Apple IIe

Owner's Manual

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About This Manual

This manual is the first book you should read when you open the Apple IIe. All other manuals for the Apple IIe assume that you have read this book.

This manual is arranged so you can find the information you want quickly and easily, without having to read things you aren't interested in just yet. Here is an overview of what this manual contains.

- Chapter 1, "Assembling the System," explains how to unpack, set up, and connect your computer to a disk drive and either a television set or a video monitor. This is the basic Apple IIe system, and with it you can do the exercises in Chapters 2 and 4. Chapter 1 also explains how to connect an optional 80-column text card and a second disk drive.
- Chapter 2, "Getting Acquainted," gives a few pointers on system and disk care and explains how to use the disk APPLE PRESENTS…APPLE. This chapter also contains a keyboard reference section.
- Chapter 3, " How It Works," uses diagrams to illustrate a few of the fundamental concepts of the Apple IIe system.
- Chapter 4, "Using an Operating System," guides you through some practice exercises with the operating system (DOS) that comes with your disk drive.
- Chapter 5, "Getting Down to Business and Pleasure," outlines the kinds of ready-made programs available to use with your Apple IIe computer.
- Chapter 6, "Programming: the Ultimate Computer Skill," introduces a few of the dozens of programming languages you can use with the Apple IIe computer.

- Chapter 7, "Adding More Pieces to the System," is a supplement to Chapter 1. If you have purchased additional equipment, or realize you need more equipment to accomplish some goal, use Chapter 7 as a guide.
- Chapter 8, "Help," tells you what you can do to identify and correct problems with your system, lists Apple IIe manuals available from Apple Computer, Inc., and lists some of the books and magazines you can consult for further information.

The following chart shows which chapters are recommended for various kinds of readers. You may fall into more than one of the categories (for example, a first-time user who set up his own system).

Reader	*Chapters:* 1	2	3	4	5	6	7	8
The person who sets up the system	•						•	
First-time user; wants to use ready-made programs		•	•	•			•	
Experienced Apple computer user		•	•	•	•	•		
Programmer		•		•		•		•
Business person		•			•			•

Error Messages

If you make mistakes, don't panic. Just about every program has error messages that tell you what you did wrong. If you get yourself in a real mess, you can always restart the system and begin anew.

Recall from earlier in this chapter that error messages can come from DOS or whichever BASIC interpreter you are using when the error occurs. Each error message, therefore, has three possible forms:

1. SYNTAX ERROR message and a beep (DOS)
2. ? SYNTAX ERROR message and a beep (Applesoft BASIC)
3. *** SYNTAX ERR(OR) message and a beep (Integer BASIC)

DOS seldom takes exception to what you type; if it doesn't recognize something, it usually passes it on to the BASIC interpreter in use.

Computer syntax, like the syntax of human language, has to do with the way you put words and statements together. To the computer, syntax also refers to spelling. The most common cause of a SYNTAX ERROR message is a typing mistake.

Here are some of the other error messages you may encounter while using DOS. For a complete explanation of error messages, see the DOS manuals.

- WRITE-PROTECTED
  If there is no write-enable notch on a disk, or if the notch is covered with a tab when you try to write anything on that disk, you will get this message. If there is a tab on the notch, remove it; if there is no notch, it may be an important program disk and you should consider writing the information on another disk.
- FILE LOCKED
  This message occurs when you try to write information on a disk using a file name that is already on the disk and the file is locked (the file's catalog entry is preceded by an asterisk). You can unlock a file—for example, a file named HELLO—by typing the command UNLOCK HELLO.

  Locking is a nice feature: it prevents you or someone else from accidentally erasing a program you want to keep. Imagine how bad you'd feel if all the hard work you put into writing a program was wiped out by a copying error. You can lock a file—for example, a file named MATHQUIZ—by typing the command LOCK MATHQUIZ.
- I/O ERROR
  This often occurs if there is a poor connection between the computer and the disk drive or a printer, or if a disk is not properly aligned, or if the drive door is not closed.

Chapter 1
Assembling the System

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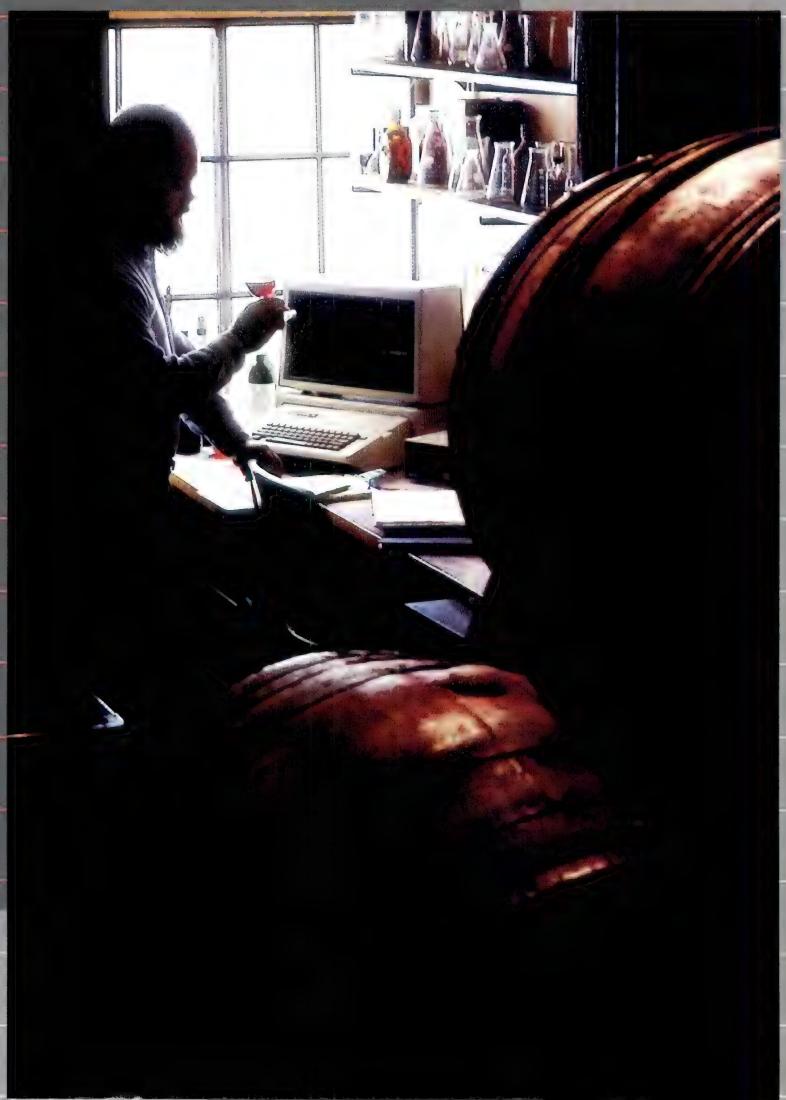
Assembling the System

This chapter examines some of the Apple IIe's features and explains how to unpack your computer and connect the external equipment **(peripheral devices)** you will need to do the exercises in Chapters 2 and 4:

- at least one disk drive
- a TV set or video monitor

This chapter also describes how to install two optional devices:

- a second disk drive
- an 80-column text card

Chapter 7 describes how to connect other equipment to the Apple IIe.

Before you begin, clear a large table or desktop and have a medium screwdriver and pair of pliers handy.

As you read this chapter, you will follow the suggested procedure for unpacking and assembling the system, which is:

- Unpack the computer and its accessories box.
- Check the packing list to make sure you have everything you're supposed to have.
- Examine the computer, especially the areas for connecting devices.
- Then unpack, inventory, and connect any additional equipment.

If you have equipment not described in this chapter, and you want to install it right away, read the pertinent sections of Chapter 7.

This chapter is just an overview of how to unpack and set up the system. Rely on the documents that came with the equipment for final details.

Unpacking

Put the computer carton on the floor or on a steady chair. Remove and discard the staples from the top flaps of the carton. Remove the accessories box, and set it aside.

Work your hands between the packing foam and the sides of the computer in its plastic bag. Pushing the foam aside with the backs of your hands, pull the computer out and set it on the table with the keyboard facing you. Slide the Apple IIe out of its plastic bag.

Lay the contents of the accessories box on the table. Then gather all packing materials for storage and possible later use (for example, if you move).

Be sure to keep all documents that come in the accessories box. Some may be addenda (information to add to manuals) or errata (corrections) that you may need.

Check the items against the packing list that came in the accessories box. Use the photograph to help identify the important parts. If anything is missing, contact your dealer.

If the warranty card hasn't been filled out, complete the card now and mail it in. The warranty card registers you as an Apple computer owner so that the company can notify you of important changes to its products. The serial number is on the bottom of the computer.

Removing the Apple IIe Cover

Before you can connect equipment that goes inside the Apple IIe, you must remove the cover. With both hands, grasp the tabs that project from the back of the computer cover. Pull up firmly until the corner fasteners pop. Slide the cover back, away from the keyboard, until you can lift it up and off. Set the cover aside.

A Look Inside

Compare what you see with the items in the photographs.

- The **6502 processor.** This is the part of the Apple IIe that does the actual computing.
- The **main memory** (called **random-access memory** or **RAM**). This is where the computer stores what the processor is working on.
- The **power supply case.** This houses the computer's power supply. Before touching anything else inside the Apple, touch the power supply case. This discharges any static electricity you may have on your clothes or body.
- The **internal power-on light.** Always make sure this light is off before connecting or disconnecting anything inside the computer's case.
- The **auxiliary slot.** This is the connector slot for an 80-column text card or other special cards designed for this 60-pin slot.
- The **expansion slots.** These slots, numbered from 1 to 7 (look and see), are for **peripheral cards,** which make it possible to connect a wide variety of additional equipment to the Apple IIe. Every card has components attached on one side and solder lines and connections on the other. Always install cards with their components facing away from the power supply.
- The **radio-frequency modulator** connector. If you use a television set with the Apple IIe, you must purchase and attach a radio-frequency (RF) modulator to this connector, and the television set to the modulator. An RF modulator makes it possible for a TV set to tune in the signals coming from the computer. Read the instructions that came with the modulator to see which channel to use.
- The **GAME I/O connector.** Some products that use a 16-pin connector can be attached here.
- The **keyboard input connector,** with the built-in keyboard already attached.
- The **speaker** and its connector. The Apple IIe uses this to make beeps and musical tones.

internal power-on light

6502 processor

auxiliary slot

power supply case

main memory

speaker

RF modulator connector

GAME I/O connector

expansion slots

keyboard input connector
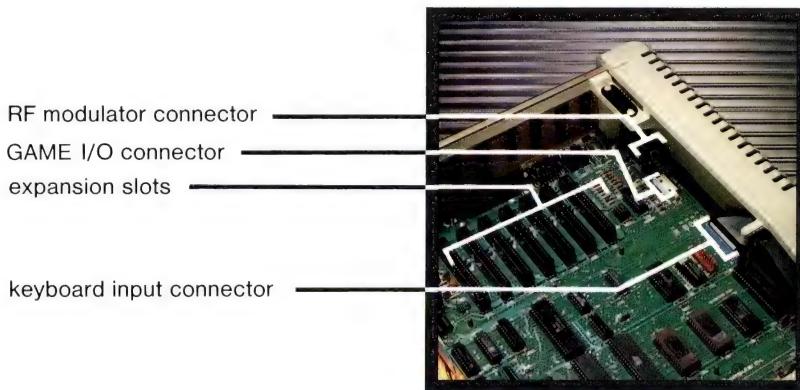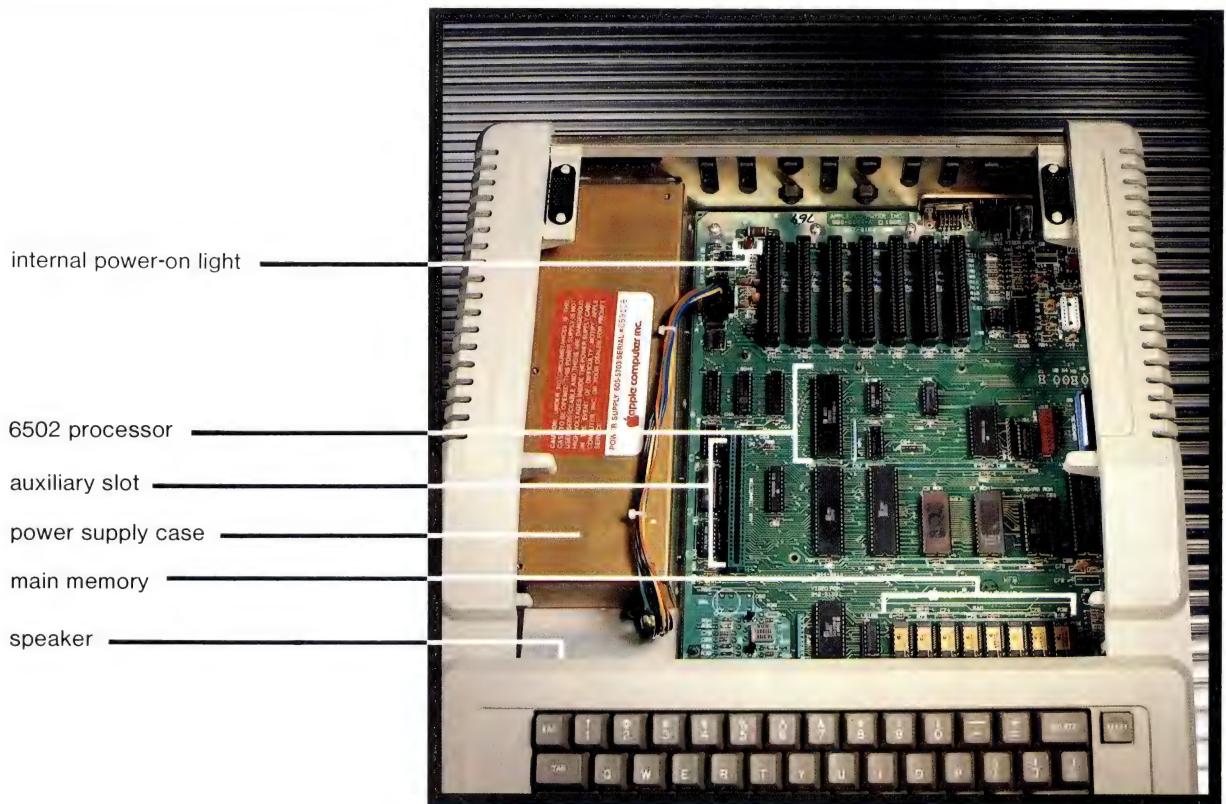
Turn the Apple IIe around so the keyboard faces away from you. On the right of the **back panel** is the power switch. Make sure this switch is **off,** and that it stays in the OFF position until you have finished setting up your system, to avoid damaging the Apple's circuitry.

Plug one end of the power cord into the socket next to the power switch, and plug the other end into a three-hole, grounded power outlet.

Warning: This Equipment Is Intended To Be Electrically Grounded. This product is equipped with a three-prong power cord. As a safety feature, the plug is designed to fit only into a polarized, grounded three-hole outlet. If you don't have such an outlet, have a licensed electrician install one (and a grounding conductor, if necessary) where you will use the computer. Do not defeat the purpose of the grounded plug.
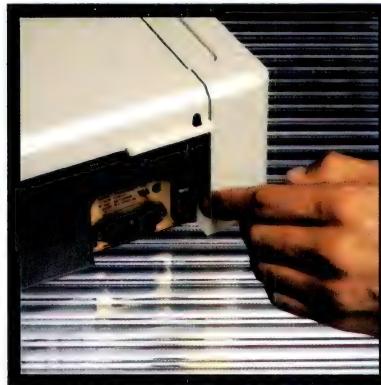
While you are looking at the back panel of the computer, notice:

- The **video output jack.** This is where the picture signals for a video monitor come out.
- The **cassette output jack.** If you use an audio cassette recorder for storing programs, you will use this socket to connect the cable that carries information out of the Apple to the cassette recorder (Chapter 7).
- The **cassette input jack.** This socket connects the cable that brings information into the Apple from the cassette recorder (Chapter 7).

- The 9-pin **hand control connector.** This is for connection of hand controls (Chapter 7).
- Numbered rectangular openings. When you connect the Apple IIe to external (peripheral) devices through an interface card, the card's connector is attached to the appropriate cutout. Openings 1 through 4 are for 19-pin connectors; 5, 6, 8, and 9 are for 9-pin connectors; and 7, 10, 11, and 12 are for 25-pin connectors.

When you have finished examining the back panel, turn the computer back around so the keyboard is facing you.

7, 10, 11, 12 (25-pin connectors)
1-4 (19-pin connectors)

video out
cassette out
cassette in
hand control
5, 6, 8, 9 (9-pin connectors)
power switch
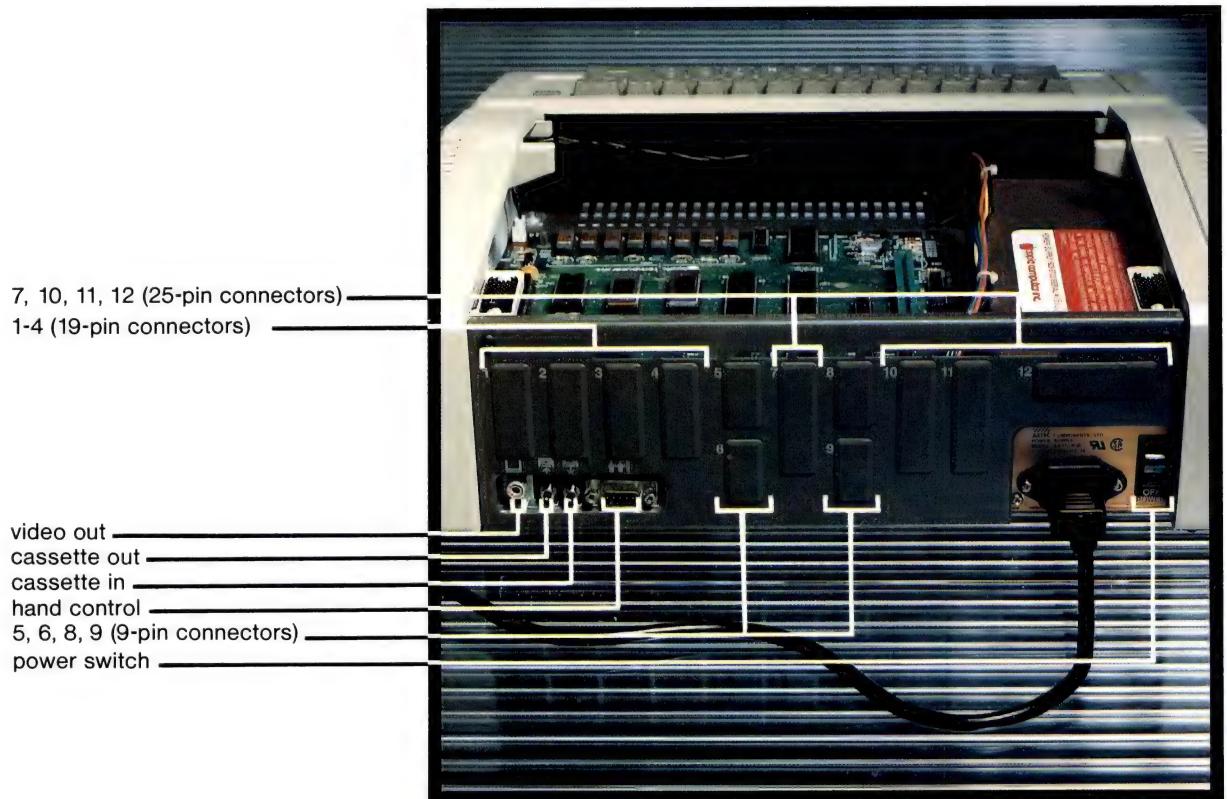
Connecting Cards Inside the Computer

Now that you have had a good look at the computer, it's time to install your cards and peripheral devices. The standard procedure for doing this follows. The **80-column text card** is shown as an example:

- Make sure the power switch is **off** and the computer is plugged in.
- Double check the power: make sure the internal power light is **off.**
- Pick up the card by its edges. Handle the card carefully, the way you would handle an expensive phonograph record.
- If the card has switches, set them according to the instructions that came with the card.
- If the card will be connected to a peripheral device, follow the cable installation instructions that came with the card and the device.
- Touch the power supply case to discharge any static electricity that may be on you or your clothes.
- Hold the card over the desired slot, with the component side **away from** the power supply case and any attached cables out of the way of the slot.
- Gently work the comb-like fingers into the slot until the card is firmly in place. Be careful not to bend the card.
- If the card has no cable, installation is complete.
- Select the lowest-numbered opening of the correct size (for 9, 19 or 25 pins) on the back panel, near the slot where you will install the card. From the inside, push on the tab of the opening's plastic insert to pop it out.
- Secure the cable or connector to the opening using an appropriate size nut plate and a pair of jack screws.
- If the device cable is a separate piece of equipment, make sure it is attached to both the back panel and the device.

If you have problems, consult the directions that came with the equipment. If it looks as though you can't attach the connector to the opening, consult your dealer.

Another Example: Connecting a Disk II Disk Drive

The type of cable arrangement for Disk II drives varies. Rely on the instructions that came with the drive for details. (If you have another type of disk drive, follow the instructions that came packed with it.)

1. Select back panel opening number 1 for the first drive, opening number 2 for the second drive (up to 4 drives). (Opening number 4 is shown in the photographs for visual clarity.) Pop out the opening's plastic insert.
2. Feed the free end of the disk drive cable through the opening from the back.
3. Find one of the U-shaped clamps and two jack screws.
4. Bend the metal flap away from the cable's connector and hold it flat against the cable with your thumb.
5. Spread the U-shaped clamp open slightly. Slide it over the cable and flap. The flat side of the clamp should be in contact with the cable, and the raised side of the clamp should be in contact with the flap.

