THE USER'S GUIDE TO
TEXAS INSTRUMENTS
TI-99/4A COMPUTER, SOFTWARE, & PERIPHERALS

LEARN HOW TO USE YOUR COMPUTER

BY THE EDITORS OF CONSUMER GUIDE®

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CONTENTS

WELCOME TO HOME COMPUTING

Congratulations on owning your new Texas Instruments TI-99/4A Home Computer! If this is your first experience in the world of home computers, you will discover that your computer opens a new world of entertainment and education to you. If you are upgrading from a less expensive computer, you'll find that the TI-99/4A offers expansion capabilities that will serve the needs of many home computer enthusiasts, from the novice to the advanced programmer.

You will quickly notice that the TI-99/4A is designed to be easy to use. And you'll undoubtedly find many uses for your computer; precisely what those uses are will depend on your interests. In learning to use your TI-99/4A, you'll become familiar with the use of your computer in particular, and computers in general. Becoming familiar with computers (i.e., becoming *computer literate*) is one of the primary benefits of owning a home computer.

A little of the basics helps us begin to realize just how useful computers can be. A computer, after all, is an electronic device that has the ability to process data. If "process data" sounds too technical, think of it this way: each time you look up an address and phone number or add all of the month's bills together, you are processing data. When you worry over your tax form each year, you are processing data. When you type a term paper or a letter and retype it to correct mistakes, you are processing data (processing words, specifically). A computer can help you perform all of these tasks—and more.

With the ability to store and recall electronic files, you can use your computer for countless household chores. Keeping close track of medical, dental, insurance, and automobile maintenance records are just some of the possibilities that come to mind.

Tracking home finances is one of the most popular applications for home computers. You can examine your budget, plan expenses, and project your financial future based on expected salary adjustments and inflation. If you are considering the costs of a new home, you can use the computer to calculate real estate financial

values and provide comparisons between housing choices. You can also calculate exact payments on loans, adjusting for different interest rates. And at the end of the year, during your annual income tax planning ritual, you can use your computer in the role of tax accountant.

Education is one of the most exciting areas for personal computer use, particularly for your TI-99/4A. The educational software packages available for your computer number in the hundreds—at levels from preschool to college. Programs are available for spelling, grammar, reading concepts, mathematics, history, music, foreign languages, and other subjects. Much of the educational software available comes in a question-and-answer drill format: you respond to questions posed on the screen, and the computer monitors your answers. Some programs take the form of interactive simulations: you are placed in a situation (say, the Battle of Gettysburg) so that you can learn about the event. The wide array of educational software on the market for the TI-99/4A will continue to grow as the popularity of educational software increases.

Games and hobbies also adapt to computerization. In addition to the video games you can play on your TI-99/4A, there are a number of thinking games and simulation games. Simulations of popular sports such as football and soccer, along with common board games such as chess and checkers, can be played using the computer.

Your computer can even expand your horizons by tapping into information networks—with the use of a telephone. Information networks offer the latest news, stock exchange prices, airline schedules, electronic classified ads, and national restaurant and movie reviews. Some services of this type even offer electronic shopping and banking.

With appropriate software and peripherals (accessories), all of these applications are now available to you. This text provides the information you'll need to choose the right software and accessories for whatever you want to do.

Many people are under the impression that to use a home computer they have to become programmers, but that is far from the truth. You'll find that using your computer is easier than you ever dreamed. For example, your computer uses plug-in cartridges as a form of software. All you have to do is insert the cartridge into a slot, and the computer is ready to perform. The software is easy to use because it presents you with a list of choices. By simply following the step-by-step instructions outlined on the screen, you'll find that commercial software packages require no programming knowledge at all.

If you want to learn programming, you have that option, too. The programming language called BASIC is built into your computer, allowing you to write your own programs and save them on cassette or floppy disk. The 16K memory that is a standard feature of your TI-99/4A provides ample storage for the novice to intermediate programmer. And your computer is capable of using many additional programming languages, including Extended BASIC, Pascal, Logo, and Assembly Language.

Whether you are a first-time computer owner or one who is trading up from a basic learning computer, you'll find that you have a powerful, expandable home computer in your TI-99/4A. The purpose of this text is to help you get maximum use out of your new computer.
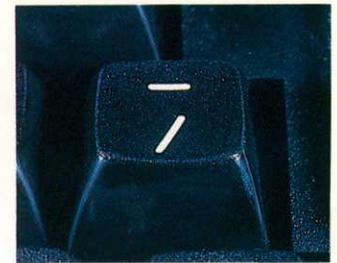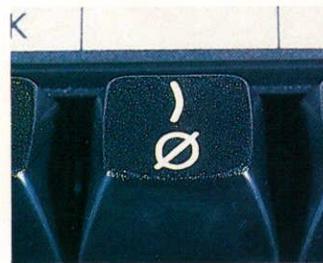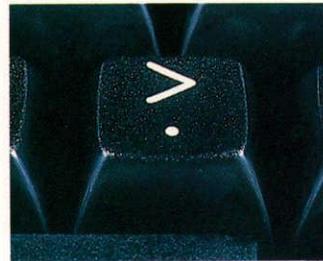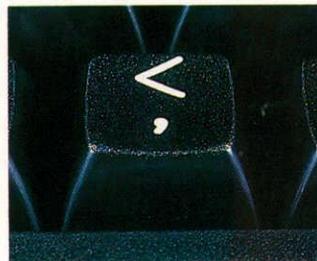
GETTING STARTED

TI-99/4A computer (front view)
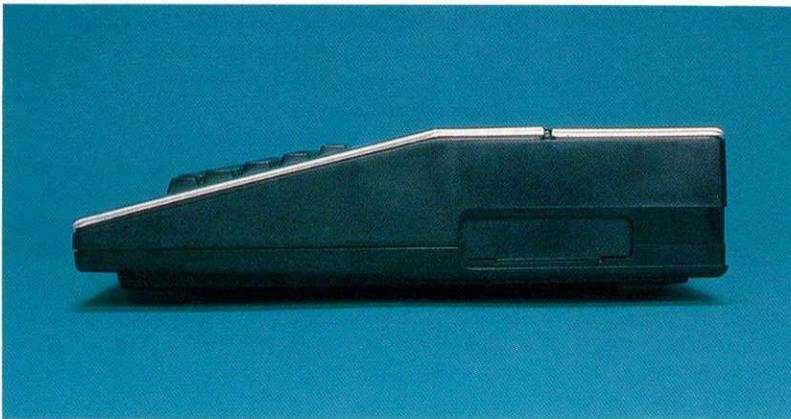
TI-99/4A computer (right side view)

To get the most from your new computer system, you must take the time to become acquainted with its parts. Every system includes some basic components: the computer, a monitor or television set to connect to the computer as a means of display, and software to use with the computer. In addition to these basic parts, you may have purchased some peripherals such as a set of joysticks, a cassette recorder or disk drive system, and the cables needed to connect these items to your computer.

The heart of your computer system is the TI-99/4A Home Computer Console, which contains the keyboard, a slot for the use of cartridge software, and a built-in version of the BASIC computer programming language. In the box with your Home Computer Console is the Video Modulator (a TV adapter which allows you to connect the computer to a television set). Also packed with your computer should be two books: *User's Reference Guide* and *Beginner's BASIC*, both supplied by Texas Instruments. A separate Power Supply that connects to the computer completes the basic computer system. Before you set up your computer, let's take a tour.

On the front of the computer, at the right side, are the Power On switch and the Power Indicator Lamp. Sliding the Power On switch to the right turns your computer on.

On the right side of the computer is a slot that is covered by a sliding door. This slot houses the Expansion Connector. You'll use this connector to attach many peripherals (but more about that later). The door that covers the Expansion Connector should remain closed when the connector is not in use. (And you should be careful not to touch the metal pins on the Expansion Connector; delicate circuits inside the computer can be damaged by static electricity if you touch these pins.)

On the left side of the computer is the Game Controller Port; it has nine little pins. This is where you plug in joysticks when you want to play games.
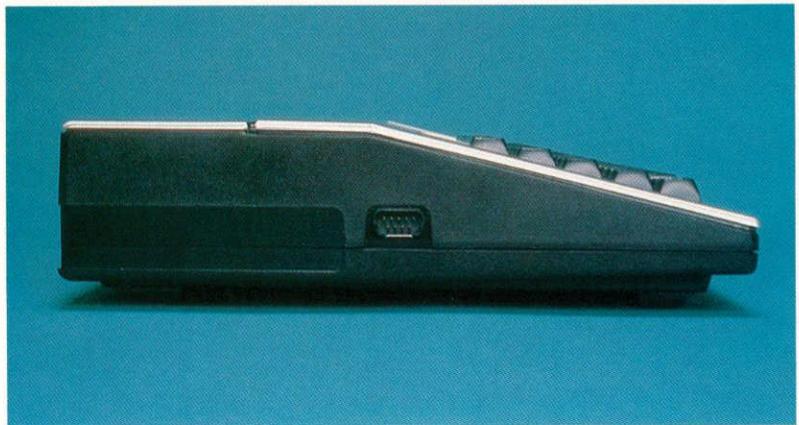
TI-99/4A computer (left side view)

On the rear of the computer you'll find three more connectors. The connector on the left rear of the computer, resembling the Game Controller Port, is where you attach the Cassette Recorder Interface Cable. Next, to the right, is a connector with four pins; here you plug in the Power Cord. Finally, on the right rear of the computer is a circular connector (with five pins). This is where you connect your video monitor or television set.
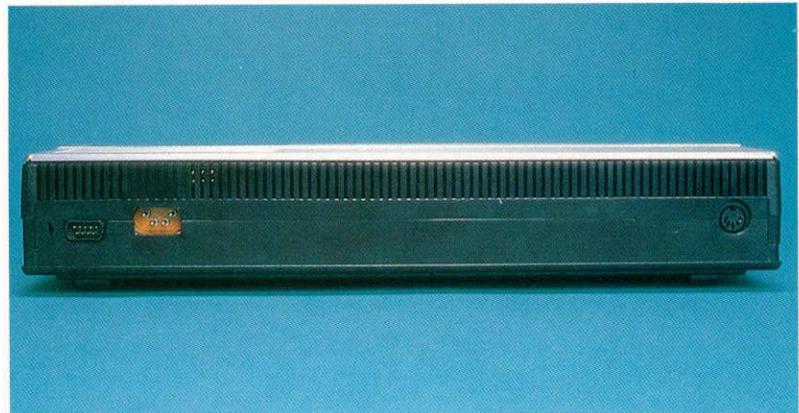
TI-99/4A computer (rear view)

Your TI-99/4A uses *cartridge software* (referred to as Solid State Software by the manufacturer). The right half of the computer console contains a large access area for these cartridges. To the rear of the cartridge software access area is a series of ventilation slots. THESE SLOTS SHOULD NEVER BE OBSTRUCTED; they are necessary to maintain proper cooling of your computer when it is in operation. The area on the left side of the computer console is the keyboard. It resembles the keyboard of a normal typewriter, plus some special function keys. (Chapter 3 covers the functions of the keyboard in detail.)

TI-99/4A computer (top view)

HOOKING UP YOUR TI-99/4A

Here are the components you need to set up your TI-99/4A computer. All these components (except the television) come with your computer.

Video modulator

TI-99/4A Home Computer console

Standard home color (or black-and-white) TV

Power supply

TEXAS INSTRUMENTS, INC.
ATA 0483
POWER SUPPLY PART NO. 9500?2

9

Place the computer console on a firm surface, with room for any accessories that you may have purchased. If you are using a television set as a monitor, you'll need a screwdriver to connect the computer to it. Unwrap the books in the cellophane wrapper. Between them you'll find some papers; you'll also find some strips of plastic (gray on the front and black on the back). These plastic strips are called overlays. One of the strips has some writing on it; place that strip on the computer console in the angled space just above the keyboard.

Pick up the Power Supply that was packed with your computer. Insert the four-pin plug at the end of the Power Supply cable into the four-pin connector on the left rear of the computer. Plug the Power Supply into a standard 115-volt AC electrical outlet. As a safety precaution, you may want to unplug the Power Supply when you finish using the computer (and replug it the next time).

To link your computer to a television follow these steps:

STEP 1
Turn the television set OFF. Loosen the screws on the VHF antenna terminals on your television set and remove the antenna cable.

Step 1

STEP 2
Pick up the Video Modulator that was provided with your computer system. Connect the Video Modulator Television Interface Cable to the VHF antenna terminals on the TV set. Tighten the TV set antenna screws.

Step 2

STEP 3
Connect the television VHF antenna cable to the Video Modulator antenna terminals and tighten the screws.

Step 3

10
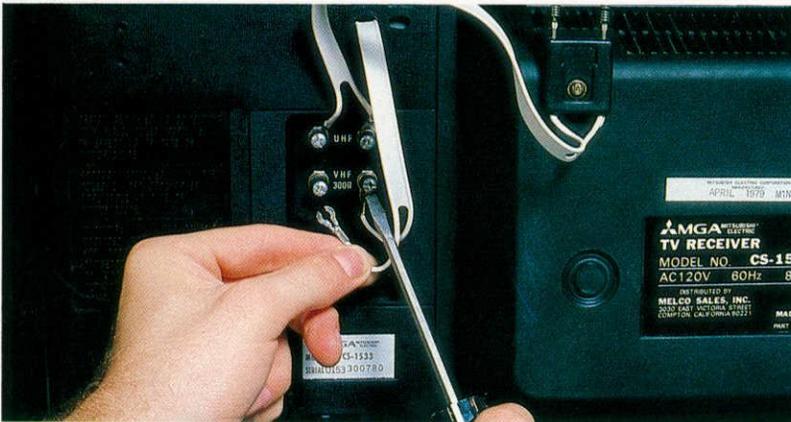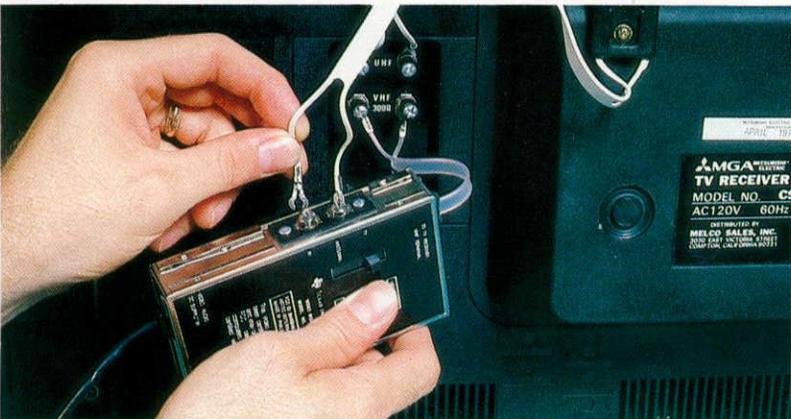
STEP 4

Locate the five-pin plug at the end of the Video Modulator's computer interface cable and insert it into the circular five-pin connector on the right rear of the computer. Be sure that the pins are properly aligned to the socket to avoid breaking the pins. Connect the plug firmly, but don't try to force it into position.

Step 4

STEP 5

Use the peel-and-stick adhesive tape on the rear of the Video Modulator to attach the modulator to your television set.
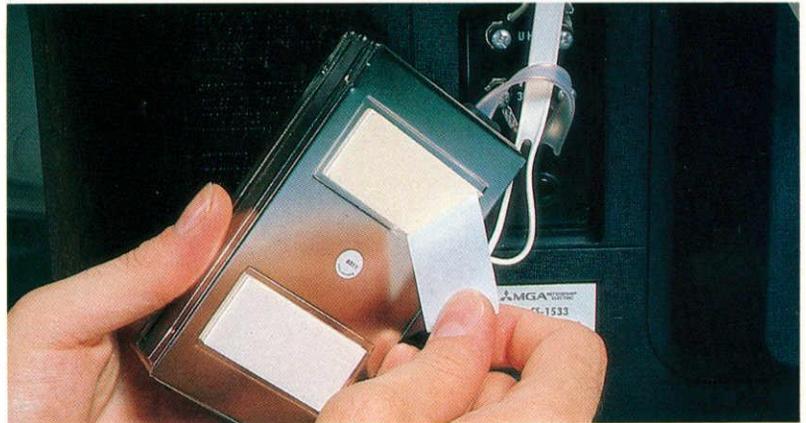
Step 5

STEP 6

In your area, television channel 3 or 4 should be unused. Place the channel select switch at the bottom of the Video Modulator in the unused channel position. Also set your television set to that channel.

Step 6

STEP 7

Set the switch at the top of the Video Modulator to the MODULATOR position.

Step 7

11
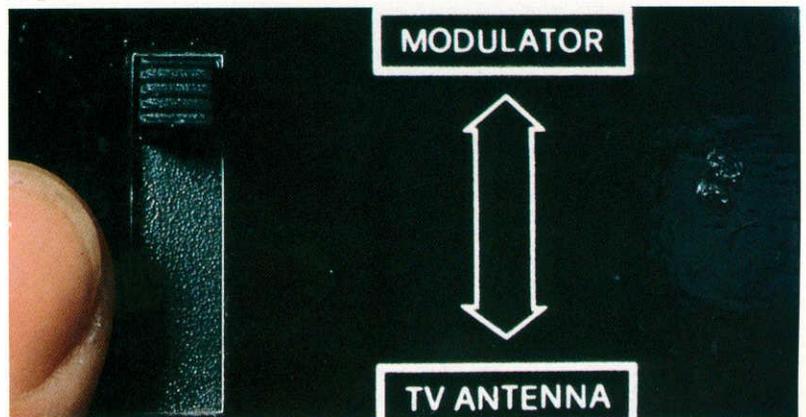
Step

If you are using the TI Color Monitor, follow these steps:

STEP 1
Unpack the TI Color Monitor, and locate the Color Monitor Video Cable supplied with the monitor.

