wires

Connector (P32)
from Power Supply

Ground Lug
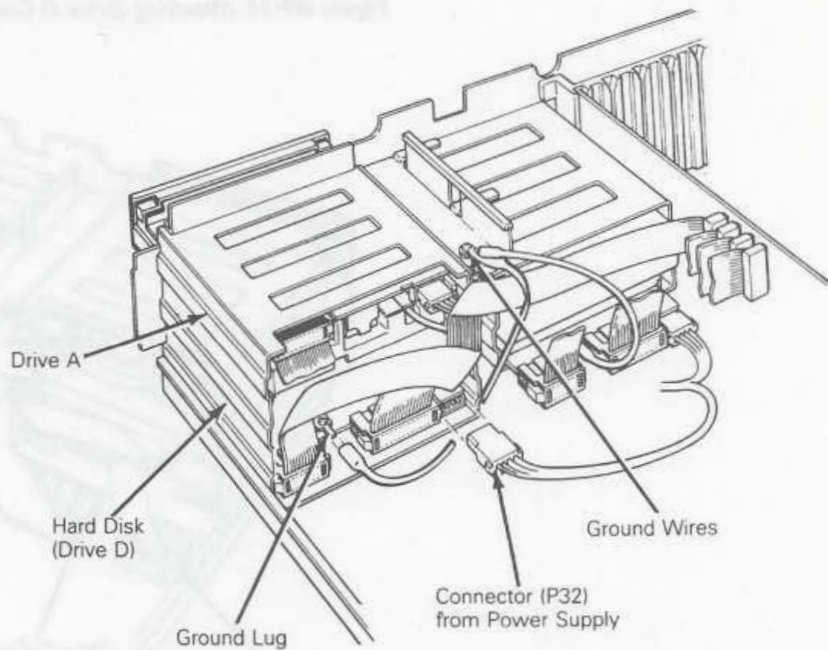
9. **REINSTALL MOUNTING CLIPS.** Slide drive D and drive A into place in the computer and reinstall the mounting clips (Figure R9-36). (Be sure that the double clip is in the correct place.) You'll also need to install a fourth screw and mounting clip, which were included in the accessory package that accompanied the computer.

10. **REINSTALL DRIVE-COVER ASSEMBLY.** Replace the drive-cover assembly (Figure R9-36).

Figure R9-36 Reinstalling Mounting Clips and Cover Plate
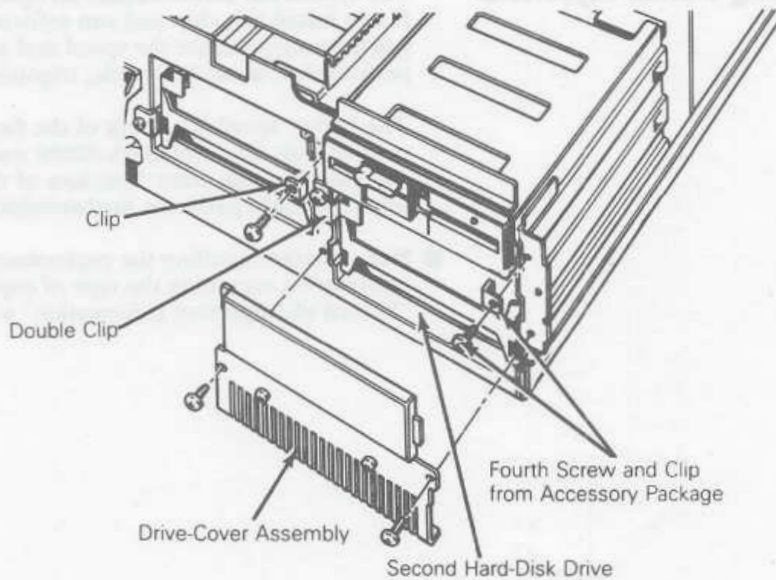
Clip

Double Clip

Fourth Screw and Clip
from Accessory Package

Drive-Cover Assembly

Second Hard-Disk Drive

If you are finished installing options in the computer, follow the instructions that are included at the end of this chapter to replace the computer cover.

■ **Note**–To complete the installation, after you have replaced the computer cover, run the SETUP program from the *Setup and Test Diskette,* entering the information relative to the hard-disk drive that you copied in the "Record of Important Information" section of Chapter 1. Finally, you must *initialize* the hard disk (see "Preparing a Hard Disk" in this Reference Guide for detailed instructions).

Installing a Math Coprocessor

The system can accommodate an optional Intel 80287 math coprocessor chip. If you install this chip and run software designed for the 80287 coprocessor, you'll greatly increase the speed and precision of your computer in the performance of all arithmetic, trigonometric, and logarithmic functions.

The higher speed is a result of the fact that the math coprocessor works in parallel with the computer's 80286 microprocessor. While the microprocessor controls all of the other functions of the computer, the coprocessor simultaneously performs mathematical functions.

■ **Note**–Before installing the coprocessor chip, record all identification information regarding the type of coprocessor, serial number, etc., in the "Record of Important Information" section of Chapter 1.

To install the math coprocessor chip:

1. **DISCHARGE STATIC ELECTRICITY.** The coprocessor chip is static-sensitive. To avoid the possibility of damaging the chip, you should reduce the static electricity in your body by maintaining contact with a metal portion of the computer while you are installing the chip.

2. **FIND THE COPROCESSOR SOCKET.** Refer to Figure R9-37 for the location of the socket for the coprocessor.

Figure R9-37 The Coprocessor Socket

Rear of Computer

Power Supply Box

Coprocessor Socket
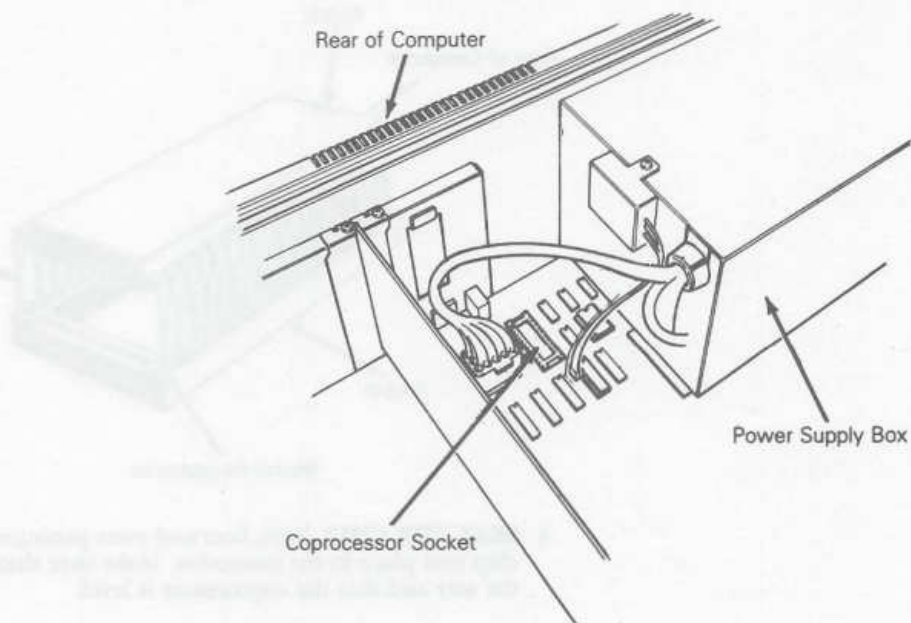
3. **ALIGN COPROCESSOR WITH SOCKET.** With the notch on the coprocessor facing toward the rear of the computer, align the pins on the coprocessor with the receptacles in the socket (Figure R9-38).

▼ **Caution**—The pins on the coprocessor are very fragile and they bend easily. Be particularly careful with them and make sure that they are all aligned at a 90 degree angle with their receptacles before going on to the next step.

Figure R9-38 Aligning the Coprocessor with Socket Receptacles
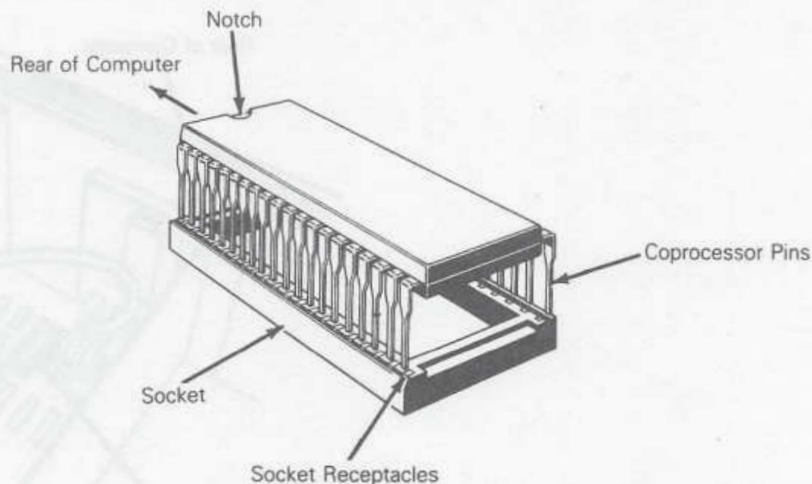
4. **SEAT THE CHIP.** With firm and even pressure, push the coprocessor chip into place in the connector. Make sure that the pins are inserted all the way and that the coprocessor is level.

Replacing the Cover

Before you put the cover back on the computer, make sure that you have gone through all of the necessary steps for the specific installation you require. The following are guidelines for making your final check:

• Have you recorded all the requested information in the "Record of Important Information" section of Chapter 1?

• Is the option firmly in place?

• If there are screws that hold the option in place, are they all tightly screwed down?

• Are all of the required cables and wires that connect the board to the computer firmly attached?

• If there are internal switch settings to be set or changed because of the installation of the new option, are they all in their new settings? (This does not apply to all options. If switch settings were required, the necessary information was included with the installation instructions for the option.)

• Are all of the cables and wires tucked down out of the way so that the cover will slide on easily?

• Are all loose screws and other extraneous objects removed from inside the computer.