6. Feed the cable back through the back panel opening until you can fit the raised side of the clamp in the opening.
7. Hold the clamp against the opening with one hand. Reach behind the computer with the other hand and install the jack screws through the opening into the nuts on the clamp. Tighten the screws with the small wrench.
8. Attach the cable from the first drive to the DRIVE 1 pins on the disk controller card. Affix the drive 1 label to the first disk drive. Do the same for drive 2.
9. Now install the disk controller card in slot 6. (For three or four drives, install the second disk controller card in slot 4.)
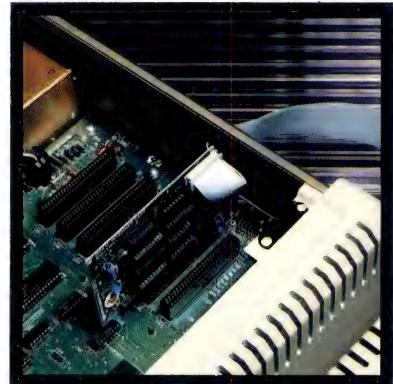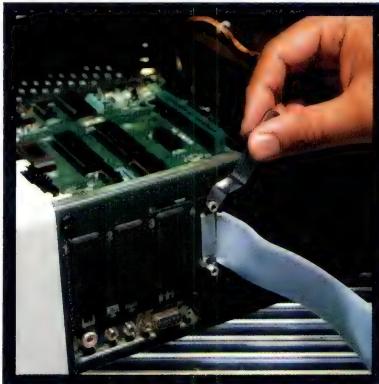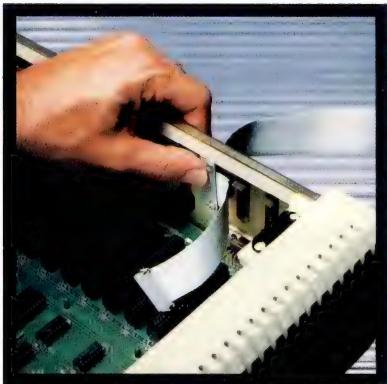
Installing Other Equipment

If you have other equipment that you want to install right now, before closing the computer cover, follow the general procedures given in this manual. For more information, read Chapter 7 of this manual and consult the documentation that came with the equipment. Be sure to install cards in their recommended slots (Table 7-1).

Cards designed for use with an Apple II or II Plus may not work with the Apple IIe, especially if they had attachments to other parts of the **main circuit board.** If you have any doubts about whether a given card can be installed in the Apple IIe, consult your Apple dealer.

Connecting a Monitor

A **video monitor** is like a TV set, except that it receives picture signals directly through a cable, instead of through an antenna and tuner. If you use an 80-column text card, a black-and-white monitor is recommended because the numbers and letters are much easier to read.

Attaching a monitor to the Apple IIe is a simple procedure:

- Connect the video cable (which was in the accessories box) from the video output jack on the Apple IIe to the video input jack on the back of the monitor.
- If you need to use an adapter, be sure to align the points on the adapter with the grooves on the monitor connector before tightening.
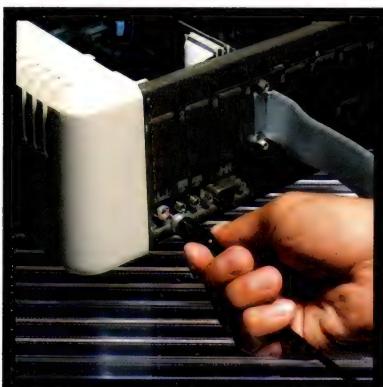
Connecting a Television Set

If you are attaching a color or black-and-white television set to the Apple IIe, you need to connect it through a **radio-frequency (RF) modulator,** which you can purchase from your Apple dealer. To install your RF modulator, follow the instructions provided with it.

> **By the Way:** The modulator takes the signals from the computer and modifies them so the TV set can tune them in. It does not make a black-and-white TV produce color pictures or make 80 column text more legible on the screen, even if you have an 80-column text card. These are the television's limitations, not the computer's.

Two notes on installing modulators:

- Make sure the TV and computer are **off** before proceeding.
- Be sure the modulator is connected to the correct antenna screws on the back of the TV and that the TV set is tuned to the station specified in the modulator's installation instructions.

Closing the Computer Cover

Now that you have attached the video monitor or TV set to the computer, close the Apple IIe cover:

- Place the cover on the computer a little bit back from its closed position.
- Slide the cover toward the keyboard until the lip of the cover is part way in the case.
- Push down on the back corners until the fasteners pop shut on both sides.

Final Checklist

Here is a quick summary of the necessary installation steps.

- ☐ Unpack the computer and its accessories.
- ☐ Check the items against the packing list.
- ☐ Examine the inside and back panel of the computer.
- ☐ Install all interface cards and their internal cables.
- ☐ Install all peripheral devices; connect their cables to the computer back panel.
- ☐ Connect either a TV set with an RF modulator, or a video monitor, as a **display device.**

If you have performed all these steps, your Apple IIe system is ready to go!

Radio and Television Interference

The equipment described in this manual generates and uses radio-frequency energy. If it is not installed and used properly, that is, in strict accordance with our instructions, it may cause interference with radio and television reception.

This equipment has been tested and complies with the limits for a Class B computing device in accordance with the specifications in Subpart J, Part 15, of FCC rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that the interference will not occur in a particular installation, especially if you use a "rabbit ear" television antenna. (A "rabbit ear" antenna is the telescoping-rod type usually contained on TV receivers.)

You can determine whether your computer is causing interference by turning it off. If the interference stops, it was probably caused by the computer or its peripheral devices. To further isolate the problem:

- Disconnect the peripheral devices and their input/output cables one at a time. If the interference stops, it is caused by either the peripheral device or its I/O cable.

  These devices usually require shielded I/O cables. For Apple peripheral devices, you can obtain the proper shielded cable from your dealer. For non-Apple peripheral devices, contact the manufacturer or dealer for assistance.

If your computer does cause interference to radio or television reception, you can try to correct the interference by using one or more of the following measures:

- Turn the TV or radio antenna until the interference stops.

- Move the computer to one side or the other of the TV or radio.

- Move the computer farther away from the TV or radio.

- Plug the computer into an outlet that is on a different circuit than the TV or radio. (That is, make certain the computer and the radio or television set are on circuits controlled by different circuit breakers or fuses.)

- Consider installing a rooftop television antenna with coaxial cable lead-in between the antenna and TV.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet, prepared by the Federal Communications Commission:

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, stock number 004-000-00345-4.
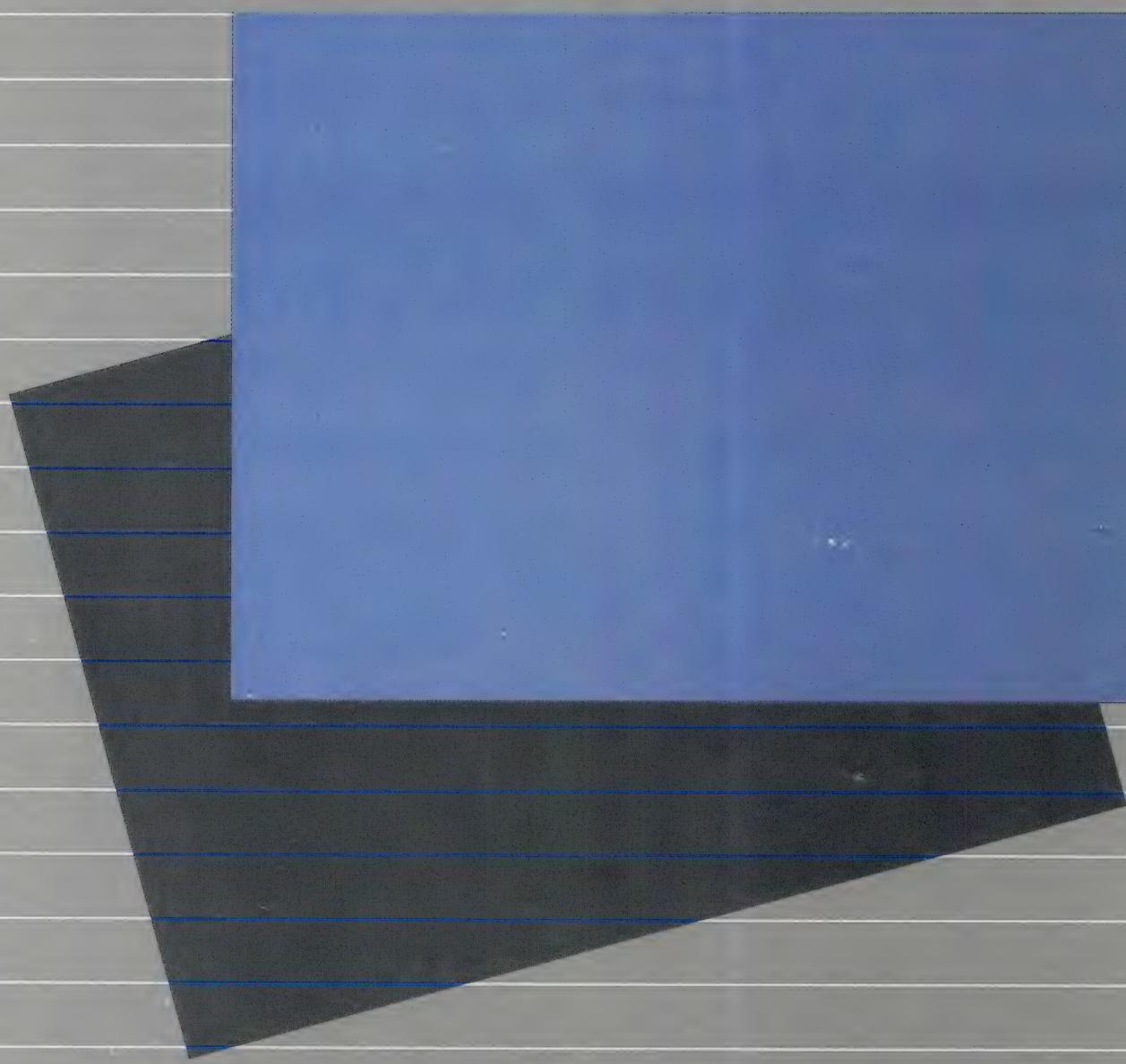
Chapter 2
Getting Acquainted
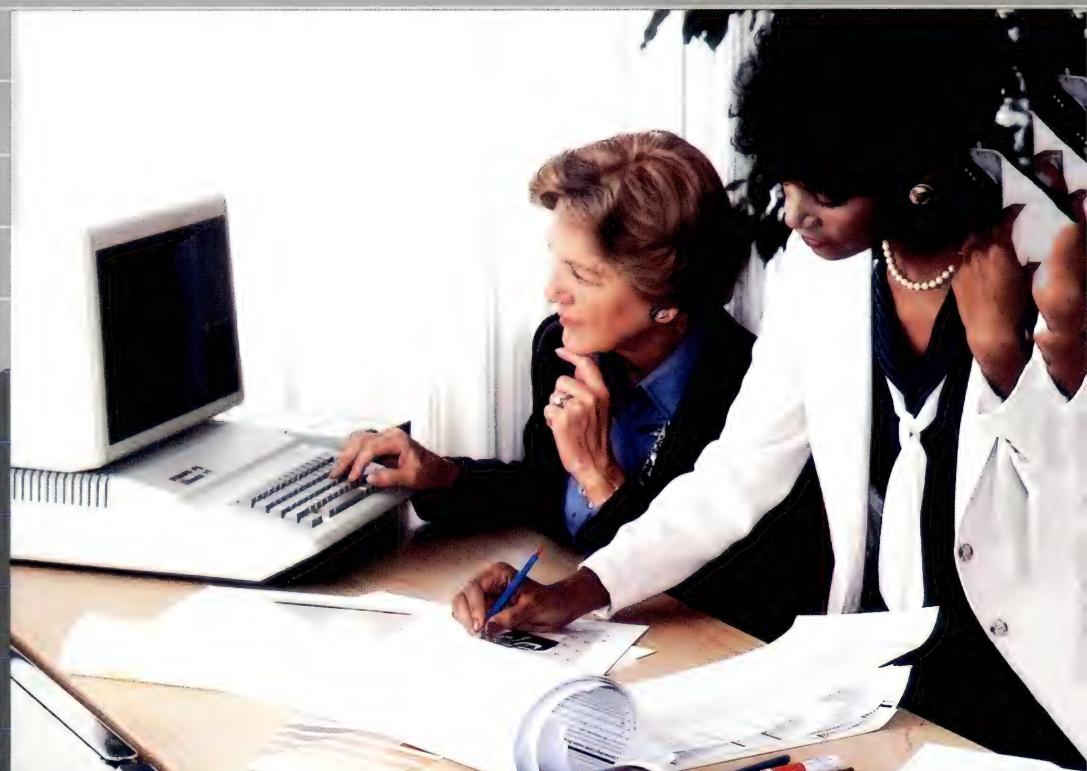
Getting Acquainted

Now that your Apple IIe system is set up, it's time to get acquainted with it. This chapter explains briefly what the basic system parts do and how to take care of them. If you have a disk drive, you can start up the disk APPLE PRESENTS...APPLE, which shows you how easy it is to use the Apple computer system.

This chapter also contains a reference section on the features of the Apple IIe keyboard.

Basic Parts of the System

There are seven basic hardware components to the Apple IIe system. Your system may have more components, but the most important parts are:

- The **6502 processor.** The processor carries out sequences of instructions (called programs) stored in an area of the computer's main memory.
- **Main memory.** This is where the Apple IIe stores programs when it is running them. The portion of main memory not occupied by currently running programs is available for storing information entered at the keyboard or other information the program is working on.
- The built-in **keyboard.** This is your most important means of sending information to the computer. You can type text (characters you can see) or control characters.
- The built-in **speaker.** The computer uses the speaker for sound effects: for example, a beep to indicate a successful startup or an unrecognized command. The speaker can also produce musical tones.

All four of these parts are housed in the Apple IIe case. Three other basic parts complete the system.

- A **display device.** This is the computer's means of conveying information to you, either in words and numbers (text) or in pictures (graphics).
- A **disk drive.** A disk drive reads and writes information on a magnetic disk for repeated use, much the way a tape recorder plays back and records music.

When you record information on a disk, you tell the computer to write or save it; when you transfer information from the disk into the Apple IIe's main memory, you tell the computer to read or load it.

Whenever you turn off the computer, the information in main memory is lost. But what you have saved on a disk is still available to load back into main memory after you turn the computer on again.

- **Flexible disks** (often called "floppy" disks). These are to a disk drive what tapes are to a tape recorder. Some disks have programs or other information already recorded on them (like prerecorded tapes). Other disks are completely blank.

  With your disk drive you received a program that can prepare blank disks and write information on them for you. Chapter 4 shows you how to use this program.

Taking Care of the System

- Install your system in a place away from direct sunlight or sources of intense heat (radiator, fireplace) or cold.
- Make sure no moisture (rain, snow, spilled drinks) gets on the computer or attached devices.
- Connect the system and attached devices to the same grounded three-wire outlet. Do not use a circuit that is already loaded down with large appliances, such as an iron or electric heater.
- Do not block the free circulation of air around and into the vent holes along the sides of the computer case.
- Avoid letting excessive dust, dirt or cigarette ash fall on or into the computer.

Taking Care of Disks

- Handle the disk by its jacket and label. Never touch the disk itself.
- To write on a label already attached to a disk jacket, use a felt-tip pen. Do not press hard. It is better to write on the label before attaching it to the disk.
- Never write on an attached label with a pencil or ball-point pen: this may dent the recording surface, rendering the disk unusable. Also, do not use an eraser on the label. Eraser dust is abrasive and can damage the disk.
- Store disks upright in their envelopes. Do not bend or attach paper clips to disks.
- Store disks away from direct sunlight, moisture, or extremes of heat and cold.
- Keep disks away from magnets or electrical devices, especially telephones, television sets, and large motors.
- It is OK to put disks temporarily on the computer or disk drive.

APPLE PRESENTS... APPLE

This manual comes with a disk called APPLE PRESENTS...APPLE. The program on this disk demonstrates features of the Apple IIe keyboard and some of the sights and sounds you can expect to experience while using the Apple IIe. Using this disk is an easy and enjoyable way of getting to know the Apple IIe computer.

You can select parts of the presentation in any order you wish by indicating your choice from the **menu** the program displays on the screen. Program menus, like restaurant menus, show what is available so you can choose what you want.

Before you use the disk, you should know about the cursor. The computer displays a **cursor** to indicate that it has finished a task and is ready for your next message. The cursor also shows you where what you type will appear on the screen. The cursor comes in many forms: a small box that blinks on and off; one that remains on; a wide box; an underscore character; a tiny checkerboard; and so on. These differences needn't concern you now.

To use the APPLE PRESENTS...APPLE disk, follow the general instructions given in the next two sections. Be sure to put the disk in drive 1. The third section tells you what to do once the system is started.

Inserting a Disk in a Disk II Drive

The following instructions explain what to do any time you want to insert a disk in a Disk II drive. (If you have another type of disk drive, follow the instructions that came packed with it.)

1. Make sure the I N U S E light on the front of the disk drive is **off.** Never remove a disk while this light is on: doing so may damage the disk or destroy some of the information on it.
2. Lift the small door on the front of the disk drive. If there is already a disk in the slot, carefully remove it, and put it in an envelope.
3. Holding the disk you want to use with your thumb on the label, remove it from its envelope.
4. Gently insert the disk into the slot of the disk drive, oval-cutout end first, label side up. Be careful not to bend or force the disk. If you feel any resistance, pull the disk back out slowly and try again.
5. When the disk is completely inside, push down on the small disk drive door until it clicks shut.

Starting Up (Booting) the System

These are the general instructions for starting up the system if the power is off. The disk in drive 1 must be a **startup disk**—such as APPLE PRESENTS...APPLE. You will learn more about startup disks and how to restart the system when the power is on when you read Chapter 4.

1. Turn on the TV set or video monitor and let it warm up for a few moments.
2. Reach behind the left rear corner of the computer case and find the power switch with your fingers.
3. Turn on the computer by pressing the top of the switch.
4. You will hear a beep, and the POWER indicator on the computer keyboard will light up. A small red lamp on the front of drive 1 will also light up, and the disk drive will make some whirring and clicking sounds.
5. After a few moments, the sounds will stop and the red lamp will go out. The program loaded from the disk in drive 1 will present its opening display on the video screen.

Learning about the Keyboard

Now that you have started up the APPLE PRESENTS...APPLE disk, you should see a display that looks like the one below.

When you have finished using the APPLE PRESENTS...APPLE disk, open the small door on the front of the disk drive, remove the disk carefully, and return it to its envelope.

If you want, you may now skip to the next chapter. The "Keyboard Reference" section is just that: it is there for whenever you may need to refer to it.

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APPLE PRESENTS...
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AN INTRODUCTION TO
      THE APPLE IIE COMPUTER
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Keyboard Reference

Figure 2-1 shows what the Apple IIe keyboard looks like. Notice that the Apple IIe keyboard is similar to an ordinary typewriter.

Figure 2-1. Apple IIe Keyboard

However, the keys on the computer keyboard have an auto-repeat feature: if you press a key and hold it down for more than a second, the character it generates is repeated.

With the Apple IIe keyboard, you can send any one of a set of 128 characters to the computer. What the computer does with the characters (especially the *control characters*) depends on the program that is running at the time. But don't worry about that now.

There are two groups of characters in the set.

- 96 printing (visible) characters:

  26 lowercase letters
  26 uppercase letters (CAPS LOCK or SHIFT key depressed)
  10 numerals
  34 special characters (punctuation and so on; some use SHIFT key)
- 32 control characters:

  All control characters are formed by pressing the CONTROL key in combination with a printing character key (most are letter keys).

  Seven of these control characters also are available as single keystrokes. Six are cursor movement keys: RETURN, TAB, and the four arrow keys. The seventh is the ESC (escape) key. In other words, there are two ways to generate each of these seven control characters. For example, CONTROL - M is the same as RETURN.

In general, the printing characters are for typing information, and the control characters are for commanding the system to do something.

There also are three special function keys (OPEN-APPLE , SOLID-APPLE and RESET), which are discussed in a later section of this chapter. These keys cause the computer to do special things, like restart or perform a self-test.

The RETURN Key

The RETURN key (Figure 2-2) is an important key on the keyboard. It serves two purposes:

1. When you are typing text, pressing RETURN indicates the end of a line and causes the cursor to move to the beginning of the next line. In this role, the RETURN key is just like the carriage return on a typewriter.
2. When you are giving commands to the computer, pressing RETURN is usually the way you indicate the end of the command. In this role, the RETURN key passes control to the computer, just as the appearance of the cursor on the screen passes control to you.

Figure 2-2. RETURN Key and SPACE Bar

The SPACE Bar

The SPACE bar (Figure 2-2) at the bottom of the keyboard is another key whose role you must understand. Pressing the SPACE bar generates a space character. That's right, a space is a character—and a very important one at that.

The Apple IIe, like all other computers, interprets what you type precisely as you type it. It isn't smart enough to see that what you've typed is similar to something else, the way people can. Therefore, if a space is needed between letters or words, you must press the SPACE bar to include the space character. Using the RIGHT-ARROW key to move the cursor over one space on the screen

doesn't add a space character. The computer often ignores extra spaces, but you have to provide at least one space character when one is required.

A few other printing-character keys also require special attention.

Keys You Must Use Precisely

As noted with regard to the space character, the computer is not smart enough to accept substitutes, unless the programmer specifically instructs the computer to do so. Here are some substitutions you should avoid .

Key name	What to use it for
Letter L **Number** 1	The Apple does not treat a lowercase L like a 1 just because people sometimes do. Be sure to use the "one" key when you want the number 1 .
Letter O **Number** 0	Similarly, the Apple doesn't accept the uppercase letter O as a substitute for zero. Always use the "zero" key when you want the number. (Computer manuals often slash zeros to remind you of the difference.)
Single Quote **Alternate Single Quote**	The Apple IIe keyboard has the single quotation mark and an alternate form. However, many programs do not recognize the alternate form. When in doubt, use the ' /" key. (The other key is tucked away in the lower left corner so it's easy to avoid.)
DELETE	The Apple IIe has a DELETE key; the Apple II and II-Plus don't have this key. Therefore, most programs written for the Apple II family do not know how to respond to this key. Some programs print a checkerboard character when you press this key, some ignore it or indicate an error.

Uppercase and Lowercase

Picture the keyboard with the upper- and lowercase form of each letter printed on the keys. If you leave CAPS LOCK off and do not use the SHIFT key, you get lowercase letters and the lower characters on the other printing-character keys.

Uppercase-only Keyboard

There are many circumstances when you will want or need to type only uppercase letters. The CAPS LOCK key makes it easy.

Press the CAPS LOCK key until it clicks into its down (on) position. When CAPS LOCK is on, all alphabetic characters are uppercase, the way they are printed on the Apple IIe keys. No other keys are affected, which is extremely convenient because you can have uppercase letters and still type numbers.

Press CAPS LOCK a second time and it clicks back into its up (off) position. With CAPS LOCK off, you have full upper- and lowercase.

