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Your IBM® PC

A Guide to the IBM PC (DOS 2.0) and XT

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INTRODUCTION

Whether you are a novice or an experienced computer user, this book will show you how to use the IBM Personal Computer. The book describes both the PC using Version 2.0 of PC-DOS and the PC XT. All descriptions of the PC and its operation apply also to the XT unless stated otherwise; we fully describe features or variations unique to the XT. If your PC uses Versions 1.0, 1.05, or 1.1 of PC-DOS, the companion to this book, *Your IBM PC: A Guide to the IBM Personal Computer* (Osborne/McGraw-Hill, Berkeley, CA), is recommended.

In this book you will learn about three aspects of using the IBM PC. First, you will be introduced to the parts that can make up an IBM PC system, including components from both IBM and other manufacturers. Second, you will see the wide variety of ways in which the PC can be used, either with applications programs that you buy or with programs that you write yourself. Last and most important, you will see how to control the PC by entering various commands from the keyboard and learn how to write your own programs.

Chapters 1 and 2 are addressed to everyone who uses the PC. Chapter 1, The IBM PC, describes the parts common to all PC systems and some typical additions that give your computer specific capabilities. A range of applications for the PC is also presented so that you will have an idea of the flexibility of the PC. Chapter 2, Getting the PC Up and Running, provides an overview of how to use the PC. This chapter assumes no prior

experience with the PC. When you have finished Chapter 2, you will be able to run programs written in the IBM BASIC language and to use the PC-DOS Version 2.0 operating system.

Chapter 3, Operating Systems, Disks, and PC-DOS, explores Version 2.0 of PC-DOS in depth, showing you how to use this most popular operating system for the PC.

Chapters 4 through 11 are for readers who wish to program the PC in BASIC. As with Chapters 1 and 2, you do not need any experience with BASIC to use these chapters. However, some introductory programming background will be helpful.

Chapter 4, Starting BASIC, Chapter 5, The Elements of BASIC, and Chapter 6, Extending the Power of BASIC, work together to enable you to compose your own solutions to problems by writing programs in BASIC. These chapters explain the programming process and how programs are entered, changed, saved, and retrieved. They also explain how to write programs that take advantage of the PC's features.

Chapter 7, BASIC Files, shows you how to store and retrieve data from various storage and input/output devices. For example, you will learn how to organize information from BASIC programs, put it onto floppy or fixed disks, and then access that information efficiently.

Chapter 8, The PC Memory, is useful after you get some experience programming in BASIC or if you are using other languages with the PC. This chapter discusses how the memory of the PC is organized and how it is accessed. This chapter also illustrates how BASIC programs interact with memory and how you can control this process.

Chapters 9, 10, and 11 can be used by anyone who is programming in BASIC.

Chapter 9, Graphics, demonstrates how to generate figures and charts on the PC from BASIC. Graphics is an important part of many programs, since using appropriate graphics can greatly enhance the communication between a user and a program.

Chapter 10, Sound and the PC, provides a guide to generating sound with the PC through BASIC. Using BASIC you can create sounds from scratch, specifying frequencies and durations of the sound, or you can transfer music to the PC, specifying notes, tempos, note lengths, and so on.

Chapter 11, Communications, explains how to use the PC to communicate with other devices, including other computers, other PCs, and various input and output devices. This chapter explains both how to use

communications hardware with already written programs and how to write your own communications programs in BASIC.

Chapter 12, DOS Program Development Tools, shows how to use three development tools that accompany PC-DOS.

The last chapter, Chapter 13, Keeping the PC Up and Running, offers advice about getting a space ready for your system and about coping with problems that may occur while you are operating the PC. This chapter also outlines some sound installation and operating procedures, and explains how to troubleshoot problems yourself as well as where you can go for more help.

CONTENTS

1

THE IBM PC

The IBM Personal Computer, which we will call the IBM PC or simply the PC, is a complete computer system. All PCs are made up of a few basic parts and typically of a few optional parts that tailor the PC for a particular application.

This book deals with both the standard IBM PC and its XT, or "eXTended," version, which is basically a PC with some added hardware features. Throughout this book, the term PC is used generically to refer to both the PC and the PC XT versions. Where relevant, any differences between the two are specified.