If you have checked all of these items in the affirmative then you are ready to put the cover back on the computer.
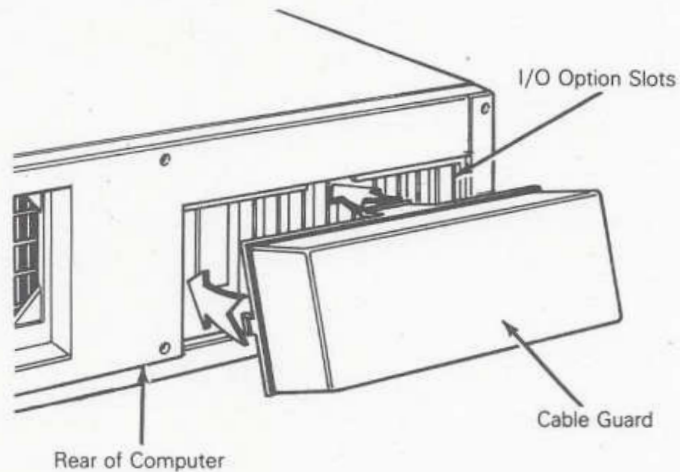
To replace the computer cover:

1. **SLIDE ON COVER.** Placing yourself in front of the computer, position the bottom edges of the cover under the rails on the sides of the computer. Slide the cover back until it reaches the rear panel (Figure R9-39).

2. **REINSTALL SCREWS.** Reinstall the five cover mounting screws (Figure R9-39).

*Figure R9-39 Installing the Cover and Returning Cover Screws*

Computer Cover

Rail

Rear of Computer
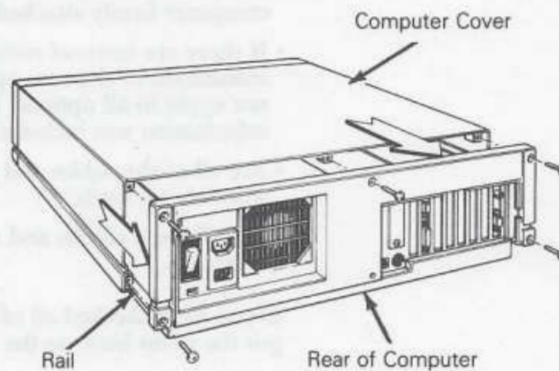
3. **CONNECT CABLES.** Reconnect all the cables that you disconnected when you removed the cover. Also, connect cables for any new option you may have installed, if applicable.

4. **REPLACE PLASTIC CABLE GUARD.** Clip the cable guard, the plastic enclosure that covers the option slots, back into place (Figure R9-40).

Figure R9-40 Replacing the Cable Guard

I/O Option Slots

Cable Guard

Rear of Computer
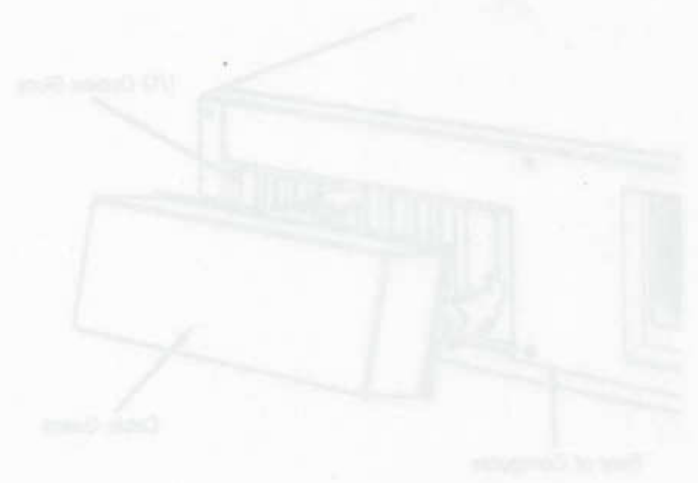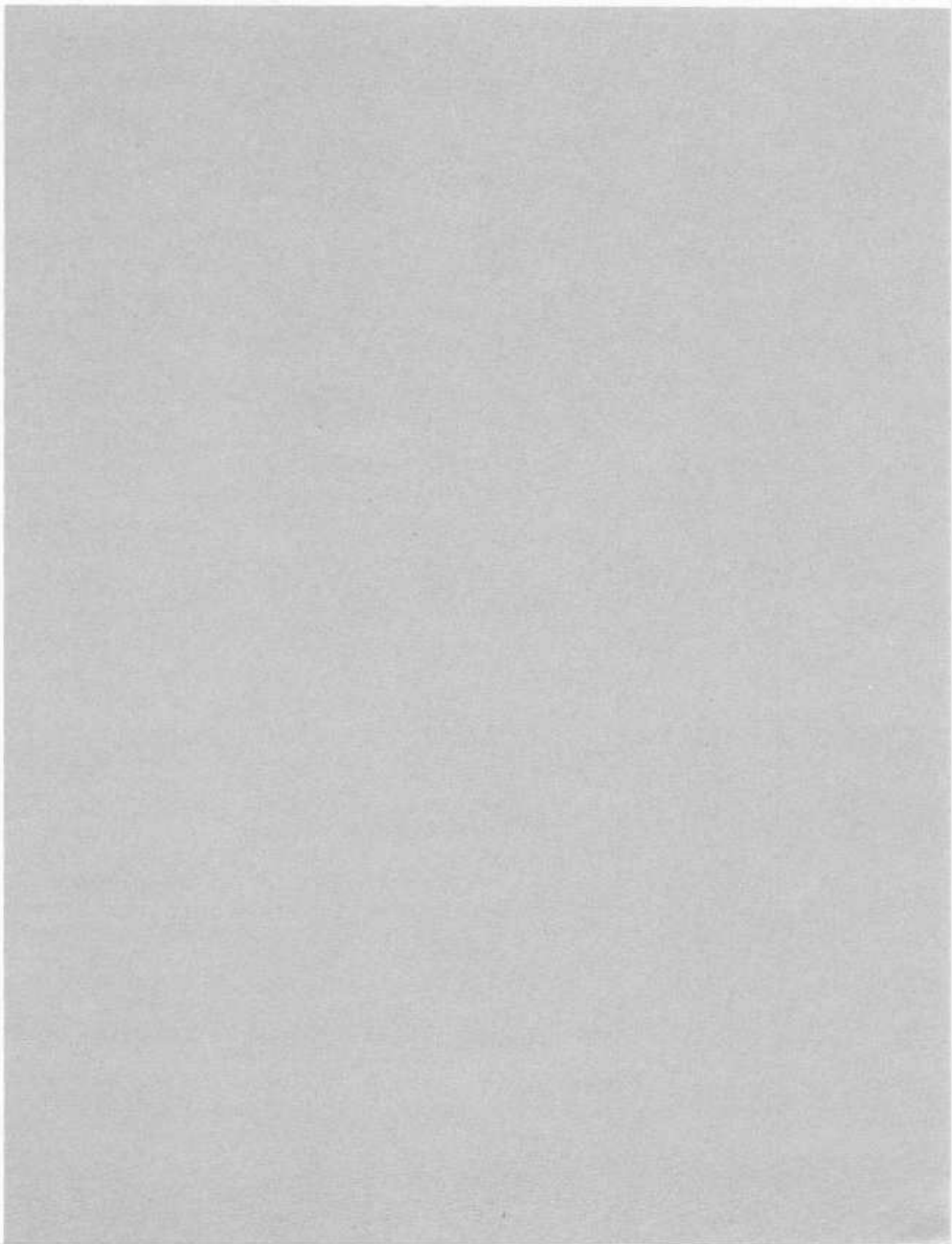
Appendixes

Appendix A—ASCII Character Codes

Table A-1 contains a list of all ASCII character codes, with decimal and hexadecimal conversions. The column headed "Graphic Character" lists all of the associated IBM graphic characters.

In GW-BASIC Text Mode, you can see the graphic characters on your monitor with the command

PRINT CHR$(n)

where n is the decimal equivalent of the ASCII code.

You can also enter any of these characters from the keyboard:

1. Press the ALT key.

2. Enter the three-character decimal value of the ASCII code on the numeric keypad.

Table A-2 lists the ASCII control character abbreviations and their meanings.

Table A-3 lists the extended codes and their meanings returned by the INKEY$ system variable.

Table A-1 ASCII Code Conversion Listing

ASCII Character	Decimal Value	Hex Value	Graphic Character	ASCII Character	Decimal Value	Hex Value	Graphic Character
NUL	000	00	(null)	EM	025	19	↓
SOH	001	01	☺	SUB	026	1A	→
STX	002	02	☻	ESC	027	1B	←
ETX	003	03	♥	FS	028	1C	∟
EOT	004	04	♦	GS	029	1D	↔
ENQ	005	05	♣	RS	030	1E	▲
ACK	006	06	♠	US	031	1F	▼
BEL	007	07	•	SP	032	20	(space)
BS	008	08	◘	!	033	21	!
HT	009	09	○	"	034	22	"
LF	010	0A	◙	#	035	23	#
VT	011	0B	♂	$	036	24	$
FF	012	0C	♀	%	037	25	%
CR	013	0D	♪	&	038	26	&
SO	014	0E	♫	' (apostrophe)	039	27	'
SI	015	0F	☼	(	040	28	(
DLE	016	10	►	)	041	29	)
DC1	017	11	◄	*	042	2A	*
DC2	018	12	↕	+	043	2B	+
DC3	019	13	‼	, (comma)	044	2C	,
DC4	020	14	¶	- (hyphen)	045	2D	-
NAK	021	15	§	. (period)	046	2E	.
SYN	022	16	▬	/	047	2F	/
ETB	023	17	↨	0	048	30	0
CAN	024	18	↑	1	049	31	1

ASCII Character	Decimal Value	Hex Value	Graphic Character	ASCII Character	Decimal Value	Hex Value	Graphic Character
2	050	32	2	K	075	4B	K
3	051	33	3	L	076	4C	L
4	052	34	4	M	077	4D	M
5	053	35	5	N	078	4E	N
6	054	36	6	O	079	4F	O
7	055	37	7	P	080	50	P
8	056	38	8	Q	081	51	Q
9	057	39	9	R	082	52	R
:	058	3A	:	S	083	53	S
;	059	3B	;	T	084	54	T
<	060	3C	<	U	085	55	U
=	061	3D	=	V	086	56	V
>	062	3E	>	W	087	57	W
?	063	3F	?	X	088	58	X
@	064	40	@	Y	089	59	Y
A	065	41	A	Z	090	5A	Z
B	066	42	B	[	091	5B	[
C	067	43	C	\	092	5C	\
D	068	44	D	]	093	5D	]
E	069	45	E	^	094	5E	^
F	070	46	F	_ (underline)	095	5F	_
G	071	47	G	`	096	60	`
H	072	48	H	a	097	61	a
I	073	49	I	b	098	62	b
J	074	4A	J	c	099	63	c