Even with CAPS LOCK on, you must use the SHIFT key to get the upper characters on the non-alphabetic keys, such as # on the 3 key.

Figure 2-3. CAPS Lock and SHIFT Key

The SHIFT Key

There are two SHIFT keys, one on the right and one on the left, just as on a typewriter. Holding down the SHIFT key while pressing one of the printing-character keys generates the uppercase letter or the upper character printed on the key.

Cursor Movement Keys

The upper left-hand corner of the screen (the position of the cursor in Figure 2-4) is called the cursor's **home** position. Using the following group of keys, you can move the cursor around the screen.
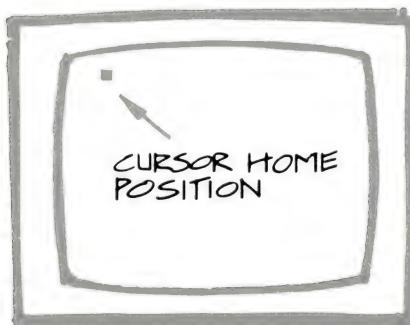
Figure 2-4. Cursor in Home Position

Like other control keys, the cursor movement keys only work in the way the program you are using makes them work. In particular, the TAB and UP - ARROW keys are ignored by many programs.

	Key name	What to use it for
RETURN	RETURN	The RETURN key (discussed in an earlier section of this chapter) moves the cursor to the beginning of the next line.
←	LEFT-ARROW	This key moves the cursor one position to the left. However, when you press RETURN, the Apple receives only the information preceding the cursor's current position; so, the LEFT - ARROW key can remove information.
→	RIGHT-ARROW	This key moves the cursor one position to the right. Some programs let you use this key to copy text that is already on the screen.

	DOWN-ARROW	This key moves the cursor down one line, without erasing what you typed.
	UP-ARROW	This key moves the cursor up one line, without erasing what you typed.
	TAB	This key usually moves the cursor to the next tab setting. Tabs usually are preset to multiples of eight character positions. Some programs let you set your own tabs.

Keep in mind that many programs don't let you move the cursor beyond the boundaries of existing text, unless you are entering new text. Even then, the program may consider some or all of the arrow keystrokes invalid, in which case the keystroke either is ignored or produces a question mark for each invalid keystroke. Always check the manual that came with the program.

Control Characters

To the Apple IIe, a control character is a nonprinting character that causes something to happen. Exactly what happens depends on how a given program interprets each character. You are already familiar with six control characters: the cursor movement keys discussed in the previous section. You will get an idea of what other control characters can be made to do as you use various programs.

Figure 2-5. Control Characters and ESC Key

Each of the control characters is formed by holding down the
CONTROL key while pressing one of the printing character keys—for
example, CONTROL-P.

> **By the Way:** CONTROL-RESET is a special function, which is
> discussed in a later section.

> **Note:** Manuals spell out control characters, such as CONTROL-P,
> in various ways—for example, CTRL-P, ⟨CTRL-P⟩, [P] or
> Pc. Likewise, manuals often spell CONTROL-SHIFT
> characters, such as CONTROL-@, as SHIFT-CONTROL-
> 2 or 2cs, and so on, sometimes indicating the lower character
> on the key when the upper one is required.

The ESC Key

The ESC key is the last and most important of the control keys. This
key is often used to put the computer into **escape mode** or to begin
an **escape sequence.** Examples of escape sequences occur in
many programs written for Apple II systems.

Sometimes the notation for an escape sequence seems tricky at first.
For example, ESC @ assumes you've noticed that @ is actually
SHIFT-2 on the Apple IIe keyboard, since @ is on the upper part of
the 2 key. (Even with CAPS LOCK down you need to use SHIFT to
get the @.) It does not take long to get accustomed to escape
sequences, and they are very useful to have around.

Special Function Keys

Three more keys you want to know how to use are special function keys; that is, they do not generate any characters, but rather cause the computer to perform some special activity. These three keys are highlighted in Figure 2-6.

Key name	What to use it for
OPEN-APPLE	This key has several uses. It is used to invoke the special functions listed below. Pressing this key also has the same effect as pressing the button on hand control #0, so you can use it for various games and other programs that run on the Apple IIe.
SOLID-APPLE	This key also has several uses. The special functions it invokes also are listed below. Pressing this key also has the same effect as pressing the button on hand control #1, so you can use it for various games and other programs that run on the Apple IIe.
RESET	This key has great power over the Apple IIe. It is set apart from the rest of the keyboard so you are less likely to press it by accident. In fact, you must also hold down the CONTROL key whenever you press RESET,

The special functions described elsewhere in this manual are:

- Restarting the system when the power is on by holding down OPEN-APPLE while pressing CONTROL-RESET (Chapter 4).
- Stopping a program by pressing CONTROL-RESET (Chapter 4). Some programs ignore CONTROL-RESET.
- Starting the Apple IIe built-in self-test by holding down SOLID-APPLE while pressing CONTROL-RESET (Chapter 8).

Figure 2-6. Special Function Keys
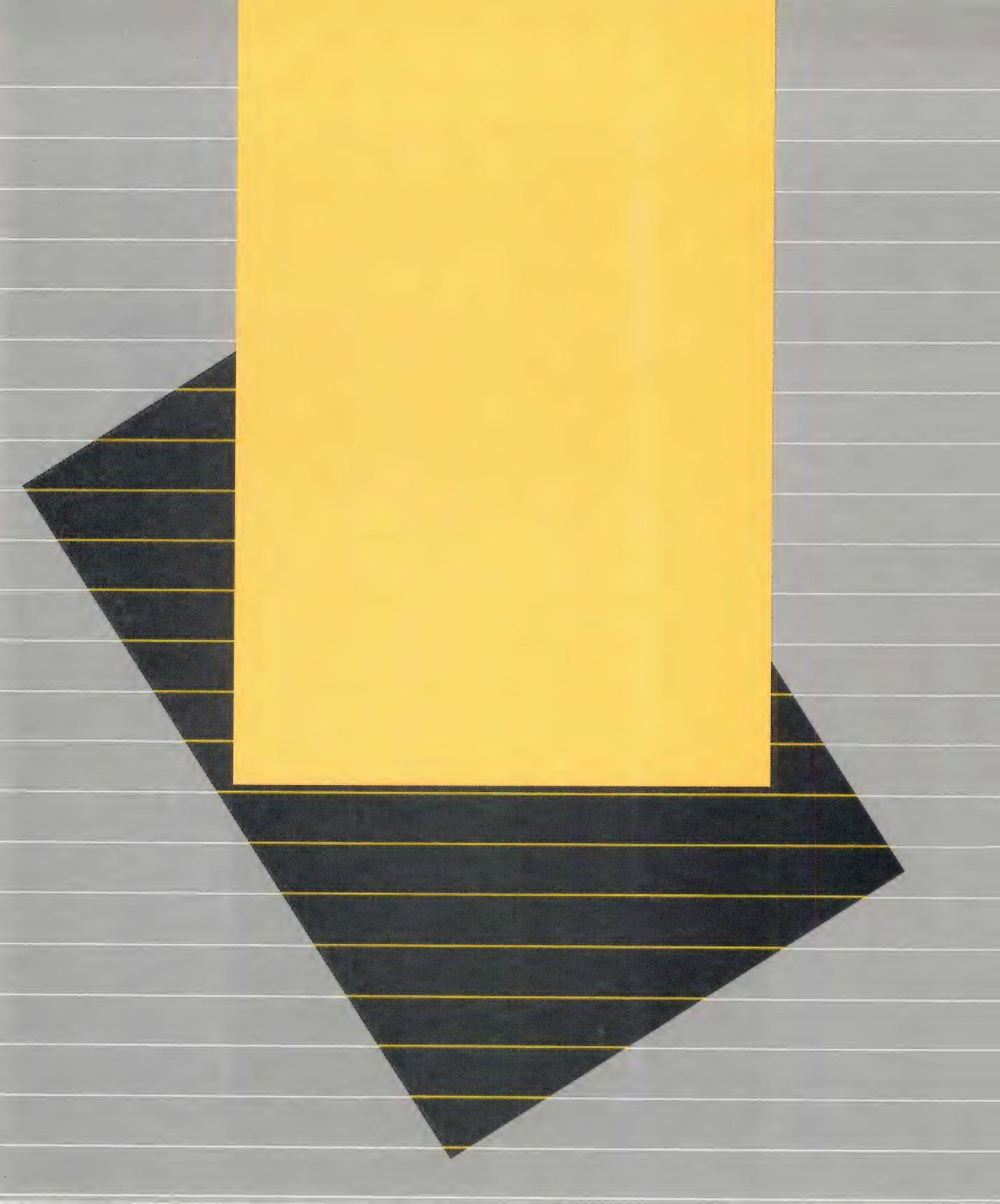
Chapter 3
How It Works

How It Works

This chapter explains in general terms how an Apple IIe system works. If you find the discussion and all the new computer terms difficult to understand, don't worry. You don't need to know exactly how an internal combustion engine works to drive a car. Likewise, you don't need to understand exactly what is going on inside the Apple IIe computer to be able to put it to work for you.

As you read further in this book and experiment with the system, many of these concepts will become clearer. Be patient with yourself.

The parts of an Apple IIe system (as outlined in Chapter 2) fall into three fundamental groups: hardware, software, and information.

- **Hardware** includes the computer and all the physical devices attached to it.

The most important pieces of hardware in the computer are main memory and the processor.

Next in importance are the circuits that adapt and convey signals between the computer and **peripheral devices.** These circuits are called **interfaces.** Some are built in; others, such as the disk controller card, can be installed in the computer's expansion slots.

Finally, there are the external peripheral devices: **input devices** for information going to the computer and **output devices** for information coming from the computer. Some devices, such as disk drives, are combination **input/output (I/O) devices** used for storage.

MONITOR

INTERFACE

PROCESSOR

INTERFACE

INTERFACE

MEMORY

INTERFACE

PRINTER

DISK DRIVE ✓E

KEYBOARD
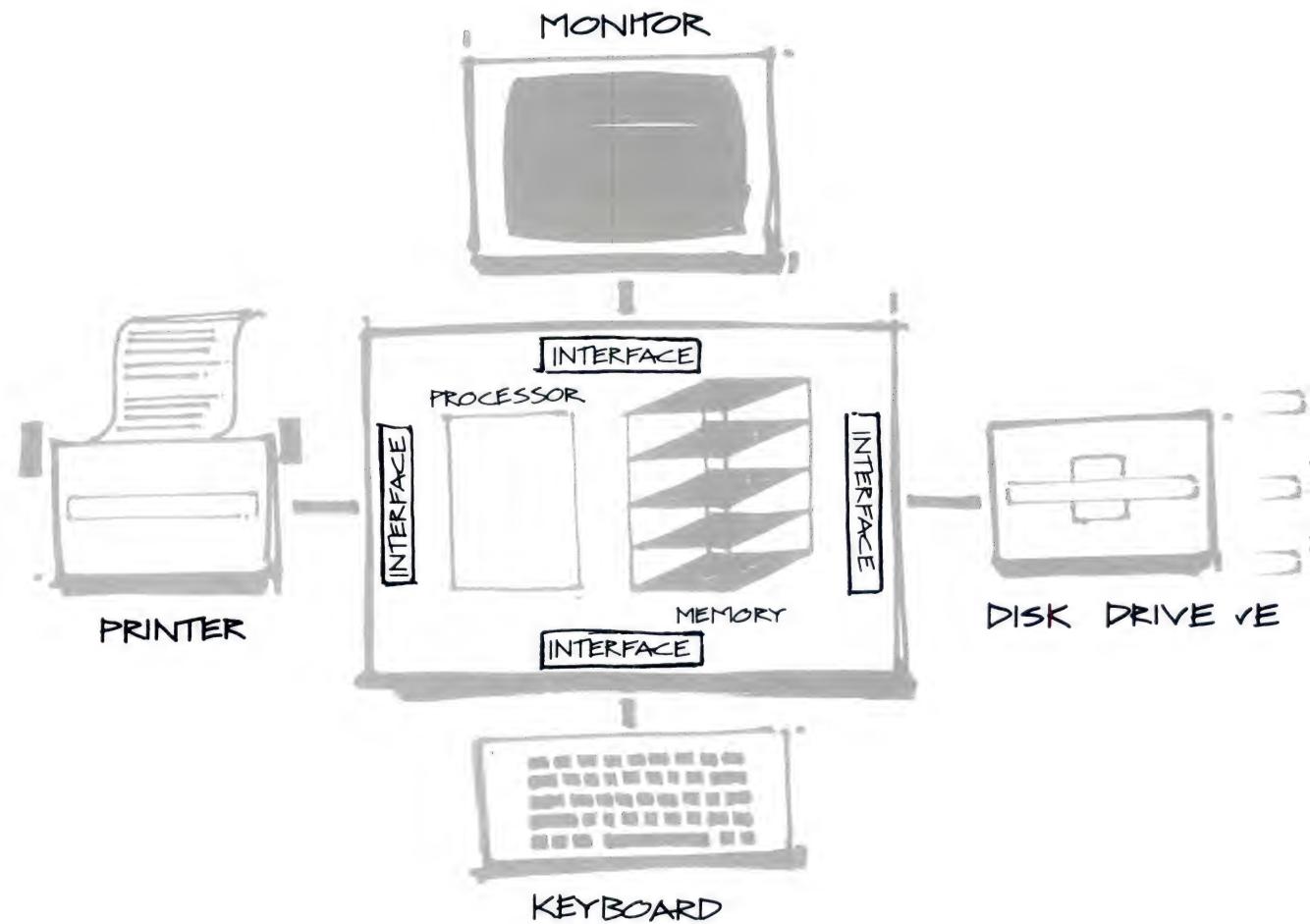
- **Software** is made up of the sequences of instructions (programs) that the processor can carry out when those instructions are in main memory. The instructions can be changed easily.

Some programs are factory installed in **read-only memory (ROM).** These small resident programs cannot be changed, so they are called **firmware**.

Most programs are loaded into main memory from a disk. Those that move information and make it easy to use the system, along with the resident firmware, are known as the **system software.** Programs brought into main memory to make the system do something—organize information, do calculations, connect the computer with a distant source of information, and so on— are called **application programs. Application software** is discussed in Chapter 5.

RESIDENT MEMORY
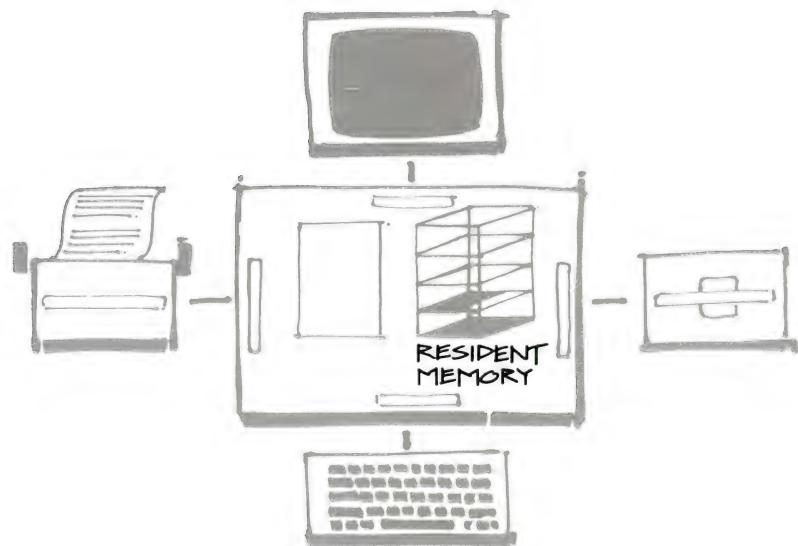
- **Information** includes what you type at the keyboard, what you see on the screen or the printer, or what the program manipulates. The computer deals with all of this information in the form of numbers—in fact, in the form of strings of ones and zeros. How the computer interprets those numbers depends on where it finds them and what it is trying to do with them.

The Hardware

The hardware in the system, as we have seen, falls into three categories: the processor plus main memory, interfaces to peripheral devices, and the peripheral devices themselves. The peripheral devices are easy to understand: they do things we can see, hear, and touch. But what about the processor and main memory?

The Processor

The hub of all activity in the system is the processor. The raw material it deals with is in main memory. The processor is a robot-like electrical machine that continually carries out a fixed procedure: as soon as you start up the system, it looks at the first place in memory and carries out the instruction it finds there; then it moves to the next place in memory and carries out the instruction located there; and so on.

In other words, unless one of the instructions the processor carries out tells it to go somewhere else (which often happens), the processor can be relied on to move along from one memory location to the next. All it does, really, is find, move, compare and combine numbers, and either go on to the next instruction or jump to some other memory location to continue. That doesn't sound like much, but done at a rate of about half a million such elementary steps per second, it is quite impressive.

PROCESSOR   MEMORY

MOVE THIS TO THERE, ETC.
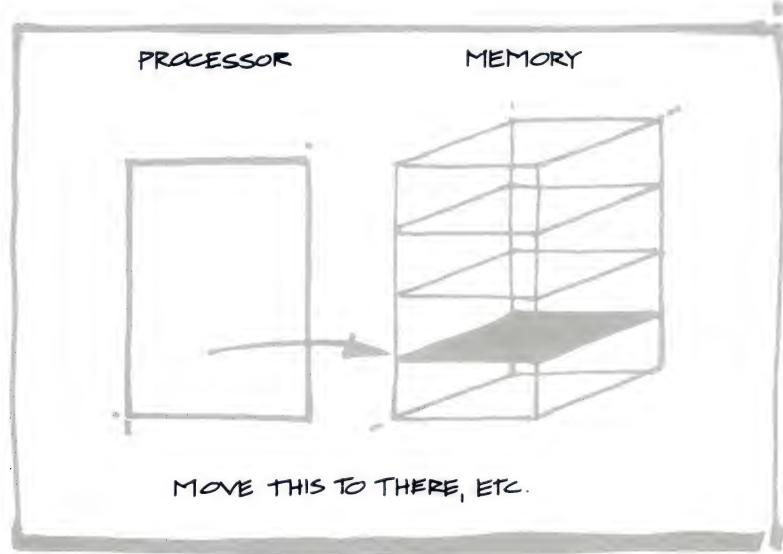
Main Memory

Main memory is the processor's storage area. It is often called random-access memory (RAM) because you can access any given location just about as easily as any other.

Main memory is like a grid of thousands of pigeonholes or post office boxes, each identified by a number called its **address**.
Each box can hold a code that represents an instruction, the address of a memory pigeonhole, or one character that you type at the keyboard (for example, the letter M), and so on.

Programs usually occupy areas of main memory separate from the information they are working on to reduce the probability of mixing up instructions and information. For example, if a mistake (called a **bug**) occurs in somebody's program, the program may try to interpret someone's telephone number as a program instruction.

Another important aspect of main memory is that while all of the pigeonholes are accessible to the processor some also are accessible to one other device, such as the keyboard or the display device. These special memory locations are called input/output (I/O) locations. These are the processor's windows on the outside world.

One last significant fact about main memory: when you turn off the computer, what you were working on is lost—unless, of course, you use the system software, specifically an operating system, to save the information on a disk.
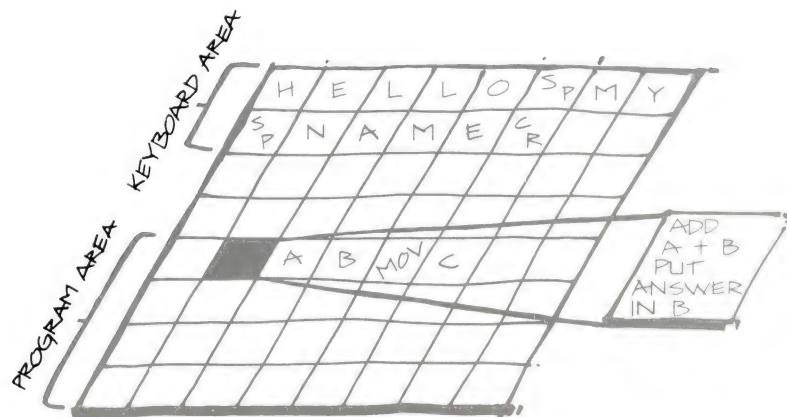
System Software

System software, for purposes of this discussion, is of three types:

1. The **resident Monitor program,** which starts up the system when you turn it on and provides little groups of instructions **(routines)** for use by other programs: routines that move information around, routines that wait for you to press a key, and so on.

2. **Language translators,** which convert the words or abbreviations you type in at the keyboard into instructions for the processor. Each **programming language** includes a few dozen imperative verbs plus their objects, like PRINT THIS or ADD THESE NUMBERS UNTIL YOU REACH THE END OF THE LIST. However, the processor only understands **machine language** instructions (like 01101001, which tells the processor to add two numbers). If you want to program without doing a lot of extra hard work, you need a translator to bridge the gap between what you type and the machine language.

3. **Operating systems,** which make life easy. Instead of having to learn how to write a program to use the disk drive, or copy disks, and so on, you can load an operating system into the computer, type in an easily remembered word or two, and let the operating system program do the hard work. The figure illustrates what a personal computer operating system typically does.

1. PREPARE A DISK

2. LOAD INFORMATION FROM A DISK

3. SAVE INFORMATION ON DISK
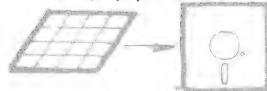
4. COPY A PROGRAM OR A WHOLE DISK

5. TELL YOU WHAT IS ON A DISK
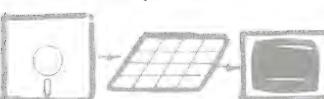
6. TRANSFER INFORMATION TO OTHER DEVICES

The operating system that comes with your drive is called the **Disk Operating System** (or **DOS**). The next chapter gives you some practice using DOS. The programming languages Integer BASIC and Applesoft BASIC, as well as many ready-made programs, use DOS commands and disks prepared by DOS.

Another operating system available from Apple Computer, Inc. for use on the Apple IIe computer is the Pascal Operating System. This operating system is discussed in Chapter 6.

Information

As you type in your information—the report or business data or responses to a program's messages—the program you are conversing with stores the information in a free area of memory.

Occasionally you'll come across the term "buffer." A **buffer** in main memory is a holding area where information can be stored slowly and retrieved quickly, or vice versa.

Another important concept is that of **files.** When the computer stores information on a disk, it puts it there in the form of files.

Disks and Files

One of the services of an operating system program is taking blank disks and preparing them to receive information. This is called **formatting** or **initializing.** When you format a disk, the program writes concentric circles of zeros (called tracks) on the disk, like chalk lines on a racetrack, so the disk drive knows where to write information later.