In this chapter, you will learn what the basic parts of the PC are and what they do. You will also learn about some of the more common optional parts that can be added to a system to customize it and the applications in which those parts might be used. When we refer to parts, we mean both physical units—that is, the hardware—and the instructions or programs that control the hardware—that is, the software.

THE IBM PC SYSTEM HARDWARE

The basic hardware of a PC system consists of

- The System Unit with memory
- The keyboard

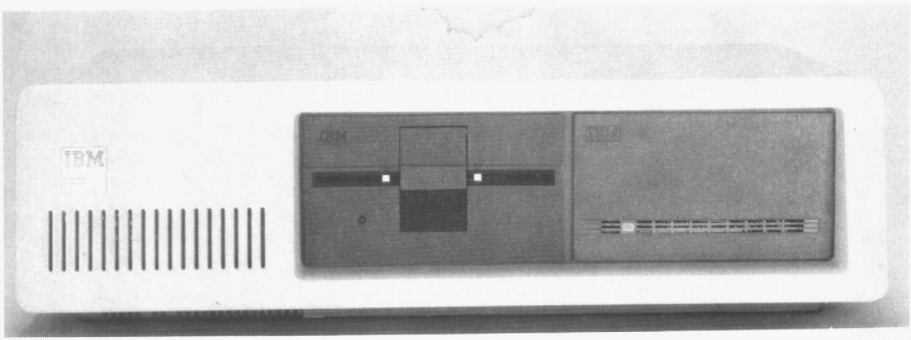

FIGURE 1-1. The IBM PC XT System Unit

- A display
- A mass storage device.

The System Unit

The System Unit, shown in Figure 1-1, is the heart of the PC. Inside the System Unit is a printed circuit board, called the System Board, that contains the basic circuitry of the PC.

The System Board for the standard PC contains five connectors, called the System Expansion Slots, into which special option cards, or boards, can be plugged to expand the functions of the PC. The *option boards* allow you to tailor the PC to your particular needs. The IBM XT contains eight System Expansion Slots, shown in Figure 1-2.

The Memory

Programs and data are stored in the memory of the PC, shown in Figure 1-3. There are two kinds of memory: ROM and RAM. *ROM* (read-only memory) is used to store programs and data that permanently reside in the PC. An example of a program stored in ROM is the Cassette BASIC program that comes with the PC. The contents of ROM are not lost when you turn the PC off. *RAM* (random-access memory) is used to store most of the programs and data that you will run. The contents of