Step 2

STEP 2
Locate the five-pin plug at the end of the Video Cable and insert it into the circular five-pin connector on the right rear of the computer. Be sure that the pins are properly aligned to the socket to avoid breaking the pins. Connect the plug firmly, but don't try to force it into position.
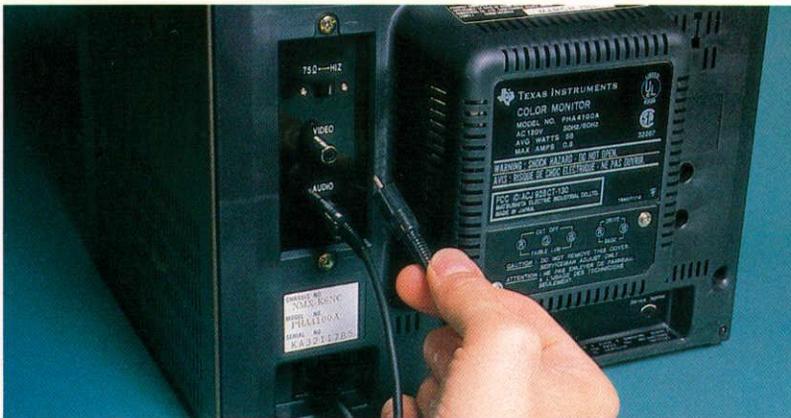
Step 3

STEP 3
Locate the jacks marked "VIDEO" and "AUDIO" on the rear of the Color Monitor. Insert the plugs on the end of the Video Cable into these jacks. The plugs are different sizes, so you can't put them in the wrong places.

Plug the joystick cable into the Game Controller Port.

If you purchased TI joysticks with your computer, follow these steps: Locate the nine-pin plug at the end of the joystick cable. Insert this plug firmly into the Game Controller Port on the left side of the computer.

12

If you are using a cassette recorder for program storage, follow these steps:

STEP 1
Obtain the TI Cassette Recorder Interfacé Cable. This cable is not supplied with the computer; it is supplied with the TI Cassette Program Recorder, or you can buy it separately if you want to use a different cassette recorder.
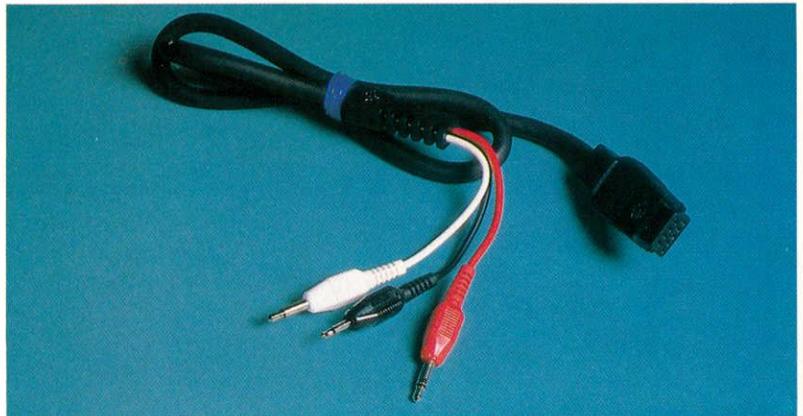
Step 1

STEP 2
Locate the nine-pin plug at one end of the Cassette Recorder Interface Cable. Insert this plug firmly into the jack on the left rear of the computer.

Step 2

STEP 3
Locate the set of three plugs at the other end of the cable. The wires that lead to these plugs are color-coded (red, black, and white).

Step 3
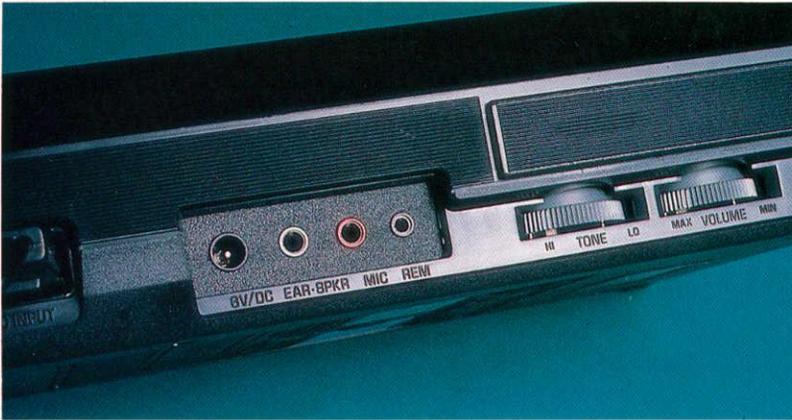
Step 4

STEP 4

Locate the jacks labeled MIC, EAR (or external speaker), and REM on your cassette recorder.
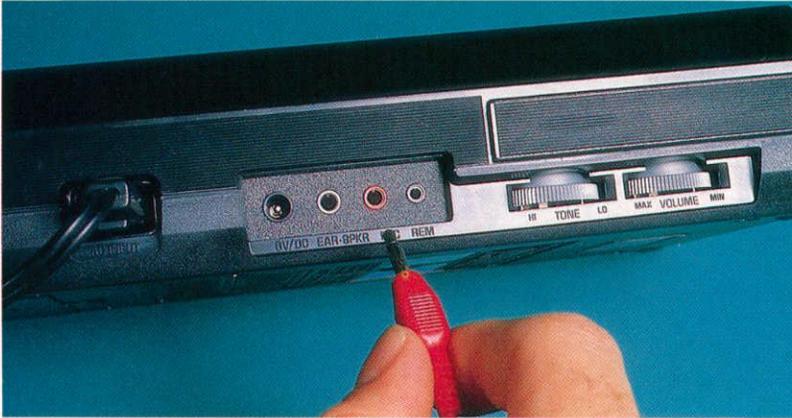
Step 5

STEP 5

Insert the plug with the red wire into the recorder's microphone jack (labeled MIC).
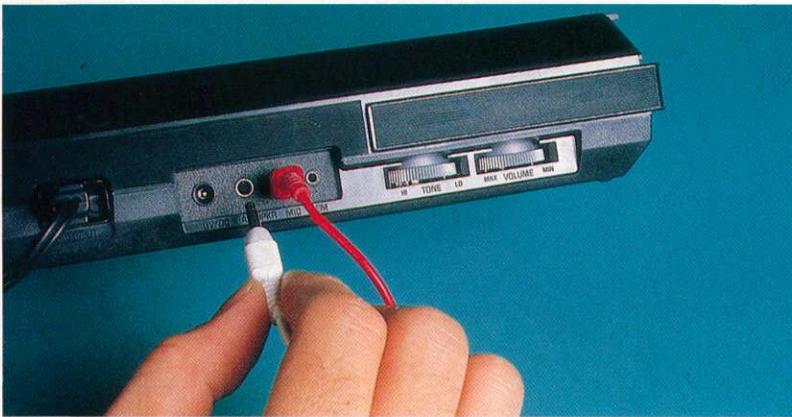
Step 6

STEP 6

Insert the plug with the white wire into the recorder's earphone (or external speaker) jack (labeled EAR).
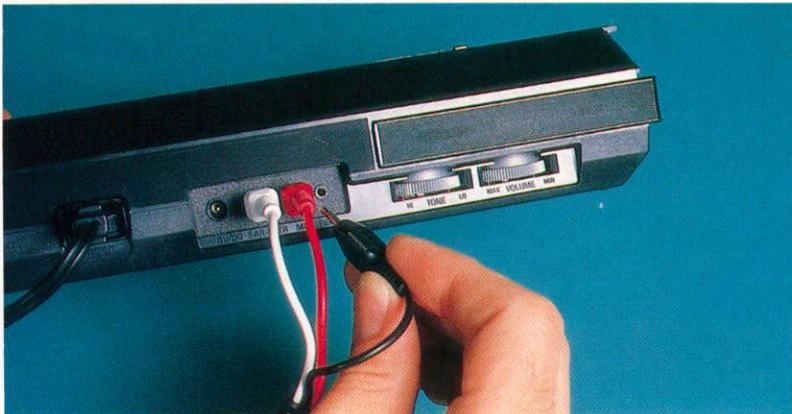
Step 7

STEP 7

Insert the plug with the black wire into the recorder's remote jack (labeled REM).

Now you're ready to turn on and use your computer. Turn on the Power On switch at the front of the computer. The red Power On lamp should light. (If the red Power On lamp does not light, check the Power Supply cable connection at the rear of the computer and make sure that the Power Supply is plugged into a working outlet.) Turn on your television set or TI Color Monitor. Fine tune your television set for the best picture possible. If the image shown in the photograph on this page does not appear on your screen, check the cable connections between the computer and the TV set or monitor.

If you have purchased any software cartridges with your computer, this is an excellent time to try one of the cartridges with your new computer. Insert the software cartridge into the cartridge access slot on the right half of the computer console. Press the cartridge firmly and fully into the access slot. The screen will clear, then display the TI Color Pattern and the words, PRESS ANY KEY TO BEGIN.

Press any key on the keyboard. A menu will appear on the screen, indicating that you should type the number 1 to select TI BASIC, or type the number 2 to use the software cartridge that you have inserted. Your screen should look similar to this:

TI Color Pattern

                TEXAS INSTRUMENTS
                HOME COMPUTER

PRESS
1   FOR TI BASIC
2   FOR THE ATTACK
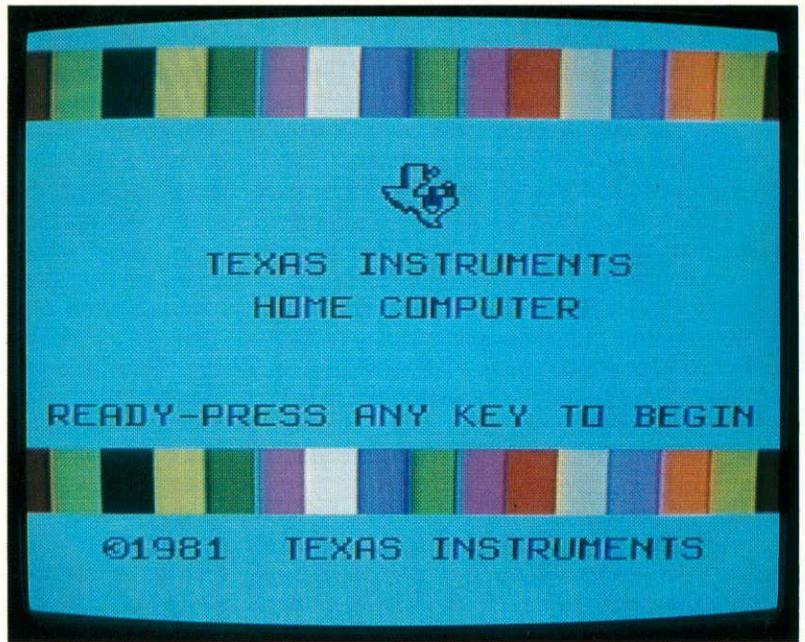
GENERAL PLACEMENT AND CARE OF YOUR COMPUTER

Find a convenient location for your new TI-99/4A computer system. The computer console should be placed on a desk, table, or other flat surface that is elevated enough so that you can rest your hands comfortably on the keyboard. To provide the least amount of possible static interference, the surface that you place the computer on should be nonmetallic. NEVER place the computer directly on top of a television set or video monitor. The heat generated by most monitors and television sets could damage your computer. The ventilation slots along the rear and at the top of the computer console should not be restricted or covered when the computer is turned on.

You may want to consider obtaining a computer desk for your system. Many computer owners eventually expand their systems. If you decide to add the Peripheral Expansion System (described in Chapter 4), you will need an additional 12 inches of space behind the computer. You may also need space for a printer, should you decide to purchase one.

CLEANING

Your computer does not require any special cleaning. When you want to clean the computer, use a damp, lint-free cloth. Never use commercial cleaners or other formulas on the computer surface.

TIPS TO REMEMBER WHEN YOUR SYSTEM LOCKS UP

If you use your computer often, and particularly if you learn to program, a time will come when your computer appears to stop functioning. Suddenly the keyboard will appear to ignore your requests for attention. But don't panic. All computers lock up at one time or another.

If you are a programmer, you will find that this happens often, usually due to errors in the program. What has happened is known in computer lingo as a system crash, and it happens occasionally to everyone who uses a personal computer often. The best plan of action to follow if your system crashes is to proceed slowly while trying to find the cause.

A system crash can occur for a number of reasons. A first check that you might want to make would be your computer's connections. Are all of the cables tight? If you were using cartridge software, is the cartridge fully inserted? If you were using a command that's used to print information on a printer, it is also a potential trouble point. Your computer must hear a series of signals from your printer as it is printing. If a cable is loose and these signals aren't heard, the computer will appear to lock up as a result.

If your TI-99/4A is equipped with a disk drive, it can be a cause of a system crash. You should suspect this area of your system if the computer went haywire the moment you used a command to load or save information using the disk drive. The drive itself is not usually the cause of the problem; often, the floppy disk is defective or is the victim of mishandling.

There are some tasks that you can perform routinely to minimize the bad effects of a system crash. If you are programming, you should use the SAVE CS1 command (on a cassette system) or the SAVE command (on a disk system) to save the information that you're using often. Doing so will minimize the amount of information you lose when system crash occurs.

TROUBLESHOOTING GUIDE

If your computer doesn't appear to be operating normally, the following troubleshooting guide may help you to isolate the cause of the problem. If the troubleshooting guide does not solve the problem, contact your dealer for assistance.

Problem	Correction
Power indicator fails to light when the power switch is turned on	Make sure the Power Supply is plugged firmly into the wall outlet and the Power Supply cord is firmly connected to the plug at the rear of the computer.
Picture and/or sound fails	Make sure the computer is turned on. Make sure the Video Modulator cables are properly connected and the TV set is tuned to the channel selected on the Video Modulator.
Joysticks do not operate correctly	Make sure the ALPHA LOCK key is in the UN-LOCKED (or up) position and the joystick cable is connected to the nine-pin connector on the LEFT SIDE of the computer (NOT the connector on the rear).
Cassette recorder does not operate correctly	Make sure the Cassette Recorder Interface Cable is connected to the nine-pin connector on the REAR of the computer (NOT the connector on the left side).
Computer will not respond to input at the keyboard; garbled characters or other erratic symptoms are present	Turn your computer OFF. Wait five seconds or more. Turn the computer back on. If the problem persists, contact your dealer for assistance.

MEET THE KEYS

This chapter introduces you to your computer's keyboard and also provides a brief peek at the world of programming your computer. Your computer's keyboard is a significant part of your system; the keyboard lets you tell the computer what you want it to do. The keyboard is not only important, it is also very easy to use. Let's jump right in and get acquainted with the keys.

DELETE INSERT ERASE CLEAR BEGIN PROCEED AID REDO BACK

TEXAS INSTRUMENTS

DEL INS ERASE CLEAR BEGIN PROC'D AID REDO BACK

SHIFT KEY

ALPHA LOCK KEY

CONTROL KEY

RIGHT ARROW KEY

LEFT ARROW KEY

SPACEBAR
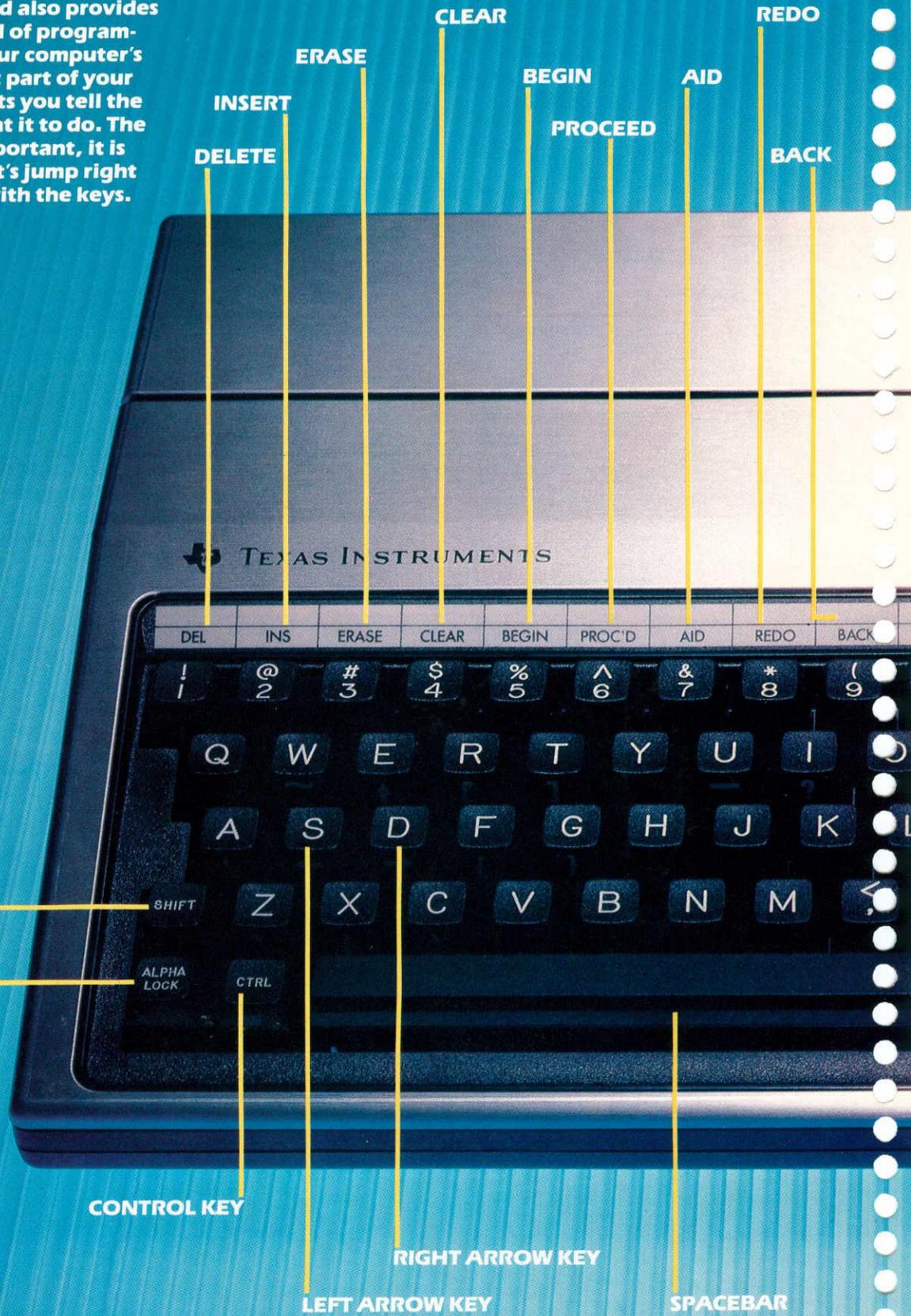
QUIT

TI-99/4A
computer

QUIT

ENTER

SHIFT

FCTN

ENTER KEY

SHIFT KEY

FUNCTION KEY

LET'S GET STARTED

Turn your computer on. And then turn on your TV set. Tune the TV set to the proper channel, if necessary, and slide the switch on the Video Modulator to MODULATOR. The TI Color Pattern should appear on the screen.
SCREEN 1

Take a good look at the keyboard. It resembles the keyboard that you might see on an ordinary typewriter, with one key for each letter of the alphabet and one key for each numeral (0 through 9). There are also keys with punctuation marks and keys with words on them such as SHIFT and ENTER. In this chapter, we'll explain how each of these keys is used.