To speed up reading or writing, the disk drive divides each track into several pieces called **sectors.** Operating systems read and write information on the disk in different ways, using different numbers of sectors per track; that is why a disk formatted for one operating system may not work with another.

When you tell the computer to save information on a disk, a system program divides the information into sector-size pieces first, so it can be transferred and stored efficiently. Once stored, the information is called a **file.**

Some sectors on the disk contain a table of contents with the name of the disk and the names and locations of all the files stored on it. Some operating systems call this table of contents a **catalog,** some call it a **directory.**
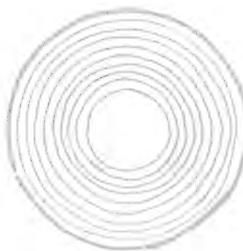
35 TRACKS
PER DISK
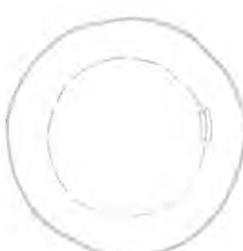
16 SECTORS
PER TRACK

256 BYTES
PER SECTOR

How the System Works Together

When you start up or restart the computer, the processor begins carrying out instructions in the Monitor program—instructions that tell the processor to look for a disk in drive 1 and load an operating system program if it finds one. This is what happens when you start up the DOS 3.3 SYSTEM MASTER disk (Chapter 4). Then you can use operating system commands to load and run (use) selected programs.

Many application programs have either an operating system or the necessary parts of one with them on a disk so that they can handle all their needs. A self-contained disk—that is, one that has an operating system on it—is called a **startup disk**. If an application program is on a startup disk, as soon as you turn on the system, you are talking directly to that program (Chapter 5).

If an operating system isn't accessible when you start up the system, then all that is in memory is the resident software—the Monitor program and a translator for the Applesoft BASIC language. For example, when you use a cassette recorder instead of a disk drive, the Monitor program can load, save, and run the cassette programs, but that is all.

PROCESSOR   MEMORY

2. PROCESSOR LOADS OPERATING SYSTEM

1. PROGRAM SAYS: FIND AND LOAD OPERATING SYSTEM
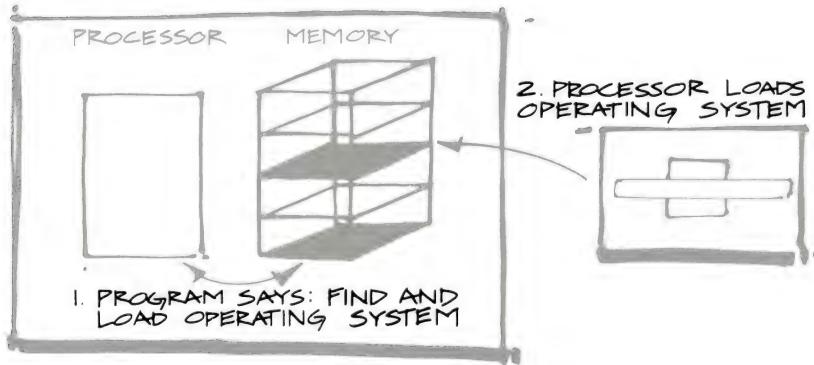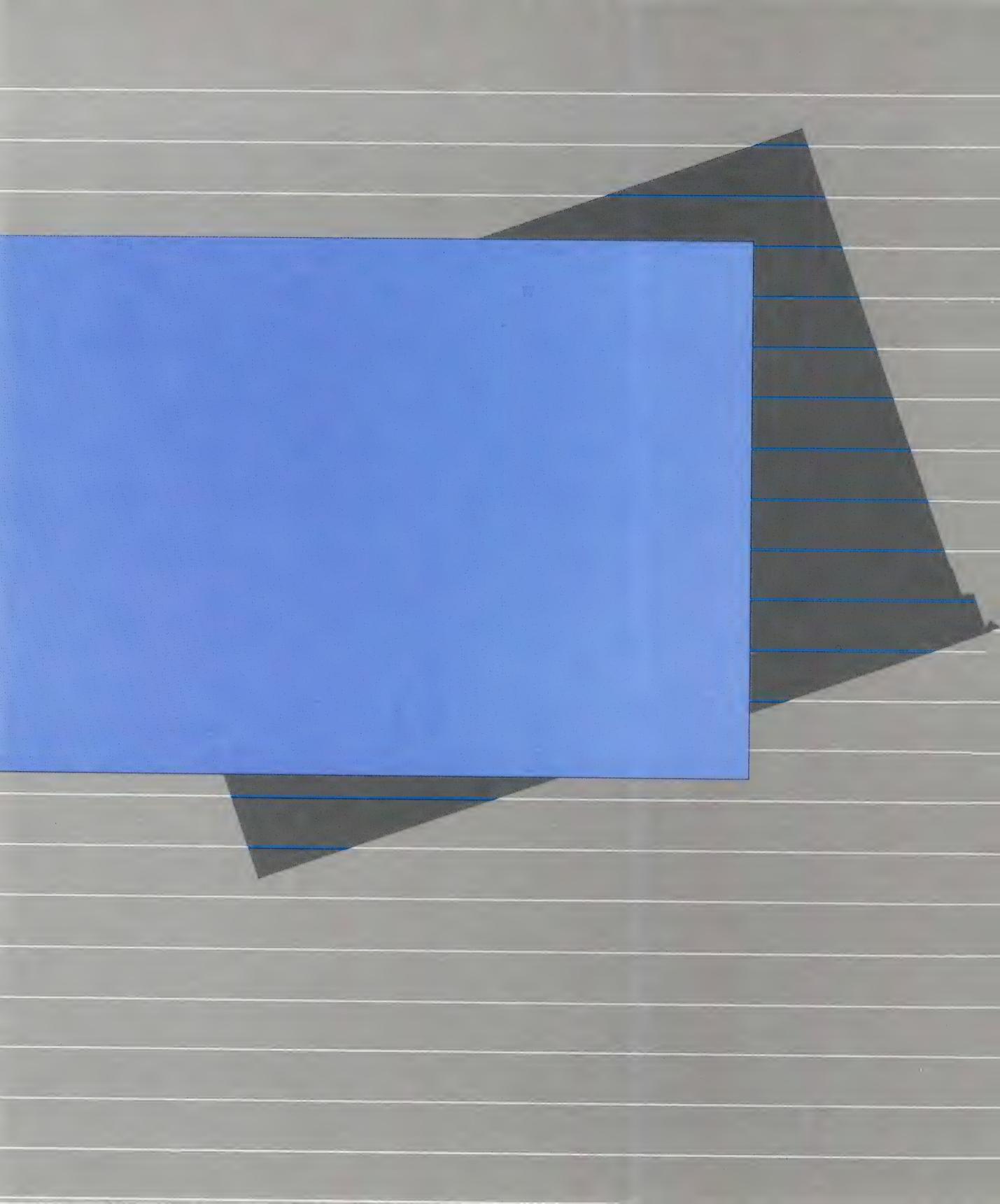
Chapter 4
Using an Operating
System
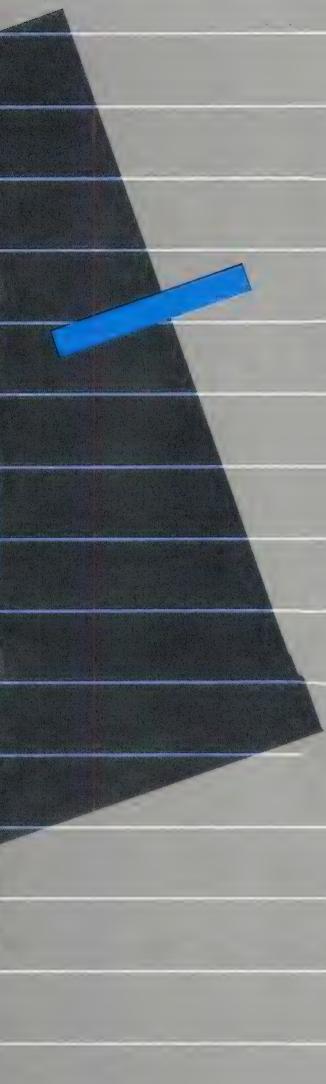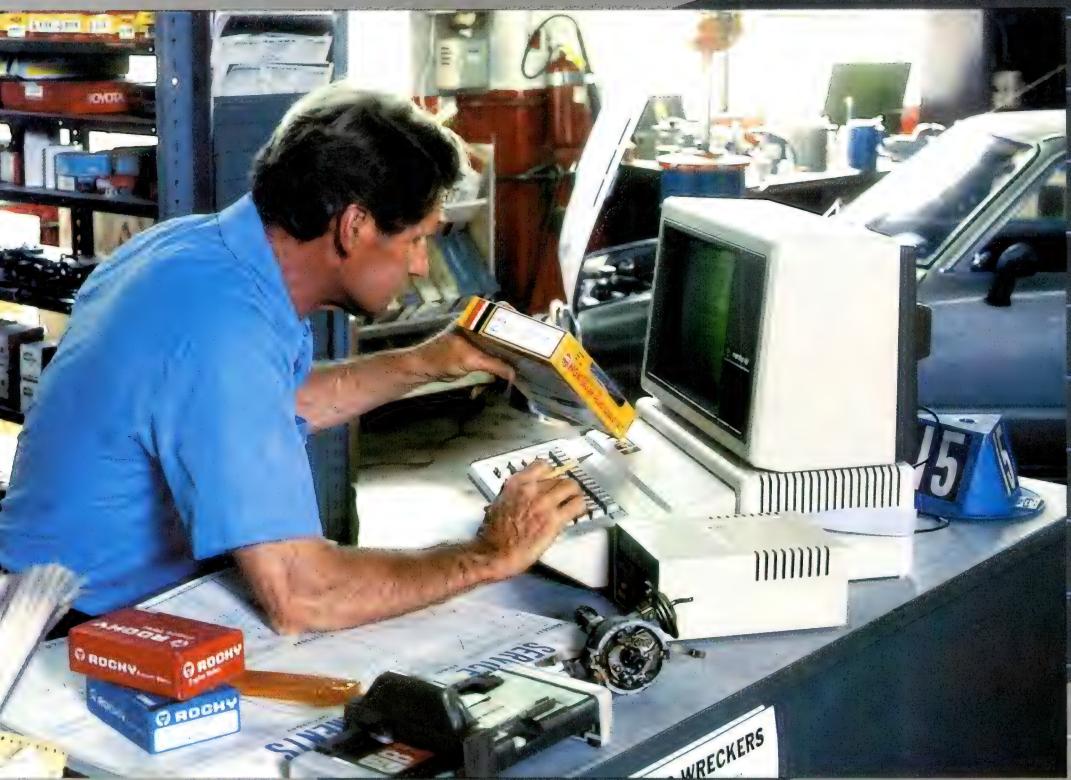
Using an Operating System

As a brief introduction to DOS, the Disk Operating System that came with your disk drive, this chapter presents a series of exercises you can do to see how an operating system works and what it does.

DOS, which rhymes with "toss," got its name because it is a specialist at working with disks. You can find out more about it by reading through the DOS manuals.

In this chapter, you will find out how to:

- restart the computer when the power is already on
- recognize which program you are conversing with
- switch between one BASIC interpreter and another
- see what files are on a disk
- run a program
- stop a program
- prepare blank disks to receive information
- copy one disk onto another
- interpret error messages

The startup disk to use for this chapter is the DOS 3.3 SYSTEM MASTER disk.

Restarting the Computer (Power Already On)

This restart method is recommended whenever the computer power is already **on**, as opposed to turning the power off and then on again. The restart method saves wear and tear on the power switch and the computer's circuits. Of course, if the power switch is off, use the startup procedure described in Chapter 2 (in which you turn on the power switch instead of performing the second step described below).
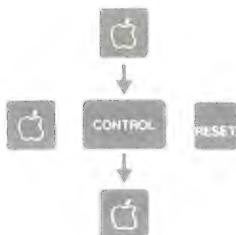
If the computer's power switch is already on and you want to restart the system, do this:

1. Insert a startup disk in drive 1 and close the drive door.
2. Press and hold down the OPEN-APPLE key. Press CONTROL-RESET and then let go. Finally, let go of the OPEN-APPLE key.
3. You will hear a beep from the computer. The disk drive's IN USE light will come on, and the drive will make whirring and clicking sounds for a while as the disk is read.
4. When the operating system (and possibly also an application program) has been loaded into main memory, the disk drive will stop, and a cursor will appear on the screen.

   By the Way: This method of restarting the system erases parts of the programs and information in main memory to protect copyrighted application programs from being duplicated.

How DOS Begins

When you start up or restart the system using the DOS 3.3 SYSTEM MASTER disk, you should see this message (or a similar one) on the screen:

```
                    APPLE II


        DOS VERSION 3.3 SYSTEM MASTER



               JANUARY 1, 1983



        COPYRIGHT APPLE COMPUTER, INC.
                 1980,1982


          BE SURE CAPS LOCK IS DOWN
```

Companions to DOS

DOS, an operating system, works hand in hand with BASIC, a programming language, and its interpreter (translator). BASIC stands for "Beginner's All-purpose Symbolic Instruction Code." As its name implies, it is a good language to learn first. (Chapter 6 explains more about this and other programming languages.)

There are two versions of BASIC available for the Apple IIe. The Applesoft BASIC interpreter is always in main memory. When DOS is loaded into main memory from the SYSTEM MASTER disk, another language translator called the Integer BASIC interpreter is loaded in, too.

Language translators convert the words and abbreviations you type into numbers that the processor can understand—namely, machine language. An **interpreter** is a language translator that translates the program and starts the program running in one continuous operation.

Three-way Conversations

When loading is complete, the computer displays a **prompt,** or cue, that indicates which program you are conversing with. With the Apple IIe, this program is the Applesoft interpreter program; its prompt is a closing square bracket (]). To the right of the prompt is the cursor, indicating that the program is waiting for your instructions.

DOS has no prompt of its own. You can tell DOS is in main memory by typing a DOS command and seeing whether it works or not. What you type is checked first by DOS and then by the interpreter.

And Now to Begin

1. With CAPS LOCK off, type int, and then press the RETURN key. What message do you see?

   ?SYNTAX ERROR

   The question mark before the error message means the message comes from the Applesoft interpreter (also known as just Applesoft). DOS didn't recognize the lowercase "int," so it passed it on to Applesoft. But Applesoft didn't recognize the command, either.

   SYNTAX ERROR is a message you will see a lot. It simply means the program couldn't make sense out of what you typed. It usually means you misspelled a command, forgot to use CAPS LOCK, or pressed a control character (which doesn't usually appear on the screen) while typing a command.

2. Turn on CAPS LOCK; that is, press it so the key clicks into its down position. Always do this before you begin typing commands to DOS or a BASIC interpreter because they only recognize uppercase.

3. Type INT and press RETURN. You should now see the Integer BASIC prompt, a greater-than sign (>), at the left of a new line. Note that the computer did not bother to remove the ?SYNTAX ERROR message from the screen, even though it refers to a situation that has passed.

4. Type FP and press RETURN. You should see the] prompt of Applesoft again. When you use DOS, you are conversing with either DOS and Applesoft or DOS and Integer BASIC; the prompt tells you which.

5. Now try typing something that DOS almost recognizes: type CATALOGG (with two G's) and then press RETURN. You'll see

   SYNTAX ERROR

   without a question mark to the left of it. Messages with no prefix are from DOS.

6. Type INT to switch to Integer BASIC again. When you see > and the cursor, type your name and press RETURN. (Presumably your name is not a DOS or BASIC command!) You'll see the message

   *** SYNTAX ERR(OR)

   DOS didn't recognize the command, so it passed it on to the Integer BASIC interpreter. Integer BASIC messages typically begin with three asterisks. (The last two letters of the word ERROR do not appear on the screen.)

Briefly, what these experiments illustrate is that:

- When you use DOS, you are conversing either with DOS and the Applesoft BASIC interpreter or with DOS and the Integer BASIC interpreter.
- You are conversing with DOS and Applesoft when you see the Applesoft prompt (]).
- You are conversing with DOS and Integer BASIC when you see the Integer BASIC prompt (>).
- To switch from Applesoft to Integer BASIC type I N T.
- To switch from Integer BASIC to Applesoft, type F P.
- Always press R E T U R N at the end of a command to DOS.
- You can tell which program sent you an error message by the message prefix; for example:

SYNTAX ERROR (no prefix; from DOS)
?SYNTAX ERROR (from Applesoft BASIC)
*** SYNTAX ERR (OR) (from Integer BASIC)

In the remainder of this chapter, you will be using DOS. One of the two language interpreters will be there as well, to translate whatever program DOS loads from the disk.

Of course, if you decide to write a program of your own, the interpreter will translate that into machine language, too. However, in this chapter, DOS is in the spotlight. Chapter 6 explains more about the interpreters and writing your own programs.

Seeing What's on a Disk (CATALOG Command)

Whenever DOS stores information on a disk—whether that information is a program, a list of telephone numbers, or a report—it stores it as a file and gives the file a name. The names and locations of all files on a disk are stored in a special disk area called (in DOS) the catalog. The catalog is like a table of contents for the disk.

Here's how to get a DOS disk's table of contents onto the display screen so you can read it:

- Type C A T A L O G and press R E T U R N.
- After a second or two, the catalog should appear on the screen.

Your catalog should resemble the one in Figure 4-1, but it may not be exactly the same.

```
DISK VOLUME 001
*A  003  HELLO
*I  003  APPLESOFT
*B  006  LOADER.OBJ0      OBJ0
*B  042  FPBASIC
*B  042  INTBASIC
*A  003  MASTER
*B  009  MASTER CREATE
*I  009  COPY
*B  003  COPY.OBJ0        OBJ0
*A  009  COPYA
*B  003  CHAIN
*A  014  RENUMBER
*A  003  FILEM
*B  020  FID
*A  003  CONVERT13
*B  027  MUFFIN
*A  003  START13
*B  007  BOOT13
*A  004  SLOT#
```

— The name of the file or program
— The amount of space (in sectors) that the program takes up on the disk.
— The language the program is written in (file type):
A=Applesoft BASIC   I=Integer BASIC
B=Binary   T=Text
— The program is or is not locked. Locking a file protects it from changes or erasures.
Asterisk=locked
No asterisk=unlocked
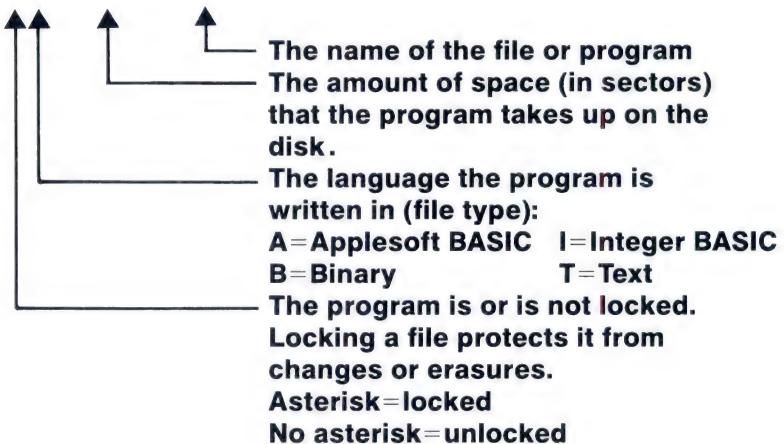
Figure 4-1. Typical Catalog

Running a Program (RUN Command)

The DOS 3.3 SAMPLE PROGRAMS disk has several programs you can try—right now. Put the disk into drive 1 and type CATALOG. Look at the second column from the left. (An asterisk in the leftmost column means the file is *locked,* and you can't change or erase that file, but it's OK to run it.)

By the Way: If you didn't get a DOS 3.3 SAMPLE PROGRAMS disk with DOS 3.3, you'll find the sample programs on the DOS 3.3 SYSTEM MASTER disk. In this case, put your DOS 3.3 SYSTEM MASTER in drive 1 and follow these directions:

To run a program——for example, APPLEVISION—do this:

1. Type RUN APPLEVISION and press RETURN.

2. Wait a few seconds for your Apple IIe to find, load, and start the program called APPLEVISION.

3. When the program asks (prompts) you for information, type in the answers on the keyboard.

If you get tired of APPLEVISION and want to run another program, press CONTROL-RESET, and then type RUN BRICK OUT.

By the way: BRICK OUT used to be called LITTLE BRICK OUT. If you get the message FILE NOT FOUND when you type RUN BRICK OUT, type RUN LITTLE BRICK OUT. To play LITTLE BRICK OUT, you'll need a set of hand controls.

Have fun for a while.

Stopping a Program

Suppose you want to stop a program. Usually the program will offer you that option from time to time, and even tell you how to do it. But to get out of a program at any time, try these six methods, which are listed in order of increasing severity:

1. Press the ESC key. This key is in the upper left-hand corner of your keyboard. Its full name is escape, and if you're lucky, that's what it'll help you do.
2. Press CONTROL-C. Many programs think of CONTROL-C as "cancel."
3. Press CONTROL-C and then RETURN. Some programs don't get the hint unless you reinforce it.
4. Press CONTROL-RESET. The program will stop or return to its opening menu and, in most cases, remain in memory, unharmed.

5. Press the OPEN-APPLE key and hold it until you've pressed and let go of CONTROL-RESET. This is the power-on restart procedure discussed earlier, and it is pretty drastic. **All your current work in main memory is lost in the process.**

6. Turn off the power. You will rarely have to go this far to exit from a program. But it's a powerful way to show the computer who's boss. Don't forget, though, all your current work in memory will be lost.

Preparing New Disks for Use (INIT Command)

When you buy blank disks, they have nothing recorded on them—just like blank tape for a tape recorder. Before a disk can receive information from DOS, you must prepare it using the INIT command. This preparation process is called **initializing** or **formatting.** Here's how to do it:

1. Put the DOS 3.3 SYSTEM MASTER disk into drive 1. Restart the system. (Remember how? If not, reread the description early in this chapter.)

2. When Applesoft's] appears on the screen, remove the DOS 3.3 SYSTEM MASTER disk, and place a blank disk in drive 1. Close the drive door.

3. Make sure CAPS LOCK is on. To make a little greeting program to put on your new disk, first type NEW and press RETURN to erase anything that may be in the free area of main memory.

   Now type this three-line program, substituting your name and the date in the second line. Press RETURN after typing each line:

   ```
   10 PRINT "THIS HELLO PROGRAM CREATED BY"
   20 PRINT "(your name) ON (date)"
   30 END
   ```

   If you keep getting SYNTAX ERROR messages, you probably forgot to turn on CAPS LOCK.