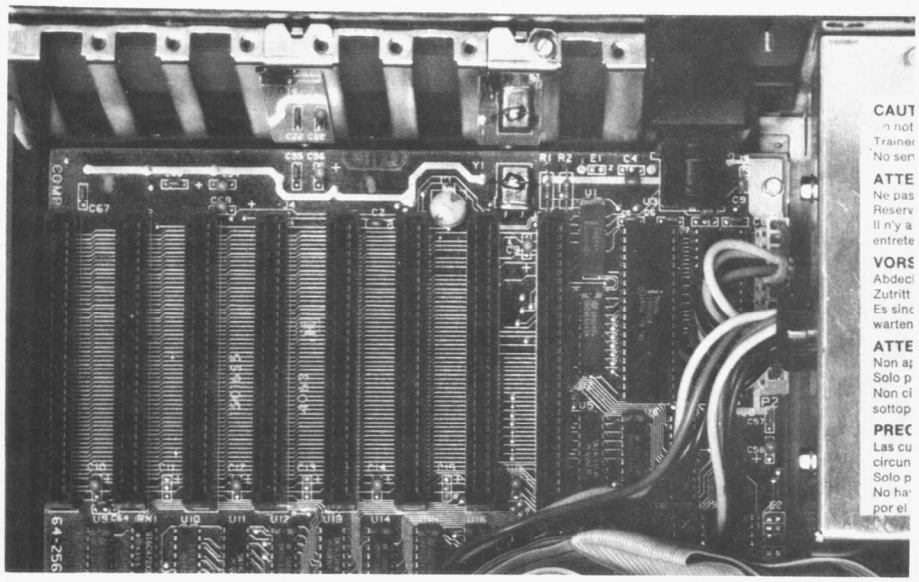

FIGURE 1-2. System Expansion Slots on the System Board

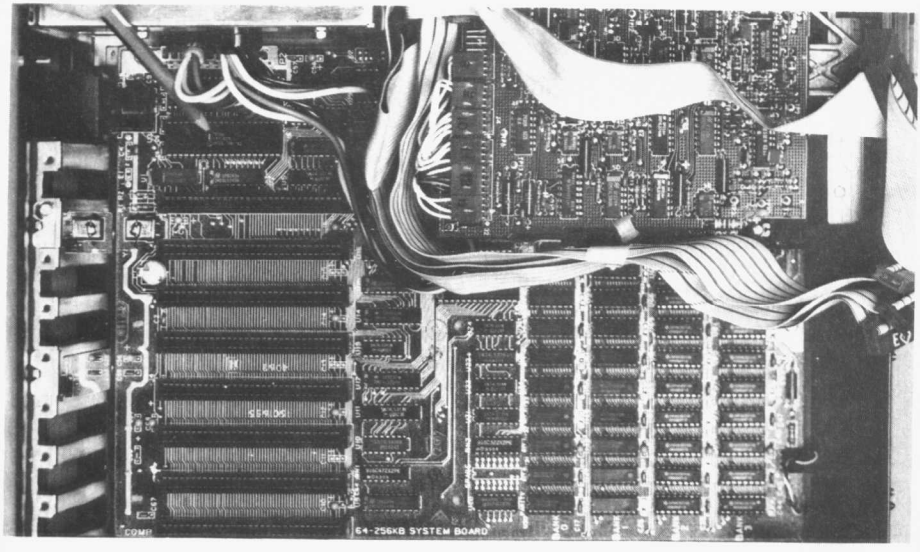

FIGURE 1-3. The 8088 microprocessor and memory on the System Board

RAM are lost when the PC is turned off.

Memory is organized in units called *bytes*. A single byte represents a value that can be interpreted in a number of ways, depending on the application. For example, a byte in memory can be used to represent a single character or a number. The System Board typically contains 40 kilobytes, or KB, of ROM (1 kilobyte = 1024 bytes). There are two slightly different versions of the standard PC: the older can have up to 64KB of RAM on the System Board; the more recent PC, as well as the PC XT, can hold up to 256KB of RAM. As we will see, the memory size can be expanded further through the installation of memory cards in the System Expansion Slots.

The Keyboard

The PC's keyboard is shown in Figure 1-4. The keyboard is like a regular typewriter keyboard with some additional keys that the PC uses for special functions. These keys will be discussed in Chapter 2.

The Display

There are four kinds of displays that can be used with the PC: the IBM Monochrome Display, a black and white video monitor, a color monitor (such as IBM's color monitor), or a regular television. Figure 1-5 shows some examples of displays that you can use with the PC.

FIGURE 1-4. The PC keyboard

The equipment required to attach a display to the PC depends upon the type of display that you use. An IBM Monochrome Display requires a Monochrome Display and Parallel Printer Adapter; a color or black and white video monitor or a television requires a Color/Graphics Monitor Adapter. Either adapter can be installed in a System Expansion Slot.

For programs that primarily display letters and numbers, the IBM Monochrome Display is a good choice. However, if you plan to use color and graphics to draw figures and shapes, you will want to configure your PC with the Color/Graphics Monitor Adapter. With this adapter, the least expensive display is a regular television with an RF modulator, a device that allows you to connect a television to the PC. The highest quality image requires a color RGB monitor—that is, a monitor having separ-