ASCII Character	Decimal Value	Hex Value	Graphic Character	ASCII Character	Decimal Value	Hex Value	Graphic Character
d	100	64	d	}	125	7D	}
e	101	65	e	~	126	7E	~
f	102	66	f	DEL	127	7F	Δ
g	103	67	g		128	80	Ç
h	104	68	h		129	81	ü
i	105	69	i		130	82	é
j	106	6A	j		131	83	â
k	107	6B	k		132	84	ä
l	108	6C	l		133	85	à
m	109	6D	m		134	86	å
n	110	6E	n		135	87	ç
o	111	6F	o		136	88	ê
p	112	70	p		137	89	ë
q	113	71	q		138	8A	è
r	114	72	r		139	8B	ï
s	115	73	s		140	8C	î
t	116	74	t		141	8D	ì
u	117	75	u		142	8E	Ä
v	118	76	v		143	8F	Å
w	119	77	w		144	90	É
x	120	78	x (underbar)		145	91	æ
y	121	79	y		146	92	Æ
z	122	7A	z		147	93	ô
{	123	7B	{		148	94	ö
¦	124	7C	¦		149	95	ò

ASCII Character	Decimal Value	Hex Value	Graphic Character	ASCII Character	Decimal Value	Hex Value	Graphic Character
	150	96	û		175	AF	»
	151	97	ù		176	B0	▒
	152	98	ÿ		177	B1	▒
	153	99	Ö		178	B2	▓
	154	9A	Ü		179	B3	│
	155	9B	¢		180	B4	┤
	156	9C	£		181	B5	╡
	157	9D	¥		182	B6	╢
	158	9E	Pt		183	B7	╖
	159	9F	ƒ		184	B8	╕
	160	A0	á		185	B9	╣
	161	A1	í		186	BA	║
	162	A2	ó		187	BB	╗
	163	A3	ú		188	BC	╝
	164	A4	ñ		189	BD	╜
	165	A5	Ñ		190	BE	╛
	166	A6	ª		191	BF	┐
	167	A7	º		192	C0	└
	168	A8	¿		193	C1	┴
	169	A9	⌐		194	C2	┬
	170	AA	¬		195	C3	├
	171	AB	½		196	C4	─
	172	AC	¼		197	C5	┼
	173	AD	¡		198	C6	╞
	174	AE	«		199	C7	╟

ASCII Character	Decimal Value	Hex Value	Graphic Character	ASCII Character	Decimal Value	Hex Value	Graphic Character
	200	C8	╚		225	E1	β
	201	C9	╔		226	E2	Γ
	202	CA	╩		227	E3	π
	203	CB	╦		228	E4	Σ
	204	CC	╠		229	E5	σ
	205	CD	═		230	E6	μ
	206	CE	╬		231	E7	τ
	207	CF	╧		232	E8	Φ
	208	D0	╨		233	E9	Θ
	209	D1	╤		234	EA	Ω
	210	D2	╥		235	EB	δ
	211	D3	╙		236	EC	∞
	212	D4	╘		237	ED	$\emptyset$
	213	D5	╒		238	EE	$\in$
	214	D6	╓		239	EF	$\cap$
	215	D7	╫		240	F0	$\equiv$
	216	D8	╪		241	F1	$\pm$
	217	D9	╜		242	F2	$\geq$
	218	DA	╓		243	F3	$\leq$
	219	DB	█		244	F4	$\int$
	220	DC	▄		245	F5	
	221	DD	▌		246	F6	$\div$
	222	DE	▐		247	F7	$\approx$
	223	DF	▀		248	F8	$\circ$
	224	E0	$\propto$		249	F9	●

ASCII Character	Decimal Value	Hex Value	Graphic Character	ASCII Character	Decimal Value	Hex Value	Graphic Character
	250	FA	●		253	FD	2
	251	FB	√‾		254	FE	▮
	252	FC	n		255	FF	(form feed)

Table A-2 ASCII Control Character Abbreviations

Control Character	Meaning	Control Character	Meaning
NUL	Null	DC1	Device control 1
SOH	Start of heading	DC2	Device control 2
STX	Start of text	DC3	Device control 3
ETX	End of text	DC4	Device control 4
EOT	End of transmission	NAK	Negative acknowledge
ENQ	Enquiry	SYN	Synchronous idle
ACK	Acknowledge	ETB	End of transmission
BEL	Bell	CAN	Cancel
BS	Backspace	EM	End of medium
HT	Horizontal tabulation	SUB	Substitute
LF	Line feed	ESC	Escape
VT	Vertical tabulation	FS	File separator
FF	Form feed	GS	Group separator
CR	Carriage return	RS	Record separator
SO	Shift out	US	Unit separator
SI	Shift in	SP	Space
DLE	Data link escape	DEL	Delete

Appendix B—Troubleshooting

Bootup

When I try to turn on the computer, nothing happens.

1. Check to see if the power cord is plugged into a live outlet and is pushed all the way into the AC receptacle on the rear of the computer.

2. Make sure that the voltage selection switch is set for the proper voltage.

The computer is on, but the monitor doesn't display a cursor or message.

1. Make sure monitor power is on.

2. Adjust the brightness by turning the brightness control knob clockwise.

3. Check the monitor power cord connection.

4. Check the video cable connection to the computer and the monitor.

5. Make sure that the display adapter is properly seated in the correct expansion slot.

6. Make sure that the switch on the main system board is set correctly, either to MONO or COLOR.

After booting up, I see the following message:

```
Invalid configuration information - please run SETUP
program
Strike the F1 key to continue
```

1. The system configuration information in the SETUP program is incorrect. Press F1 and run the SETUP program from the *Setup and Test Diskette* to correct parameters.

Main System

When I press keys on the keyboard, nothing happens.

1. Make sure that the system keylock is unlocked and that the keyboard is plugged into the computer.

2. Check the video cable connection to the computer and the monitor.

3. Be sure that you have correctly set the primary display type in the SETUP program. Also, if you have switched from a monochrome to a color monitor using the MODE command from MS-DOS, verify that the display power is on and that the color display option card is correctly installed.

When I try to move the cursor with the cursor movement keys, I only get numbers on the screen.

1. Check the LED labeled NUM LOCK on the LED panel of the keyboard. If it is on, press the NUM LOCK key once to turn it off. Then you can move the cursor with the cursor keys.

When I press the CAPS LOCK, NUM LOCK, and SCROLL LOCK keys, the status lights on the LED panel of the keyboard don't work.

1. Make sure that the keyboard is plugged into the computer.

I plugged my IBM-compatible keyboard into the correct socket on the computer but it still doesn't work.

1. Make sure that you don't have another keyboard plugged into the other socket at the same time. Only one keyboard at a time can be plugged in.

2. Be sure to reboot the system so it can identify the new keyboard.

The diskette drive that I installed won't work or it works incorrectly.

1. Run the SETUP program and select the proper diskette drive type.

2. Check that the cabling for the drive is correctly installed.

3. Make sure that the drive-select pins on the drive are set correctly.

4. Make sure you are using the correct media for the drive.

The hard-disk drive that I installed won't work or it works incorrectly.

1. Run the SETUP program and select the proper hard-disk drive type.

2. Check that the cabling for the drive is correctly installed.

3. Make sure that the drive-select pins on the drive are set correctly.

4. Review "Preparing a Hard Disk" in the Reference Guide of this manual to see if you did everything that is necessary to setup the hard disk.

When I press the dual-speed button the system speed doesn't change.

1. The button has probably been disabled in the SETUP program. (See Reference 7, "Dual-Speed Operation," in this manual.) You can use the MS-DOS SPEED command to temporarily change system speed or to enable the button.

I need to change the power voltage so I can use the computer in another country.

    1. The only change necessary is to the voltage selection switch. Refer to Chapter 3 in this manual for the location of this switch.

My unit feels hot.

    1. Check the location of your unit. It needs to have at least three inches of clearance on all sides.

Options **The image on the screen of my monitor flickers or wavers.**

    1. Secure the video cable connection to the computer and the monitor.

Can I install a second hard disk in my system?

    1. Yes, you can. Refer to Reference 9,"Installing Internal Options," in this manual.

I installed a 1MB RAM board in my system, but it only seems to recognize 640K of RAM.

    1. MS-DOS can only recognize up to 640K of RAM. The remaining memory is counted as expansion memory.

    2. Run SETUP program and set expansion memory appropriately.

I installed an 80287 math coprocessor in my system. Do I need to change any internal switches?

    1. No. However, you should run the coprocessor test to assure yourself that the chip is properly installed. This test can be found under the system checkout option on the *Setup and Test Diskette*.

My serial device (printer, modem, etc.) outputs garbled characters.

    1. Use the MODE command to set the baud rate, parity, etc. The baud rate and other transmission parameters assigned to the port must match the requirements of the device connected to that port.

    2. Secure the cable that connects the device to the computer.

    3. Refer to Reference 8, "Installing Serial and Parallel Devices," and review the pin assignments for the port to which your serial device is connected. The pin signals on your cable must be compatible with the pins on the computer's port.

My serial device (printer, modem, etc.) doesn't output anything.

1. Make sure that the serial device power is turned on and that the device is on-line.

2. Verify that the device is plugged to the correct connector on the rear of the computer.

3. Secure both ends of the cable connection.

4. Use the MODE command to set the baud rate, parity, etc. The baud rate and other transmission parameters assigned to the port you are using must match the requirements of the device connected to that port.

5. Verify that cable pinouts are correct.

MS-DOS and Software

When I try to set the real-time clock with the MS-DOS command SETCLOCK, I see the message

```
Command not required for this computer
```

1. You can't set the time and date with the SETCLOCK command (It is not required on this system.). The settings for the real-time clock are controlled in the SETUP program.

The time and date settings I make with the MS-DOS commands, TIME and DATE, are not saved when I turn off my computer.

1. The TIME and DATE commands will only make temporary changes. To set the time and date that will be in effect when you boot up the computer, run the SETUP program.

I used the /4 parameter to format a double-density diskette in the 1.2MB high-density diskette drive but now I can't access any of the files on that diskette in a 360K diskette drive.

1. Once you write to a diskette in a high-density drive, that diskette can only be read in a high-density drive.

The MS-DOS command, SPARE, seems to take a very long time to execute. Is this normal?