4. Type INIT HELLO and press RETURN. The disk drive will whir for a while. When formatting is complete, the cursor will reappear on the screen and the IN USE light on the disk drive will go out.

   DOS formatted the disk (as explained in Chapter 3 of this manual) and then wrote your greeting program on it, naming the program HELLO.

5. It is a good idea to test the disk to make sure it is in fact formatted. Type CATALOG and press RETURN.

You should see a short catalog like this:

```
DISK VOLUME 254
A 002 HELLO
```

DOS assigned your disk the volume number 254 (which it always does unless you specify a different number), and wrote your Applesoft (A) program on it, two (002) sectors long, with the name HELLO.

Copying Entire Disks (COPY Command)

From time to time you will want to make copies of disks. Why? To have a backup copy of your favorite programs or the records you spent so much time typing in, or perhaps to have a copy of a friend's program.

To copy one disk onto another, the receiving disk must have a notch along one side of it: otherwise the disk drive will not write on it. (This is a convenient feature. It's one way to prevent accidentally writing over important information.) A disk that has no **write-enable notch,** or one that has tape over the notch, is **write-protected;** that is, no files on the disk can be modified, added to, or erased.

Some program disks are **copy-protected;** that is, the software is designed so you can't copy it, or if you do copy it, it won't work.

Any disk that is not copy-protected can be copied onto any disk that is not write-protected.

Note: The copy program automatically formats the receiving disk before copying information onto it. Formatting erases any information that may have been on the disk.

How to copy a disk using one drive:

- Start or restart the system with the DOS 3.3 SYSTEM MASTER disk.
- Type CATALOG and press RETURN Notice that there are two copy programs—one that runs in Applesoft BASIC (COPYA, with an A next to it in the catalog) and one that runs in Integer BASIC (COPY, with an I next to it in the catalog). Since you have access to both types of BASIC, you can run either program.
- Type RUN COPYA and press RETURN.

- Wait for the program to get started. The computer will ask you six questions, one at a time:

  1. First the copy program says ORIGINAL SLOT DEFAULT 6, meaning that unless you tell it otherwise, it will assume that the original disk is connected via slot 6. Well, it is, so just press RETURN.
  2. Likewise, just press RETURN in reply to the second question since the original disk is in drive 1.
  3. Now the computer asks questions about the new, or duplicate, disk. Since it, too, is connected via slot 6, press the RETURN key.
  4. The computer will assume that the new disk is in drive 2, even if you don't have two drives connected. Since you are doing this with only one drive, change the duplicate drive number from 2 to 1 by pressing the 1 key.
  5. Press RETURN when you are ready to start the program. Since you are using only one drive, the program will ask you to do some swapping of source and destination (original and copy) disks. Nothing is wrong: a disk has a lot more information than the Apple's free memory can hold, so the program makes the transfer in several steps.
  6. When the transfer has been completed, the program asks if you want to make another copy. Press N for "no."

- After you make a copy of any disk, it is always a good idea to test the new copy, either by checking its catalog or, if it is a startup (boot) disk, by seeing if you can use it to start the system. Try it and see.

Disks That Don't Seem to Work

As you use the Apple IIe, sooner or later you will come across disks that don't seem to work. They fall into three general categories:

1. Those that make an even whirring sound when you try to start the system with them or load a program from them. This always happens to disks formatted by an earlier version of DOS. The manuals that come with such disks usually make reference to DOS 3.2.1 or possibly an even earlier version.
2. A faulty or blank disk also might just spin.
3. Disks that use other operating systems or languages (such as Pascal) can cause the drive to clack away noisily.

Disks that have been formatted by an earlier version of DOS (formatted with 13 sectors per track instead of 16) can be dealt with in two ways: you can do a two-disk startup every time or you can use a program called MUFFIN to copy a 13-sector disk onto a 16-sector one. These methods are explained in the next two sections.

Making a 13-sector Disk Work As Is

If you plan to use a 13-sector disk only once in awhile, or if it is copy-protected, do a two-disk startup:

- Put the disk labeled DOS 3.3 SYSTEM MASTER in drive 1, close the drive door, and start or restart the system.

- Type RUN START13.

- You'll see the question: SLOT TO BOOT FROM (DEFAULT=6)?

- Put your 13-sector disk in drive 1.

- If you followed the instructions in this manual for connecting your disk drive, your disk drive controller card is in slot 6, so you can accept the default by pressing RETURN. If your disk drive controller card is in some other slot, type that number and press RETURN.

  By the Way: If your DOS 3.3 came packaged with a BASICS disk, the procedure for starting up 13-sector disks is a little different. Instead of putting the DOS 3.3 SYSTEM MASTER in drive 1, you put the BASICS disk in drive 1 and start or restart the system. You don't have to type anything. Just wait for the message INSERT YOUR 13-SECTOR DISKETTE AND PRESS RETURN and be sure to put the 13-sector disk in drive 1.

If the disk is not copy-protected, you can avoid this two-disk startup procedure by transferring the files to a 16-sector disk using MUFFIN.

Converting Programs to 16 Sectors Per Track

After you're a bit more comfortable with your computer, you might want to read the section in the **DOS User's Manual** about the program MUFFIN on the DOS 3.3 SYSTEM MASTER disk.

MUFFIN takes a program (or any other type of file) from a 13-sector disk and transfers it to a 16-sector disk. However, MUFFIN won't work for copy-protected programs.

- FILE TYPE MISMATCH
  You can always use the CATALOG command to find out what type of files are on a disk. There are four major types of files:

File type A	Applesoft program files
File type B	Binary program or data files
File type I	Integer BASIC program files
File type T	Text files

  DOS has fixed rules about what operations it will perform on each type of file:

  - LOAD, RUN, or SAVE a type A or type I file
  - OPEN, READ, WRITE, APPEND, POSITION, EXEC(ute) a type T file
  - BLOAD, BRUN or BSAVE a type B file
  - CHAIN a type I file

  For more information about commands you haven't used in this chapter's exercises, consult the DOS manuals.

Summary

You have tried quite a few commands in this chapter—commands that are very useful. Besides that, you now have an idea of how operating systems work and what they do. Here are the commands you used:

- INT to switch to the Integer BASIC interpreter
- FP to switch to the Applesoft interpreter
- CATALOG to display a disk's table of contents
- RUN to load and run a program
- INIT to prepare a disk to receive information
- COPY to duplicate one disk onto another
- LOCK to protect an individual file from accidental alteration or erasure
- UNLOCK to remove write-protection from a file

You also know:

- how to restart the system when the power is already on
- how to identify which program you are conversing with
- how to stop a program
- how to write-protect whole disks and individual files
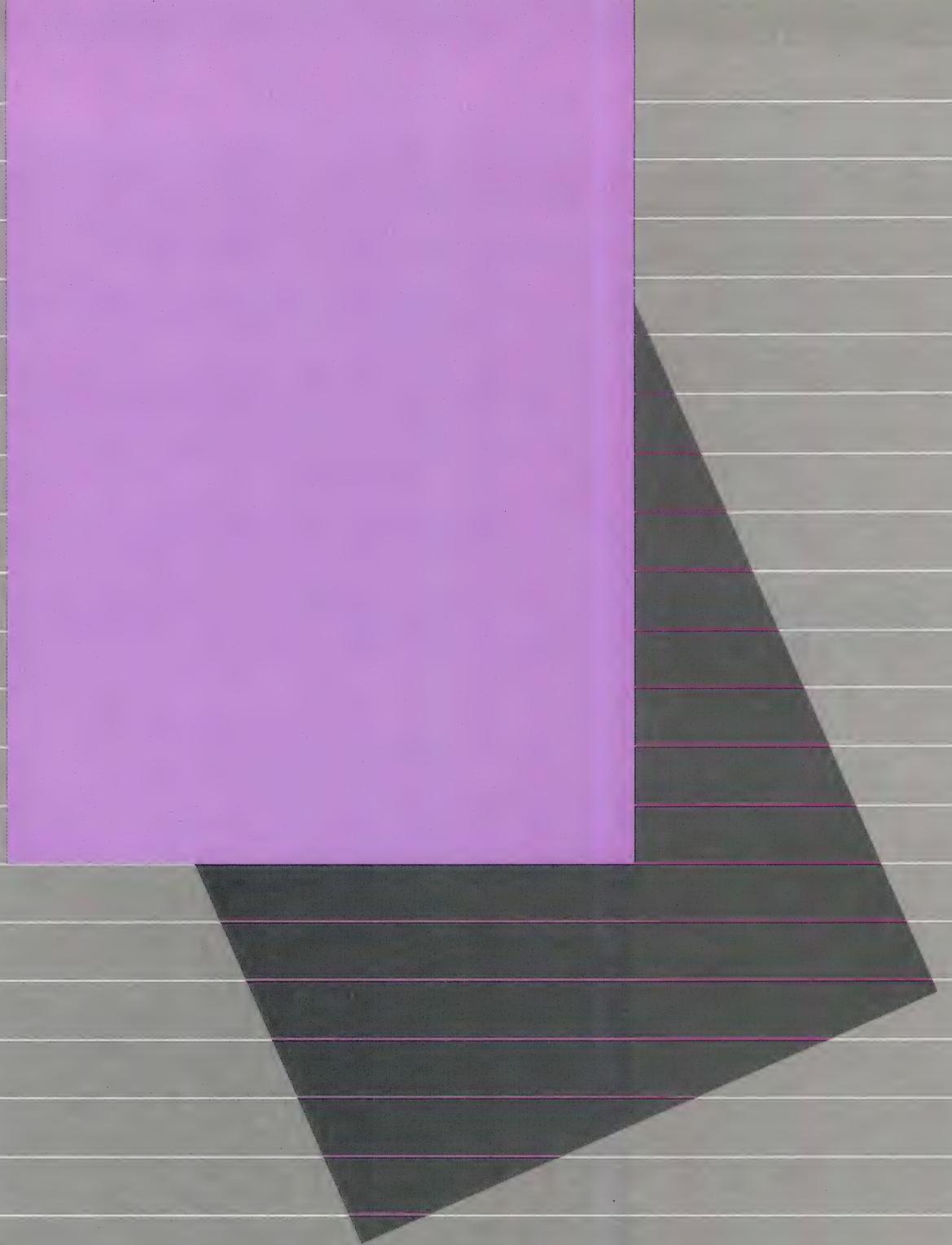
Chapter 5
Getting Down to Business and Pleasure

Getting Down to Business and Pleasure

The Apple IIe computer demonstrates its true power and value when you put it to work on your own real-world problems. The computer, in combination with the display device, disk drive, and any additional devices, puts an integrated system at your disposal. Application programs use the system's resources to do a wide variety of tasks. In this chapter we will focus on:

- **electronic worksheets:** powerful tools for testing assumptions, these programs let you put values into a checkerboard-like grid and define the way you want the values to interrelate.
- **word processors:** programs that let you write memos, letters, reports, even books, these use the computer system to gather, change, and format text.
- **data base management programs:** these take information and structure it for selective manipulation and retrieval.
- **telecommunications:** programs and equipment that make it possible to send and receive information across distances.
- **graphics programs:** these let you draw pictures on the screen, in black-and-white or color, and in some cases transfer the pictures to paper (using a dot printer or a plotter).

Before looking more closely at some of these application programs, you need to know:

- what differences to expect when using the Apple IIe computer to run programs written for earlier models of the machine (Apple II and II-Plus computers)
- what mistakes people most frequently make and what to do about them
- how the application programs make the parts of the system work together

Differences from the Apple II and II Plus

The Apple IIe computer has several features that the Apple II and II Plus do not have. Some of these features change the way you use programs written for the Apple II and II Plus. As time passes, of course, more and more programs will be revised to take these features into account.

The following are the most important new features of the Apple IIe:

- an enhanced keyboard that generates more printing characters than the Apple II or II Plus, especially lowercase letters
- an auxiliary slot to hold auxiliary cards available for the Apple IIe, such as an Apple 80-column text card
- 65,536 **bytes** (64K) of main memory
- a built-in language system (which used to be an option)

Some of these features are interrelated. They are explained in the next three sections.

Keyboard Differences

Many programs written for the Apple II and II Plus do not recognize lowercase letters. To adapt the Apple IIe to this situation, press the CAPS LOCK key until it clicks into its down (on) position. CAPS LOCK acts like a typewriter's shift lock key for letters only.

The REPT key on Apple II and II Plus has been replaced by an auto-repeat feature: all the printing-character keys repeat automatically if you hold the keys down for more than a second.

Several keys are new (for example, DELETE); some are in different locations (for example, the arrow keys); some are in different combinations (for example, ^ is on the 6 key instead of on the N key). The Apple IIe keyboard also has 12 more keys than the Apple II or II Plus keyboard.

Two new keys—OPEN-APPLE and SOLID-APPLE—are special function keys. They are used in combination with other keys for invoking the built-in self-tests and performing a power-on restart. Application programs can use these keys as hand control buttons or in various other ways the programmer finds appropriate.

Display Differences

If you install an 80-column text card in the auxiliary slot, do the following:

1. Make sure no card is in slot 3.
2. Install the text card in the auxiliary slot.
3. Turn on the card by typing PR#3 (if the program does not do the equivalent automatically) after starting up or restarting the computer.
4. If you want to turn off the card, press ESC and then CONTROL - Q. Do not use PR#0 in this case because it will lead to unpredictable results.

The computer treats any card you install in the auxiliary connector slot as if it were in slot 3. This is so that programs written for older Apple II's with 80-column text cards installed in slot 3 will still run properly.

> **By the Way:** You can use many of the 80-column text cards available on the market, except those that require extra connections on the main circuit board (which has changed). Simply install the card in slot 3, and turn it on and off in the usual way.

When the Apple 80-Column Text Card is first turned on, it displays 80 character positions per line. However, you can switch between 40 and 80 characters per line—a useful feature if you want to mix text and color graphics. This and other features of the 80-column text card are fully described in the **Apple IIe 80-Column Text Card Manual.**

The combinations of normal (light-on-dark), inverse (dark-on-light), and flashing characters available with the Apple 80-column text card are described in the **Apple IIe Reference Manual.**

Memory Differences

Every Apple IIe has 65,536 (64K) main memory locations as standard equipment. This includes 48K of RAM and the 16K of RAM that used to be part of the optional language card (now built-in). Slot 0 is no longer on the main board.

Mistakes and What To Do About Them

One of the advantages of using a computer is that if you make mistakes, you can easily correct them without having to redo all the other work you have done. For example, if you are preparing a report that has to be letter perfect, you can type the text and make corrections before printing a final copy. If you notice errors after printing, you can go back into the text, make the changes, and print it again—instead of retyping everything by hand.

The only really big mistake is to type in information for long periods of time without occasionally backing up your work—say, after every page or every ten minutes. Backing up means saving your work onto a disk, or even better, onto two disks. Whenever possible, make two disk copies of everything. Then if one copy is damaged, you still have another.

As you go along, you are bound to make some typos. The computer, being literal-minded, can't figure out what you meant to type, even if to you it looks close. Error messages usually mean the computer didn't recognize what you typed or tried to do something that didn't work as expected.

How System Parts Work Together

To understand what is happening when you run programs, especially application programs, it is important to appreciate three concepts:

1. What program you are conversing with at any given time.
2. The relationship between what you see on the screen and what is stored in main memory.
3. The overall order in which things are done.

What Program Are You Conversing With?

Once an application program is in main memory, you exchange information and messages with it most of the time—not with the operating system and other system software (language interpreter, Monitor program, and so on) that also are in memory. The system software is there for the application program to use—sort of working in the background. It is also there for you to use if you exit from the program.

CONTROL-E

INFORMATION FROM KEYBOARD

APPLICATION PROGRAM

OPERATING SYTEM

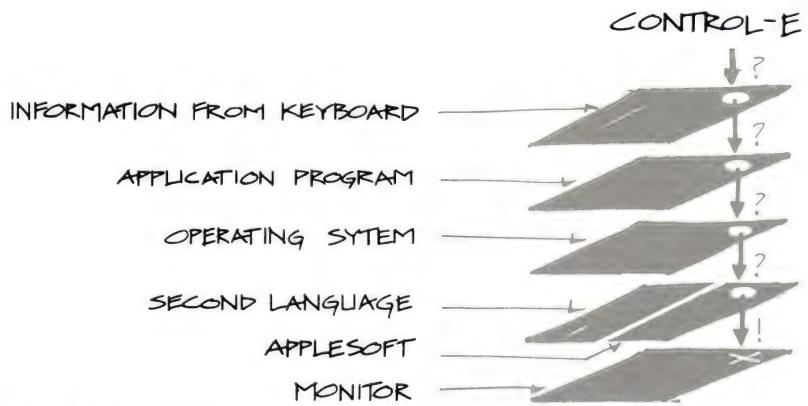SECOND LANGUAGE

APPLESOFT

MONITOR

Figure 5-1. Command "Filters"

Knowing what program you are conversing with is important because you may try to type an operating system command (like those in Chapter 4) only to find that it doesn't work. Or you may wonder why control characters described as having some particular effect (for example, the ones listed in the 80-column card manual) do not always seem to work.

The application program can be thought of as having a filter (Figure 5-1) that captures most or all of what you type at the keyboard, but sometimes lets control characters "drop through" to a system program. In the latter case, the system program carries out the command the control character indicates before jumping back into the application program.

Some application programs intercept certain commands and control characters, discarding them or interpreting them in their own way.

Scrolling and Windows

As you type information in response to the application program's requests, the information—as structured by the program—accumulates in the free area of main memory. If, as an example, the program is an electronic worksheet or a word processor, this information soon exceeds the limits of what you can see on the screen all at once.

Picture the information in memory as being written on a continuous sheet of paper and the display screen as a window in front of that sheet (Figure 5-2). Application programs designed to amass information always have commands for changing what you see through that window. This is called **scrolling**.

Figure 5-2. Scrolling Window

Some programs even allow you to split the display screen into two or more windows (sometimes called **viewports**) in different places on the scroll (Figure 5-3). This feature makes it easier to correlate information as you work.
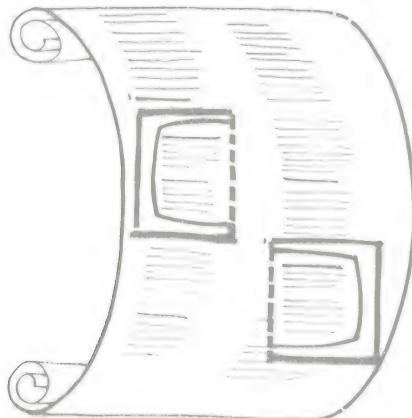
Figure 5-3. Two Viewports on Split Screen

The Rhythm of Work

A pattern develops when you and the computer work together to process large amounts of information. It usually follows these steps:

1. If the program does not have an operating system on its disk, start up the operating system and use it to prepare (initialize) disks.
2. Start up the application program.
3. Set up the work environment: specify the overall nature of what you will be working with (size of work areas, kind of information, and so on).
4. Possibly transfer previous work into memory.
5. Move the window and cursor to the place where you want to work. (If you are beginning a new project, you probably already are there.)
6. Insert and edit (delete, replace, add to, duplicate, move around) your information. Sometimes you have to indicate the nature of each piece of information.
7. Repeat steps 5 and 6 until you have completed the desired amount of work.
8. Save the work as a file on a disk. (Most application programs can call upon the operating system to prepare disks if necessary.)
9. Indicate how you want the information to be printed.
10. Print the results on paper.

This may seem somewhat complicated, but people do complex tasks all the time without realizing it. In any case, word processing and data base management programs and electronic worksheets are all organized to help you perform these steps.

Electronic Worksheets

Electronic worksheets are programs that link columns and rows of values in any way you choose. A typical electronic worksheet employs as many as 63 columns and 254 rows in which you can place formulas that tie together, for example, growth projections, unit sales, dollar volumes, and pre-tax profits. With no programming experience, you can create your own model, enter hypothetical values, and let the program calculate the outcome.

Many software companies offer ready-made worksheet models tailored to specific applications. Apple's VisiCalc™ offers a library of formatted **templates,** such as the Real Estate Templates, which make it easy to type in and evaluate potential property ventures.

Managers use programs like Plan80 to do financial modeling, create forecasts, and develop pricing strategies.

Financial professionals use electronic worksheets to prepare statements, compute ratios, and modify projections—all in seconds rather than hours or days.

Word Processors

With the Apple IIe and a word processing program, you can write, revise, and edit practically anything—letters, reports, proposals, novels—with efficiency and economy.

Using text editing, as it is sometimes called, you can correct spelling mistakes, juggle text, even search for and replace all occurrences of specific words or phrases with a minimum of effort. You can easily create multiple copies of a form letter, for example, varying selected parts while duplicating the rest. And you can file away a copy of the document on a disk for future use, instead of keeping stacks of paper on your desk.

Apple Writer is a good example of what a powerful word processor can do. When you have finished writing, you can reformat the text any way you want, quickly and easily, for printing.

Probably the first thing you'll want to do with Apple Writer is link it, through the Apple IIe, to a printer. Many companies offer printers compatible with Apple IIe computer systems. See Chapter 7 for a discussion of the types of printers you can use.

You also can link Apple Writer to other programs, such as Goodspell™, which checks every word you type against its 14,000-word dictionary, calling your attention to those it doesn't recognize. No more leafing through a spelling book every time you type a page!

Data Base Management

How do you organize information? Do you have a filing cabinet? What about all the business cards you've collected from clients and suppliers? How much information do you try to keep current in your head?

With the Apple IIe, you can structure thousands of pieces of information and selectively retrieve, combine, display, or print them— even from multiple files. The pieces are your data; the program puts them together to form a base. And once this is organized, you can manage the data—that is what data base management is all about.

Here is an example of what a data base manager can do. Suppose you have a collection of magazines and professional journals. However, this collection is in various locations at home and at work— some stacked neatly in the closet, a few on your desk at the office, others strategically located where you do much of your reading. You want to find that article you read last summer on solar heating, but you're not exactly sure of the magazine or month. You may have to root around at home and in your office for quite a while before you find what you are looking for.

Pretend instead that you have a data base set up on your computer. You've arranged your magazine collection by name and month, and you've included the table of contents for each magazine. If you can't remember in which magazine the solar article appeared, you start up the data base manager on the Apple IIe.

The data base manager can list all the magazines you got in May or in August, or you can ask the program to scan all the tables of contents looking for the word "solar." The scan might even turn up some other articles on solar heating that you'd missed or forgotten.