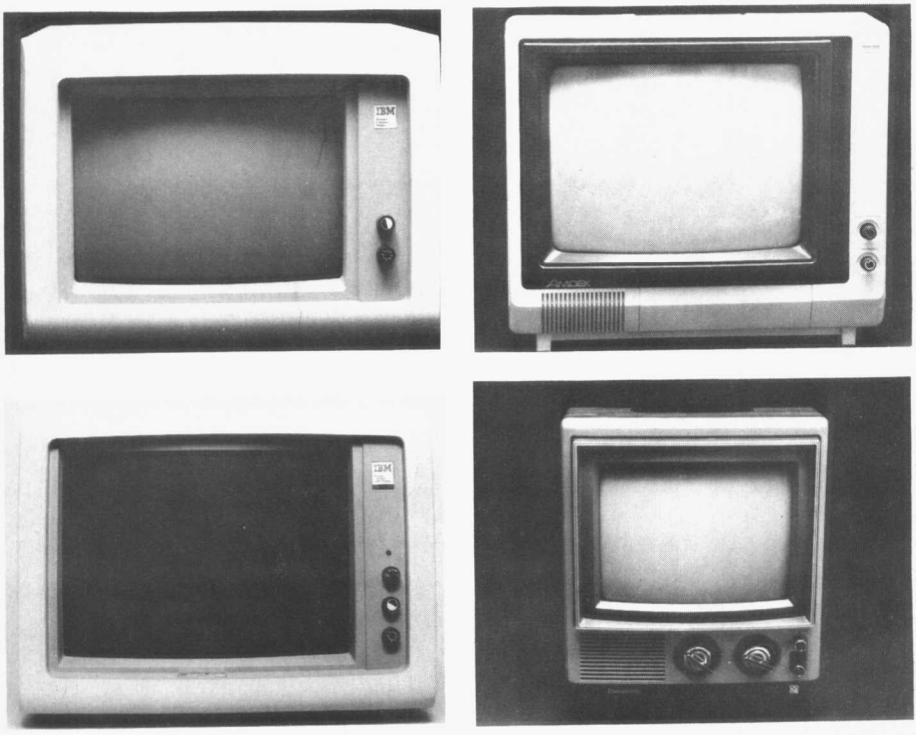

FIGURE 1-5. Displays (clockwise from upper left): the IBM Monochrome Display, black and white monitor, television, and IBM's color monitor

ate inputs for the red, green, and blue color signals. The IBM color monitor is a high-resolution RGB monitor specifically tailored for use with the PC.

Mass Storage Devices

Mass storage devices allow you to store programs and data permanently. The speed and ease with which you can access this stored information depend upon the type of device that you use.

FLOPPY DISK DRIVE

The PC comes standard with one double-sided floppy disk drive. However, it is common to purchase a second floppy drive for an arrangement as shown in Figure 1-6. A double-sided floppy disk can store up to 360,000 bytes of data. A single-sided floppy disk can hold as much as half that amount, 180,000 bytes.

To use a floppy disk drive, you must install the Diskette Drive Adapter card in a PC System Expansion Slot. This card provides the electronics necessary to allow the PC to control up to four floppy drives.

FIXED DISK DRIVE

The IBM XT comes standard with a fixed disk capable of storing 10 megabytes, or MB, of data (1 megabyte is approximately equal to 1 million bytes); see Figure 1-7. Not only does the fixed disk have considerably more storage space than a floppy disk; it is much faster than the floppy. You can outfit the standard PC with the 10MB fixed disk by attaching IBM's Expansion Unit.

CASSETTE RECORDER INTERFACE

The standard PC contains a cassette recorder interface through which a typical audio cassette recorder can be attached and used as a mass storage device. The XT does not have the cassette interface.

STANDARD PERIPHERALS

The PC can communicate with other kinds of devices outside of the System Unit. For this, IBM supplies several adapter cards that can be