Press any key on the keyboard and the screen will change.
SCREEN 2

Press the number 1 key and the screen will change again.
SCREEN 3

PROMPT AND CURSOR

On the screen, below the words TI BASIC READY, you see an arrow-shaped character and a flashing block. These are two important screen characters: the prompt and the cursor. That arrow-shaped character is called the *prompt* in computer lingo. The prompt always shows you on what line the letters or numbers you type will appear. The flashing block is known as the *cursor*. The cursor will always show you where the very next character that you type will appear.

The cursor is important in another way, too; it shows you when your computer is waiting for you to provide some type of information. When the cursor is on the screen and flashing, your computer isn't doing any work. It's just sitting there, waiting for you to tell it what to do next.

NOTE: In the photographs in this chapter, the cursor is a slightly lighter color than the letters and numbers shown on the screen. Because the cursor blinks on and off, it appears in a lighter color in photographs. On your TV or monitor screen, the cursor is the same color as the letters and numbers whenever it blinks on.

SCREEN 1
The TI Color Pattern will appear each time you turn your computer on.

SCREEN 2
This screen follows the TI Color Pattern. Press the 1 key to use TI BASIC.

SCREEN 3
Note the arrow-like prompt and the flashing cursor at the left edge of the screen.

Now let's give your keyboard a try. Type any words or sentences you wish for a few moments. Keep looking at your computer's screen as you type. What happens when you reach the edge of the screen and continue to type?

Right! The letters continue on the very next line on the screen.
SCREEN 1
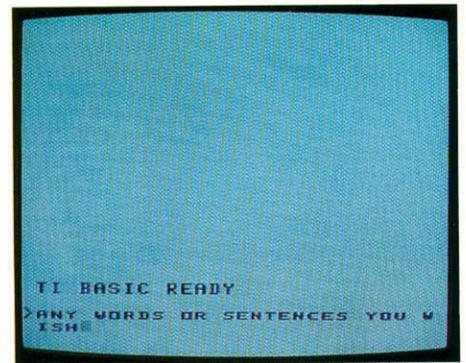
SCREEN 1
When what you are typing is continued on the next line, that is called wraparound.

Now, press any letter (or number) key and hold it down for several seconds. What happens?

Right again! The computer printed the letter (or number) over and over as long as you held the key down. This built-in feature of your computer is known as *auto repeat*.
SCREEN 2
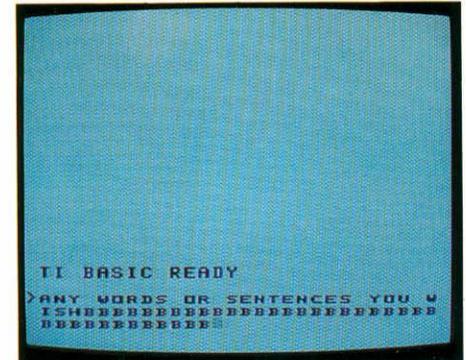
SCREEN 2
Holding down a key for several seconds causes the *auto repeat* of the character.

If you try to type more than four lines, you'll notice that any more letters you type won't appear, and the cursor won't move any farther on the screen.
SCREEN 3

To make the cursor move farther, you'll need to learn to use the ENTER key.
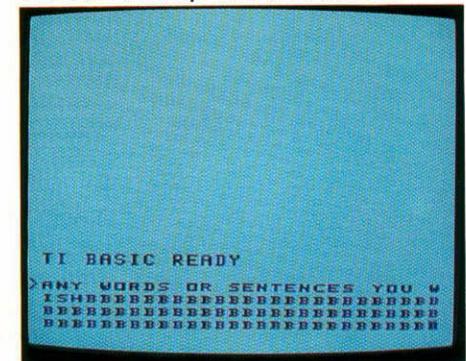
SCREEN 3
When you get to the end of four lines on the screen, the cursor will stop.

THE ENTER KEY

The ENTER key is located on the right edge, halfway down the keyboard. You use it to enter information into the part of the computer that actually does the thinking (or calculating). As you type, letters and numbers appear on the screen, but the computer doesn't actually think about what it should do with any of those characters until you press the ENTER key.

Press the ENTER key now. What happened? The computer beeped at you, wrote * INCORRECT STATEMENT, and began a new line (with a prompt at the left).
SCREEN 1

Next type in about twenty letters—any letters you want—but do not put any spaces between the letters. Press the ENTER key. Your computer now responds with a different message, BAD NAME.
SCREEN 2

Now try typing in an instruction that your computer can follow. Type

CALL CLEAR

but don't press ENTER yet. (If you made a mistake, press the ENTER key and try again.) Notice that the computer sits there, with the flashing cursor at the end of the line. The computer is waiting patiently for you to tell it to get started.
SCREEN 3

Now, press ENTER. What happened? Surprise! The entire screen turns blank, and the cursor appears at the bottom of the screen.
SCREEN 4

The CALL CLEAR command is used to clear the screen. But the computer didn't recognize the command until you pressed the ENTER key.

**SCREEN 1**
INCORRECT STATEMENT is one error message you can get from the computer.

SCREEN 2
BAD NAME is another error message.
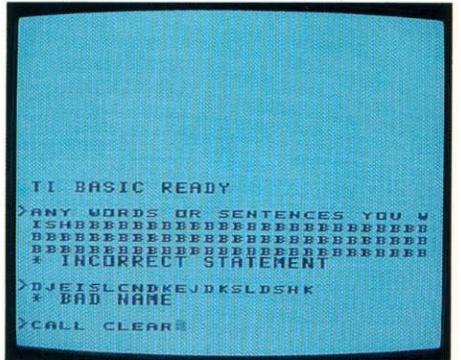
SCREEN 3
Until you press ENTER, the computer will not act on your command.
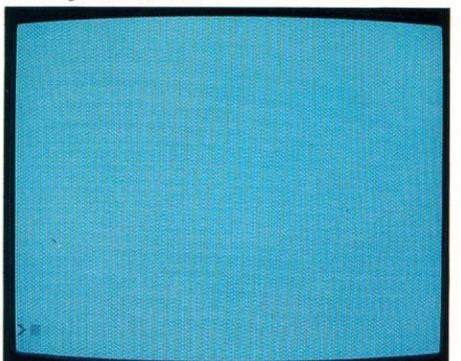
SCREEN 4
The CALL CLEAR command produces a blank screen, with a prompt and a flashing cursor.

ENTER key

The computer recognizes only a very specific set of words. You'll learn about your computer's vocabulary if you delve into BASIC programming. For now, remember that your computer's ENTER key always tells the computer to act upon whatever information is in the line that you just typed.

Even if you use a series of words or a command that is not in the computer's vocabulary, the computer won't know anything is wrong until you press ENTER and it tries to interpret those words. To see what we mean, type

THIS MAKES NO SENSE AT ALL.

The sentence appears on the screen.
SCREEN 1

That sentence means nothing to the computer. Still, your computer doesn't care right now, because you haven't pressed ENTER yet. The computer won't try to translate those words into its language until you press ENTER. So, let's press ENTER! Now, the computer will read the sentence you just typed, discover that none of those words are in its vocabulary, and print out the message * INCORRECT STATEMENT, to tell you that it doesn't understand what you said.
SCREEN 2

Instead of INCORRECT STATEMENT, the computer displays BAD NAME if you type in a word that has more than fifteen characters and then press ENTER.

Before starting the next exercise, type the words CALL CLEAR and press ENTER to clear the screen.
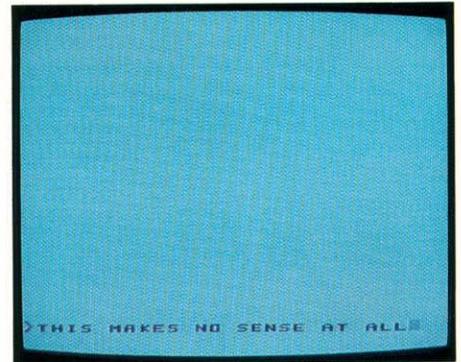
SCREEN 1
The computer won't know you've made a mistake until you press ENTER.
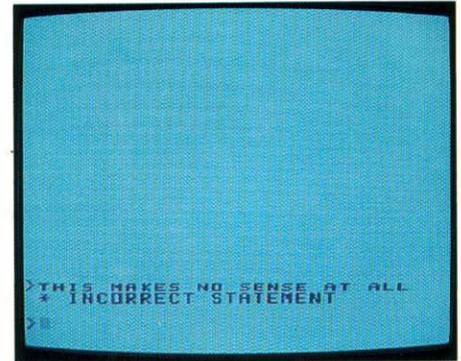
SCREEN 2
After you press ENTER, the computer will tell you if you made a mistake.

THE SPACEBAR

The long rectangular key at the very bottom of the keyboard is called the *spacebar*. If you're familiar with typing, you already know about the *spacebar*. It's used to add spaces between the words that you type. Let's try the *spacebar* with different words. Type the following sentence, pressing the *spacebar* once after each word to leave a space:

THIS IS MY COMPUTER.

The sentence appears on the screen.
SCREEN 1

Like the other keys, the *spacebar* is a "repeat" key. This may come in handy at times, when you want to add large spaces between words. Try this now. Type the word

LARGE

The word appears after your sentence.
SCREEN 2

Then hold the *spacebar* down for a few seconds. When the cursor gets to the end of the line, it automatically wraps around to the beginning of the next line and continues on.
SCREEN 3

Now type the word

SPACE

The large gap caused by your holding down the *spacebar* may look strange in this case, but there may be times when you'll want a large space between words on the screen.
SCREEN 4

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.

SPACEBAR

SCREEN 1
Pressing the spacebar puts spaces between characters or words on the screen.
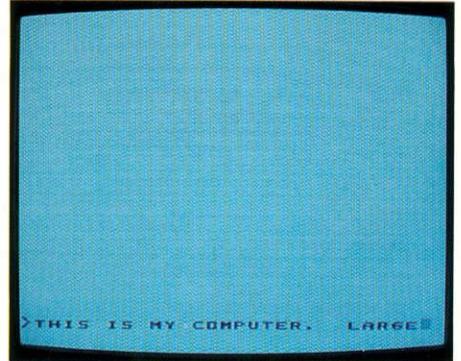
SCREEN 2
When the cursor reaches the end of a line on the screen...
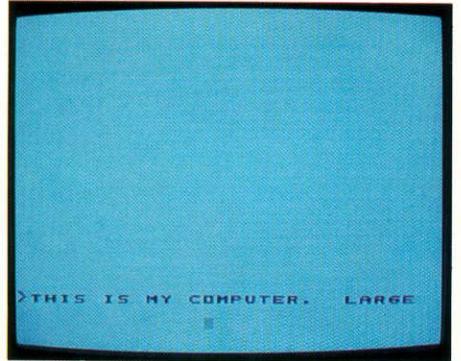
SCREEN 3
...it wraps around to the next line.
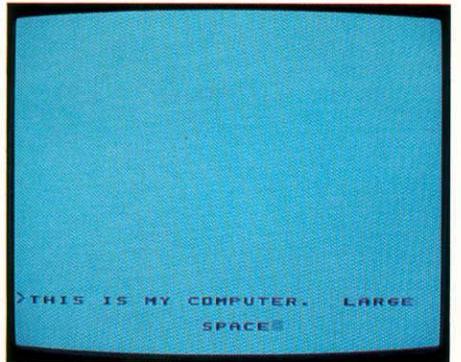
SCREEN 4
The screen display will leave space where you have pressed the spacebar.

One key for each letter in the alphabet is located on your keyboard. But they are not laid out in alphabetical order. Instead, the location of the keys follows what is known as the typewriter, or "QWERTY," format. QWERTY comes from the first six keys on the left in the top row of letters. If you are already a typist, then you are familiar with where each of the keys is located. If you are not a typist, you may wish to locate each letter of the alphabet on the keyboard now.

First, press each letter key in the order they appear on the keyboard, starting with the top row.
SCREEN 1

SCREEN 1
The letter keys on the keyboard are not placed in alphabetical order.

Now try typing all the letters in alphabetical order.
SCREEN 2

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
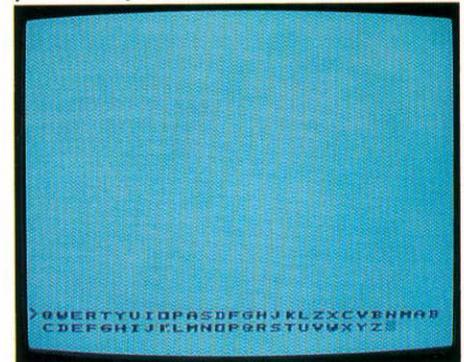
SCREEN 2
You may have to practice to be able to find all of the keys in alphabetical order.

LETTER keys

THE ALPHA LOCK KEY
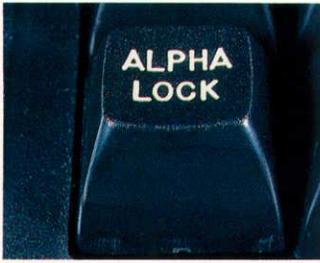
Your computer can create uppercase (capital) and lowercase (small) letters. On the lower left side of the keyboard, locate the key marked ALPHA LOCK. The ALPHA LOCK key causes all of the letters to be displayed as uppercase letters. The ALPHA LOCK key gets its name from the fact that it can be locked in the down position. Let's try using the ALPHA LOCK key. Press the ALPHA LOCK key until it locks in the down position. Now, type a few words, like this:

A FEW WORDS

(Don't worry if you make a mistake; we'll learn how to fix mistakes a little later.) Your words appear on the screen.
SCREEN 1

Press the ALPHA LOCK key again (to "unlock" it) and again type

A FEW WORDS

See the difference?
SCREEN 2

The first A FEW WORDS you typed (in uppercase) is about twice as large as the second (which is in lowercase). The lowercase letters on the screen are not true lowercase letters. The TI-99/4A always represents a lowercase letter by displaying a character that is roughly half the size of the uppercase letter.

There are two rules for using the ALPHA LOCK key: 1) when you use TI Joysticks to play games, the ALPHA LOCK key must be unlocked, in the up position, and 2) when you are programming in BASIC, leave the ALPHA LOCK key locked, in the down position (because some commands in TI BASIC require the use of capital letters).

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
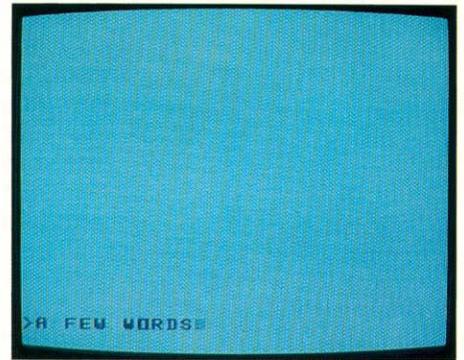
SCREEN 1
All of the letters displayed on the screen look like conventional uppercase letters.
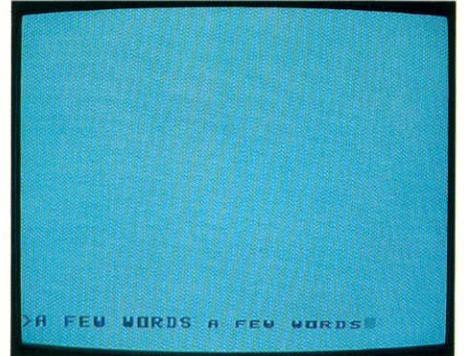
SCREEN 2
Uppercase letters are about twice as tall as lowercase letters.

ALPHA LOCK key

On the lower left and lower right sides of the keyboard, locate the two keys marked SHIFT.

Like the ALPHA LOCK key, the SHIFT keys are used to type uppercase letters. The SHIFT keys have an additional function, however—one which the ALPHA LOCK does not perform: for every key on the keyboard which has two symbols on it (such as the key with the number 4 and the dollar sign), the SHIFT key gives you access to the upper symbol.

Try typing various keys now (letters, numbers, or other symbols) with and without a SHIFT key depressed, and notice the results.

First type all the letters in the top row of the keyboard *without* using a SHIFT key. Then type the same letters *with* a SHIFT key held down.
SCREEN 1

Hold down the spacebar until the cursor moves to the beginning of the next line. Now type all the number keys *without* using a SHIFT key. Then type the same keys *with* a SHIFT key held down.
SCREEN 2

Use the spacebar to move the cursor to the next line. Now type a few symbol keys *without* using a SHIFT key. Then type those keys again *with* a SHIFT key held down.
SCREEN 3

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
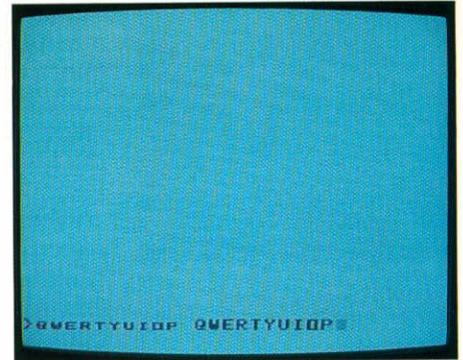
SCREEN 1
Pressing the SHIFT key with a letter key creates an uppercase letter.
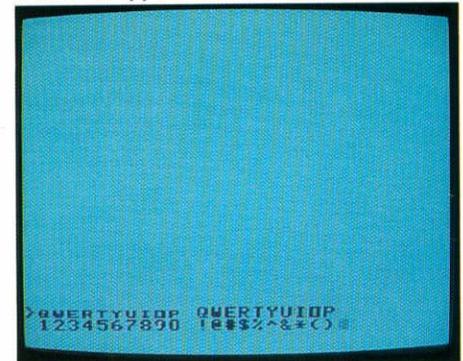
SCREEN 2
Pressing the SHIFT key also creates the symbols on the upper half of the number keys.
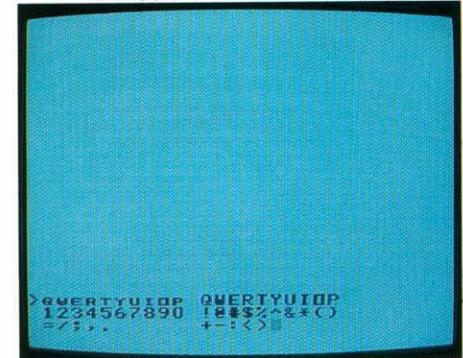
SCREEN 3
Other keys have two symbols on them as well.