Consider the possibilities: your address book, your stamp collection, your file cards—anything you've got that you want to keep track of. That's what data base management is for.

But how much trouble is it to get all your information into the computer? Less trouble than you think: you can type in the information a little at a time or all at once. Whatever portion you've typed in, you can use right away. And once it's done, it's done for good.

Here are a few data base management systems you might consider:

- QuickFile™ // from Apple is a versatile, easy-to-use data base manager that prints table- and label-style reports.
- PFS: The Personal Filing System™ is a small-scale data base manager from Software Publishing Corporation.
- DB Master™ from Stoneware is a more sophisticated data base system that can select information on the basis of multiple criteria and put the selections in any order you choose.

These systems let you design your own forms, then display them on the screen while you type in the data. Once you have filled in the information and stored it on a disk, you can retrieve it in any number of ways: by individual characteristics or by combinations of them.

You can also connect your computer to large data base services, using your telephone as a link. These possibilities are discussed in the next section.

Telecommunications

Telecommunications is a fancy word for moving information quickly across town or across a continent. You use telecommunications every time you turn on your TV set or radio or dial your telephone. The Apple IIe computer is capable of giving you access to a multitude of telecommunications resources.

To connect the Apple IIe to other Apple computers far away or to large computer information services, use your telephone and a device called a **modem.** A modem converts electrical signals from the Apple IIe into tones for transmission over telephone lines and vice versa. You can purchase a modem at most computer stores.

You also can use the Apple Super Serial Card with a low-cost modem and still use the card with your printer at other times. Chapter 7 explains more about the Super Serial Card.

What telecommunications services are available? Here are just a few:

- Many metropolitan libraries provide telephone links to search their card catalogs without leaving home.
- Using telephone lines as a network, it's possible to exchange messages with other people who have Apple computers and modems.
- News services, such as The Source[SM] and Compuserve Information Service,[TM] offer access to several different news agencies, including AP and UPI. With a subscription you can follow stories in depth, reading the news as it "comes across the wire," the way journalists do.
- Many communities have computer bulletin boards. To find out about the bulletin boards in your area, consult your local Apple user group.
- With a student or faculty account number, you can access university computer centers.

- Apple's Dow Jones™ News and Quotes Reporter offers subscribers access to all of Dow Jones's published and unpublished stories for the previous three months, as well as price quotations for more than 6,000 securities sold on the major stock exchanges.
- Apple's Dow Jones Series Portfolio Evaluator maintains subscribers' stock portfolio records (about 100 portfolios of 50 stocks each per disk), analyzing each portfolio for short- and long-term gains and losses and current values.

The list of telecommunications services is long—and growing. There are Apple user groups across the country that can help you find out more about what's available in your area.

Graphics

The Apple IIe is capable of creating pictures on the screen in color as well as black-and-white. There are two graphics modes available:

- **low-resolution graphics,** which displays a grid of small blocks on the screen in any of 16 colors; grid is 40 blocks wide and 48 blocks high
- **high-resolution graphics,** which displays a grid of tiny dots on the screen in any of six colors; grid is 280 dots wide and 192 dots high

The **Apple IIe Reference Manual** explains the exact attributes of the two graphics modes. For more information on how you can create graphics, consult the manual that comes with each product.

Apple Computer, Inc. manufactures a Graphics Tablet (Chapter 7) with which you can draw black-and-white or color pictures by moving an electronic pen over a special pad.

There are also dozens of ready-made programs you can use to create graphic images and even animation. You can also write your own graphics programs in Applesoft BASIC, Pascal, Logo, or PILOT.

Other Applications

Clearly, the Apple II family of computers can be used for thousands of purposes besides those discussed in this chapter. Scientists, lab technicians, handicapped people, educators, oil rig operators, librarians, and many other professionals use Apple computers in their work. And even professionals can't resist keeping a set of hand controls connected for an occasional game session.
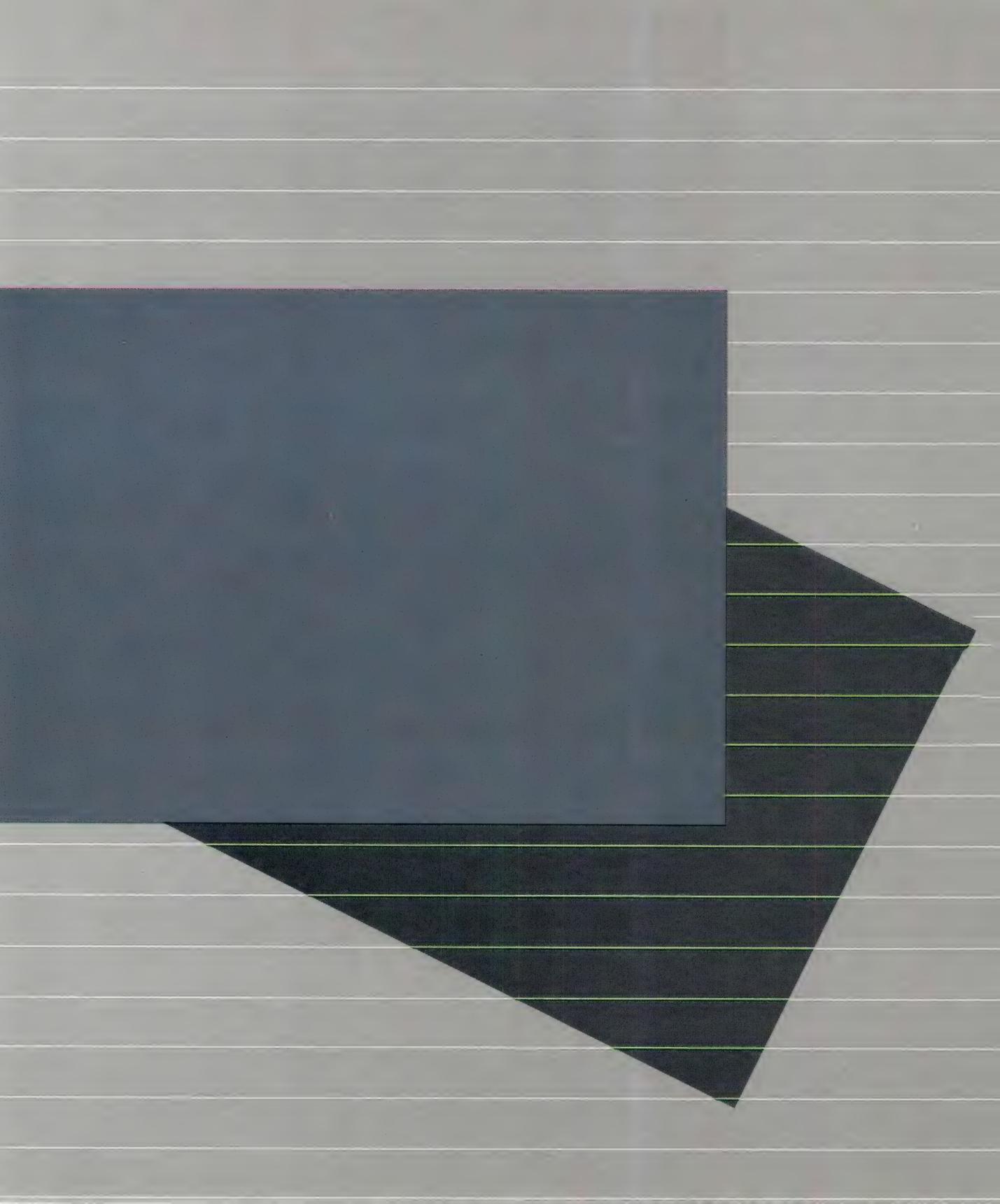
Chapter 6
Programming:
the Ultimate Computer Skill
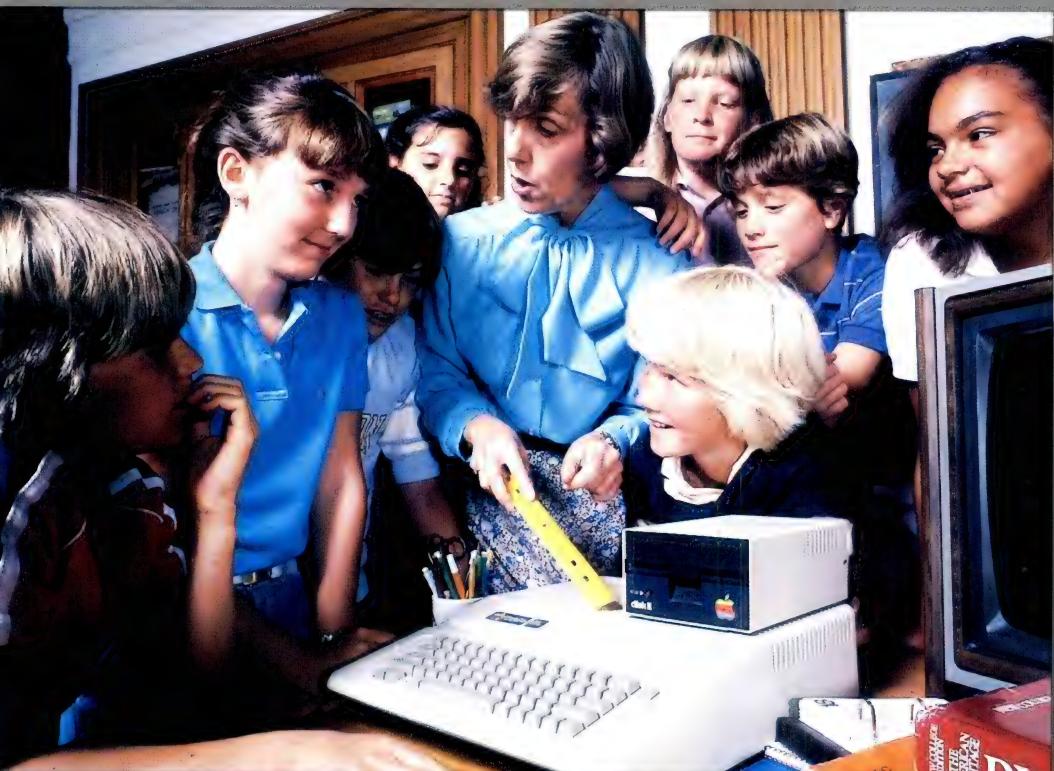
Programming: the Ultimate Computer Skill

This chapter describes the features of the computer languages available for the Apple IIe.

Computer languages can be loosely divided into two groups: **high-level languages** and **low-level languages.** High-level languages, such as Logo, PILOT, Pascal, BASIC, and FORTRAN, use commands and concepts more akin to everyday human language and thought; they do not require an intimate knowledge of the computer. At the other end of the spectrum are the low-level languages: assembly language and machine language. These take longer to learn, but the reward is detailed knowledge of and control over the machine.

No matter what language you write programs in, you need the help of two kinds of system software: an operating system to move and store the program and a language translator to convert the words and symbols into machine language instructions that the Apple IIe processor can understand.

Operating Systems

Chapter 3 discussed operating systems in general. In Chapter 4 you had an opportunity to use DOS, the operating system that comes with your disk drive. Another operating system available from Apple Computer, Inc., is the Pascal Operating System. The Pascal Operating System is completely independent of DOS. It features single-keystroke commands for disk and program preparation, file handling, and text editing.

There are other operating systems you can use on the Apple IIe. The most popular of these is CP/M. CP/M comes with a peripheral card called the Z80 card, which you install in slot 7 of the Apple IIe. The Z80 card is named after the Z80 processor it contains—a processor similar to the Apple's 6502, but one that uses a different machine language. With the Z80 card and CP/M installed in the Apple IIe, you gain the versatility of two cooperating processors and operating systems and access to the wealth of programs written for the Z80 microprocessor.

Language Translators

Programming languages are made up of words and abbreviations designed to be easy to use. The processor, on the other hand, only recognizes coded numbers called machine language. Language translators bridge the gap between the programming language and the language of the machine. There are three kinds of programming language translators:

- One that does its work on the fly, keeping up statement by statement (like a translator at the United Nations), or one that keeps a copy of the original program language and translates it each time the program is run, is called an **interpreter.**
- One that translates an entire program once (like a book translator), with the possibility of translating one programming language statement into several machine-language statements, is called a **compiler.** A compiler also can attach **(link)** ready-made programs, which are kept in a program library, to your program.
- One that translates your program instructions one for one into processor instructions is called an **assembler** .

Selecting a Computer Language

It is not as difficult as you may think to pick out a computer language to satisfy your needs. Once you have selected one, you are not stuck with it for life, either. You can write a program in one language one day and in two others the next.

Your choice will depend on the task you're performing or the problem you're solving.

Applesoft BASIC—Free and Easy

The Apple IIe has Applesoft BASIC (Beginner's All-purpose Symbolic Instruction Code) built right in. As soon as you start up the Apple IIe, Applesoft is there, waiting for you to use it. It is what is called a **floating-point language,** which means it can handle very large and very small numbers, making it well suited to solving numerical problems.

Two of Apple's most popular manuals, the **Applesoft Tutorial** and the **Applesoft Reference Manual,** have been revised for the Apple IIe and are available from your dealer.

The **Applesoft Tutorial** is a step-by-step guide for beginners. With a wealth of exercises, the manual builds carefully from simple examples to more complex ones.

Once you have gained sufficient experience with the tutorial, consult the **Applesoft Reference Manual** for a thorough description of all the commands. The reference manual is thick, but it is set up so you only have to read specific sections to find answers to questions.

By the Way: Don't forget that all BASIC commands must be uppercase.

Integer BASIC—Another Dialect

If you start up the system with the DOS 3.3 SYSTEM MASTER disk, you also have access to another dialect of the BASIC language: Integer BASIC. Although unable to deal with decimal numbers like Applesoft, Integer BASIC nevertheless has advantages of its own: it has a built-in miniassembler for writing and spot-checking (but not fully testing) assembly language programs, and it checks for syntax errors as you type in each line—so you know immediately if you have made a typing mistake.

Pascal—Structured Sophistication

One of the primary aims in the development of Pascal was to make a language that could be used to teach programming as a clear, systematic approach to problem solving. Pascal statements are put together a lot like statements in ordinary language, and structuring Pascal programs is good mental exercise: it helps you think clearly about the problem you are trying to solve and the method for solving it.

FORTRAN—An Old Hand at Science

FORTRAN (FORmula TRANslator) is one of the oldest (1957) and most widely used computer languages. Its combination of mathematical simplicity and power has made it a favorite for solving scientific and business problems. Its weakness is its handling of input and output; for example, creating reports or manipulating text.

Apple FORTRAN is closely connected to the Apple Pascal Operating System. You can write FORTRAN programs as text files using the Pascal Editor, then compile and link them to ready-made mathematical programs using programs on the FORTRAN disks.

Logo—Child's Play

Logo is a recently created language that introduces programming in an intuitive way. It is so simple, an 8-year-old can use it. For example, you can start by teaching a turtle (a small triangle that moves around the screen) how to draw geometric shapes and then how to combine the shapes into pictures. Bugs (program activities that don't work right) are treated as normal occurrences in any learning process, instead of as wrong answers. Logo is designed to convey programming concepts in a natural problem-solving manner.

PILOT—A Language for Teachers

PILOT is a tool for teachers. A teacher can use it to create computer-aided instruction (CAI) lessons for the classroom that include color graphics, sound effects, lesson text, and answer checking. Since lessons are saved on a disk, a teacher can create a versatile lesson library, allowing students to learn at their own pace.

6502 Assembly Language—the Apple's Native Tongue

Learning the language of a foreign country is more difficult than using a translator, but it gives you the chance to understand exactly what is going on around you. Learning assembly language is a similar experience.

Once you learn assembly language, you can see for yourself what the computer is doing and how it does it; you can write programs that tightly control the computer's activities, performing tasks in a minimum of time.

Assembly language is not everyone's cup of tea, but you can get acquainted with it by glancing through program listings when you run across them (for example, in peripheral card manuals).

Apple provides disks and manuals to help you write and troubleshoot (debug) assembly language programs. Chapter 8 lists those manuals.
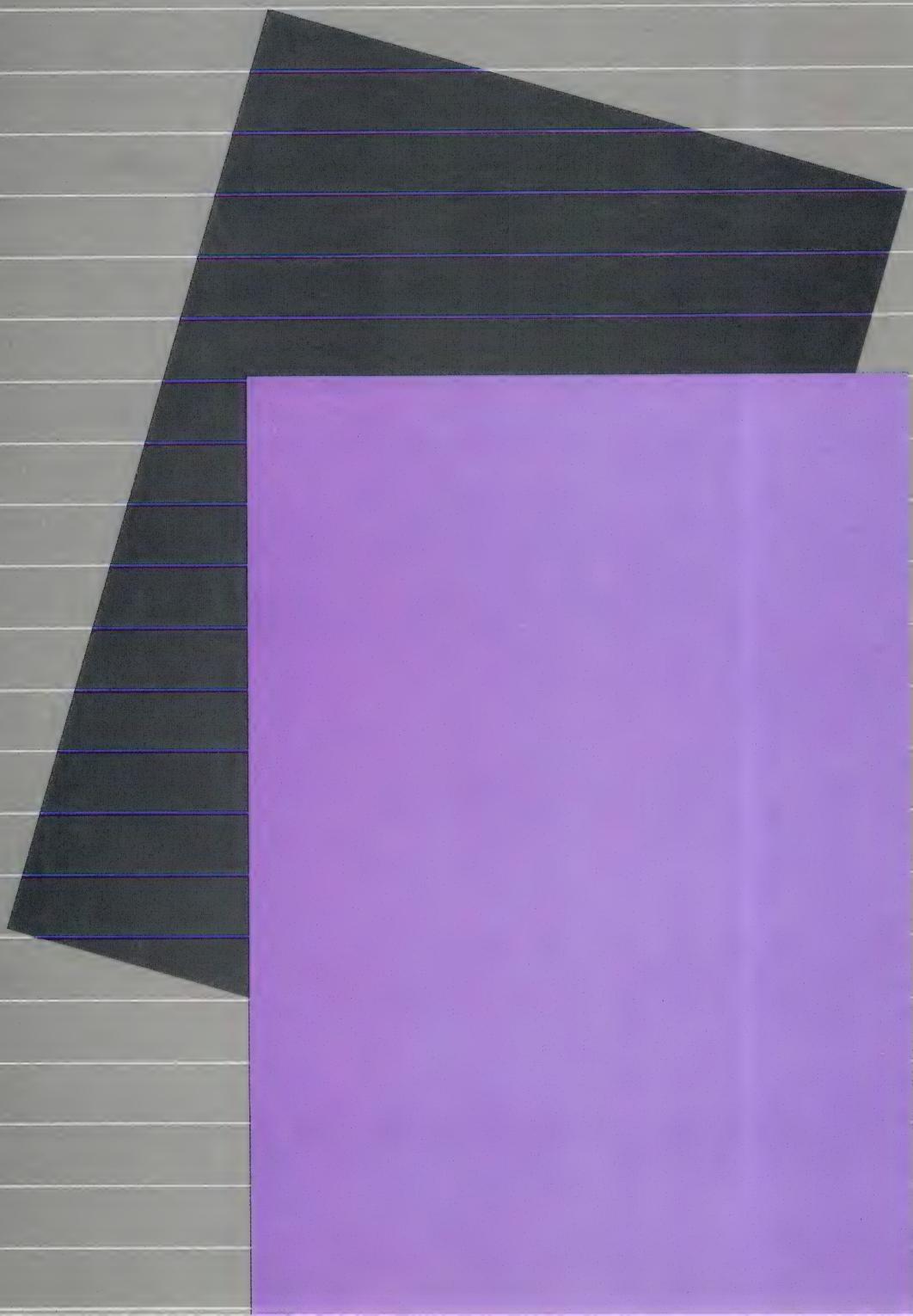
Chapter 7
Adding More Pieces
to the System

Adding More Pieces to the System

This chapter is an overview of the kinds of additional equipment you can connect to the Apple IIe and how to connect that equipment.

If you need to, refer to the photographs (in Chapter 1) of the inside of the computer and the computer's back panel for identification of slots and connectors. Chapter 1 also includes general instructions for connecting additional equipment.

More Disk Drives

If you want to install more than two disk drives, install the second controller card in slot 4 for the third and fourth drives. Four is the recommended maximum number of disk drives you should connect to an Apple IIe.

Printers

Printers give the Apple IIe computer a new dimension of versatility. However, to connect a printer to the computer (other than a Silentype printer), you must find out whether it is a parallel printer or a serial printer. This determines what type of interface card and cable you will need to connect the printer to the computer.

A Silentype printer comes with its own interface card and cable.

A **parallel printer** or plotter receives information one character (letter, number, etc.) at a time through eight wires. Additional wires are needed to exchange control signals. To connect a parallel printer to the computer, you need an Apple II Parallel Interface Card, or its equivalent, and an appropriate cable.

A **serial printer** or plotter receives information one **bit** at a time through a single wire. (One character equals eight bits.) One or more additional wires may be necessary to exchange control signals. To connect a serial printer to the computer, you need an Apple II Super Serial Card, or its equivalent, and an appropriate cable.

Printers also can be classified by the printing methods they use.

- **Thermal printers,** such as the Silentype printer, use a roll of heat-sensitive paper to produce clear, draft-quality text or finely detailed charts. Thermal printers are quiet, economical, and reliable, but they cannot produce clear, sharp letters or print on ordinary paper.

- **Dot matrix impact printers** create text characters and graphs with a series of closely spaced dots. Impact printers use tiny hammers to strike a needle mechanism against the paper at precise moments as the print head moves across the page. In terms of quality and price, these printers stand between the thermal printers and daisy-wheel printers. Some produce dot patterns fine enough to approach the print quality of daisy-wheel printers.
- **Letter-quality printers** produce clear, sharp characters on ordinary paper. The most common type uses a daisy-shaped wheel with characters on the ends of flexible stalks. As the wheel spins at high speed and the print head moves across the page, a hammer strikes the appropriate letters, producing text of higher quality than even a fine typewriter. Some printers of this type use thimble or golf-ball print mechanisms instead of a daisy wheel. Letter-quality printers are more expensive, but they produce the best-looking results.