1. Yes, it is. The program does a bit-by-bit analysis of all of the surfaces in the hard-disk drive, which requires time.

Some of my software applications programs run erratically and others won't run at all.

1. Check to see if the system is running in high speed. Some programs will not run properly when high speed is enabled.

The system isn't saving my new SETUP configuration.

1. Make sure you always exit the SETUP program with option "7 Exit SETUP and save new configuration" from the SETUP menu. If you are doing this and the system is still not saving your new configuration, then have your service representative check the battery.

Miscellaneous

I lost my keys. What can I do?

1. Contact your service representative for instructions on obtaining a replacement key.

Appendix C–Device Error Messages

The following messages are hardware related. They will usually appear at the time you boot up the computer. Some of them indicate that the computer has had some problem in the boot-up procedure. Others are merely informational messages. In all cases, the list below explains the situation and a course of action to follow.

Messages

xx0h Optional ROM bad Checksum = nn

Possible cause– An optional adapter (address xx0h) installed in your system has an on-board ROM that has a bad checksum (nn).

Correction– Swap adapters to isolate the bad one and return the bad board to the appropriate manufacturer.

00xxk Base Memory, 0yyk Expansion

Possible cause– This is an informational boot-up message that indicates the memory sizes. It is displayed as the system tests the base and expansion system memory.

Correction– None required.

Decreasing available memory

Possible cause– A RAM error was encountered.

Correction– Make sure that the RAM chips on the main processor board and any expansion boards are plugged in correctly. If the error persists, swap expansion boards to isolate the bad one and return the bad board to the appropriate manufacturer for repair.

Diskette drive reset failed

Possible cause– The diskette drive has a reset problem.

Correction– Make sure the diskette is properly inserted in the drive and that the adapter is properly inserted in the slot and retry. If the problem persists, contact your service representative.

```
Diskette drive seek to track 0 failed
```

Possible cause— The diskette drive has a seek problem.

Correction— Make sure the diskette is properly inserted in the drive and that the adapter is properly inserted in the slot and retry. If the problem persists, copy the backup diskette and retry. If the problem still persists, contact your service representative.

```
Diskette read failure - strike F1 to retry boot
```

Possible cause— The diskette has a read problem.

Correction— Make sure the diskette is properly inserted in the drive and that the adapter is properly inserted in the slot and retry. If the problem persists, copy your backup diskette of the boot disk and retry. If the problem persists, contact your service representative.

```
Display adapter failed; using alternate
```

Possible cause— The adapter configured by the switch on the system board is not the same display adapter that the system found during power-on initialization.

Correction— Check the switch to ensure that it is set for the monochrome or graphics adapter on the system.

```
Error, press F1 key to continue
```

Possible cause— This message usually follows a power-on error message. It allows the system to try a reboot, even though the system may not be functional.

Correction— Follow the action suggested for the specific message, and then turn power off and back on again. If the system error message and this `Press F1...` message reappear, try pressing the F1 key.

If the system still does not boot, call your service representative. If the system does boot after the corrective action, proceed with caution, and as always, back up data regularly.

```
Gate A20 failure
```

Possible cause—This informational message indicates a gate failure.

Correction—Contact your service representative.

```
Hard disk controller failure
```

Possible cause—The hard disk controller has failed.

Correction—Check to verify that the hard disk is properly cabled and that the adapter is inserted properly in the slot and retry the operation. If the problem persists, contact your service representative.

```
Hard disk failure
```

Possible cause—The hard disk controller has failed.

Correction—Check to verify that the hard disk is properly cabled and that the adapter is inserted properly in the slot, then retry the operation. If the problem persists, contact your service representative.

```
Hard disk read failure - strike F1 to retry boot
```

Possible cause—The hard disk controller has failed.

Correction—Press the F1 key. If the problem persists, check that the hard disk is properly cabled and the adapter is inserted properly in the slot, then retry the operation. If the problem persists, contact your service representative.

```
Invalid configuration information - please run SETUP
program
```

Possible cause—Configuration information is invalid.

Correction—Run the SETUP program to set CMOS memory. (See Chapter 5 in the tutorial and "The SETUP Program" in the Reference Guide for details.)

Keyboard clock line failure

Possible cause—The keyboard is not working properly.

Correction—Check that only one keyboard is plugged into the system board, that it is plugged in properly, and that no keys are jammed. If the problem persists, contact your service representative.

Keyboard controller failure

Possible cause—The keyboard is not working properly.

Correction—Check that only one keyboard is plugged into the system board, that it is plugged in properly, and that no keys are jammed. If the problem persists, contact your service representative.

Keyboard data line failure

Possible cause—The keyboard is not working properly.

Correction—Check that only one keyboard is plugged into the system board, that it is plugged in properly, and that no keys are jammed. If the problem persists, contact your service representative.

Keyboard failure

Possible cause—The keyboard is not working properly.

Correction—Check that only one keyboard is plugged into the system board, that it is plugged in properly, and that no keys are jammed. If the problem persists, contact your service representative.

Keyboard is locked - please unlock

Possible cause—The lock in the display/keylock panel on the front of the machine is in the locked position.

Correction—Turn the key in the lock to the unlocked position.

Keyboard stuck key failure

Possible cause—The keyboard is not working properly.

Correction—Check that only one keyboard is plugged into the system board, that it is plugged in properly, and that no keys are jammed. If the problem persists, contact your service representative.

Memory address line failure at nnn, read xxx expecting yyy

Possible cause—During a memory test to determine if shorts occur on address lines, line nnn failed; test expected yyy, but read xxx.

Correction—Contact your service representative.

Memory data line failure at nnn, read xxx expecting yyy

Possible cause—During a memory test to determine if shorts occur on data lines, line nnn failed; test expected yyy, but read xxx.

Correction—Contact your service representative.

Memory high address line failure at nnn000-nnnFFF

Possible cause—During a memory test, memory high addresses are determined to be not unique.

Correction—Turn off the power, make sure the memory card is installed properly, and try again. If the problem persists, contact your service representative.

Memory odd/even logic failure at nnn, read xxx expecting yyy

Possible cause—During a memory test to determine if byte/word accesses on even/odd boundaries are successful, a failure occurred at nnn; test expected yyy, but read xxx.

Correction—Contact your service representative.

```
Memory parity failure at nnn000-nnnFFF
```

Possible cause—During a memory test, a parity failure has occurred.

Correction—Turn off the power, make sure all memory expansion boards are installed properly, and try again. If the problem persists, contact your service representative.

```
Memory tests terminated by keystroke
```

Possible cause—Informational message indicating that you have pressed a key during the base or expansion memory test to terminate the test before completion.

Correction—None required.

```
Memory write/read failure at nnn, read xxx expecting yyy
```

Possible cause—During a memory test, the RAM is found to be bad at physical address nnn; test expected yyy, but read xxx.

Correction—If the read and expected values match, it indicates a software test error. If they do not match, contact your service representative.

```
No boot device available - strike F1 to retry boot
```

Possible cause—The system could not find a diskette or a hard disk with the system files necessary to boot.

Correction—Press the F1 key. If the system displays the same message, insert the correct system diskette and boot again.

```
No boot sector on hard disk - strike F1 to retry boot
```

Possible cause—You tried to boot the system from a hard disk without the system files necessary to boot.

Correction—Press the F1 key. If the system displays the same message, insert the correct system diskette, enter the SYS command to copy the system files from the diskette to the hard disk, and boot again.

```
Non-System disk or disk error
Press a key to retry
```

Possible cause– This message appears if you have a dual-diskette system and one of the following conditions exists:

• You didn't insert a diskette in drive A.

• The diskette in drive A does not contain a valid copy of the MS-DOS operating system.

• Something is wrong with the diskette in drive A that is preventing a normal boot.

This message can also occur in a hard-disk system. If the computer cannot boot from the diskette in drive A, it automatically tries to boot from the hard disk. If the hard disk does not contain the necessary software to boot or has an internal problem that will not allow a boot, this message is displayed.

Correction– Make sure you have inserted a system diskette in drive A. If you did not, insert one now and press any key to retry. If you want to boot from the fixed disk, make sure the necessary files are on the disk. If you think something may be wrong with the system diskette in drive A, try inserting another copy of the system diskette and press any key. If the message persists, call your service representative.

```
Not a boot diskette - strike F1 to retry boot
```

Possible cause– An attempt was made to boot the system from a diskette without the necessary system files.

Correction– Press the F1 key. If the system displays the same message, insert the correct system diskette and boot again.

```
Phoenix 80286 ROM BIOS Version x.xx
Copyright 19xx Phoenix Software Associates Ltd
All Rights Reserved
```

Possible cause– This is an informational message which indicates ROM initialization and version.

Correction– None required.

- strike F1 to retry boot

Possible cause—System failed to boot.

Correction—Press the F1 key to retry. If system fails to boot, turn the power off and insert the operating system diskette into drive A. Turn the power on.

Strike the F1 key to continue

Possible cause—Either there is a potential problem with the CMOS or you haven't performed HDINIT on a hard disk. (An explanatory message usually precedes this message.)

Correction— For the first problem, if you want to continue, press the F1 key to load the system and then run the SETUP program to set up the CMOS. If you haven't performed HDINIT on a hard disk, prepare the hard disk as described in the Reference Guide under "Preparing a Hard Disk".

Timer chip counter 2 failed

Possible cause—This message indicates a hardware error.

Correction—Contact your service representative.

Timer or Int Cntrl bad
or
Timer or Interrupt Controller Bad

Possible cause—This indicates a problem with the timer or interrupt controller.

Correction—Turn the power off, wait a few seconds, and turn the power on again. If the message reappears, call your service representative.

Time-of-day clock stopped

Possible cause—This indicates that there is a hardware problem with the real-time clock.

Correction—Contact your service representative.

```
Unexpected HW interrupt nn at xxx:yyy.
Type (R)eboot, other keys to continue
```

Possible cause– A hardware (HW) interrupt has been generated, but no device initialized the vector for the hardware interrupt.

Correction– Contact your service representative.

```
Unexpected interrupt in protected mode
```

Possible cause– This indicates a hardware error.

Correction– Contact your service representative.

```
Unexpected SW interrupt nn at xxx:yyy.
Type (R)eboot, other keys to continue
```

Possible cause– The software (SW) currently executing has executed an interrupt which has not been initialized. (nnn is the interrupt number; xxx:yyy is the address.) For example, interrupt six is caused by execution of an invalid op code. This error is distinguished from the Unexpected HW interrupt error by polling the interrupt controller to see whether or not a hardware device generated the interrupt. If not, this message is displayed.