SHIFT keys

THE FUNCTION KEY

At the bottom of the right side of the keyboard is a key marked FCTN (with a gray dot on the front). This is your FUNCTION key. The FUNCTION key has a special purpose: it makes other keys on the keyboard perform more than one job. Using the FUNCTION key is similar to using the SHIFT key; you hold it down while you press another key. By doing this, what happens on the screen is the result of the *function* of the key you typed with the FUNCTION key. The special functions of the letter keys are indicated on the fronts of the keys.

Let's try this to see how it works. First, hold the FUNCTION key and press the I key. What character appeared?
SCREEN 1

A question mark just appeared on the screen. Examine the front of the I key on the keyboard, and you will see the question mark symbol.

Now while you hold the FUNCTION key press the R key and then the T key. The left and right brackets appear.
SCREEN 2
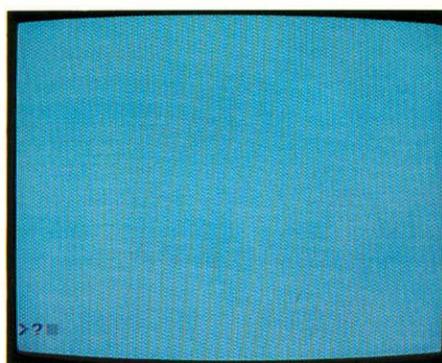
SCREEN 1
Pressing the FUNCTION key with the I key creates a question mark on the screen.
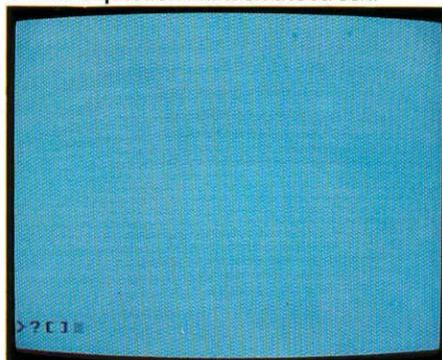
SCREEN 2
Pressing the FUNCTION key with the R and T keys creates the left and right brackets.

FUNCTION key

28

Now hold the FUNCTION key and press the P key to get a quotation mark.
SCREEN 1

Then hold the FUNCTION key and press the O key to get the apostrophe.
SCREEN 2

In each case, the character that's on the front of the key appears on the screen when you press the FUNCTION key with the letter key. In this manner, the keyboard of your TI-99/4A can create many more characters than there are keys.

Most of the characters that you see on the front of the keys are used in special cases, such as in typing a letter when using word processing software with your TI-99/4A. The UP and DOWN arrow keys are used in an editing mode during BASIC programming; that is a more complex programming function that is detailed in your TI BASIC Handbook. You'll need these keys only if you become extensively involved in BASIC programming.

The special functions of the keys in the top row are indicated on the plastic overlay. The FUNCTION key is like an "international translator" who, when called into action, changes the very language of your keyboard. To help you keep track of this new language, you have placed the strip of words above the number keys on your keyboard. Don't worry about just what the names that make up this new language mean right now. We'll explain these functions when we discuss each of the number keys.

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
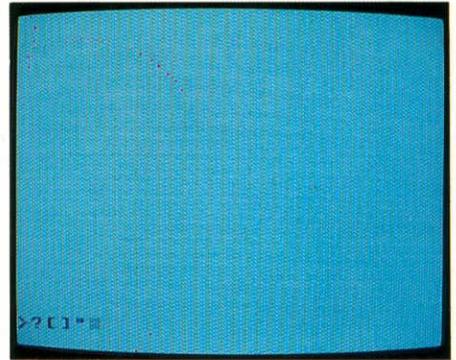
SCREEN 1
Pressing the FUNCTION key with the P key creates a quotation mark.
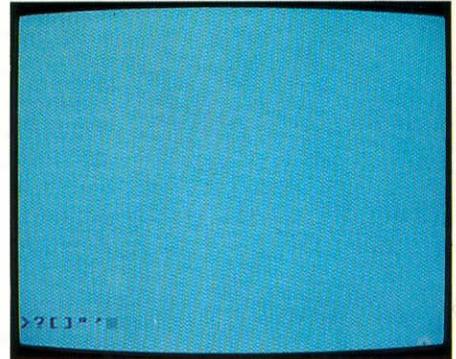
SCREEN 2
Pressing the FUNCTION key with the O key creates an apostrophe.

THE LEFT AND RIGHT ARROW KEYS
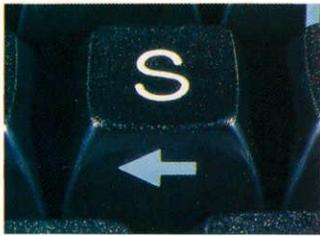
When you use the spacebar, the cursor moves to the right. But suppose you make a mistake or want to add a letter or word in the middle of a sentence. Perhaps you decide you want to erase a letter or an entire word. You can add and erase letters and words with your computer. But to do so, you must first be at the place in the sentence where you want to add or remove characters.

Let's find out how to do this. Type the sentence

THIS IS MY COMPUTER.

Right now, the cursor is near the end of the line. **SCREEN 1**
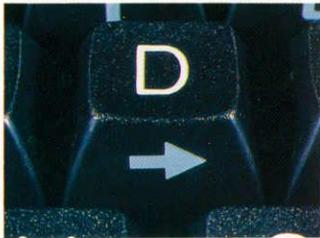
Look at the S key and the D key. On the front of these keys you see arrows that point to the left and to the right. These keys, used with the FUNCTION key, move the cursor back and forth. Let's try it!

Hold the FUNCTION key and press the S key nine times. The cursor is now on top of the letter C in COMPUTER (if you had a period at the end of your sentence). **SCREEN 2**

Hold the FUNCTION key and press the D key six times. Your cursor is now positioned on top of the letter E. **SCREEN 3**

By using the S key as a left arrow key and using the D key as a right arrow key, you can move the cursor to any spot within a line of typing. You can think of using the left and right arrow keys to move the cursor as being similar to lifting a pencil from one place on a sheet of paper and placing it at another spot on that same sheet of paper.

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
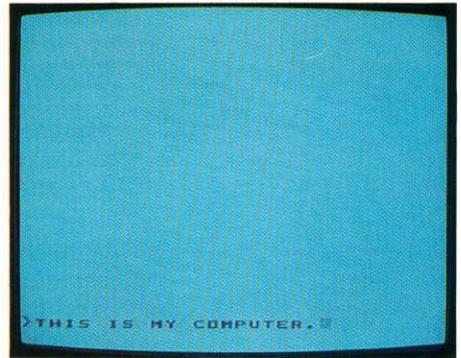
SCREEN 1
The LEFT ARROW and RIGHT ARROW keys move the cursor back and forth within a line.

SCREEN 2
Using the FUNCTION key with the S key moves the cursor to the left.

SCREEN 3
Using the FUNCTION key with the D key moves the cursor to the right.

LEFT ARROW key • RIGHT ARROW key

THE CONTROL KEY AND NUMBER KEYS

THE CONTROL KEY

The key marked CTRL, to the left of the spacebar, is the CONTROL key. It works like the function key—you hold it down with another key on the keyboard and the combination tells the computer to do something special. But the control functions are not indicated on the keyboard because they change. You'll only use control functions with special software programs, and the specific software program will provide instructions for their use (and usually a handy reference card to tell you which keys do what).

THE NUMBER KEYS

The number keys in the top row operate a little differently from the letter keys. There are no uppercase numbers. Instead, each number key contains two characters. One (in the lowercase position) is a number, and the other (in the uppercase position) is a symbol of some sort. You type the number key alone to produce the number on the screen. To produce the symbol that is above the number, you hold the SHIFT key and type the number key.

Remember how this works? Hold the SHIFT key down, and type the number keys from one through nine and then zero. Your screen will show the symbols on the upper part of the keys.
SCREEN 1

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
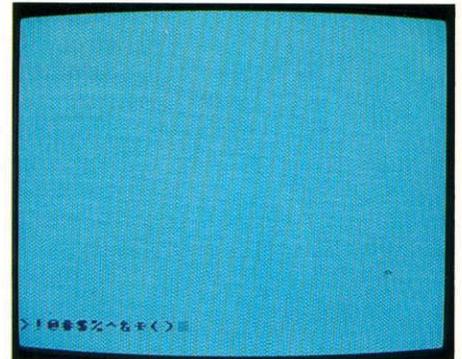
SCREEN 1
Pressing the SHIFT key with a number key creates a symbol on the screen.

CONTROL key • NUMBER keys

THE 1/! KEY–DELETE FUNCTION

The 1/! key is at the left end of the top row of keys. If you simply press the key, a numeral 1 appears on the screen. Now hold the SHIFT key and press the 1/! key. The exclamation mark appears next to the numeral.
SCREEN 1

The special function of the 1/! key is indicated on the label just above the key. The letters DEL stand for DELETE. By holding down the FUNC-TION key and the 1/! key, you can delete (re-move) characters that you don't want in a line. The DELETE key operates much like an eraser on a sheet of paper. The DELETE key has some advantages over a normal eraser, however. It's much neater—in addition to not leaving a mess after use, the DELETE key won't leave blank spaces where you've erased mistakes.
Let's try using the DELETE key. Type

THIS IS MY OLD COMPUTER.

Your sentence appears.
SCREEN 2

Now use the left arrow key to move the cursor to cover the letter O in the word OLD.
SCREEN 3

Now, hold the FUNCTION key down, and press the 1/! key four times. What does our sentence say now?
SCREEN 4

By using the DELETE key, you've deleted the word OLD. Each time you press DELETE, the character (or space) on which the cursor rests is erased, and all of the letters to the right of the cursor move to the left by one space. This auto-matically takes care of the space that was occu-pied by the deleted character.

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.

1/! key
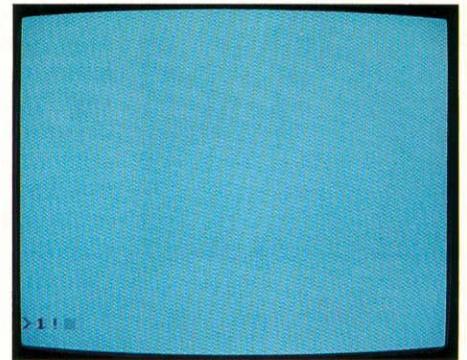
SCREEN 1
Press the 1/! key twice, once by itself and once with the SHIFT key.

SCREEN 2
To delete the word OLD, first move the cursor to the left...

SCREEN 3
...so that it is on top of the O in OLD. Press the FUNCTION and 1/! keys four times.

SCREEN 4
This is what the sentence looks like when you have removed the word OLD.

THE 2/@ KEY–INSERT FUNCTION

The 2/@ key is located in the top row of keys, just to the right of the 1/! key. If you simply press the key, a numeral 2 appears on the screen. Now hold the SHIFT key and press the 2/@ key. That strange-looking symbol that just appeared on your screen is an abbreviation for the word AT.
SCREEN 1

The special function of the 2/@ key is indicated on the label just above the 2/@ key. The letters INS stand for INSERT Holding down the FUNCTION key while depressing the 2/@ key turns the 2/@ key into an INSERT key. You'll use the FUNCTION key and the 2/@ key to insert characters into a line that you have already typed.

Let's give this a try! Type

THIS IS MY COMPUTER.

Your sentence appears on the screen.
SCREEN 2

Now use the left arrow key to move the cursor to cover the C in the word COMPUTER.
SCREEN 3
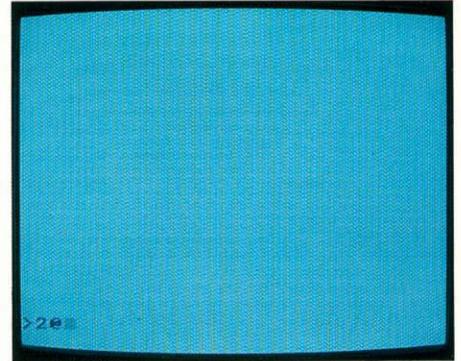
SCREEN 1
Press the 2/@ key twice, once by itself and once with the SHIFT key.
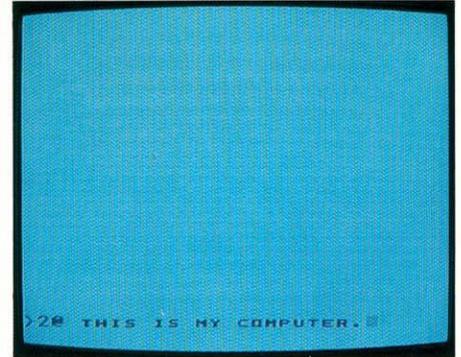
SCREEN 2
To insert a word between MY and COMPUTER, move the cursor left...

SCREEN 3
...so that it covers the C in COMPUTER.

2/@ key

Now, hold the FUNCTION key down and press the 2/@ key. You won't see any difference on the screen, but your computer is now in the insert mode. Type the word NEW and press the spacebar once. What does the sentence say now?
SCREEN 1

By using the INSERT key, you've inserted new text into an existing line. Notice that as you insert the new text, existing words move to the right to create room for the new characters.

You will stay in the insert mode until you use the arrow keys to move your cursor in either direction. To see how this works, hold the FUNCTION key down and press the left arrow key until the cursor is over the letter N in the word NEW.
SCREEN 2

Now, type the word OLD.

Notice what happened! Since you are not in the insert mode any longer, the word OLD was not inserted between words. Instead, it simply replaced the word NEW as you typed.
SCREEN 3

Remember, once you are in the insert mode, the characters that you type are added to your original text; when you are not in the insert mode, any characters that you type will replace the original text.

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.

SCREEN 1
The FUNCTION and 2/@ keys combined allow you to insert words.

SCREEN 2
Moving the cursor turns off the insert mode.
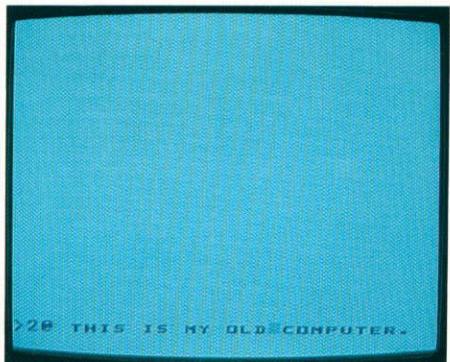
SCREEN 3
With the insert mode off, any new characters you type replace whatever was there before.

2/@ key

THE 3/# KEY–ERASE FUNCTION

The 3/# key is located in the top row of keys, just to the right of the 2/@ key. If you simply press the key, a numeral 3 appears on the screen. Now hold the SHIFT key and press the 3/# key. Your screen shows the # symbol (which means number).
SCREEN 1
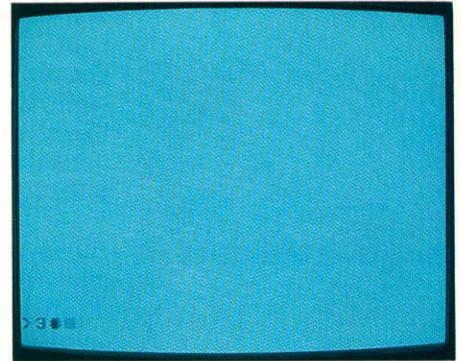
SCREEN 1
Press the 3/# key twice, once by itself and once with the SHIFT key.

The special function of the 3/# key is indicated on the label just above the 3/# key. Since the DELETE key can be thought of as an eraser, you may wonder about the ERASE function of the 3/# key. Well, the 3/# key can also be likened to an eraser—it's just a much bigger eraser! Want to see what we mean?

Try it on for size. Again, type in the sentence

THIS IS MY COMPUTER.
SCREEN 2

SCREEN 2
When you press the FUNCTION key with the 3/# key...

Hold the FUNCTION key down, and press the 3/# key. How much text was erased?
SCREEN 3

Imagine that! The entire sentence vanished, and the cursor is sitting next to the prompt. The ERASE function will always erase any characters that you've typed on a line.
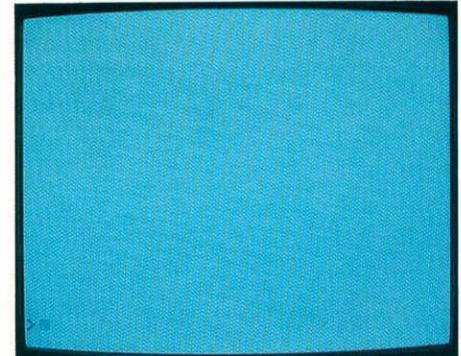
SCREEN 3
...the whole line disappears!

3/# key

THE 4/$ KEY–CLEAR FUNCTION

The 4/$ key is located in the top row of keys, just to the right of the 3/# key. If you simply press the key, a numeral 4 appears on the screen. Now hold the SHIFT key and press the 4/$ key. Your screen shows the $ symbol (which means dollars).
SCREEN 1

The special function of the 4/$ key is indicated on the label just above the 4/$ key. By holding down the FUNCTION key and the 4/$ key, you command the computer to clear the screen, to stop a BASIC program that is running on the computer.

Right now, it's difficult for you to see how this key would work, because you're not running a BASIC program on your computer. But we'll fix that!

First press ENTER so you can start your program on a new line. (Don't worry if a BAD NAME message appears when you press ENTER.)