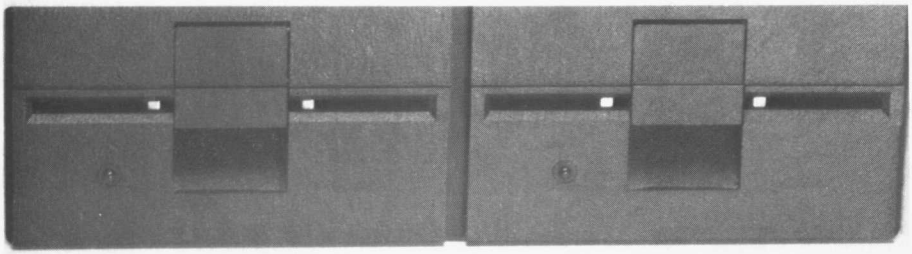

FIGURE 1-6. Floppy disk drives mounted in the System Unit

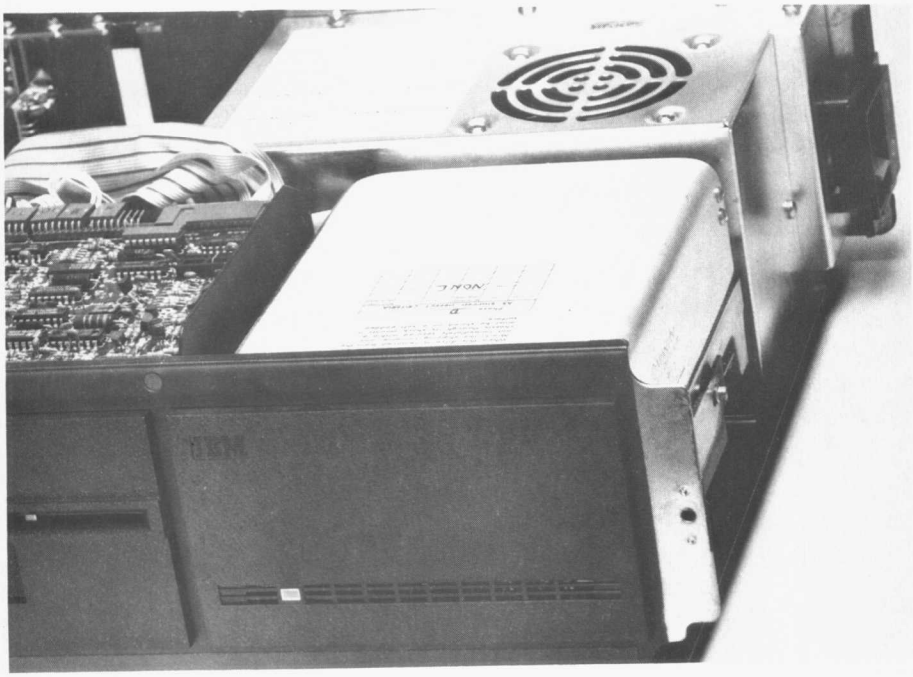

FIGURE 1-7. A hard disk drive

installed in the System Expansion Slots and that connect to the devices with the appropriate cables.

IBM Printers and the Parallel Printer Adapter

The IBM 80 CPS Matrix Printer provides hard copy for your programs. This printer, shown in Figure 1-8, can print a total of 96 characters and 64 special graphics characters with various printing styles and with either 66, 80, or 132 characters per line. There is also an IBM Graphics Printer, which offers a variety of character sizes as well as special graphics capabilities.

There are two kinds of adapter cards that you can use to connect the printer to the PC: either the Parallel Printer Adapter or the combination Monochrome Display and Parallel Printer Adapter.

Asynchronous Communications Adapter

The Asynchronous Communications Adapter, shown in Figure 1-9, allows you to connect your PC with other devices for data communication. This communication can be with another PC, with a device set up to

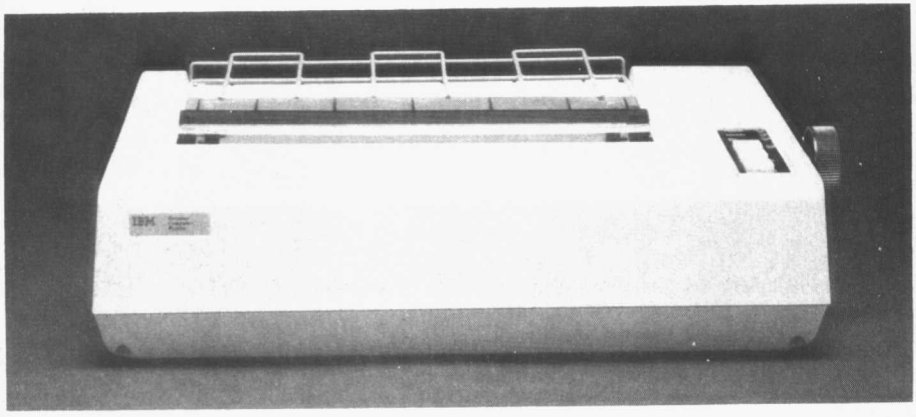

FIGURE 1-8. The IBM 80 CPS Matrix Printer

communicate with the RS-232 or current loop standards (both described in Chapter 11), or with another computer—for example, a remote database service—over telephone lines. The XT comes standard with an Asynchronous Communications Adapter card.

Game Control Adapter

The Game Control Adapter, shown in Figure 1-10, allows you to connect either joysticks or game paddles to the PC. These devices can be used to supply input that is more direct than the keyboard for programs such as games.