Correction– Contact the representative from whom you received the software.

```
Unexpected type 02 interrupt at xxx:yyy.
Type (S)hut off NMI, (R)eboot, other keys to continue
```

Possible cause– An unknown NMI interrupt has occurred (address xxx:yyy), possibly from 80287 or memory parity.

Correction– Reseat the 80287 math coprocessor chip. Make sure it is installed properly. If the message persists, contact your service representative.

```
Unexpected HW interrupt nn at xxx:yyy.
Type (R)eboot, other keys to continue
```

Possible cause—A hardware (HW) interrupt has been generated, but no device initialized the vector for the hardware interrupt.

Correction—Contact your service representative.

```
Unexpected interrupt in protected mode
```

Possible cause—This indicates a hardware error.

Correction—Contact your service representative.

```
Unexpected SW interrupt nn at xxx:yyy.
Type (R)eboot, other keys to continue
```

Possible cause—The software (SW) currently executing has executed an interrupt which has not been initialized. (nn is the interrupt number; xxx:yyy is the address.) For example, interrupt six is caused by execution of an invalid op code. This error is distinguished from the Unexpected HW interrupt error by polling the interrupt controller to see whether or not a hardware device generated the interrupt. If not, this message is displayed.

Correction—Contact the representative from whom you received the software.

```
Unexpected type 02 interrupt at xxx:yyy.
Type (S)hut off NMI, (R)eboot, other keys to continue
```

Possible cause—An unknown NMI interrupt has occurred (address xxx:yyy), possibly from 80287 or memory parity.

Correction—Reset the 80287 math coprocessor chip. Make sure it is installed properly. If the message persists, contact your service representative.

Appendix D–Specifications

Operation	Operating temperature	10 to 33 degrees C (50 to 91.4 degrees F)
	Ambient relative humidity	20 to 80 percent noncondensing
	Operating altitude	0 to 10,000 feet
	Nonoperating altitude	0 to 35,000 feet
Storage	Temperature	−40 to +60 degrees C (−40 to +140 degrees F)
	Relative humidity	5 to 95 percent noncondensing
Power	Domestic power	120 VAC nominal, 50/60 Hz, single-phase, 4.5 A maximum RMS
		Operating range: 90 to 132 VAC
	International power	240 VAC nominal, 50/60 Hz, single-phase, 2.25 A maximum RMS
		Operating range: 180 to 264 VAC
	Power consumption	250 watts (maximum)
Clearance Space Required	Three inches on all sides	
Microprocessor / Memory	CPU	80286
	Optional coprocessor	80287
	Memory	RAM: 640 kilobytes, 15 megabytes addressable ROM: 32 kilobytes, expandable to 128 kilobytes Sockets for four 28-pin ROM chips
1.2 Megabyte Diskette Drive	Type	Half-height diskette drive
	Storage capacity	1.2 megabytes
	Recommended diskette type	5¼-inch, 96 TPI, double-sided, high-density, double track
	Transfer rate	500 kilobits/s (high-density mode) 300 kilobits/s (low-density mode)
	Access time (including settling)	Track to track: 18ms Average access time: 94ms

Optional 360 Kilobyte	Type	Half-height diskette drive
Diskette Drive		
	Storage capacity	360 kilobytes
	Recommended diskette type	5¼-inch, 48 TPI, double-sided, double-density, 16 sectors per track, 256 bytes per sector, 40 tracks per side
	Transfer rate	250 kilobits per second
	Access time (including settling)	Track to track: 19ms Average access time: 53ms

Input/Output

RS-232C port
   Type: IBM PC AT-compatible RS-232C
   Speed: 50-9600 baud
   Character Length: 5, 6, 7, or 8 bits
   Stop Bits: 1, 1.5, 2 bits
   Selectable Address: COM1, COM2, jumper selectable
   Connector: 9-pin, D-shell, IBM PC AT-compatible

Parallel Port
   Type: Centronics parallel printer port compatible
   Selectable Address: LPT1, LPT2, jumper selectable
   Connector: 25-pin, D-shell, IBM PC AT-compatible

Keyboard Adapter
   4-pin proprietary interface, RJ-9 connector and
   5-pin IBM PC AT-compatible connector

I/O Slots
   Six 16-bit IBM PC AT-compatible slots
   Two 8-bit IBM PC AT-compatible slots

Keyboard

Type: Lightweight, detachable
Layout: IBM PC AT-compatible
Number of keys: 84
Interface: 4-wire, RJ-9 connector
Cable: 4-wire coiled, 1.2 meters (3.9 ft) relaxed length
Indicators: LED status indicators for CAPS LOCK, SCROLL LOCK, and NUM LOCK

Cords

3-pronged AC power cord: 1.83 meters (6.0 ft)
Serial port adapter interface cord: 0.90 meters (2.92 ft)

Computer and Keyboard

	Computer	Keyboard
Height	4.6 in	1.4 in
	162 mm	36.0 mm
Depth	17.9 in	5.6 in
	447.0 mm	142.0 mm
Width	21.1 in	17.7 in
	537.0 mm	449.0 mm
Weight	(with one diskette drive)	
	40.0 lbs	2.6 lbs
	18.1 Kg	1.2 Kg
	(with one diskette and one hard-disk drive)	
	46 lbs	2.6 lbs
	20.8 Kg	1.2 Kg

Appendix E—System Memory Map

Table E-1 Memory Address Map

Address	Purpose
000000H to 09FFFFH	640K RAM on system board
0A0000H to 0BFFFFH	128K reserved for display adapter boards
0C0000H to 0DFFFFH	128K reserved for ROM on option boards
0E0000H to 0EFFFFH	64K reserved ROM space on system board; also duplicated at FE0000H.
0F0000H to 0FFFFFH	64K ROM BIOS on system board; also duplicated at FF0000H
100000H to FDFFFFH	15MB reserved for RAM option boards
FE0000H to FEFFFFH	64K reserved ROM space on system board; also duplicated at 0E0000H.
FF0000H to FFFFFFH	64K ROM BIOS on system board; also duplicated at 0F0000H.

Appendix F – Scan Codes

Figure F-1 Hexadecimal Values of Keyboard Scan Codes

‡ Does not return a scan code

Table F-1 Keyboard Scan Codes in Hex

Code	Key	Code	Key	Code	Key	Code	Key	Code	Key
01	ESC	12	E	23	H	34	. >	45	Num Lock
02	1 !	13	R	24	J	35	/ ?	46	Scroll Lock
03	2 @	14	T	25	K	36	Shift[3]	47	Home 7
04	3 #	15	Y	26	L	37	PrtSc *	48	↑ 8
05	4 $	16	U	27	; :	38	Alt	49	PgUp 9
06	5 %	17	I	28	' "	39	Spacebar	4A	-
07	6	18	O	29	` ~	3A	Caps Lock	4B	← 4
08	7 &	19	P	2A	Shift[2]	3B	F1	4C	5
09	8 *	1A	[{	2B	\ ¦	3C	F2	4D	→ 6
0A	9 (	1B	] }	2C	Z	3D	F3	4E	+
0B	0)	1C	Enter	2D	X	3E	F4	4F	End 1
0C	- _	1D	Ctrl	2E	C	3F	F5	50	↓ 2
0D	= +	1E	A	2F	V	40	F6	51	PgDn 3
0E	←[1]	1F	S	30	B	41	F7	52	Ins 0
0F	Tab	20	D	31	N	42	F8	53	Del
10	Q	21	F	32	M	43	F9		
11	W	22	G	33	, <	44	F10		

1. Backspace key   2. Left Shift key   3. Right Shift key

Table F-2 Extended Codes

Code	Key(s)	Code	Key(s)
3	(Null character) NUL	82	INS
15	(SHIFT TAB) —<divide divide (symbols)	83	DEL
		84–93	F11 through F20 (SHIFT F1 through SHIFT F10)
16–25	ALT Q, W, E, R, T, Y, U, I, O, P		
30–38	ALT A, S, D, F, G, H, J, K, L	194–103	F21 through F30 (CTRL F1 through CTRL F10)
44–50	ALT Z, X, C, V, B, N, M	104–113	F31 through F40 (ALT F1 through ALT F10)
59–68	F1 through F10 (when disabled as soft keys)		
71	HOME	114	CTRL PRTSC
72	Cursor up	115	CTRL cursor left (previous word)
73	Page up (PGUP)	116	CTRL cursor right (next word)
75	Cursor left	117	CTRL END
77	Cursor right	118	CTRL page down (PGDN)
79	END	119	CTRL HOME
80	Cursor down	120–131	ALT 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, -, =
81	Page down (PGDN)	132	CTRL page up (PGUP)