Now type this sentence, just as it is shown:

10 PRINT 1234567890

(If you make any mistakes, you should now know how to correct them! Just move the cursor back to the incorrect character, and retype the correct character.) When you've finished typing the line, press the ENTER key.
SCREEN 2

Next, type the following sentence:

20 GO TO 10

Then press ENTER again.
SCREEN 3

You've just created a simple BASIC program.
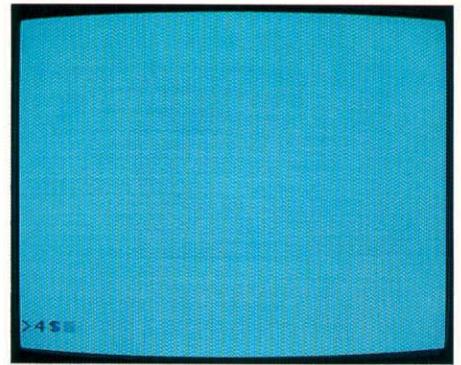
SCREEN 1

Press the 4/$ key twice, once by itself and once with the SHIFT key.
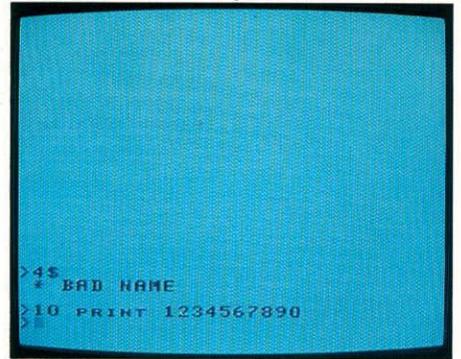
SCREEN 2

This is the first line in your very first computer program.
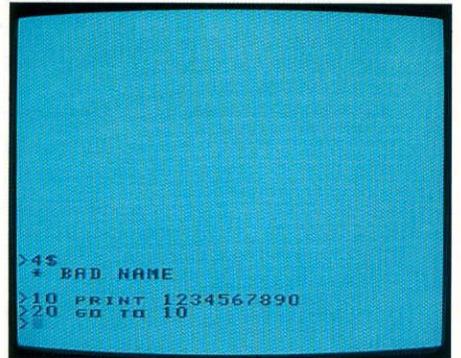
SCREEN 3

With this second line, you have completed your program. To see what it does...

4/$ key

36

Now type the word RUN.
SCREEN 1

Then press the ENTER key. What's the result of your program?
SCREEN 2

Your computer takes off, rapidly showing the numbers across the screen from top to bottom. When you're tired of watching your computer repeat this mindless task, try typing a letter or number on the keyboard. Try pressing the space-bar. Try typing STOP or ENOUGH or any word you like. What happens?

Absolutely nothing! Your computer is ignoring you as it busily prints rows of numbers on the screen. How can you get the computer to stop this operation?

You could pull the plug out of the wall outlet, but it's not necessary to take such drastic action. It's times like these when the CLEAR key comes in handy. Hold the FUNCTION key down and press the 4/S key. The computer will beep, and your screen will show

* BREAKPOINT AT 20.

You have stopped the program from running.
SCREEN 3

Any time that you are running a BASIC program, you can interrupt it by using the CLEAR key. Using the CLEAR function is like placing a stop sign in front of a moving computer! It forces the computer to come to a screeching halt.

Before starting the next exercise, type CALL CLEAR and press ENTER to clear the screen.
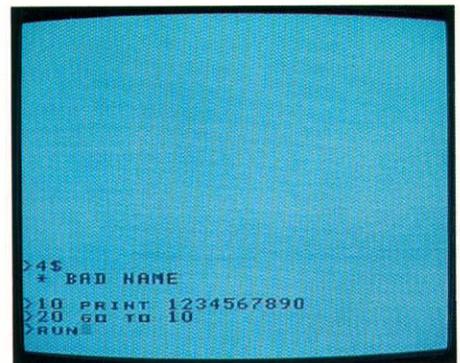
SCREEN 1
...type the command RUN...
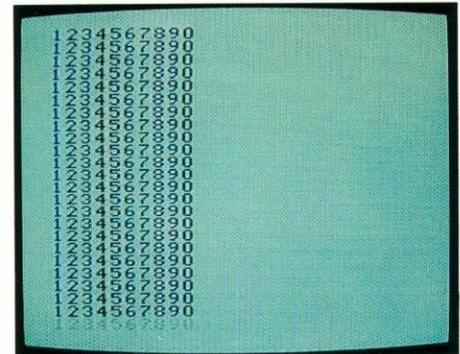
SCREEN 2
...and press ENTER. The screen will be moving very quickly.
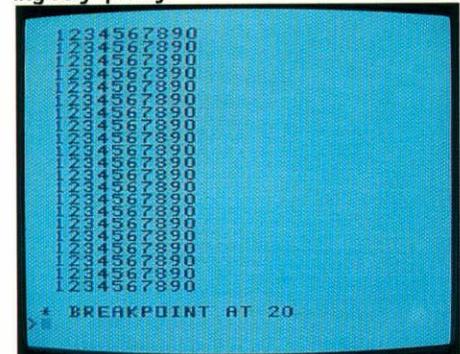
SCREEN 3
By pressing the FUNCTION key and the 4/S key at the same time, you stop the program.

THE 5/% KEY—BEGIN FUNCTION

The 5/% key is located in the top row of keys, just to the right of the 4/$ key. If you simply press the 5/% key, a numeral 5 appears on the screen. Now hold the SHIFT key and press the 5/% key. The screen displays the percent symbol (%).
SCREEN 1

The special function of the 5/% key is indicated on the label just above the 5/% key. The BEGIN command is used only with certain software packages (or in BASIC programming); if you press the BEGIN key now, the computer will not respond at all.

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
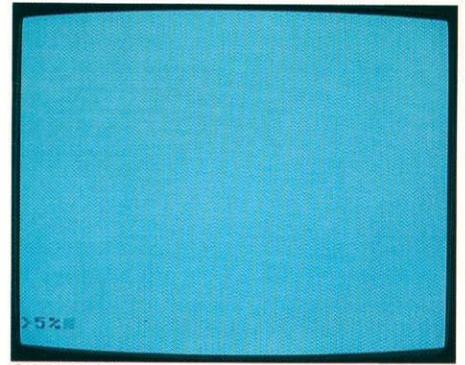
SCREEN 1
Press the 5/% key twice, once by itself and once with the SHIFT key.

5/% key

THE 6/∧ KEY—PROCEED FUNCTION

The 6/∧ key is one of four number keys that have special meaning when used in certain ways during BASIC programming. These four keys are the 6/∧ key for the exponent sign (∧), the 8/* key for the asterisk, the 9/(key for the left parenthesis, and the 0/) key for the right parenthesis. Let's discover what is meant by these symbols.

First, the 6/∧ key. Press the key by itself and a numeral 6 appears on the screen. Now hold the SHIFT key and press the 6/∧ key. The screen displays the exponent sign (∧).
SCREEN 1

The exponent symbol, or SHIFT key and the numeral 6, tells the computer to raise a number to the power of another number. This is easier to demonstrate than it is to explain, so let's try it. You may already know that $6^2 = 36$. The number 2 indicates that the number 6 is raised to the power of 2. The exponent symbol on your computer can be used to perform the same kind of calculation! First, press the ENTER key to begin a new line. Now type

PRINT 6∧2.

and your problem appears on the screen.
SCREEN 2

Next, press the ENTER key. Notice your computer's answer (36) is displayed on the screen.
SCREEN 3
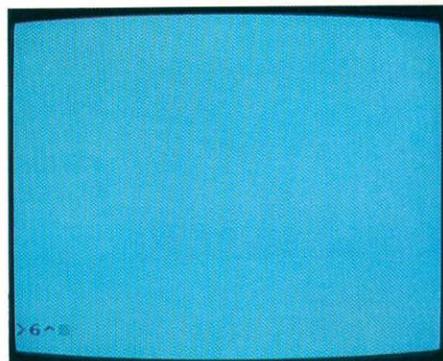
SCREEN 1
Press the 6/∧ twice, once by itself and once with the SHIFT key.
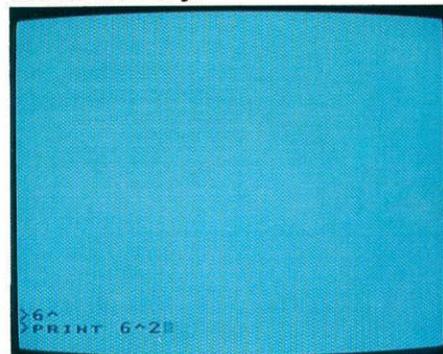
SCREEN 2
The caret indicates that an exponent follows it.
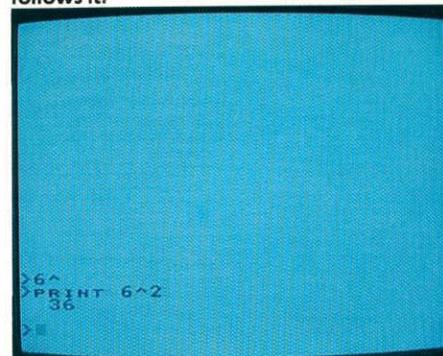
SCREEN 3
PRINT tells the computer to perform the equation and display the answer.

6/∧ key
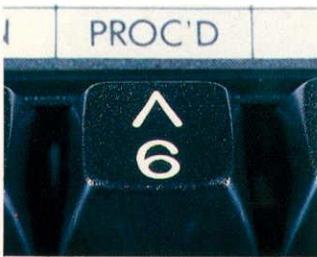
The exponent symbol can be used to calculate numbers raised to various powers. Type

PRINT 14∧6

and the problem appears on the screen.
SCREEN 1

Now press ENTER. Your computer's answer of 7529536 shows that your computer can handle fairly large numbers!
SCREEN 2

Now, try this: type

PRINT 9999∧9999

and see this problem appear.
SCREEN 3

Now press ENTER. Your computer's message,

* WARNING:
  NUMBER TOO BIG

shows that even computers have limits!
SCREEN 4

The special function of the 6/∧ key is indicated on the label just above the 6/∧ key. The PRO-CEED command (abbreviated PROC'D) is used only with certain software packages (or in BASIC programming); if you press the PROCEED key now, the computer will not respond at all.

Before starting the next exercise, type CALL CLEAR and press ENTER to clear the screen.

6/∧ key

SCREEN 1
This PRINT command tells the computer to raise 14 to the 6th power.

SCREEN 2
The answer is displayed slightly indented underneath the command.
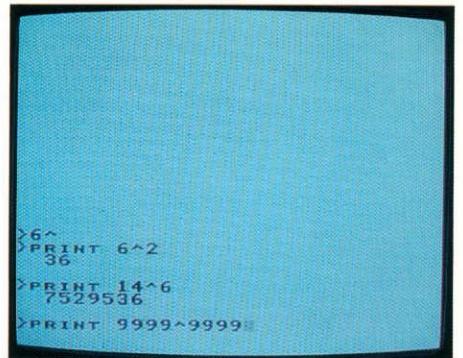
SCREEN 3
The computer can work with even very large numbers...
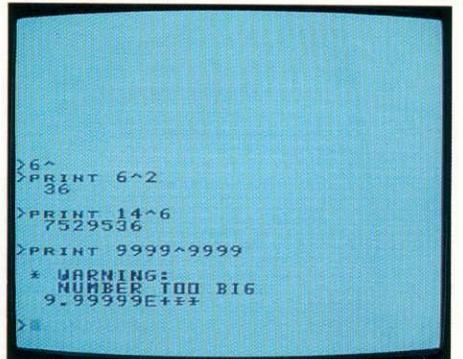
SCREEN 4
...but not too large!

THE 7/& KEY—AID FUNCTION
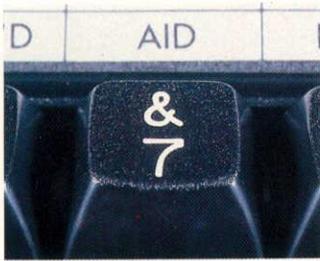
The 7/& key produces the numeral 7 when pressed by itself; it produces the ampersand symbol (&) when the SHIFT key is held down.

SCREEN 1

The ampersand symbol is not used for any special functions, but may be useful in normal typing of text.

The special function of the 7/& key is indicated on the label just above the 7/& key. The AID command is used only with certain software packages; if you press the AID key now, the computer will not respond at all.

Before starting the next exercise, press ENTER, type the words CALL CLEAR, and press ENTER again to clear the screen.
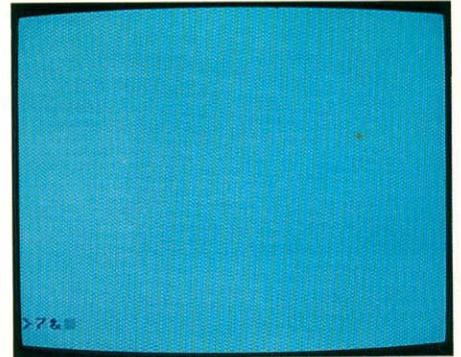
SCREEN 1
Press the 7/& key twice, once by itself and once with the SHIFT key.

7/& key

THE 8/* KEY–REDO FUNCTION
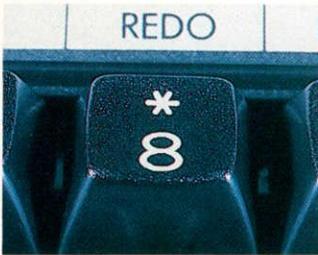
The 8/* key produces the numeral 8 when pressed by itself; it produces the asterisk symbol (*) when the SHIFT key is held down.
SCREEN 1

The asterisk is used to tell the computer to multiply numbers. In everyday writing, we use the letter x to represent multiplication. Humans, therefore, understand the statement 4 x 2 = 8. But to the computer the letter x is just that—a letter x. The computer can't tell whether we want x to represent the letter x, or whether we want x to represent multiplication. So the computer uses the asterisk for multiplication instead. Press ENTER to start on a new line. Then type

PRINT 4*2

and your problem appears on the screen.
SCREEN 2

Then press the ENTER key. The answer (8) appears on your screen, as the computer calculates the product of 4 x 2.
SCREEN 3

The special function of the 8/* key is indicated on the label just above the 8/* key. The REDO command is used only with certain software packages (or in BASIC programming); if you press the REDO key now, the computer will not respond at all.

Before starting the next exercise, type CALL CLEAR and press ENTER to clear the screen.

SCREEN 1

Press the 8/* key twice, once by itself and once with the SHIFT key.

SCREEN 2

The asterisk acts as a multiplication sign.
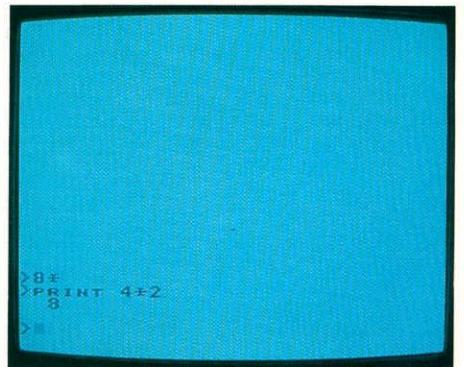
SCREEN 3

PRINT tells the computer to multiply the numbers and display the answer.

8/* key

Press the 9/(key alone to get the numeral 9. Hold the SHIFT key and press the 9/(key to see the symbol for the left parenthesis appear on your screen. Press the 0/) key alone to get the numeral 0. Hold the SHIFT key and press the 0/) key and the right parenthesis symbol will appear.
SCREEN 1

The parentheses keys are important in complex math problems to tell the computer which part of a problem to perform first. You can demonstrate this on your system now.

First, press ENTER to start a new line. Now, type

PRINT 2 + 2*4

and press ENTER. The computer will calculate and display its answer (10) on the screen.
SCREEN 2

Now, type

PRINT (2 + 2)*4

and be sure to include the parentheses.
SCREEN 3

Now press ENTER. What happens? Strange, you say! This time, the computer printed a different answer (16).
SCREEN 4

Actually, the computer is correct in both cases. The first time, it multiplied 2 by 4 to produce 8, then added 2 to get the sum of 10. In the second problem, the computer performed the calculation that was inside the parentheses first: it added 2 and 2 to get the sum of 4, then multiplied that sum by 4 to get a final answer of 16.

Before starting the next exercise, type CALL CLEAR and press ENTER to clear the screen.

9/(key ● 0/) key
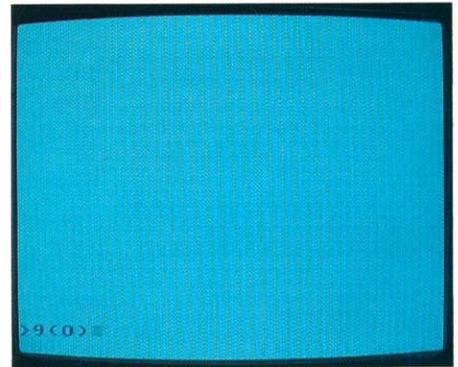
SCREEN 1
The 9/(key and the 0/) key produce numerals and the parentheses symbols.
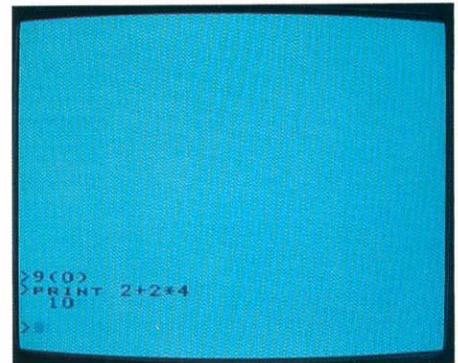
SCREEN 2
PRINT tells the computer to perform the equation and display the answer.
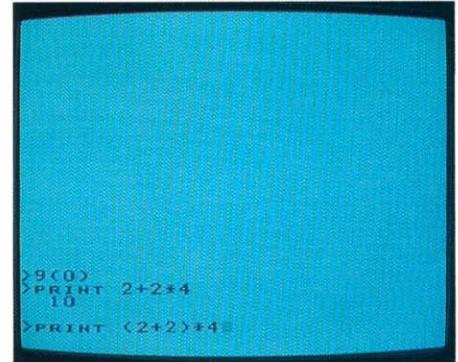
SCREEN 3
Add parentheses to the same equation...
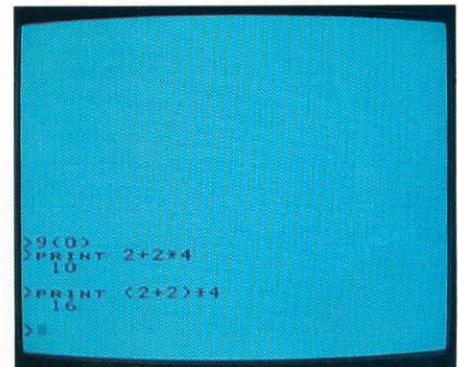
SCREEN 4
...and you get a different answer!

THE PLUS/EQUALS KEY

While we are on the subject of math, let's examine the final key on the top row, the +/= key. It is used for calculations. Pressing this key alone creates the symbol = . Holding the SHIFT key while pressing this key produces a +

You'll use the + in addition problems, and there is no limit to the number of times it can be used. Type

PRINT 2 + 4 + 56 + 3 + 1010

and press ENTER. Your computer displays its answer (1075) after it performs the entire calculation.
SCREEN 1

The special function of the +/= key is indicated on the label above the +/= key. By holding down the FUNCTION key and the +/= key, you command the computer to quit. Try it and see what happens.