Expansion Unit

If you need additional expansion slots, or if you want to add the IBM fixed disk to the standard PC, you can add the IBM Expansion Unit to your system. The IBM Expansion Unit comes with its own power supply, a 10MB fixed disk, and eight additional System Expansion Slots for extra option cards. The unit, which is the same size as the System Unit, has room for still another fixed or floppy drive. The Expansion Unit will work with either the PC or the XT.

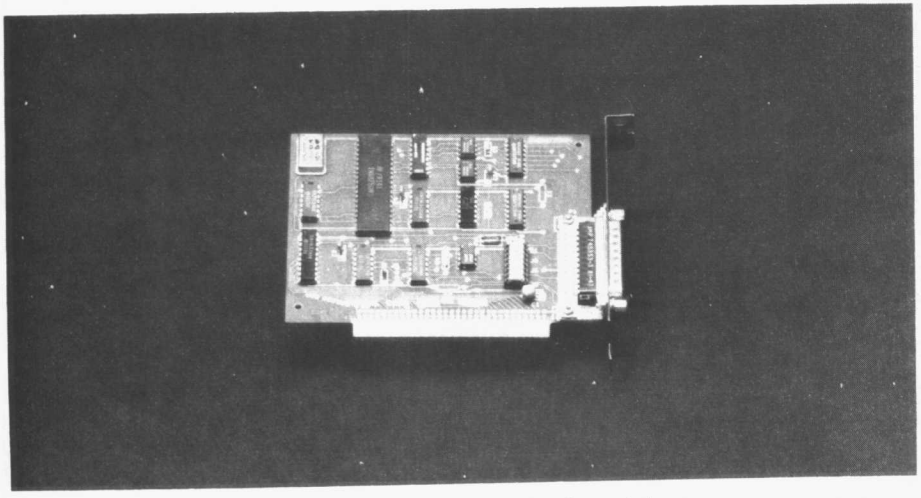

FIGURE 1-9. The Asynchronous Communications Adapter

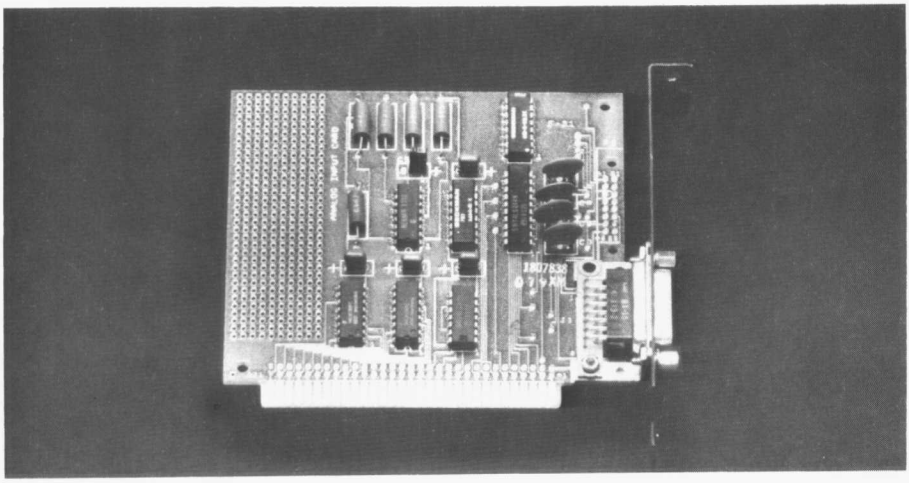

FIGURE 1-10. The Game Control Adapter

ADDITIONAL OPTIONS

Several other types of options enable your system to perform specific tasks. These options are available from manufacturers other than IBM.

Memory Boards

The PC can accept a total of 640KB of RAM. To add to the 64KB that can be installed in the System Board, there are a variety of memory expansion boards available that contain from 64 to 512KB of RAM.

Figure 1-11 shows one such memory expansion board. This particular board can have a maximum of 256KB of RAM and also contains three other options: a battery-run clock and calendar (so that your PC always keeps track of the time and date even when it is turned off), a serial interface port, and a parallel interface port.

Network Communications Boards

Network communications boards allow several PCs to be connected in an arrangement called a *network* (or actually a local network). Systems