Appendix G–International Keyboards

Figure G-1 United Kingdom English Keyboard

Figure G-2 French Keyboard
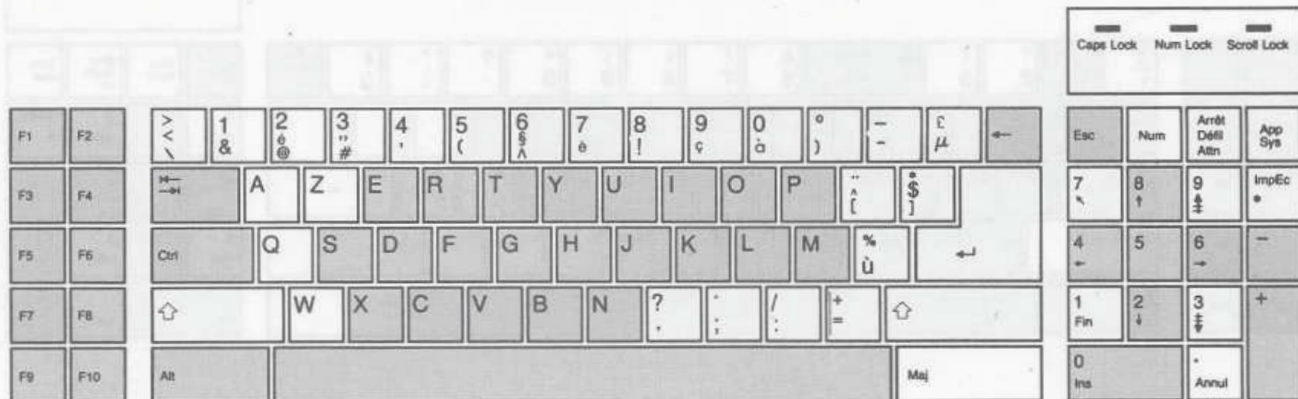
Figure G-3 German Keyboard
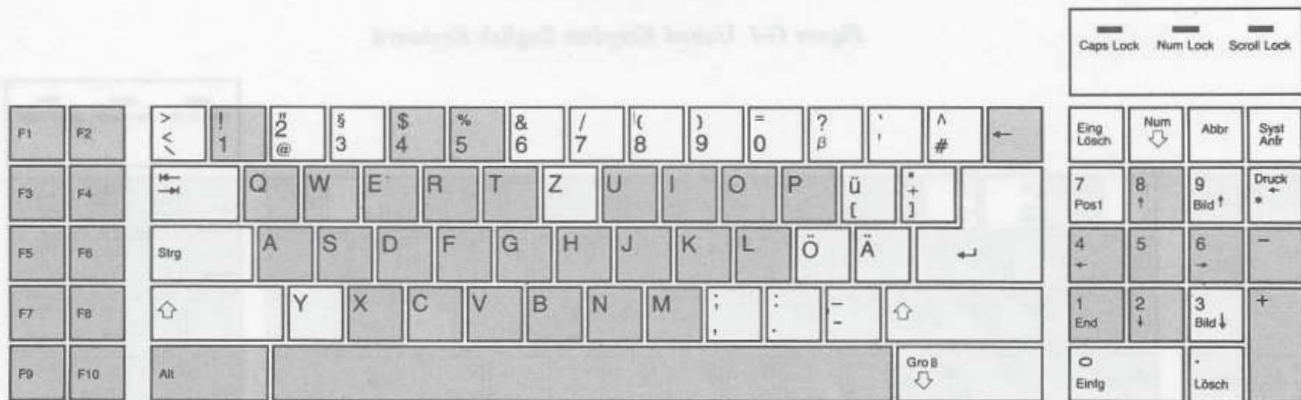
Figure G-4 Italian Keyboard
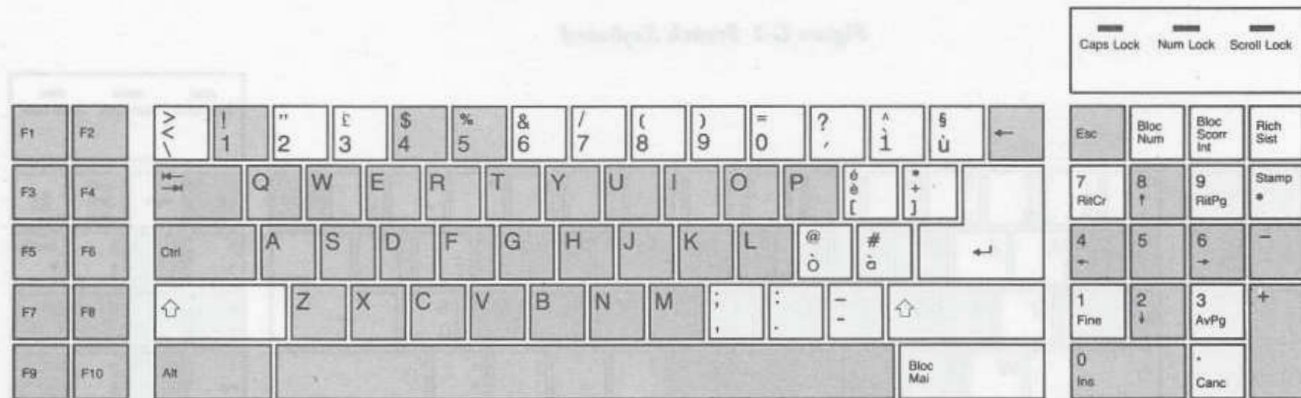
Figure G-5 Spanish Keyboard
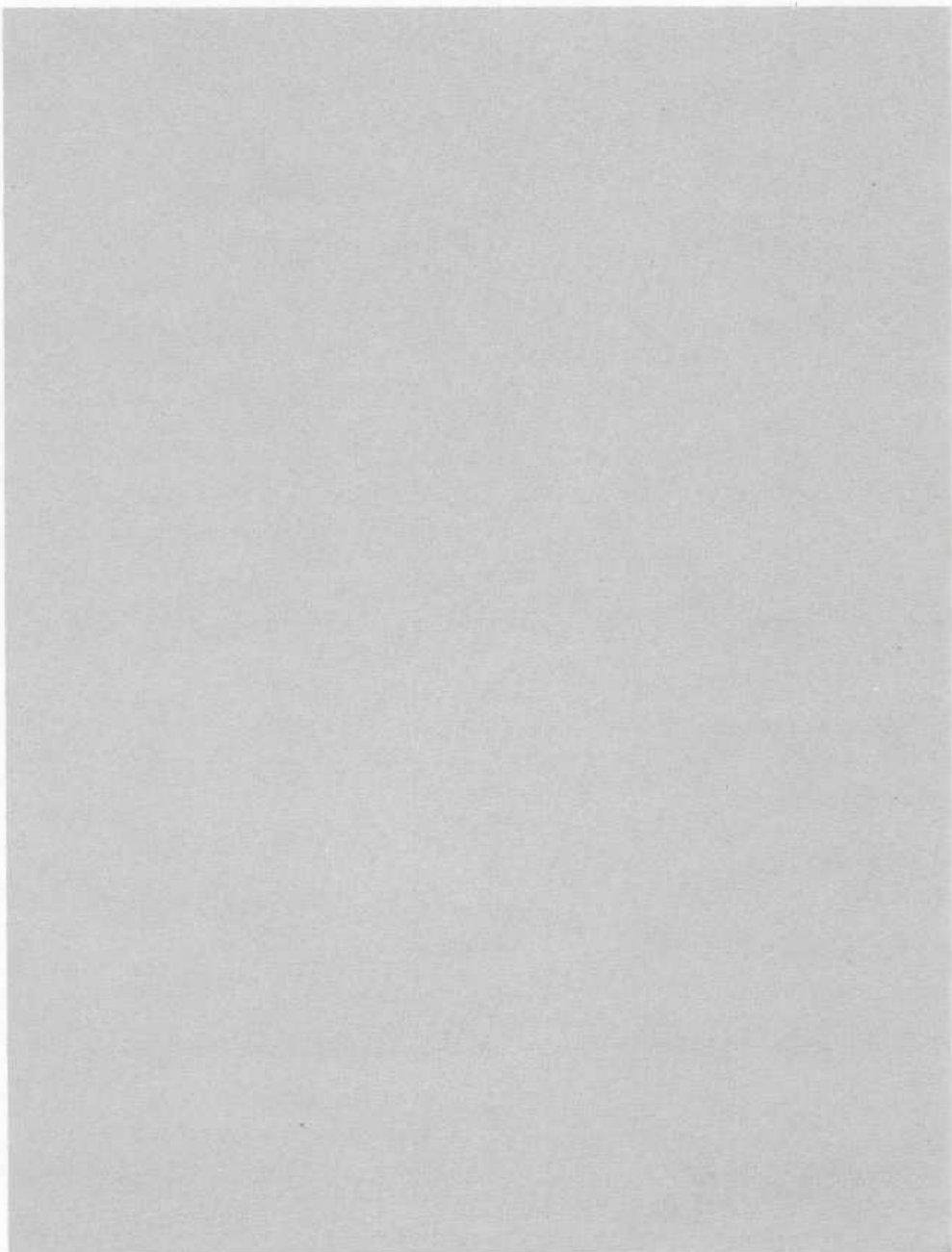
Glossary

Glossary

AC
Alternating current; typically the type of power supplied by most power companies.

adapter board
Any of a wide range of printed circuit boards with a variety of functions designed to permit operation between different parts of the system and/or a subsystem. Each plugs into one of the eight expansion slots inside the computer.

adapter card
See *adapter board*.

alphanumeric characters
The letters, numbers, and symbols that appear on a standard typewriter keyboard.

applications program
A program or set of programs intended for a specific area of use, such as word processing or accounting, as opposed to programs that perform system functions, such as an operating system.

ASCII
American Standard Code for Information Interchange. A standard 8-bit information code, allowing for standardization between data communciations devices.

back up
To create an extra copy of data or programs for safekeeping.

backup
Data that has been copied in case the original is lost, damaged, or changed.

BASIC
See *GW-BASIC*.

boot
A term used to describe the loading sequence and starting up of an operating system.

byte
Typically a unit of eight binary bits which together represent one character.

CMOS
Complementary metal oxide semiconductor; low-power memory. A logic circuit technology that uses very low power. CMOS memory holds setup and real time clock information in this system.

column
One of the screen's vertical display positions. Each column is one character wide.

command
A word or character that causes a computer to do something.

compatibility
The ability of a specified unit to replace another, with little or no reduction in function or performance.

configuration	1. A set of computer equipment connected to operate as a system.
	2. A set of variables chosen to let you set up the computer to do what you want it to.
configure	The SETUP program allows you to record all of the options that your computer has to work with.
control code	A special character, normally neither displayed nor printed. Control codes are sent from the keyboard by pressing the CTRL key simultaneously with certain other keys on the keyboard.
controller	A printed circuit board that connects a computer to a peripheral. It monitors and manages that peripheral.
coprocessor	An integrated circuit that increases speed and precision in performing arithmetic and trigonometric operations and logarithmic functions. An optional 80287 chip can be installed in your system.
CPU	Central processing unit; the heart of the system, also referred to as the 80286 microprocessor in this system.
cursor	A position indicator on the screen showing where the next keystroke will appear. By default, the cursor is a blinking rectangle or underline character.
cursor keys	The keys on the numeric keypad that move the cursor up, down, right, and left.
cylinder	On a Winchester disk, all of the tracks under a read/write head that can be accessed without mechanical movement of the head.
data	Basic elements of information which can be processed or produced by a computer.
DC	Direct current; the type found coming from a battery. An electric current that flows in one direction and is relatively constant.
default	The original value of a parameter or function key code when others have not been specified.
diagnostics	A specialized program that checks the computer for problems and tries to isolate those problems that it finds.
diskette drive	A unit which reads or writes diskettes.

display	1. The image that appears on the monitor screen.
	2. Synonym for monitor.
DOS	Disk Operating System. A program with which the computer stores, locates, and retrieves files on disk; reads the keyboard, and issues information to the monitor and other peripherals.
double-sided **double-density diskette**	A floppy diskette that can store 360K of data. It is compatible with the IBM PC and PC/XT format.
error messages	Text displayed by the computer when an incorrect response is typed; explains the problem and indicates what to do next.
execute	To carry out an instruction or series of instructions.
firmware	A term referring to software that has been permanently placed in memory—usually into ROM (read-only memory).
formatting	Preparation of a blank floppy diskette or hard disk so that it's usable by the operating system.
formatted disk or diskette	A disk or diskette that has been properly prepared or formatted for use with a specific operating system and/or drive.
function keys	The set of keys (F1 through F10) on the left of the computer keyboard.
graphics characters	Alternate characters, available through GW-BASIC or the ALT key used for drawing line drawings.
GW-BASIC	The version of the Beginner's All-purpose Symbolic Instruction Code programming language that accompanies this system. It is functionally equivalent to IBM's BASICA.
hard disk	A high-speed, sealed, large-capacity, magnetic storage system for microcomputers. A hard disk is permanently sealed in a drive unit to prevent contaminants from affecting the read/write head. The disk is capable of storing larger amounts of data than a diskette.
hardware	Physical components of computer and data processing equipment; contrast with software and firmware.
head	A device used to read, write, or erase data on a magnetic storage medium, such as a diskette or hard disk.