It may have come as a surprise; your screen turned solid blue (if you're using a color set), the computer beeped, and the TI Color Pattern reappeared on the screen.
SCREEN 2

Now, press any letter on the keyboard. You'll see the message

PRESS 1 FOR TI BASIC

appear on the screen.
SCREEN 3

Type the number 1. Now, the message

TI BASIC READY

will appear, and you are back in the computer's BASIC programming mode.
SCREEN 4

PLUS/EQUALS key
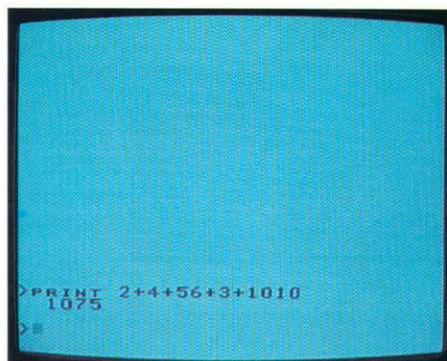
SCREEN 1
The computer can add many numbers and display the answer instantly.

SCREEN 2
You command the computer to QUIT by pressing the SHIFT and +/= keys at the same time.

SCREEN 3
Press the 1 key to get back to TI BASIC.

SCREEN 4
The prompt and the cursor reappear, and you're ready to get back to work.

THE SLASH/HYPHEN KEY
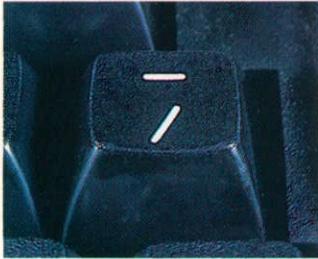
You've seen characters used for addition and multiplication, but what about subtraction and division? Locate the SLASH/HYPHEN key, directly above the ENTER key.

By pressing the SLASH/HYPHEN key alone, you will create the slash symbol (/). In normal text, you can use this symbol to separate words, just as we did in describing the name of this key. But you can also use the slash symbol to tell the computer to divide one number by another. Now, you can try using the slash symbol for division by typing the following:

PRINT 12/2

The division problem appears on the screen.
SCREEN 1

Press ENTER, and the answer (6) appears. To the computer, the statement PRINT 12/2 is the same as the statement 12 ÷ 2 = is to you and me.
SCREEN 2

On the other hand, we can hold the SHIFT key and type the SLASH/HYPHEN key to create the hyphen symbol. If you're typing normal text, you can use the hyphen between words. In math calculations, the hyphen symbol becomes the computer's subtraction (minus) symbol. Try this:

PRINT 800-250

The subtraction problem now appears.
SCREEN 3

Press ENTER and the answer of 550 will be displayed on your screen.
SCREEN 4

This key does not have any special functions.

Before starting the next exercise, type CALL CLEAR and press ENTER to clear the screen.

SLASH/HYPHEN key
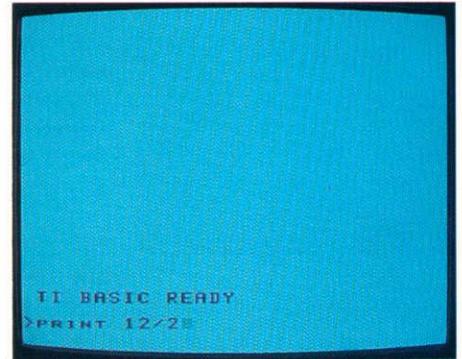
SCREEN 1
The slash acts as a division symbol.
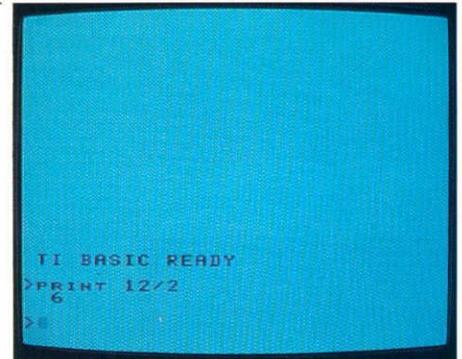
SCREEN 2
PRINT tells the computer to divide the numbers and display the answer.
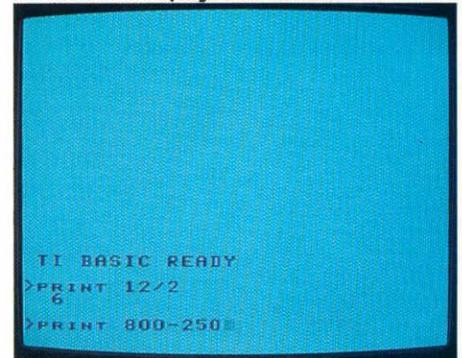
SCREEN 3
The hyphen acts as a minus sign.
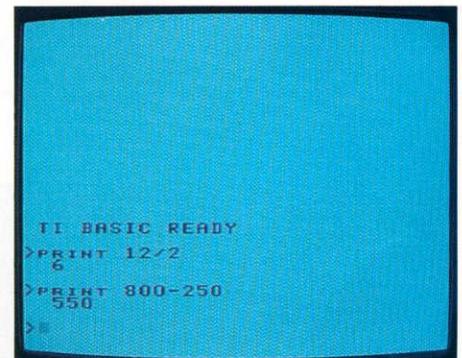
SCREEN 4
PRINT tells the computer to subtract the numbers and display the answer.

THE PUNCTUATION MARK KEYS
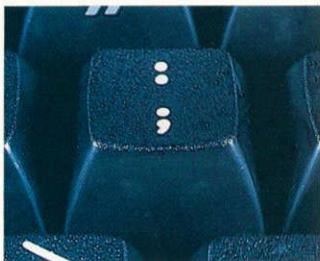
The :/; key, the ,/< key, and the ./> key all operate in a fairly standard way. If you hold the SHIFT key down while typing any of these keys, the symbol on the upper half of the key is produced. If you type the key without holding the SHIFT key, the symbol on the lower half of the key is produced.

Hold the SHIFT key and press the ./> key. You'll see the symbol that's at the top of the key produced on your screen. Release the SHIFT key, and press the ./> key again. This time, you'll see the period appear on your screen.
SCREEN 1

Now try pressing the ,/< key, first with the SHIFT key, and then without.
SCREEN 2
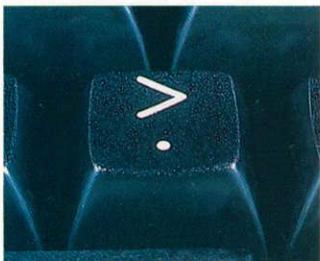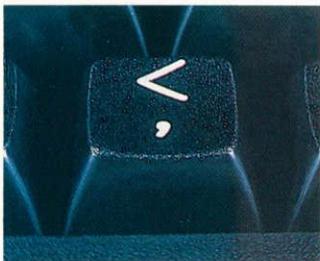
Now press the :/; key, first with SHIFT, then without SHIFT.
SCREEN 3

The symbols produced by the ./> and ,/< keys when the SHIFT key is held are called the *greater than* and *less than* symbols. You'll use the *greater than* and *less than* symbols often if you write your own BASIC programs.
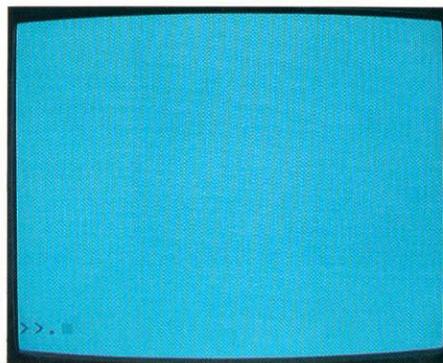
SCREEN 1
Press the ./> key twice, first with the SHIFT key and then without it.
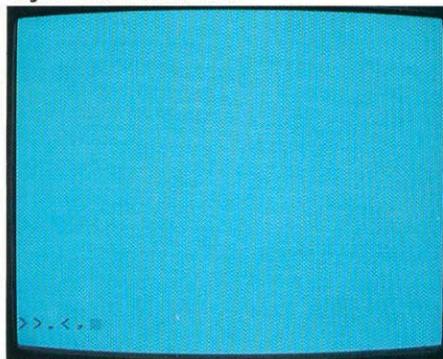
SCREEN 2
Press the ,/< key twice, first with the SHIFT key and then without it.
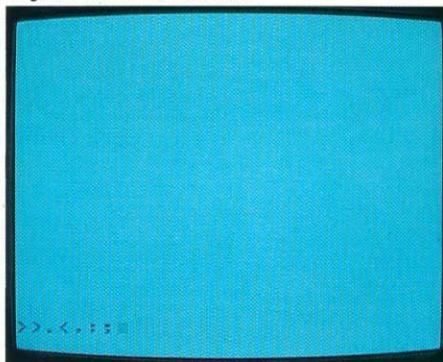
SCREEN 3
Press the :/; key twice, first with the SHIFT key and then without it.

COLON/SEMICOLON • COMMA/LESS THAN • PERIOD/GREATER THAN keys

BASIC PROGRAMMING

Now, let's take a look at the language that your computer speaks. It is called BASIC, and it is not the mystery that many people suspect it to be. BASIC is an easy-to-use computer programming language that uses English words to control the computer. The best proof of BASIC's ease of use lies in the fact that you've been using it throughout this chapter! Words like PRINT, GOTO, RUN, and CALL CLEAR are BASIC commands that tell the computer to perform a certain task.

Think of your computer as an electronic calculator. A calculator doesn't possess any intelligence when you first turn it on. Instead, it stares blankly back at you and waits for you to tell it what to do. It's the same with your computer! Whenever you type a command that tells your computer to do a certain task, you are programming it, just as you are programming a calculator when you press its keys. What makes your computer more powerful than a calculator is its ability to remember what you tell it. The computer has a powerful memory that stores various types of information until they are needed.

So far, we haven't made much use of your computer's memory, because we have been giving the computer immediate commands to carry out. For instance, when you told your computer to PRINT a word, it would print that word on the screen immediately, and then forget it. But, you can give your computer the power of total recall! All you need to do is use what is known as a *line number*—which is simply a number at the beginning of a line of information. The computer uses line numbers as a means of remembering what it should do next.

When a collection of line numbers and lines are typed into the computer, that collection of information is called a *program*. A program is simply a series of steps which explain what your computer should do.

A SIMPLE PROGRAM

MAKE YOUR COMPUTER
A CALCULATOR

Let's try a simple program now. First, if you have anything on your screen, press ENTER to start on a new line. Now type the word NEW and then press the ENTER key. The NEW command clears the computer's memory and displays the TI BASIC READY message on the screen. (It *seems* to do the same thing as the CLEAR key, but the CLEAR key only clears the screen, not the memory.)

Now, type the following, and don't forget to press ENTER at the end of each line! (Don't be concerned if a program line runs over onto the next line. Just press ENTER when you're done typing each numbered program line.)

```
10 CALL CLEAR
20 PRINT "THIS PROGRAM WILL"
30 PRINT "MULTIPLY TWO NUMBERS."
40 PRINT "WHAT IS THE FIRST NUMBER?"
50 INPUT A
60 PRINT "WHAT IS THE SECOND NUMBER?"
70 INPUT B
80 C = A*B
90 PRINT "THE ANSWER IS"
100 PRINT C
```

The program lines now appear on your screen.
SCREEN 1

Now, type the word RUN.
SCREEN 2

Then press the ENTER key. The RUN command tells the computer to read the program. What do you see?
SCREEN 3

The computer wants you to give it a number, so press a number key and then press ENTER.
SCREEN 4

SCREEN 1

This is how the whole program should look on your screen.

SCREEN 2

RUN is the command that will start the program.

SCREEN 3

Pressing the ENTER key starts the program.

SCREEN 4

We chose the number 3 as our first number.

Now it wants another number, so press another number key.
SCREEN 1

SCREEN 1
We chose the number 9 as our second number.

Press ENTER again. Presto! The computer multiplied the numbers and is showing you the answer—just like a calculator.
SCREEN 2

SCREEN 2
As soon as you entered the second number, the computer displayed the answer.

Now, type the word LIST.
SCREEN 3

Then press the ENTER key. The LIST command tells the computer to display on the screen all of the commands in the program. You will see the program displayed on the screen, just as you entered it.
SCREEN 4

SCREEN 3
LIST tells the computer to display the commands in the program.

Take a close look at this program. The numbers from 10 through 100 are the line numbers. Each line number is followed by a word or group of words that form a BASIC command. To run the program the computer begins with the smallest line number and performs the job that it is told to do by that particular line. Then it proceeds to the next line and follows the instructions given it by that line. The computer continues to perform the steps outlined in each line of the program. Once the computer runs short of work to do (in this case, after line 100), it assumes that it has finished running the program. That's when it displays the word **DONE**.

Do **not** clear your screen and do **not** turn off your computer at this time. Go on to the next exercise.

SCREEN 4
Examine the program listing carefully.

SOME BASIC COMMANDS

You have used one BASIC command a number of times—PRINT. Whenever the computer sees the word PRINT, it will print (display on the screen) the information that follows the word PRINT. If the information begins and ends with quotation marks ("THIS PROGRAM WILL"), the computer prints the information exactly as you typed it. If the information is not enclosed in quotation marks, the computer will assume that you are using the word or letter following the PRINT command to represent a number, and the computer will print that number.

You also used a command called INPUT in this program. The INPUT command causes the computer to print a question mark, and the computer then waits for you to provide some type of information. Line 50 and line 70 of the program use INPUT commands to store the numbers to be multiplied. You use INPUT commands in a program in which there is information that you will want to change every time you run it.

And you used the LIST command. The word LIST tells the computer to display any program that is stored in its memory. LIST can be very helpful if a program does not operate properly and you want to examine the program to see if you have made any typing errors.

If you enter a very long program, you will discover that when you use LIST, parts of the program race past the top of the screen so quickly that you cannot see those parts of the program. There is a solution to this problem. You can LIST parts of a program by entering specific line numbers.

Type

LIST 10-50

The command appears on the screen.
SCREEN 1

SCREEN 1
LIST followed by line numbers tells the computer to list only those programs lines...

Now press ENTER.
Your computer now lists lines 10 through 50.
SCREEN 2

SCREEN 2
...as soon as you press ENTER.

Now, type

LIST 60-80

The new command appears.
SCREEN 3

SCREEN 3
With this command the computer will list only the program lines you specify...

Then press the ENTER key.
This time, your computer lists lines 60 through 80.
SCREEN 4

SCREEN 4
...but not until you press ENTER.

COLOR COMMANDS

You may want to try using your computer's color and sound capabilities with BASIC commands. The TI-99/4A can use a variety of sound and color commands that can add musical and visual effects to your programs. You can see an example of the color commands available by trying this simple program.

First, type NEW and press the ENTER key to clear the program that we just used from the computer's memory.

Now, type the following program (and don't forget to press ENTER after you finish typing each line):

10 FOR X = 1 TO 16
20 CALL CLEAR
30 PRINT "THE NUMBER IS"
40 PRINT X
50 CALL SCREEN(X)
60 FOR Y = 1 TO 100
70 NEXT Y
80 NEXT X

Check your work to be sure there are no errors.
SCREEN 1

Now type the word RUN and press the ENTER key. What's the result?
Your screen turned a series of colors as the program caused the computer to display all sixteen of its screen colors (including solid black, which may have caught you by surprise!).
SCREENS 2 AND 3

Do **not** clear your screen and do **not** turn off your computer at this time. Go on to the next exercise.
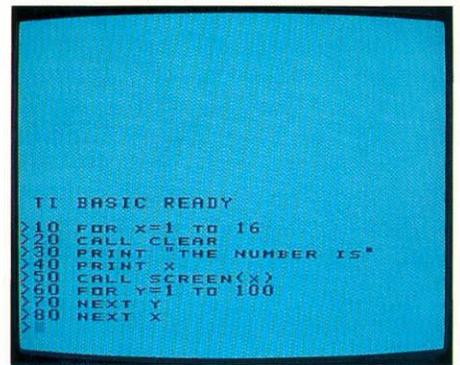
SCREEN 1
The whole program will look like this on your screen.
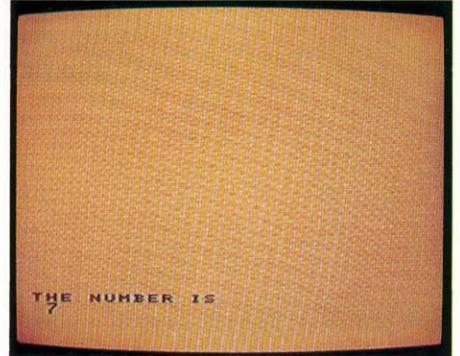
SCREEN 2
RUN commands the computer to display 16 colors. This is number 7.
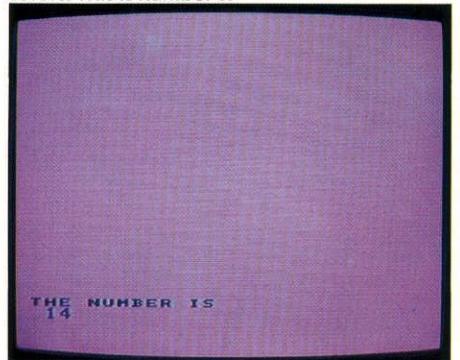
SCREEN 3
This is number 14.

SOUND COMMANDS

Now, let's try your computer's "voice" by making a simple change to the program that is in the computer's memory. Type the following line:

45 CALL SOUND(100,110*X,2)

The press ENTER.
SCREEN 1

Now, type RUN and press the ENTER key. This time, you heard sixteen different tones from your TV set speaker as it displayed the colors.

There are many other BASIC commands that you can use with the TI-99/4A. This introduction was designed to provide an idea of how simple BASIC programming can be. If you decide to learn more about BASIC, a beginner's BASIC manual comes with your computer. If you later want to learn more advanced programming, you may want to purchase a more detailed BASIC reference text. BASIC programming is just one of the many ways that you can enjoy using your TI-99/4A.
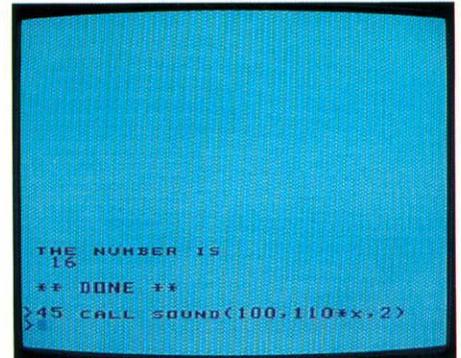
SCREEN 1
Type this additional line into your program and you will be ready for sound and color.