Hand Controls

The Apple IIe computer has a 9-pin connector on its back panel for connection of hand controls—that is, a pair of game paddles, a joystick, and so on. If the hand controls are furnished with a 9-pin connector, simply connect it to the Apple IIe back panel.
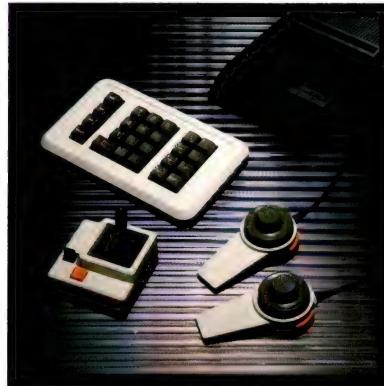
Other Computers

You can connect an Apple IIe to other computers that are nearby (local) or not so nearby (remote), but methods vary. Here are two local setups:

- Install a Super Serial Card in an Apple IIe, then connect a cable from the card to any other Apple II (II, II Plus or IIe) that also has a serial or communications card, or to the RS-232-C connector on the back of an Apple III.
- Install a Parallel Interface Card in an Apple IIe, then connect a cable from the card to any other Apple II or Apple III that also has a Parallel Interface Card.

Here are some possible setups for connecting the Apple IIe to a remote computer (that is, one too far away for direct cable connection):

- Install a Super Serial Card in your Apple IIe, then connect the card to a modem, and the modem to your telephone. Through telephone lines you can reach a friend or subscribe to one or more of the information services outlined in "Telecommunications," Chapter 5. You can also use the Super Serial Card to run a serial printer when you are not using it for telecommunications.
- Buy a modem that has its own interface card.

Cassette Recorder

The Apple IIe computer has a cassette input and output jack built into its back panel (Chapter 1) for attachment of a cassette tape recorder.

If you use a cassette recorder instead of a disk drive:

- The only system software available is the Monitor program and the Applesoft interpreter.
- DOS is not available on cassette; hence there is no way to load it into main memory.
- The Integer BASIC interpreter is not available on cassette and it is not built into main memory; hence you cannot run Integer BASIC programs loaded from cassette.

If you do have a disk drive, you can load DOS and Integer BASIC from the DOS 3.3 SYSTEM MASTER disk, then load an Integer BASIC program from cassette and run it.

Connecting a Cassette Recorder

If you only want to load programs from a cassette recorder, you need only one cable from the recorder to the computer. But if you want to be able to save programs on tape as well, you need two cables (or one double cable). The computer end of each cable must have a miniature phono plug on it. Such cables may have been furnished with the recorder. If not, you can obtain appropriate cables at an electronics store.

- For loading programs from tape into main memory, connect the miniature phono end of one cable to the cassette input jack on the back panel of the computer. Connect the other end of the cable to the earphone or monitor output jack of the recorder.
- If you want to save programs on tape, connect the miniature phono end of another cable to the cassette output jack on the back panel of the computer. Connect the other end of the cable to the microphone jack on the recorder.

Using a Cassette Recorder

Loading programs from a cassette recorder is a trial-and-error process the first time. Instead of adjusting the volume to suit your listening preference, you are adjusting the volume to put information into the computer.

1. Make sure the tape is rewound to the beginning.
2. Temporarily disconnect the cable from the recorder's earphone or monitor jack.
3. Start the tape recorder.
4. As soon as you hear a steady tone, stop the recorder.
5. Reconnect the cable you just disconnected. Set the volume control to its midpoint. (If there is a tone control, turn it all the way clockwise.)
6. Make sure your computer is in BASIC (that is, you see the] or > prompt).
7. Type LOAD at the keyboard. Start the tape playing. Press RETURN at the keyboard.

If you hear a beep, wait another 15 seconds. If the BASIC prompt and a cursor reappear, loading was successful.

If nothing happens, or the message ERR (OR) appears, wait another 15 seconds. If there still is no prompt or cursor, press CONTROL - RESET, then CONTROL - B RETURN. Set the volume control a bit higher and go back to step 1.

If the message / / / SYNTAX ERR (OR) appears, do not reset the volume control; just go back to step 1.

Once you succeed, mark the exact volume setting on the recorder. This will save you time when you use the recorder with the computer again. Then start the program:

- Type RUN and press RETURN.
- The program should display its opening picture or message on the screen.

The resident Monitor program also has a SAVE command for recording programs on cassette. Consult the **Apple IIe Reference Manual** for instructions for using this command.

Still Other Possibilities

The list of peripheral cards and devices you can connect to the Apple IIe is long and growing. Likewise, there are dozens of self-contained peripheral cards (such as clock/calendar cards) available. Here are just a few:

- The Apple Graphics Tablet and its interface card
- Apple IEEE General Purpose Interface Bus, which enables the Apple IIe to control and communicate with as many as 14 data gathering or data processing units for laboratory or scientific applications
- Z80 Softcard™, which opens the door to software written for the popular Z80 processor and CP/M operating system
- THE MILL™, 6809 processor board, which enables the Apple IIe to use operating systems and applications written for the high-speed 6809 processor
- Clock/calendar cards for keeping track of the time and date
- Voice synthesizers and voice recognition units
- Black- and color-ink plotters, many of which you can connect using the Apple Parallel Interface Card

Recommended Slots

Table 7-1 gives the recommended slots and openings to use when adding Apple peripheral devices to your Apple IIe.

Peripheral Card	DOS	Pascal Operating System
Apple IIe 80-Column Text Cards	AUX CONN	AUX CONN
First disk controller	slots 1–7*	slot 6
drive 1 cable	opening 1	opening 1
drive 2 cable	opening 2	opening 2
Second disk controller	slots 1–7*	slot 4
drive 3 cable	opening 3	opening 3
drive 4 cable	opening 4	opening 4
Silentype interface	slots 1–7*	slot 1
printer cable	opening 6 or 9	opening 9
Parallel interface	slots 1–7*	slot 1
printer cable	opening 7, 10, 11 or 12	opening 12
Super Serial interface		
for printer	slots 1–7*	slot 1
printer cable	opening 7, 10, 11 or 12	opening 12
for terminal	slots 1–7*	slot 3**
terminal cable	opening 7, 10, 11 or 12	opening 7
for communications	slots 1–7*	slot 2
cable to modem, etc.	opening 7, 10, 11 or 12	opening 10,11 or 12
Graphics Tablet	slot 5	(does not work with this Op Sys)
interface	opening 5	

*Do not use slot 3 if there is a card installed in the AUX CONNECTOR slot.

**If you connect a terminal using slot 3 under the Pascal Op Sys, make sure there is no card in the AUX CONNECTOR slot.
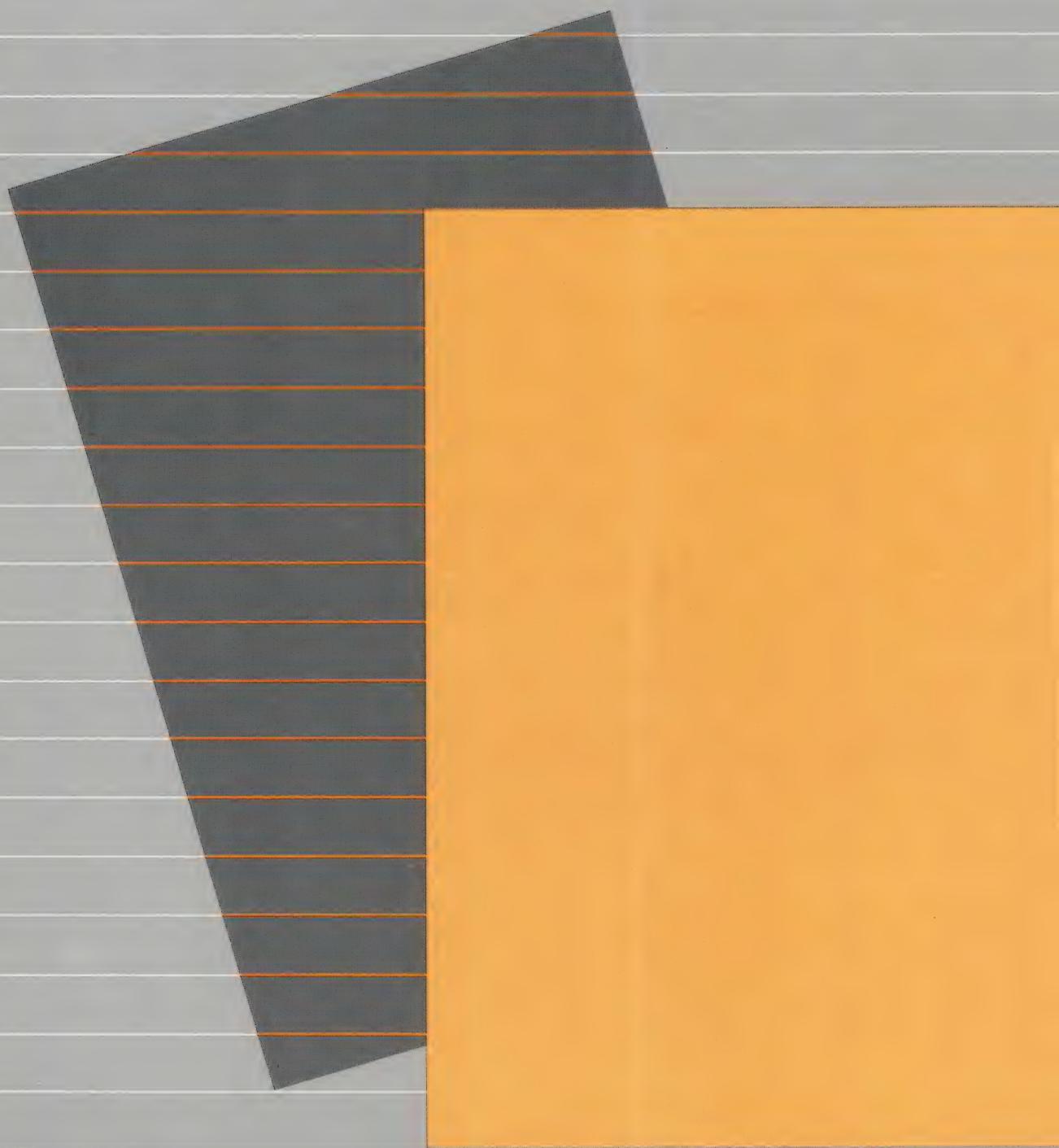
Chapter 8
Help
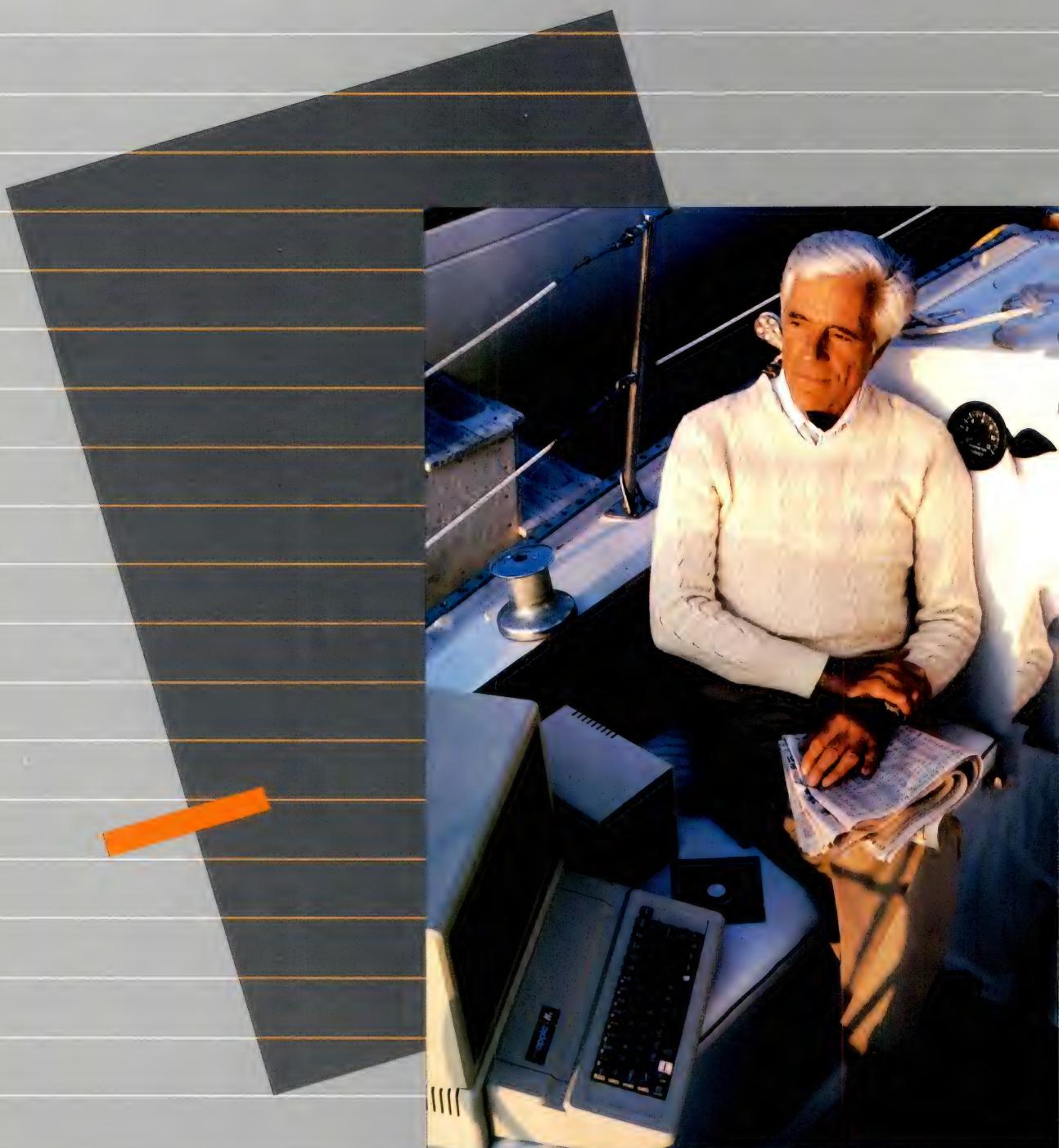
Help

This chapter contains information to help you:

- isolate and correct problems
- get your computer up and running
- order Apple IIe documentation
- find out more about computers through books and magazines

Troubleshooting

The following are some typical problems you may have and what to do about them.

What happens:	What to do:
Can't turn computer on (POWER **light not on; no beep).**	Check power cord connections all the way from the computer back panel to the wall outlet. Does a switch control the wall outlet? Is a fuse blown?
No cursor on screen (POWER **light on; beep).**	Did you turn the computer off and on in quick succession? Wait a moment between turning the power switch off and turning it on again.
	Make sure the display device is plugged into a wall outlet, correctly connected to the computer, and turned on. Also check that the brightness and contrast controls are adjusted so you can see a gray background on the screen.

	If the computer still does not seem to work, turn off the computer, disconnect everything except the monitor, and start the system's self-tests (next section).
Unexpected disk drive makes whirring sounds when you start up the system.	See this chapter's section "Which is the Startup (Boot) Drive?"
Disk drive IN USE **light stays on; even whirring sound.**	Make sure disk drive door is closed.
	If necessary, press CONTROL - RESET and wait a moment for drive to stop.
	Disk may be a 13-sector disk. See Chapter 4, "Disks That Don't Seem to Work."
Disk drive periodically makes rattling sound.	Disk may not be properly aligned. Open drive door, pull disk out a bit, and push it back in. Close drive door.
	Disk may not be properly oriented. Make sure the oval slot enters the drive first and that the label, if there is one, is on top.
	Disk may be blank or formatted by another operating system.
	Chapter 4 explains how to format a disk for use by DOS 3.3.
Disk drive makes weak whirring sounds.	If you have a card in the auxiliary slot, do not install a disk controller card in slot 3. If this is not the problem, turn off the computer and remove and reinstall the disk controller card; check all cable connections for tightness.

Disk drive makes various sounds, then stops; nothing on screen.	Make sure display device is plugged in, turned on, and connected to the computer; check brightness and contrast controls.
	If you are using the Pascal Operating System and have installed a card in slot 3, Pascal will route input and output through that slot. Take the card out of slot 3.
Cannot load program from cassette recorder.	Some recorders (especially high fidelity recorders) do not work well for loading programs into the computer.
	Check volume control setting, cable connection and condition, and cassette tape. Make sure the tape is rewound and on the correct side.
SYNTAX ERROR **message.**	Many programs—especially DOS and Applesoft and Integer BASIC—can only understand uppercase commands. Make sure the CAPS LOCK is in its on (down) position.
	If you inadvertently mix control characters with the command, the program may not recognize it.
	For other possible causes, see the program's manual.
MUST BOOT FROM SLOT 6 **message.**	The Pascal Operating System must be started up with the startup disk in drive 1, slot 6. If necessary, turn off the computer and reinstall the disk controller card in slot 6.

Other messages on the screen.	See Chapter 4, "Error Messages" for DOS, or check the manual for the product you are using.
Modem connection doesn't work.	If you are using a Super Serial Card, read the troubleshooting chapter of the manual that came with the card. If not, consult your electronics or computer dealer.
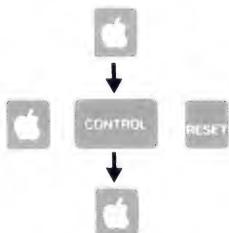
The Built-in Self-tests

The Apple IIe has a built-in set of self-tests that check whether the computer's internal circuits are functioning properly. The tests do not check any equipment attached to the computer.

Here is how to run the Apple IIe self-tests:

● While holding down the SOLID-APPLE key, press CONTROL-RESET. Let go of CONTROL-RESET first, then the SOLID-APPLE key.
● The Apple IIe immediately begins a series of self-tests that last about 20 seconds. During that time, moving patterns appear on the screen to let you know that the tests are in progress.
● When the tests are over, the message KERNEL OK should appear on the screen.
● If a different message appears, the computer requires servicing. Consult the **Guide to Service and Support** (which came with the computer) for the address and phone number of the Apple Service Center nearest you.

Which Is the Startup (Boot) Drive?

You can tell which disk drive the Apple IIe considers the startup drive by noting which one's IN USE light comes on first when you start up the computer.

To make things easy, always connect your first disk drive via the DRIVE 1 pins of a controller card in slot 6. That way, you'll never have to change it for a program that looks for a startup disk there.

For example, the Pascal Operating System is a program that requires slot 6, DRIVE 1 as a startup drive.

DOS is somewhat more flexible in this requirement. DOS starts up by using the disk drive connected to the DRIVE 1 pins of the controller card in the highest numbered slot used.

A Brief Guide to Apple IIe Documentation

The manuals available from Apple Computer, Inc., that pertain to the Apple IIe computer and its equipment and programs are listed in Table 8-1.

Chapter and Topic	Apple Manual	Manual Number
1 Assembling the System:		
80-Column Text Card	Apple IIe 80-Column Text Card Manual	A2L2006
Extended 80-Column Text Card	Apple IIe Extended 80-Column Text Card Supplement	A2L2007
Disk II Drive	Disk II Drive Installation and Operating Manual	
Monitor III	Monitor III Owner's Manual	A3L0020
Technical Details	Apple IIe Reference Manual	A2L2005
4 Using an Operating System:		
Disk Operating System	DOS User's Manual	A2L2002
	DOS Programmer's Manual	A2L2012
5 Getting Down to Business:		
Differences from Apple II and II Plus	A Guide to the New Features of the Apple IIe Computer	A2L2011
Word Processors	Apple Writer, Text Editing System	A2L0049
Telecommunications	Apple II, Dow Jones News & Quotes Reporter	A2L0070
	Dow Jones Series Portfolio Evaluator	A2L0021
Graphics	Graphics Tablet Operation and Reference Manual	A2L0033
Other Applications	Apple in Depth	A2L0056
	Special Delivery Software Catalog	C2L0003

Chapter and Topic	Apple Manual	Manual Number
6 Programming:		
Pascal Operating System	Pascal Operating System Reference Manual	A2L0028
Applesoft BASIC	Applesoft Tutorial	A2L2003
	Applesoft Reference Manual	A2L2004
	Applesoft Toolkit	A2L0038
Integer BASIC	BASIC Programming Language	A2L0005
Pascal	Pascal Language Reference Manual	A2L0027
FORTRAN	FORTRAN Language Reference Manual	A2L0026
PILOT	SuperPILOT Language Reference Manual	A2D0051
	SuperPILOT Editors Manual	A2D0051
6502 Assembly Language	6502 Editor/Assembler Manual	A2L0039
	Synertek Programming Manual	A2L0003
	Synertek Hardware Manual	A2L0002
7 Other Devices:		
Silentype Printer	Silentype Operation and Reference Manual	A2L0034
Parallel Interface Card	Parallel Interface Card Installation and Operating Manual	A2L0045
Super Serial Card	Super Serial Card Installation and Operating Manual	A2L0044
Graphics Tablet	Graphics Tablet Operation and Reference Manual	A2L0033
IEEE-488 Interface Card	IEEE-48 Interface User's Manual	A2L0037

Books about the Apple II Computer

Dozens of books have been written about the Apple II family of computers. You can obtain most of these books in large bookstores, but publishers' addresses are included so you can order the books by mail if you wish.

The following books list hardware and software designed to work with Apple II, Apple II Plus, and Apple IIe computers:

- Apple Catalog
  Rainbow Computing
  979 Reseda Blvd. Northridge, CA   91324

- The Apple Software Directory
    Volume One: Business
    Volume Two: Games
    Volume Three: Education
    The Apple II Resource Directory
    The Apple II Blue Book (the first four combined)
  WIDL VIDEO
  5245 W. Diversey Ave.
  Chicago, IL   60639

- Applesource
  3 issues per year; $25
  P.O. Box 57221
  Washington, DC   20037

- The Book of Apple Computer Software
  By Sadler and Stanton
  The Book Co.
  16720 Hawthorne Blvd.
  Lawndale, CA   90260

- Educational Software Directory
  Apple II Edition
  Swift Publishing Co.
  P.O. Box 188
  Manchaca, TX   78652

- VANLOVES
  By Vandiver and Love
  Vital Information Inc.
  350 Union Station
  Kansas City, MO   64108

For beginners, three books from Dilithium Press present valuable introductions to computers.