Hertz (Hz)	A unit of frequency equal to one cycle per second.
high capacity	See *high-density drive.*
high-density drive	Can record and access 1.2 million bytes of data equivalent to 700 pages of single-spaced typed text; needs high-density diskettes.
high-density diskette	Type of diskette compatible with the high-density drive; can store 1.2 million bytes or the equivalent of about 700 pages of single-spaced text.
Hz	See *Hertz.*
input/output (I/O)	This is a general term for the equipment, such as a modem or printer, connected to a computer and the two-way exchange of information that goes on between the computer and the peripheral.
I/O	See *input/output.*
K	Equivalent to 1,024; 640K equals 640 × 1,024.
LED	Light-emitting diode; the small indicator lights found on the keyboard, front panel, and disk drives.
load	To put data and/or programs into a computer.
MB	Megabyte, or 1 million bytes.
memory	Synonym for main storage or RAM; circuitry and devices that hold the binary 1s and 0s the computer can access.
menu	A displayed list of options available to you. You usually select an action you want performed by typing a letter or number or by positioning the cursor.
MS-DOS	A disk operating system from Microsoft Corporation.
operating system	"Traffic cop" software that oversees the overall operation of a computer system; the master program that tells a computer how to do its basic tasks and controls all operations of the system.
option	An additional or alternative unit, e.g., adapter boards, monitors, that can be added to expand the capabilities of the system.
PCB	Printed circuit board. See *adapter board.*

peripherals	Equipment (usually hardware) that is external to the computer itself, e.g., disk drives, printers, modems.
port	The location at which data goes in and out of a device; a physical area for the connection of a communications line. This line can be between the CPU and anything external to it, such as a printer, another computer, a modem, or another communications line.
power on test	An automatic series of tests the computer goes through whenever you turn it on. It verifies correct operation of vital system components.
power supply	The device that produces the electrical power for operating electronic equipment. It converts AC power to DC power; energizes components such as integrated circuits, monitors, and keyboards.
printer	An output device that produces hard-copy printout.
processor	See *CPU*.
program	A set of instructions written for a computer to follow; to prepare the set of instructions.
prompt	A letter and greater-than symbol followed by a blinking cursor displayed on the screen that tells you the computer awaits your command.
RAM	See *random-access memory*.
random-access memory (RAM)	Read/write memory; computer storage that can be written to or read from.
read	1. To copy from external storage to internal storage, e.g., diskette to hard disk.
	2. To accept or copy data from input devices or a memory register, i.e., to read out; to deposit data into a storage or output medium, or a register, i.e., to read in.
	3. To transcribe data from an input device to internal or auxiliary storage. See *write*.
read-only memory (ROM)	Used to store a fixed program of the CPU; the contents cannot be modified and are not lost when power is shut off.
read/write memory	See *random-access memory*.

RGB	Abbreviation for red-green-blue, the three primary colors. RGB color monitors use three video signals (one for each primary color) to produce a variety of color shades.
ROM	See *read-only memory*.
RS-232C	The industry standard for the serial interface used to connect the computer with another computer or external equipment.
scrolling	The feature that allows you to enter and work with data that is beyond the current viewing area. When you reach the bottom of the screen while entering data, all lines on the screen move up and a new line moves onto the bottom of the screen.
sector	A segment of a disk that can be accessed by the drive head. The location, size, and number of sectors on each track are determined by the operating system.
self-test	See *power-on test*.
serial	The handling of data one bit at a time as contrasted to parallel. See *RS-232C*.
set-up	See *configure*.
software	Programs, languages, and procedures of a computer system.
spare	The procedure in which bad tracks on a hard disk are set aside so that they cannot be used by the operating system for the recording of data.
subsystem	A self-contained part of a system that performs one of the major functions, e.g, the diskette drive subsystem that includes the electronics, the head, the drive, and disk-controller board.
system	An organized collection of hardware and software that works together.
track	A section of a disk or tape; the portion of a moving storage medium, such as a disk or tape, that is accessible to a given read/write head position.
utility	Any one of several programs that perform a number of required system duties, such as editing, linking, debugging, file interchanging, and mathematical functions.
Winchester disk	See *hard disk*.

word processing   The entry, manipulation, editing, and storage of text using a computer.

write   1. To copy from internal to external storage, e.g., hard disk to diskette.

                        2. To transfer data to an output medium, e.g., a printer.

                        3. To record data in a register, location, or other storage medium. See *read*.

XENIX   An operating system from Microsoft Corporation that provides multiuser capabilities.

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WYSEpc 286 User's Guide Addendum

Use this addendum in conjunction with the *User's Guide* and the *MS-DOS Guide*. Its purpose is to acquaint you with the latest changes to the WYSEpc 286.

This addendum includes information on the subjects listed in the following table.

Each of these sections discusses features or functions added after the manuals went to press.

1 Multiple Partitions and Large Disk Support

Version 1.03 of MS-DOS 3.10 includes an enhanced FDISK utility program that lets you

• Access hard disks with a capacity of up to 117MB

• Install more than one MS-DOS partition on a hard disk

• Create partitions greater than 32MB

■ **Note**–The information in this section is relevant only if you are using version 1.03 or later of MS-DOS 3.10.

The FDISK procedures described in your *User's Guide* under "Preparing a Hard Disk" and in your *MS-DOS Guide* are correct although some terms have changed.

Physical and Logical Drives

Throughout the *User's Guide* and the *MS-DOS Guide*, the first hard disk in a system is referred to as "drive C" and the second hard disk is referred to as "drive D." These designations are still valid insofar as they refer to the *physical* drives themselves (the hardware). It is the physical drive that is identified and recorded by type during the initial SETUP procedure. (Some programs, such as the test and utility programs, including SETUP, FDISK, and SPARE, always refer only to the physical drive designators C and D.)

When you divide the physical hard-disk drive into more than one partition with the enhanced FDISK program, the partitions on the disk become *logical* drives. Although logical drives are software-based, the operating system treats each of them as an additional hard-disk drive.

Partitioning the Hard Disk

The following notes on partitioning the hard disk augment the discussion of hard-disk partitioning in the *User's Guide*.

As previously stated, you can create one large partition of up to 117MB on your hard disk or you can divide it into a maximum of four smaller partitions of varying sizes. When you partition a physical drive, the MS-DOS operating system automatically assigns a logical drive designator to the partition. (Drive designators are discussed later.)

To create one large MS-DOS partition, first back up any files you might have on the hard disk, if applicable. Then run FDISK to delete any existing MS-DOS partitions. Finally, follow the instructions in the *User's Guide* for partitioning the hard disk.

To create up to four MS-DOS partitions (logical drives) on the same hard disk, follow the instructions in the FDISK section of the *MS-DOS Guide*.

■ **Note—**If you will be running any applications programs that require strict IBM-compatibility, you must put those programs on the first partition of a physical drive and restrict the size of that partition to 32MB or less.

The MS-DOS default logical sector size is 512 bytes. However, if you create a partition that is larger than 32MB, the default size will be changed to 1024 bytes per sector or more, depending on the total capacity of the physical drive. As a result, some software may not operate correctly. Before purchasing a program, make sure that it will function properly in a system with the larger sectors.

Formatting Logical Drives

To access a logical drive, you must format it just as you would a physical drive. In your *User's Guide* under "Preparing a Hard Disk," you'll find a section on formatting the disk. All references in that section to a physical drive apply to a logical drive as well. For example, if you want to boot from logical drive E, transfer the system files to that drive by including the /S parameter with the FORMAT command:

```
FORMAT E:/S
```

The following message will appear:

```
You are about to format your hard disk.
This will destroy all data in the MS-DOS partition.
```

In this message, both "your hard disk" and "the MS-DOS partition" refer to the logical drive that you are about to format.

Booting the System from a Logical Drive

Before you can boot the system from a logical drive, you must make the drive (partition) active with the FDISK program. (Refer to the FDISK command in your *MS-DOS Guide* for instructions on activating a partition.) Only the logical drives on physical drive C can be made active, and then only one drive can be active at a time.

When you boot the system, a list of existing logical drives appears. For example, if your system has two physical hard disks each of which has been partitioned with four logical drives, you will see the following message when you boot the system:

```
Drive C has multiple DOS partitions
Logical Drive E available
Logical Drive F available
Logical Drive G available

Drive D has multiple DOS partitions
Logical Drive H available
Logical Drive I available
Logical Drive J available
```

Drive Designators

In a system with a single hard-disk drive, the first partition is always recognized as physical drive C. Any additional partitions are recognized as logical drives and are assigned the drive designators D, E, and F as they are created.

Drive designators automatically change when you install a second physical hard-disk drive. The second physical drive is designated as physical drive D. If a logical drive D previously existed on physical drive C,

• The drive designator for that logical drive automatically changes to E

• The drive designators for all subsequent logical drives on drive C also move forward by one letter

If you install a second physical hard disk, it will be designated as physical drive D. The drive designator for the first logical drive after drive D follows the the designator for the last logical drive on physical drive C. Thus, in the example above, the logical drives on the second physical drive would be designated D, H, I, and J. (See the following table.)