PERIPHERALS — EXPANDING YOUR SYSTEM

Your TI-99/4A computer is the heart of your computer system, but you still need some peripherals (accessories) to make your system complete. Peripherals are your computer's way of communicating with the outside world. They are the computer's eyes, ears, and voice, and they are necessary parts of any home computer system. For example, you use your television set as a peripheral to display the information from your computer.

Peripherals available for your TI-99/4A range from relatively inexpensive cassette recorders and joysticks for games to expansion systems with additional memory and multiple disk drives. It's helpful to know why peripherals are needed and what they can do for you.

"Which peripherals should I buy?" is a question many new computer owners ask. There is no standard answer to this question, just as there is no standard answer to the question "Which car should I buy?" The answer depends on your needs for your computer system. This chapter will explain what various peripherals do and how much they cost. With this information, you will be better equipped to decide which peripherals are suited to your needs.

COMPATIBILITY

If you purchase your peripherals from Texas Instruments, you are assured that they will be *compatible*, meaning they will work with your system. Many peripherals for your TI-99/4A are available from the manufacturer and can be found in most stores that carry the TI-99/4A computer system. A second source of peripherals is the independent companies that provide computer accessories. These companies are not associated with Texas Instruments, but they do manufacture peripherals and software for the TI computer systems.

When buying from an independent company, the company's assurances are often the only guarantee offered that the product is truly compatible with your system. This can be a problem. On the other hand, the primary advantage of dealing with independent companies is price. You can often find significant savings on accessories from independent companies.

There is no right or wrong choice to make when deciding whether to buy from the manufacturer or an independent firm. You must consider the cost of the peripheral, the stability of the company that produces it, and whether you feel that you will be satisfied with the product.

A cassette recorder provides the ability to save programs and information contained in the computer by recording them on a cassette tape. You also need a cassette recorder to load programs from cassette tape into the computer. If you plan to use your computer only for entertainment and education, you may not need a cassette recorder. The TI-99/4A can use the plug-in cartridges containing software programs, and programs available in that format may meet your needs—particularly for games and for learning exercises in many educational subjects. If you want to learn to program your computer, you will probably also want to use a cassette recorder (or a disk drive, but more about that in a moment).

Many models of computers require you to buy a specific cassette recorder, but the TI-99/4A is designed to operate with many different cassette recorders. If you already own a cassette recorder, it may work with your computer. The recorder must have three types of connections: *auxiliary, remote,* and *microphone.* These connections are normally on the side or front of the recorder.

Texas Instruments Program Recorder

You may discover that your recorder will not operate when the PLAY button is depressed and you give the command OLD CS1 to load a cassette program. If your cassette recorder shows these symptoms, you probably own a recorder that uses a different method of switching the cassette motor on and off than is used by the TI-99/4A. You can fix this with a low-cost adapter that allows many cassette recorders to operate with the TI-99/4A's method of recorder control. Rather than using an adapter, however, you could disconnect the plug that is inserted into the jack of your tape recorder. If you do this, the recorder will not be under control of the computer, and you will have to start and stop the recorder manually when loading or saving programs.

If you do not have a cassette recorder, you will find that to purchase one will cost from $25 to $80, so it will pay to compare models when considering a cassette recorder for your TI-99/4A. Texas Instruments provides a list of cassette recorders from numerous manufacturers that will operate with the TI-99/4A.

The TI Cassette Program Recorder, a portable recorder that is designed to accompany the TI-99/4A, costs about $70. The TI Cassette Program

Recorder does offer advantages over many tape recorders, and it includes the Cassette Interface Cable required for connecting the computer to the recorder. If you purchase another brand of recorder, you must obtain this cable separately. A digital tape counter and color-coded input jacks for ease of setup are features of this recorder. And the proper settings of the volume and tone controls necessary for saving programs on tape are clearly marked—which helps eliminate the trial-and-error procedure often required when you are using a cassette recorder with your computer for the first time.

One good alternate choice of recorder is the General Electric Computer Program Data Recorder (for about $50). Designed for use with many popular home computers, the GE Data Recorder features a built-in condenser microphone, automatic control of recording level, and a digital counter that allows simple indexing of various programs stored on a cassette.

DISK DRIVES
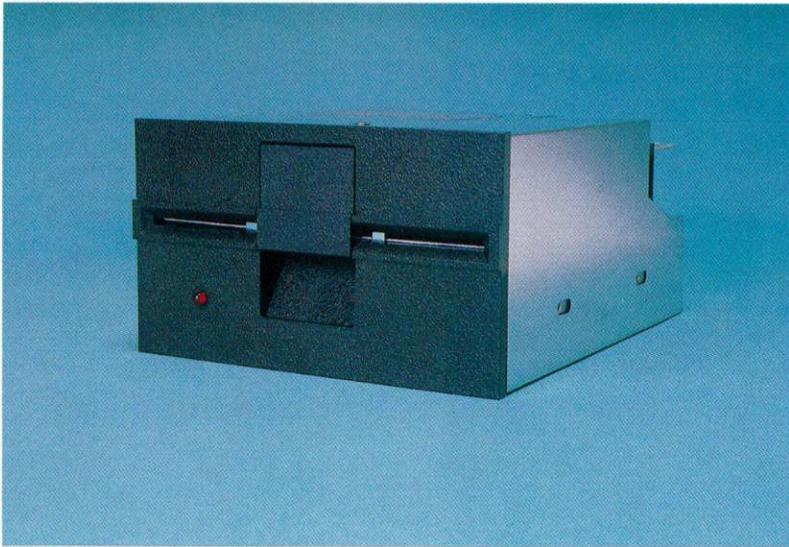
Texas Instruments Disk Memory System

A disk drive can replace a cassette recorder for storing programs and information. By adding a disk drive to your system, you gain considerably higher performance at a moderate increase in cost.

The first difference that you will notice when using a disk drive will be speed: a cassette recorder takes from one to five minutes to load software, and a disk drive can do it in seconds. A disk drive operates efficiently to find infomation, too. It stores information using a technique known as *random access*—rapidly scanning the surface of the magnetic "floppy" disk and quickly locating the required information. A cassette recorder, by contrast, provides information to the computer in *serial* form: the information is recorded on the tape as a row of data. If you have a list of names and addresses stored on a cassette and you want to recall the last name on the tape, the computer has to read all of the names on the tape until it finds the last one. This can be very time-consuming.

Much of the software for advanced uses, such as business applications, is only available on floppy disks. The ability to access information in this manner allows your computer to create extensive files; the computer uses the disk drive as an extension of the computer's memory.

Disk drives are also a more economical means of storage after the initial purchase. A single floppy disk will store the equivalent of six cassette tapes and is just slightly more expensive than a quality cassette tape. Each single-sided 5¼-inch floppy disk will store approximately 90,000 characters of information, or roughly 100 BASIC programs that are fifty lines in length.

Do you need a disk drive? Consider your applications. The fast access to information stored on the floppy disk makes a disk drive a near-must for any computer system used in small business applications. If you plan to learn programming, you may need the additional programming commands that are available when using a disk drive.

You can expect to pay from $400 to $650 if you decide to add a disk drive to your TI-99/4A computer system. The Texas Instruments Disk Memory System and disk drive cost about $400. A disk controller card and software (in the form of a disk command cartridge) can be purchased separately for about $250. The disk command cartridge enables storage of your programs and information on 5¼-inch floppy disks. The disk controller card serves as an interface (adapter) between the computer and the disk drive. A single disk controller card can control up to three disk drives.

The disk command cartridge, also referred to as the *Disk Manager*, is used to perform housekeeping functions for the information that you will store on a floppy disk. These functions will include naming disks, copying disks, and deleting files or programs. The use of a software cartridge containing the disk manager software allows more space on the floppy disk for actual program storage.

Disk drives can be placed on a smooth surface near your computer, or one disk drive can be installed in the TI Peripheral Expansion System (a convenient, attractive housing which costs about $250).

To play most games on your computer, you need a set of hand controllers, more commonly known as *joysticks*. Many games can be operated from the keyboard of your computer, but the use of joysticks allows greater control of the games with less effort. TI BASIC also possesses commands for tracking the action of the joysticks; this feature allows you to use the joysticks with programs that you may create.

Each joystick allows movement in multiple directions by means of a tracking handle; a "fire" button, used to fire weapons, is included. TI Joysticks cost about $35 per pair. If you prefer custom joysticks, an alternate choice is the WICO Joystick which requires a TI adapter (sold separately for about $13). The WICO Joystick features an oversized bat handle, a palm-sized controller base, and two weapons-firing buttons (one is mounted at the top of the bat handle). WICO Joysticks are not inexpensive (about $30 each); however, if you are an avid game enthusiast, you may prefer their design.

Texas Instruments Joysticks

WICO Joystick

MONITORS

Texas Instruments Color Monitor

Commodore Video Monitor Model 1701

Your system's primary means of communicating with you is through its display, so you may want to consider buying a monitor. The use of a TV set (if you have one to begin with) is generally a less expensive option. But due to the limitations of television broadcasting, a TV set will not produce images and characters that are as sharp and clear as those produced by a monitor.

Whether you decide to use a TV set or a monitor, the display should be color if possible. One of the primary strengths of the TI-99/4A is its ability to display multiple foreground and background colors. These colors are used extensively with programs written for the TI-99/4A, and the resultant visual effects are at their best when displayed on a color monitor or color television set.

The 10-inch Texas Instruments Color Monitor (about $400) provides excellent color resolution, using an image density of 192 by 256 dots of light on the screen. A built-in speaker provides sound with adjustable volume control. A recessed panel hides additional monitor controls for contrast and brightness.

The CBM-1701 Color Monitor from Commodore Business Machines (about $300) is a good alternate choice. Designed for use with home computers, the Commodore Color Monitor accepts a standard composite video signal and audio input, which makes it compatible with your TI-99/4A. The screen size is 13 inches (diagonally), and special circuitry has been included in the monitor to enhance picture resolution.

When you need a printed record of information from your computer, there are two ways to fill that need. One way is to use a pencil and paper. While this method involves a minimal investment, it also grows tiresome quickly. The efficient method is to use a printer.

Printers can easily be worth the expense if you have sufficient uses for a printer. If you use your computer in home financial management, the printer can provide storage copies of all transactions. Most business uses of a personal computer require the use of a printer. Mailing lists and the typing of forms, letters, and invoices can be greatly simplified with your computer and a printer.

Prices of printers vary greatly, as the type of printer varies. There are three general types of printers that can be used with your TI-99/4A: thermal printers, dot-matrix printers, and daisy wheel (or letter-quality) printers. Dot-matrix printers are the most popular, due to their relatively low cost and high reliability. In a dot-matrix printer, a print head that contains tiny hammers moves horizontally across the paper, striking the paper through an inked ribbon. Thermal printers use treated paper and a heat process to "burn" an image onto the paper. Daisy-wheel printers use a printwheel with letters on the end of tiny spokes (rather like the striking surfaces in a typewriter). These spokes are moved by a small hammer and strike the paper through an inked ribbon, producing the character on the paper. Daisy-wheel printers are often used for word processing—to print important letters and reports. Thermal printers are least expensive, costing from $100 to $400. Dot-matrix printers fall into the intermediate price range, with prices from $250 to $1,000, depending on the quality and features offered. Daisy-wheel printers are the most expensive, starting around $500 and easily costing $2,000 or more.

The TI Impact Printer (about $750) is a dot-matrix printer with excellent quality and known reliability. This printer prints characters at a speed of 80 cps and can print text or graphics, under the control of the computer's software. If you decide to use the Texas Instruments Impact Printer, you will need a cable and the RS-232 Printer Interface available from TI.

Texas Instruments Impact Printer

Connecting Other Manufacturer's Printers to Your TI-99/4A

A complete computer system is a combination of pieces of hardware, and software programs to control the hardware's operation. Getting the hardware and the software to match can be troublesome, particularly in the case of printers. Like most home computer manufacturers, Texas Instruments sells printers for its products. But a wider variety of printers is available from other vendors, and these printers can often be purchased at a lower cost.

You can find many of these printers at computer stores. You can go as far as to purchase one, cart it home, and connect it to your computer, expecting that the printer will operate with no problems. If it does, consider yourself fortunate; you have achieved a perfect match due to sheer luck.

If you choose to use a printer made by an independent company, you will need to purchase the RS-232 Interface Card or the RS-232 Interface Adapter (both priced at about $175; the card inserts in the TI Peripheral Expansion System, and the adapter plugs into the Expansion Connector on the console).

A printer comes equipped with one of two kinds of interface connections: *serial* or *parallel*. You cannot use a printer with a parallel interface connector with your TI-99/4A. The RS-232 Peripheral Interface accessories use a type of printer interface known in the computer world as a *serial* interface. Buy a printer only if it has a serial interface.

Printers will operate at a variety of speeds (called *baud rates*), and the manufacturers provide switches on the printer so that you can set the printer at a certain baud rate. Once you have done this, you have completed just half of the job. The RS-232 Peripheral Interface Card or Peripheral Interface Adapter for the TI-99/4A must also be set at a speed that will match that of the printer. If you're unsure about selecting the proper printer, get help—either from the personnel at the store where you purchased the computer, or from instructions, where available, that tell you how to set the switches that are used by the printer. Doing so will help put your computer and printer on "speaking terms."

Memory expansion is another option that is available for your computer. Before purchasing additional memory, however, you should consider your needs to determine if the memory is actually needed. Unlike many other computers in its price class, the TI-99/4A comes equipped with 16K of memory. The 16K (about 16,000 characters) of available memory is enough for most home and educational uses.

If you are programming in BASIC, you need 2K to 8K of memory for the average simple home finance program. A program to perform practice exercises in addition or subtraction may use from 4K to 10K.

If you use cartridge software, each cartridge contains an additional 30K of memory that is used by the cartridge program. While you cannot access the memory in a cartridge from a BASIC program, this memory is used by the cartridge software to perform various functions. Much of the available software for the TI-99/4A does not require the use of any additional memory. So, for most applications, you should not need additional memory in your computer.

Some business applications and advanced programming languages do require additional memory. For those applications, you need a *memory expansion card*. The TI Memory Expansion Card (about $300) plugs into the TI Peripheral Expansion System and adds 32K (about 32,000 characters) of memory to the computer.
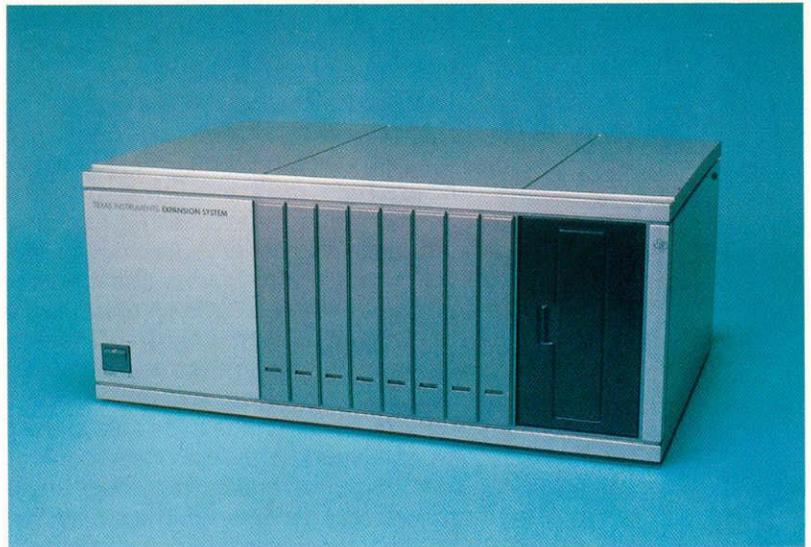
Texas Instruments Expansion System

SPEECH SYNTHESIZER/ TELEPHONE MODEM

SPEECH SYNTHESIZER

Your TI-99/4A is also capable of reproducing speech. Few other computers offer this capability. The TI Speech Synthesizer (about $100) can be used with many software packages that are designed to offer speech, and it can also be programmed to create speech using BASIC commands. Milton Bradley also makes a speech synthesizer for the TI-99/4A to be used with Milton Bradley software only. The TI Speech Synthesizer contains an electronic vocabulary of over 300 words (you must buy the Speech Editor software cartridge to be able to use the 300 word memory). The Texas Instruments Speech Synthesizer can audibly reproduce any requested letter or word. The Speech Synthesizer does not require the use of the Peripheral Expansion System, as the synthesizer is designed to connect directly to the side of the computer.

TELEPHONE MODEM

A final option that you may wish to consider is the TI Telephone Coupler (about $200). A telephone modem allows your computer to communicate with other computers using ordinary telephone lines. A standard telephone headset attaches to two rubber cups that are a part of the TI Telephone Coupler, and you then dial the number of the computer that you wish to communicate with. With the use of the TI Telephone Coupler, you can access public information networks, such as The Source, CompuServe, Dow Jones, and TEXNET. To use the TI Telephone Coupler, you must have an RS-232 Interface Card or Adapter on your computer.

One of the better alternate values for your modem dollar can be found in the Signalman Mark III modem (about $140) from Anchor Automation. The battery-powered Signalman Mark III is a direct-connect modem that can be used with your TI-99/4A. It connects to the telephone with the standard four-wire modular telephone jack (found in most homes today).

Your computer's peripherals are its eyes and ears to the world. The flexibility offered by your peripherals will greatly increase the enjoyment and usefulness you receive from your computer system.

Regardless of how powerful your computer system may be, you will find that software is the key to your gaining the greatest satisfaction from your system. Every computer, from the least expensive home computers to the large mainframe computers used by major corporations, must have a set of instructions to tell it what to do.

There are two ways for you to give these instructions to your TI-99/4A: you can buy software packages, or you can write your own programs in TI BASIC (thus creating your own software). Pre-packaged software that you can buy contains all of the steps your computer must follow to perform a task—whether the task is the planning of your family budget or communicating with another computer hundreds of miles away. The cost of such software can range from a small investment (about $10 to $40 for many home applications) to a large investment (hundreds of dollars for some business applications).

When computers similar to your TI-99/4A first appeared on the consumer market, the amount of pre-packaged software was limited, and you were often forced to learn programming so that you could create your own software. Fortunately, this situation has changed, and a wide array of software is available for your computer. You can still write your own software if you want to, but you don't have to.