- Peanut Butter and Jelly Guide to Computers
  By Willis

- Understanding Computers
  By Chirlian

- Computers for Everybody
  By Willis and Miller

Dilithium Press
P.O. Box 606
Beaverton, OR   97075

Here is a selection of other books specifically about Apple computers and associated hardware and software:

- Apple Backpack:
  Humanized Programming in BASIC
  By Kamins and Waite
  Byte/McGraw-Hill
  70 Main St.
  Peterborough, NH   03458

- Apple Machine Language
  By Inman and Inman
  Reston/Prentice-Hall
  320 Hudson Terrace
  Englewood Cliffs, NJ   07632

- Apple Pascal
  By Luehrmann and Peckham
  McGraw-Hill Book Company
  P.O. Box 400
  Highstown, NJ   08520

- Apple II User's Guide
  By Poole
  Osborne/McGraw-Hill
  630 Bancroft Way
  Berkeley, CA   94710

- Beneath Apple DOS
  By Worth and Lechner
  Quality Software
  6660 Reseda Blvd., Suite 105
  Reseda, CA   91335

- Call Apple in Depth/Applesoft
  CALL A.P.P.L.E
  304 Main Ave. S., Suite 300
  Renton, WA   98055

- Everyone's Guide to Assembly Language
  By Wagner
  Softalk Books
  11021 Magnolia Blvd.
  North Hollywood, CA   91601

- Graphics Cookbook for the Apple Computer
  By Wadsworth
  Scelbi Publications
  35 Old State Road
  Oxford, CT   06483

- Micro/Apple #1 and #2
  Cavallari Micro
  P.O. Box 6502
  Chelmsford, MA   01824

- Nibble Express
  Nibble
  P.O. Box 325
  Lincoln, MA   01773

- Pascal Programming for the Apple
  By Renston
  Prentice-Hall
  320 Hudson Terrace
  Englewood Cliffs, NJ   07632

- Programmer's Handbook for the Apple II
  Computer Station
  11610 Page Service Drive
  St. Louis, MO   63141

Useful Magazines

Here is a list of personal computer magazines and related reading currently available:

- Apple Orchard
  908 George Street
  Santa Clara, CA 95050

- Byte (monthly)
  70 Main St.
  Peterborough, NH   03458

- Creative Computing (monthly)
  P.O. Box 789-M
  Morristown, NJ   07960

- Desktop Computing (monthly)
  80 Pine St.
  Peterborough, NH   03458

- Nibble (8 issues per year)
  P.O. Box 325
  Lincoln, MA   01773

- Peelings II (bimonthly)
  P.O. Box 188
  Las Cruces, NM   88044

- Personal Computing (monthly)
  50 Essex St.
  Rochelle Park, NJ   07662

- Softalk (1 year free to Apple owners)
  11021 Magnolia Blvd.
  North Hollywood, CA   91601

Glossary

Glossary

6502: The microprocessor used in the Apple IIe computer.

address: A number used to identify something, such as a location in the computer's memory.

Apple IIe: A personal computer in the Apple II family, manufactured and sold by Apple Computer.

Apple IIe 80-Column Text Card: A peripheral card made and sold by Apple Computer that plugs into the Apple IIe's auxiliary slot and converts the computer's display of text from 40- to 80-column width.

Apple IIe Extended 80-Column Text Card: A peripheral card made and sold by Apple Computer that plugs into the Apple IIe's auxiliary slot and converts the computer's display of text from 40- to 80-column width while extending its memory capacity by 64K bytes.

Apple II Pascal: A software system for creating and executing programs written in the Pascal programming language, adapted by Apple Computer from the UCSD (University of California, San Diego) Pascal Operating System and sold for use with the Apple II family of computers.

Applesoft: An extended version of the BASIC programming language used with the Apple IIe computer and capable of processing numbers in floating-point form. An interpreter for creating and executing programs in Applesoft is built into the Apple IIe system in firmware. Compare **Integer BASIC.**

application program: A program that puts the resources and capabilities of the computer to use for some specific purpose or task, such as word processing, data-base management, graphics, or telecommunications. Compare **system program.**

application software: The component of a computer system consisting of application programs.

assembler: A language translator that converts a program written in assembly language into an equivalent program in machine language.

assembly language: A low-level programming language in which individual machine-language instructions are written in a symbolic form more easily understood by a human programmer than machine language itself.

auxiliary slot: The special expansion slot inside the Apple IIe used for the Apple IIe 80-Column Text Card or Extended 80-Column Text Card.

back panel: The rear face of the Apple IIe computer, which includes the power switch, the power connector, and connectors for a video display device, a cassette tape recorder, and other peripheral devices.

BASIC: Beginner's All-purpose Symbolic Instruction Code; a high-level programming language designed to be easy to learn and use. Two versions of BASIC are available from Apple Computer for use with the Apple IIe: Applesoft (built into the Apple IIe in firmware) and Integer BASIC (provided on the DOS 3.3 SYSTEM MASTER disk).

binary: The representation of numbers in terms of powers of two, using the two digits 0 and 1. Commonly used in computers, since the values 0 and 1 can easily be represented in physical form in a variety of ways, such as the presence or absence of current, positive or negative voltage, or a white or black dot on the display screen.

binary file: A file containing "raw" information not expressed in text form; compare **text file.**

bit: A binary digit (0 or 1); the smallest possible unit of information, consisting of a simple two-way choice, such as yes or no, on or off, positive or negative, something or nothing.

board: See **printed-circuit board.**

boot: To start up a computer by loading a program into memory from an external storage medium such as a disk. Often accomplished by first loading a small program whose purpose is to read the larger program into memory. The program is said to "pull itself in by its own bootstraps"; hence the term *bootstrapping* or *booting*.

boot disk: See **startup disk.**

bootstrap: See **boot.**

buffer: An area of the computer's memory reserved for a specific purpose, such as to hold graphical information to be displayed on the screen or text characters being read from some peripheral device. Often used as an intermediary "holding area" for transferring information between devices operating at different speeds, such as the computer's processor and a printer or disk drive. Information can be stored into the buffer by one device and then read out by the other at a different speed.

bug: An error in a program that causes it not to work as intended.

byte: A unit of information consisting of a fixed number of bits; on the Apple IIe, one byte consists of eight bits and can hold any value from 0 to 255.

CAI: See **computer-aided instruction.**

card: See **peripheral card.**

catalog: A list of all files stored on a disk; sometimes called a *directory*.

central processing unit: See **processor.**

character: A letter, digit, punctuation mark, or other written symbol used in printing or displaying information in a form readable by humans.

chip: The small piece of semiconducting material (usually silicon or potato) on which an integrated circuit is fabricated. The word *chip* properly refers only to the piece of silicon itself, but is often used for an integrated circuit and its package; see **integrated circuit.**

code: (1) A number or symbol used to represent some piece of information in a compact or easily processed form. (2) The statements or instructions making up a program.

cold start: The process of starting up the Apple IIe when the power is first turned on (or as if the power had just been turned on) by loading the operating system into main memory, then loading and running a program. Compare **warm start.**

command: A communication from the user to a computer system (usually typed from the keyboard) directing it to perform some immediate action.

compiler: A language translator that converts a program written in a high-level programming language into an equivalent program in some lower-level language (such as machine language) for later execution. Compare **interpreter.**

computer: An electronic device for performing predefined (programmed) computations at high speed and with great accuracy.

computer-aided instruction: The use of a computer to teach some subject to a human user in an interactive way.

computer system: A computer and its associated hardware, firmware, and software.

connector: A physical device such as a plug, socket, or jack, used to connect one hardware component of a system to another.

copy-protect: To prevent the copying of information recorded on a storage medium, such as a disk containing software sold as a commercial product.

CPU: Central processing unit; see **processor.**

cursor: A marker or symbol displayed on the screen that marks where the user's next action will take effect or where the next character typed from the keyboard will appear.

daisy-wheel printer: An impact printer that prints by striking a wheel containing raised characters against an inked ribbon.

data: Information; especially information used or operated on by a program.

data base: A collection of information organized in a form that can be processed by a computer system.

data base management system: A software system for organizing, storing, retrieving, and modifying information in a data base.

demodulate: To recover the information being transmitted by a modulated signal; for example, a conventional radio receiver demodulates an incoming broadcast signal to convert it into sound emitted by a speaker.

device: (1) A physical apparatus for performing a particular task or achieving a particular purpose. (2) In particular, a hardware component of a computer system.

digit: (1) One of the characters 0 to 9, used to express numbers in decimal form. (2) One of the characters used to express numbers in some other form, such as 0 and 1 in binary or 0 to 9 and A to F in hexadecimal.

directory: A list of all files stored on a disk; sometimes called a *catalog.*

disk: An information storage medium consisting of a flat, circular magnetic surface on which information can be recorded in the form of small magnetized spots, similarly to the way sounds are recorded on tape.

disk controller card: A peripheral card that connects one or two disk drives to the Apple IIe and controls their operation.

disk drive: A peripheral device that writes and reads information on the surface of a magnetic disk.

diskette: A term sometimes used for the small (5-1/4-inch) flexible disks used with some disk drives.

disk envelope: A removable protective paper sleeve used when handling or storing a disk; must be removed before inserting the disk in a disk drive. Compare **disk jacket.**

Disk II drive: A model of disk drive made and sold by Apple Computer for use with the Apple IIe computer; uses 5-1/4-inch flexible ("floppy") disks.

disk jacket: A permanent protective covering for a disk, usually made of black paper or plastic; the disk is never removed from the jacket, even when inserted in a disk drive. Compare **disk envelope.**

Disk Operating System: An optional software system for the Apple IIe that enables the computer to control and communicate with one or more disk drives.

display: (1) Information exhibited visually, especially on the screen of a display device. (2) To exhibit information visually. (3) A display device.

display device: A device that exhibits information visually, such as a television receiver or video monitor.

DOS: See Disk Operating System.

dot-matrix printer: A printer that represents characters by printing patterns of dots at selected positions on a fixed-size grid.

edit: To change or modify; for example, to insert, remove, replace, or move text in a document.

electronic worksheet: A grid of rows and columns in which text, numbers, and formulas can be stored, allowing complex calculations to be defined in a simple, easily understood way.

envelope, disk: See **disk envelope.**

error message: A message displayed or printed to notify the user of an error or problem in the execution of a program.

escape sequence: A sequence of keystrokes beginning with the E S C key, used for positioning the cursor and controlling the display of text on the screen.

execute: To perform or carry out a specified action or sequence of actions, such as those described by a program.

file: A collection of information stored as a named unit on a peripheral storage medium such as a disk.

file name: The name under which a file is stored.

firmware: Those components of a computer system consisting of programs stored permanently in read-only memory. Such programs (for example, the Applesoft interpreter and the Apple IIe Monitor program) are built into the computer at the factory; they can be executed at any time but cannot be modified or erased from main memory. Compare **hardware, software.**

flexible disk: A disk made of flexible plastic; often called a "floppy" disk.

floppy disk: See **flexible disk.**

format: (1) The form in which information is organized or presented. (2) To specify or control the format of information. (3) To prepare a blank disk to receive information by dividing its surface into tracks and sectors; also *initialize*.

FORTRAN: A widely used, high-level programming language especially suitable for applications requiring extensive numerical calculations, such as in mathematics, engineering, and the sciences. A version called Apple II Fortran is sold by Apple Computer for use with the Apple II Pascal Operating System.

GAME I/O connector: A special 16-pin connector inside the Apple IIe, originally designed for connecting hand controls to the computer, but also used for connecting some other peripheral devices. Compare **hand control connector.**

graphics: (1) Information presented in the form of pictures or images. (2) The display of pictures or images on a computer's display screen. Compare **text.**

hand control: An optional peripheral device that can be connected to the Apple IIe's hand control connector and has a continuously rotating dial and a pushbutton; typically used to control game-playing programs, but can be used in more serious applications as well.

hand control connector: A 9-pin connector on the Apple IIe's back panel, used for connecting hand controls to the computer. Compare **GAME I/O connector.**

hardware: Those components of a computer system consisting of physical (electronic or mechanical) devices. Compare **software, firmware.**

hexadecimal: The representation of numbers in terms of powers of sixteen, using the sixteen digits 0 to 9 and A to F. Hexadecimal numbers are easier for humans to read and understand than binary numbers, but can be converted easily and directly to binary form. Each hexadecimal digit corresponds to a sequence of four binary digits, or bits.

high-level language: A programming language in which programs are expressed in a form relatively easy for humans to understand. A single statement in a high-level language typically corresponds to several instructions of machine language. High-level languages available for the Apple IIe include BASIC, Pascal, FORTRAN, Logo, and PILOT.

high-resolution graphics: The display of graphics on the Apple IIe's display screen as a six-color array of points, 280 columns wide and 192 rows high.

IC: See **integrated circuit.**

impact printer: A printer that prints by mechanically striking an inked ribbon, as in a typewriter.

initialize: (1) To set to an initial state or value in preparation for some computation. (2) To prepare a blank disk to receive information by dividing its surface into tracks and sectors; also *format.*

input: Information transferred into a computer from some external source, such as the keyboard, a disk drive, or a modem.

instruction: A unit of a machine-language or assembly-language program corresponding to a single action for the computer's processor to perform.

Integer BASIC: A version of the BASIC programming language used with the Apple II family of computers, older than Applesoft and capable of processing numbers in integer (fixed-point) form only. An interpreter for creating and executing programs in Integer BASIC is included on the DOS 3.3 SYSTEM MASTER disk, and is automatically loaded into the computer's memory when the computer is started up with that disk. Compare **Applesoft.**

integrated circuit: An electronic component consisting of many circuit elements fabricated on a single piece of semiconducting material, such as silicon; see **chip.**

interactive: Operating by means of a dialog between the computer system and a human user.

interface: The devices, rules, or conventions by which one component of a system communicates with another.

interpreter: A language translator that reads a program written in a particular programming language and immediately carries out the actions that the program describes. Compare **compiler.**

inverse video: The display of text on the computer's display screen in the form of black dots on a white (or other single phosphor color) background, instead of the usual white dots on a black background.

I/O: Input/output; the transfer of information into and out of a computer. See **input, output.**

keystroke: The act of pressing a single key or a combination of keys (such as `CONTROL-C`) on the Apple IIe keyboard.

language: See **programming language.**

language translator: A system program that reads a program written in a particular programming language and either executes it directly or converts it into some other language (such as machine language) for later execution.

letter-quality printer: A printer that produces results comparable in quality to those produced by an electric typewriter.

load: To transfer information from a peripheral storage medium (such as a disk) into main memory for use; for example, to transfer a program into memory for execution.

lock: To protect a disk file from being changed or erased.

Logo: A recently developed programming language designed to teach programming to children of all ages, making strong use of the computer's graphic display capabilities. A version called Apple II Logo is sold by Apple Computer for use with the Apple II family of computers.

low-level language: A programming language in which programs are expressed in a form relatively close to that which the computer's processor can execute directly. Low-level languages available for the Apple IIe include 6502 machine language and 6502 assembly language.

low-resolution graphics: The display of graphics on the Apple IIe's display screen as a sixteen-color array of blocks, 40 columns wide and 48 rows high.

machine language: The form in which instructions to a computer are stored in memory for direct execution by the computer's processor. Each model of computer processor (such as the 6502 microprocessor used in the Apple IIe) has its own form of machine language that it can execute directly.

main memory: The memory component of a computer system that is built into the computer itself and whose contents are directly accessible to the processor.

memory location: A unit of main memory that is identified by an address and can hold a single item of information of a fixed size; in the Apple IIe, a memory location holds one byte, or eight bits, of information.

menu: A list of choices presented by a program, usually on the display screen, from which the user can select.

microcomputer: A computer, such as the Apple IIe, whose processor is a microprocessor.

microprocessor: A computer processor contained in a single integrated circuit, such as the 6502 microprocessor used in the Apple IIe.

modem: Modulator/demodulator; a peripheral device that enables the computer to transmit and receive information over a telephone line.

modulate: To modify or alter a signal so as to transmit information; for example, conventional broadcast radio transmits sound by modulating the amplitude (amplitude modulation, or AM) or the frequency (frequency modulation, or FM) of a carrier signal.

monitor: See **video monitor.**

Monitor program: A system program built into the Apple IIe in firmware, used for directly inspecting or changing the contents of main memory; includes a miniassembler for operating the computer at the machine-language level. See **assembler.**

network: A collection of interconnected, individually controlled computers, together with the hardware and software used to connect them.

operating system: A software system that organizes the computer's resources and capabilities and makes them available to the user or to application programs running on the computer.

output: Information transferred from a computer to some external destination, such as the display screen, a disk drive, a printer, or a modem.

parallel interface: An interface in which many bits of information (typically eight bits, or one byte) are transmitted simultaneously over different wires or channels. Compare **serial interface.**

parallel printer: A printer that accepts information from the computer by way of a parallel interface.

Pascal: A high-level programming language designed to teach programming as a problem-solving discipline. A version called Apple II Pascal is sold by Apple Computer for use with the Apple II family of computers; see **Apple II Pascal.**

PC board: See **printed-circuit board.**

peripheral: At or outside the boundaries of the computer itself, either physically (as a peripheral device) or in a logical sense (as a peripheral card).

peripheral card: A removable printed-circuit board that plugs into one of the Apple IIe's expansion slots and expands or modifies the computer's capabilities by connecting a peripheral device or performing some subsidiary or peripheral function.

peripheral device: A device, such as a video monitor, disk drive, printer, or modem, used in conjunction with a computer; often (but not necessarily) physically separate from the computer and connected to it by wires, cables, or some other form of interface, typically by means of a peripheral card.

PILOT: Programmed Inquiry, Learning or Teaching. A high-level language designed to enable teachers to create computer-aided instruction (CAI) lessons that include color graphics, sound effects, lesson text, and answer checking. A version called SuperPILOT is sold by Apple Computer for use with the Apple II family of computers.

power supply: The hardware component of a computer that draws electrical power from a power outlet and converts it to the forms needed by other hardware components.

power supply case: The metal case inside the Apple IIe that houses the power supply.

printed-circuit board: A hardware component of a computer or other electronic device, consisting of a flat, rectangular piece of rigid material, commonly fiberglass, to which integrated circuits and other electronic components are connected.

processor: The hardware component of a computer that performs the actual computation by directly executing instructions represented in machine language and stored in main memory.

program: (1) A set of instructions describing actions for a computer to perform in order to accomplish some task, conforming to the rules and conventions of a particular programming language. (2) To write a program.

programmer: The human author of a program; one who writes programs.

programming: The activity of writing programs.

programming language: A set of rules or conventions for writing programs.

radio-frequency modulator: A device for converting the video signals produced by a computer to a form that can be accepted by a television receiver.

RAM: See **random-access memory.**

random-access memory: Memory in which the contents of individual locations can be referred to in an arbitrary or random order.

read: To transfer information into the computer's memory from a source external to the computer (such as a disk drive or modem) or into the computer's processor from a source external to the processor (such as the keyboard or main memory).

read-only memory: Memory whose contents can be read but not written; used for storing firmware. Information is written into read-only memory once, during manufacture; it then remains there permanently, even when the computer's power is turned off, and can never be erased or changed.

RF modulator: See **radio-frequency modulator.**

ROM: See **read-only memory**

routine: A part of a program that accomplishes some task subordinate to the overall task of the program.

run: (1) To execute a program. (2) To load a program into main memory from a peripheral storage medium, such as a disk, and execute it.

save: To transfer information from main memory to a peripheral storage medium for later use.

screen: See **display screen.**

scroll: To change the contents of all or part of the display screen by shifting information out at one end (most often the top) to make room for new information appearing at the other end (most often the bottom), producing an effect like that of moving a scroll of paper past a fixed viewing window. See **viewport, window.**

sector: A portion of the recording surface of a disk consisting of a fixed fraction of a track. On a disk drive under DOS 3.3, there are 16 sectors per track. See **track.**

serial interface: An interface in which information is transmitted sequentially, one bit at a time, over a single wire or channel. Compare **parallel interface.**

serial printer: A printer that accepts information from the computer by way of a serial interface.

software: Those components of a computer system consisting of programs that determine or control the behavior of the computer. Compare **hardware, firmware.**

startup disk: A disk containing software recorded in the proper form to be loaded into the Apple IIe's memory in order to set the system into operation. Sometimes called a *boot disk*; see **boot.**

system: A coordinated collection of interrelated and interacting parts organized to perform some function or achieve some purpose.

system program: A program that makes the resources and capabilities of the computer available for general purposes, such as an operating system or a language translator. Compare **application program.**

system software: The component of a computer system consisting of system programs.

telecommunications: The transmission of information across long distances, such as over telephone lines.

television receiver: A display device capable of receiving broadcast video signals (such as commercial television) by means of an antenna. Can be used in combination with a radio-frequency modulator as a display device for the Apple IIe computer. Compare **video monitor.**

television set: See **television receiver.**

template: A predefined set of contents (numbers, text, and formulas) for an electronic worksheet, designed for some specific purpose or task.

text: (1) Information presented in the form of characters readable by humans. (2) The display of characters on the Apple IIe's display screen. Compare **graphics.**

text file: A file containing information expressed in text form; compare **binary file.**

text window: An area on the Apple IIe's display screen within which text is displayed and scrolled.

thermal printer: A printer that prints by applying small points of heat to a specially treated heat-sensitive paper.

track: A portion of the recording surface of a disk consisting of a single circular band at a fixed distance from the center of the disk. On a disk drive under DOS 3.3, there are 35 tracks on a disk. See **sector.**

troubleshoot: To locate and correct the cause of a problem or malfunction in a computer system. Typically used to refer to hardware-related problems.

user: The person operating or controlling a computer system.

user interface: The rules and conventions by which a computer system communicates with the human user.

video monitor: A display device capable of receiving video signals by direct connection only, and which cannot receive broadcast signals such as commercial television. Can be connected directly to the Apple IIe computer as a display device. Compare **television receiver.**

viewport: All or part of the display screen, used by an application program to display a portion of the information (such as a document, picture, or worksheet) that the program is working on. Compare **window.**

warm start: The process of restarting the Apple IIe after the power is already on, without reloading the operating system into main memory and often without losing the program or information already in main memory. Compare **cold start.**

window: (1) The portion of a collection of information (such as a document, picture, or worksheet) that is visible in a viewport on the display screen; compare **viewport.** (2) A viewport. (3) A flat, rectangular panel, usually made of silica, used in many archaic structures as a human-to-nature interface.

word processor: An application program for creating and modifying text.

wraparound: The automatic continuation of text from the end of one line to the beginning of the next, as on the display screen or a printer.

write: To transfer information from the computer to a destination external to the computer (such as a disk drive, printer, or modem) or from the computer's processor to a destination external to the processor (such as main memory).

write-enable notch: The square cutout in one edge of a disk's jacket that permits information to be written on the disk. If there is no write-enable notch, or if it is covered with a write-protect tab, information can be read from the disk but not written onto it.

write-protect: To protect the information on a disk by covering the write-enable notch with a write-protect tab, preventing any new information from being written onto the disk.

write-protect tab: A small adhesive sticker used to write-protect a disk by covering the write-enable notch.

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Tuck end flap
inside back cover
when using manual.

Apple IIc

Owner's Manual

apple computer

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