Table 1 Possible Drive Designator Assignments

| Partitions	One Drive Installed	Two Drives Installed Drive 1	Drive 2
1	C	C	D
2	D	E	H
3	E	F	I
4	F	G	J

Because logical drive letters will change when a second physical hard disk is added to the system, you must back up all the files on all the partitions on the first physical drive before installing the second physical drive.

Any time you do anything to alter a logical drive or the sequence of logical drives, you must run FDISK to regroup the partitions. For example, if you remove the second physical hard-disk drive from the unit, run FDISK on drive C and exit the program. This will regroup the logical drives on drive C.

2 Memory Expansion Board Installation

Some expansion boards include additional random-access memory (RAM) on the board. If you will be installing such a board, check the board's documentation to find out if the RAM on it begins at the 512K address. **To insure proper operation with this type of board, you will need to disable the last 128K of the 640K of RAM on the main system board of your computer.**

To disable the 128K of RAM between 512K and 640K, remove the plastic shunt from the pins of jumper W30 on the main system board. (Figure 1 shows the jumper location and the plastic shunt being removed.)

Figure 1 Removing Jumper W30
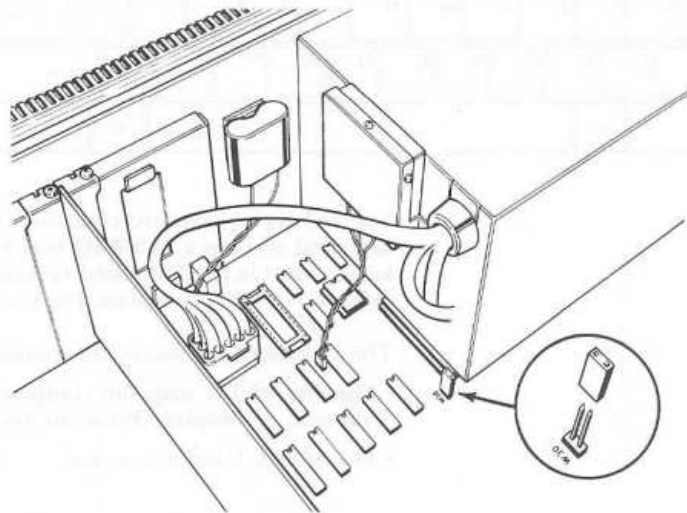
■ **Note**–To take advantage of the faster operating speed of your computer, the RAM boards that you install should be qualified to run at 10MHz. With slower boards, you may have to run your system at 6MHz instead of 10MHz for proper operation.
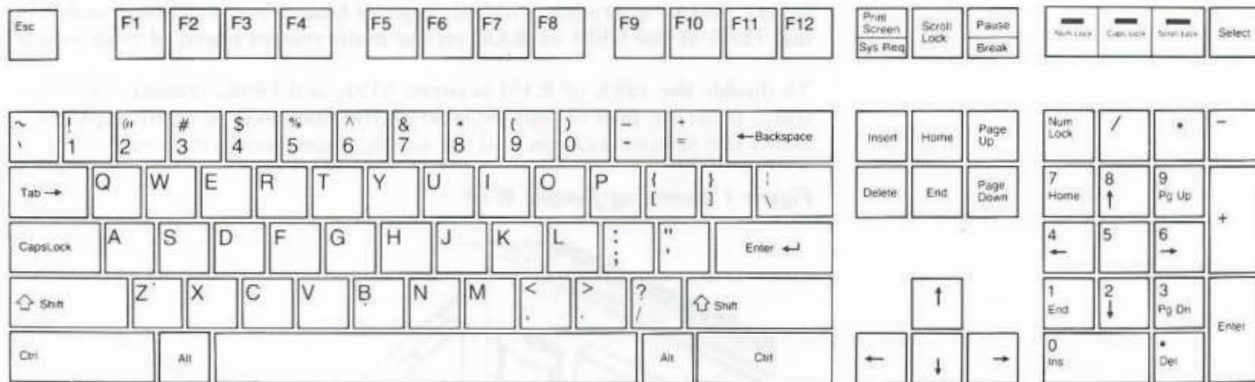
3 The Enhanced Keyboard

Your system may come with an IBM Enhanced PC-style keyboard (containing additional keys and functions) rather than a standard IBM PC AT-style keyboard. Compare your keyboard with Figure 2.

The following keys appear twice on the Enhanced keyboard. In each instance, the keys function identically.

| ENTER | HOME | PAGE UP | Cursor keys |
| END | INSERT | PAGE DOWN | DEL |

Figure 2 The Enhanced Keyboard

The Enhanced keyboard contains a SYS REQ key. Although the AT-style keyboard also has a SYS REQ key, its function is different on the two keyboards. On the Enhanced keyboard, the software running on the computer defines SYS REQ functions. Press it only in conjunction with the ALT key.

The Enhanced keyboard also contains two additional keys:

• The PAUSE key suspends computer operation, halting scrolling so that you can read the display. (Press any key to resume scrolling.)

• The SELECT key is reserved.

4 The Keyboard Test

The keyboard test has been upgraded. Replace the keyboard test section on page R4-4 with this text:

Keyboard Test – The keyboard test supports the Enhanced and the AT-style keyboards. It runs in single-test mode only. When you select this test, a graphic representation of the Enhanced keyboard is displayed and you are asked

```
Is this the keyboard that you are using? (Y/N)
```

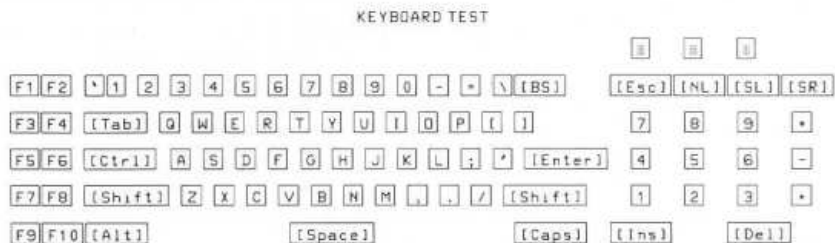### Figure R4-1 Enhanced Keyboard
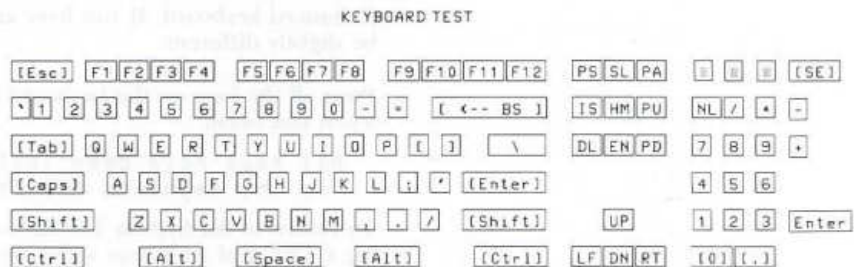
If you are using the Enhanced keyboard, type

    Y

and continue.

If you are not using the Enhanced keyboard, type

    N

The AT-style keyboard is displayed and the inquiry is repeated.

Figure R4-2 AT-Style Keyboard

This time, an N answer produces the message

```
Your keyboard is not supported by this test program.
Press any key to continue.
```

To test the keyboard, you must press each of the keys on the real keyboard in any sequence. The system scan code of the key you press is compared to a predefined scan code table. If they match, the representation of that key on the displayed keyboard is reversed from a highlighted to a normal display.

■ **Note**—This discussion of the keyboard test assumes that you have an Enhanced keyboard. If you have an AT-style keyboard, the messages will be slightly different.

Press all the keys on the keyboard in any sequence. This messages appears when you finish:

```
All keys have been tested
 Is the keyboard OK? (Y/N)
```

To return to the System Test menu before the test is finished, hold down the CTRL and ALT keys while pressing the DEL key.

5 Moving Systems with More Than One Hard Disk

Pages R2-9 and R2-10 of the *User's Guide* discuss HDPARK, the MS-DOS command that parks the hard disk heads so you can safely move the computer.

If your system is configured to support more than one hard disk, HDPARK will park the additional heads on the second hard disk.

To execute HDPARK, type

```
HDPARK
```

and follow the instructions on the screen. Then pack and move the computer.

6 Changes in the MS-DOS MODE Command Parameters

Certain changes have been made in the parameters of the MS-DOS MODE command. Mark these changes in your *MS-DOS Guide*.

Page	Action
3-82	MODE LPT*num*: ,P becomes MODE LPT*num*: ,,P
3-82	MODE LPT*num*: ,M becomes MODE LPT*num*:
3-84	MODE LPT*num*: ,P becomes MODE LPT*num*: ,,P
3-84	Delete ,M from this passage: • **MODE LPT*num*: ,M** reassigns a printer back to normal parallel output after it has been assigned to a serial port.

7 Keylock Key Identification

If you lose your key, look on the bottom of your computer, directly under the keylock panel. You will see a sticker with your key's serial number. When you talk to your service representative about key replacement, give him this number.
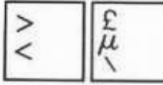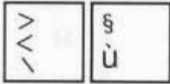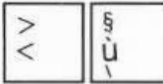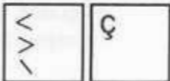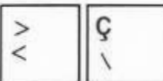
8 Math Coprocessor
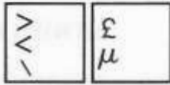
On pages R9-40 through R9-42 of the *User's Guide* you are shown how to install an optional Intel 80287 math coprocessor chip. Be sure that the version of the math coprocessor that you install in your system is the 80287-8.

9 Additional Hardware Changes on the Computer Case

Depending upon the computer model, when you remove the top cover of the computer, you will need to remove four extra screws, two on each side of the computer, under the lip of the top cover.

10 New International AT-Style Keycap Configurations

Changes have been made to the keycap legends on four of the five international keyboards referenced in Appendix G of the User's Guide. If you are working on a French, German, Italian, or Spanish keyboard, look at the keycap changes illustrated below.

Keyboard	Original	Revised
French	> < \ £ μ	> < £ μ \
German	> < \ ^ #	> < ^ # \
Italian	> < \ § ù	> < § ù \
Spanish	< > \ ç	> < ç \

FCC Notice

WARNING: This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and television reception.

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential situation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient the receiving antenna

• Relocate the computer with respect to the receiver

• Move the computer away from the receiver

• Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems".

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC rules.

WYSE