The TI-99/4A can use cassette, cartridge, or disk software. All three of these software formats have advantages and disadvantages. What format(s) you decide to use will depend on what you want to use the computer for and how much money you want to spend.

CARTRIDGE SOFTWARE

Cartridges are the easiest type of software to use. They can be used by young children, and they offer convenience and speed of program loading as primary benefits. For this reason, you will find that most educational software for the TI-99/4A comes in cartridges.

Cartridge software often provides detailed color graphics and fast action (with movements that are often faster than you will see with cassette or disk-based software). The reason for the fast graphics and sound is that cartridge software uses the computer's native programming language, known as *machine language*. Game programmers use machine language to create fast-action arcade games. In contrast, many cassette and disk programs use TI BASIC or TI Logo, programming languages that are considerably easier to use, but not as fast in operation.

The primary disadvantage of cartridge software is the inability of cartridges to store any information from the computer. A lesser disadvantage is that, in some cases, cartridge software is slightly more expensive than comparable software in cassette form.

CASSETTE SOFTWARE

Cassette software for your TI-99/4A is recorded on standard audio cassettes. Cassette software is loaded into the computer by means of a cassette recorder that is connected to the computer.

Cassette software is popular because it is inexpensive. You do have to have a cassette recorder, but the low cost of the individual cassettes is attractive.

You can buy cassettes with programs written on them, or you can buy blank cassettes. With a cassette, unlike a cartridge, you have the option of writing your own programs and saving them. Creating software in this manner is inexpensive (and fun!). Cassettes do not, however, provide the flexibility in programming offered by the use of a disk drive.

The primary disadvantage of cassette software is the time required to load programs into your computer. The exact length of time required will vary (from one to five minutes or more), depending on the length of the program.

Despite the possible limitations, many owners of TI-99/4A computer systems use cassettes as a viable means of storing programs and information. This method is low in cost, reliable, and simple to use.

DISK SOFTWARE

Floppy disks for your TI-99/4A are 5¼-inch, flat, flexible magnetic disks with protective jackets. They look something like 45 RPM records. You can buy disks with programs written on them, or you can buy blank disks. The disks themselves, and even some of the disk software, are not too expensive, but to use them you have to have a disk drive—and that is not cheap.

There are notable advantages to using disk software, however. The same program that takes five minutes to load into the computer from a cassette will be loaded in seconds when using a disk drive. In addition to the advantage of speed, disk drives also provide flexibility in the way that the computer uses information; because the disk drive uses a recording method known as *random access*, it is possible for the disk drive to locate a given bit of information (data) in a short time. By comparison, if that same bit of information is recorded at the end of a cassette, your computer must load the contents of the entire cassette into memory before the needed information is found.

The initial cost of the disk drive is the primary disadvantage of disk software, but if you purchase a disk drive, you will find a variety of advanced software, such as many business applications, available on floppy disks.

CARE OF SOFTWARE

One of the most common causes of problems when using your computer is the mishandling of software. While some mistreatments are obvious (such as the toddler getting at your floppy disk), there are more subtle ways of mishandling software which can cause problems. There are definite "do's and don'ts" regarding handling of software.

MAGNETIC FIELDS: Strong sources of magnetism can erase your cassettes or floppy disks. Keep your software away from electric motors, magnetized paper clip hangers, and the like (including your TV).

SHOCK AND VIBRATION: If you're using cassette software, shock or vibration can cause the cassette spools inside the container to shift, and jamming of the tape may occur. Rewinding the tape will usually solve the problem.

EXTREME TEMPERATURES: Cassettes and disks can warp or stretch if they are stored in hot environments. Keep your software away from direct sunlight.

AIRPORT METAL DETECTORS: Contrary to popular belief, most airport metal detectors will not harm computer software, because most metal detectors use X-rays, which will not affect magnetic disks or tapes. To be on the safe side, however, ask the airport security attendant to hand-inspect any software you want to carry onto the plane.

LABELING SOFTWARE: Writing on cassettes is not a problem, but writing on a floppy disk jacket can be disastrous if you press too hard. Never use a ball-point pen to write on a label that's attached to the jacket of a floppy disk. Instead, use a felt-tipped marker and press lightly. A ball-point pen can leave a permanent bend in the surface of the disk, and the computer will not be able to read the information on the disk's surface.

LOSS: If you obtain a large quantity of software, you may find your software collection becoming disorganized. To prevent this, you can buy a holder for your cartridges, cassettes, or disks. These holders will protect your software when it is not in use. Texas Instruments offers a storage cabinet (about $15) that will hold 12 cartridges or cassettes in two sliding drawers. And most computer or software stores sell binders or boxes for the storage of floppy disks.

SOURCES OF SOFTWARE

Don't overlook the various sources of software for your computer. Dealers that carry the Texas Instruments line are a primary source of software, but other sources exist as well. Independent companies produce software for your computer in the fields of entertainment, education, home, and business. Many of the independent software makers advertise in computer magazines. Users' groups should also be considered as a valuable source of software. Users' groups are groups of people who share a particular interest in computers. Many cities have one or more TI-99/4A users' groups that meet on a regular basis to share ideas, solve problems, and offer suggestions. Users' groups also often exchange software written by members of the group.

If you prefer to create your own programs, books are available with sample programs for the TI-99/4A. These programs may be typed into the computer and saved on cassette tape or floppy disk. Should you decide to use this source of software, make sure that the book that you purchase is written specifically for the Texas Instruments TI-99/4A. There are a number of books on the market that contain BASIC programs written to run on most computers. But each computer's version of the BASIC programming language has subtle differences. These differences can cause incorrect operation of the program that you enter into the computer. You will avoid this problem by purchasing a book containing programs that have been tested on the TI-99/4A.

When you buy blank cassettes to type programs of your own, try to get short ones (15 or 20 minutes) because they are less expensive and generally more durable. Whenever you buy pre-packaged software, make sure that you get a factory-sealed package. Also be certain that you can return a defective or damaged cartridge, cassette, or disk.

Most pre-packaged software is copyrighted. When you buy programs of this type, you cannot legally copy them and give or sell them to anyone else. Programs which are published in books and magazines, however, are *public domain software*. Software written by your friends may also be in the *public domain*—that is, it is not copyrighted and is available for use by the general public, usually without a fee. Some companies even sell public domain software; they type the program into a computer, save it on a cassette or disk, make copies, and sell them. Fees for public domain software are generally very low—perhaps $5 per program to cover the costs of making the copy.

SOFTWARE COSTS
The cost of software for your computer will vary greatly, depending on the specific software. Most software intended for entertainment, educational, and home use will be priced in the $10 to $50 range. Software for business applications tends to be considerably higher in cost, ranging from $50 to $200 or more.

Cassette software for your computer is generally priced in the $10 to $40 range, while cartridge software is often priced in the $20 to $50 range. There are a few exceptions to such costs: the Microsoft *Multiplan* electronic spreadsheet cartridge and the TI Extended BASIC cartridge both cost about $100. Software that is contained on floppy disk will cost from $20 to over $200, depending on the complexity of the program.

COMPATIBILITY
Compatibility in the personal computer world refers to the ability (or inability) to use one type of product on a particular computer system. Before purchasing software for your computer, make sure that the software is compatible with your system.

Software that is made by the computer manufacturer tends to be compatible with most, but not all, of the manufacturer's computers. In some cases, your TI-99/4A must be equipped with additional memory or other options to use a particular program. Many powerful business software packages are available only on floppy disk. Your system must have a disk drive to be able to use these software packages.

To determine if the software is compatible with your system, always read the packaging or instructions that accompany the software before you purchase it.

USING SOFTWARE
All you have to do to use a cartridge is plug it into the cartridge slot on the computer console and turn the computer on. To use a cassette, follow STEPS 1–7 under the section "MAKING CASSETTE BACKUP COPIES" to load the program into the computer, and then follow the directions as they appear on your screen. To use a disk, follow STEPS 1–4 under the section "MAKING DISK BACKUP COPIES" to load the program, and then follow the directions as they appear on your screen.

Pre-packaged software always comes with printed instructions for its users. These instructions are called *documentation*. Always read the documentation very carefully when you are using a program with which you are unfamiliar. If you can, read the documentation *before* you buy the software; this will help you make sure that the program you are buying actually does what you want it to do.

PROTECTION OF SOFTWARE
Before you use any pre-packaged cassette or disk, make a backup copy. Cassettes and disks do wear out. After much use, they develop errors. Backup copies extend the useful life of your programs by letting you save the *master* (original) cassette or disk; the master should be used only to make new error-free program copies. Use the backup copy whenever you run a program. That way, in case anything happens (like an electrical surge or lapse) your original program is safe.

Some software manufacturers have written programs which are difficult or impossible to copy. Before you buy a program, ask your dealer if it can be copied. If you have another option, don't buy this kind of software. If you already own some, or if you really need that particular package, check with your dealer or the manufacturer. Sometimes, with proof of purchase, you can get backup copies for a nominal fee.

MAKING CASSETTE BACKUP COPIES

To make a backup copy, you will have to load the program into the computer from the original cassette tape. Then you will unload (or SAVE) the program onto a new, blank cassette tape. Here's how you load the program into the computer.

STEP 1
Turn on the computer console and the TV set. Plug the cassette recorder into both the wall and the computer (see the instructions for setting up a cassette recorder in Chapter 2).

STEP 2
Insert the cassette tape containing the program you want to use into the recorder, face up. Close the cover over the tape.

STEP 3
Type

OLD CS1

and press the ENTER key.

STEP 4
On the screen, you will see the following message:

*REWIND CASSETTE TAPE   CS1
  THEN PRESS ENTER

Push the REWIND button on your cassette recorder. When the tape stops rewinding, press the ENTER key on your computer console. This brings a new command onto the screen.

STEP 5
The new command will be the following:

*PRESS CASSETTE PLAY   CS1
  THEN PRESS ENTER

Push the PLAY button on your cassette recorder. Then press the ENTER key on your computer console.

STEP 6
Now relax. The screen message will say

*READING

This message may stay on the screen for as long as five minutes, depending on the size of the program you are loading. When the message changes to

*DATA OK

it's finished loading.

STEP 7
The message

*PRESS CASSETTE STOP   CS1
  THEN PRESS ENTER

appears on the screen. So push the STOP button on your cassette recorder and then the ENTER key on the computer console.

Bravo! You have loaded a program into your computer.

If, instead of the *DATA OK message, you got a message which said

*ERROR = NO DATA FOUND
  PRESS R TO READ
  PRESS E TO EXIT

or

*I/O ERROR 56

something is amiss.

If no data was found, you may have put the tape in upsidedown or you may have used a blank tape by mistake. Examine the tape. Then replace it correctly into the recorder, close the lid, push the PLAY button on the cassette recorder, and press the R key on the computer console. Now go back to STEP 6.

If *I/O ERROR 56 appeared, check the cable connecting the cassette recorder to the computer console. Then go back to STEP 3.

The program is now loaded into your computer's memory. You will use these same seven steps to load any program from your cassette recorder into your computer, whether you are making a copy of the program or running it.

To complete the making of the backup copy, follow these eleven steps to SAVE (unload) your program onto a cassette tape.

STEP 1
Remove the tape which you have just loaded into the computer from the cassette recorder.

STEP 2
Insert a new, blank tape into the recorder and close the cover over the tape.

STEP 3
Type

SAVE CS1

and press the ENTER key.

STEP 4
On the screen, you will see the following message:

*REWIND CASSETTE TAPE   CS1
  THEN PRESS ENTER

Push the REWIND button on your cassette recorder. When the tape stops rewinding, press the ENTER key on your computer console. This brings a new command onto the screen.

STEP 5
The new command will be the following:

*PRESS CASSETTE RECORD   CS1
  THEN PRESS ENTER

Push the RECORD button on your cassette recorder. Then press the ENTER key on your computer console.

STEP 6
Now relax again! The screen message will say

*RECORDING

This message may stay on the screen for as long as five minutes. When the program has been SAVED, another message will appear on the screen:

*PRESS CASSETTE STOP   CS1
  THEN PRESS ENTER

Push the STOP button on your cassette recorder. Then press the ENTER key on the computer console.

STEP 7
The message

*CHECK TAPE (Y OR N)?

appears on the screen. Press the Y key on the computer console. (If you were to press the N key instead, the computer would erase its memory and return you to TI BASIC on the screen. Always check to be sure that the tape has recorded the program correctly from the computer memory.)

STEP 8
More instructions appear on the screen:

*REWIND CASSETTE TAPE   CS1
  THEN PRESS ENTER

Push the REWIND button on your cassette recorder. When the tape stops rewinding, press the ENTER key on your computer console. This brings a new command onto the screen.

STEP 9
The new command will be the following:

*PRESS CASSETTE PLAY   CS1
  THEN PRESS ENTER

Push the PLAY button on your cassette recorder. Then press the ENTER key on your computer console.

STEP 10
Relax one more time. The screen message will say

*CHECKING

This message may stay on the screen for as long as five minutes. When the message changes to

*DATA OK

it's finished checking.

STEP 11

The message

*PRESS CASSETTE STOP   CS1
  THEN PRESS ENTER

appears on the screen. So push the STOP button on your cassette recorder and then the ENTER key on the computer console.

If, instead of the *DATA OK message, you got a message which said

*ERROR = NO DATA FOUND
  PRESS R TO RECORD
  PRESS C TO CHECK
  PRESS E TO EXIT

or

*ERROR IN DATA DETECTED
  PRESS R TO RECORD
  PRESS C TO CHECK
  PRESS E TO EXIT

or

*I/O ERROR 66

something is amiss.

If the *I/O ERROR 66 message appeared, check the cable connecting the cassette recorder to the computer console.

If one of the other error messages appeared, you have three choices:

● Press the C key to CHECK the recording again. (Before you do this, however, adjust the recorder volume and tone controls to the correct levels.)

or

● Press the R key to record the program again. (Then follow the eleven steps for saving a program onto a cassette tape.)

or

● Press the E key to exit the recording process. (Then follow the instructions which appear on your screen.)

With some cartridge software, you can SAVE (onto the cassette) data which you have generated using the cartridge. To SAVE material from a cartridge onto a cassette tape, follow steps 1–11 exactly as if you were saving material originally loaded from a cassette.

MAKING DISK BACKUP COPIES

To make a backup copy of a program on a disk you will *initialize* (or *format*) a blank disk, a procedure we will explain in the steps that follow. Then you will have to load the program into the computer from the original disk and unload the program onto the newly initialized disk. Using one disk drive, this process takes several passes.

Here's how you initialize the blank disk:

STEP 1
Turn on the disk drive system, the TV set, and the computer console.

STEP 2
Open the little door on the disk drive. Pick up a blank disk and hold it with the label facing up and the part with the uncovered section of the disk facing away from you. Insert the disk into the disk drive, and close the little door.

STEP 3
Plug the Disk Manager Command Module (the cartridge that came with your TI Disk Memory System) into the cartridge slot on the computer console.

STEP 4
Press any key on the keyboard.

STEP 5
Press the 3 key, to select the Disk Manager Command Module.

STEP 6
The following message will appear on your screen:

       DISK MANAGER
1 FILE COMMANDS
2 DISK COMMANDS
3 DISK TESTS
4 SET ALL COMMANDS FOR
   SINGLE DISK PROCESSING

YOUR CHOICE?

After the YOUR CHOICE? message on the screen, the cursor will flash, alternating with the character 1. Press the 2 key (and then press the ENTER key).

STEP 7

The following message will appear on your screen:

        DISK COMMANDS
1 CATALOG DISK
2 BACKUP DISK
3 MODIFY DISK NAME
4 INITIALIZE NEW DISK

YOUR CHOICE?

Again, after the YOUR CHOICE? message, the cursor will flash, alternating with the character 1. Press the 4 key (and then the ENTER key).

STEP 8

The following message will appear on your screen:

        INITIALIZE NEW DISK
MASTER DISK (1-3)?
DISK NOT INITIALIZED

Press the 1 key and the ENTER key, since you are working with one disk drive.

STEP 9

The computer will ask you to name the disk:

NEW DISKNAME _ _ _ _ _ _ _ _ _ _

So now you want to name the new disk. Any name up to ten characters, with no periods or spaces in it, will work. You will want to develop your own system for naming disks and copies. The first copy of your word processing program disk, for example, might be named WPC1 (for Word Processing Copy 1).

Type your disk name choice now and press the ENTER key.

STEP 10

The computer accepts your program name and displays the following message on the screen:

40 TRACKS (Y/N)?

Whether your disk has 35 or 40 tracks will depend on what brand of blank disks you bought. When you buy blank disks, ask your dealer how many tracks they hold.

If the disk you are using has 40 tracks on it, press the Y key (and then the ENTER key). If the disk you are using has 35 tracks on it, press the N key (and then the ENTER key) and the disk will be initialized for 35 tracks.

STEP 11

The message

SCREEN IS COMPLETE
PRESS: PROC'D, REDO, BEGIN, OR BACK

will appear on your screen. Press the FUNCTION—6 key combination (for the PROC'D function) and you have finished initializing your blank disk. The whole process (when you have practiced) takes about a minute.

The message

INITIALIZING NEW DISK
WORKING . . . . PLEASE WAIT

appeared on your screen briefly and was replaced by the message

DSK1 - DISKNAME = diskname
AVAILABLE = 358   USED = 0

This tells you that the disk is indeed blank, but that it has been initialized and named.

STEP 12

Open the disk drive door and remove the initialized disk.

To actually make the backup copy, follow these steps:

STEP 1

Turn the computer off and then back on. This is called *rebooting* the system. (Turning it on in the first place is called *booting* the system.)

STEP 2

Press any key on the keyboard.

STEP 3

Press the 3 key, to select the Disk Manager Command Module.

STEP 4
The following message will appear on your screen:

> DISK MANAGER
> 1 FILE COMMANDS
> 2 DISK COMMANDS
> 3 DISK TESTS
> 4 SET ALL COMMANDS FOR
>   SINGLE DISK PROCESSING
>
> YOUR CHOICE?

After the YOUR CHOICE? message on the screen, the cursor will flash, alternating with the character 1. Press the 2 key (and then the ENTER key).

STEP 5
The following message will appear on your screen:

> DISK COMMANDS
> 1 CATALOG DISK
> 2 BACKUP DISK
> 3 MODIFY DISK NAME
> 4 INITIALIZE NEW DISK
>
> YOUR CHOICE?

Again, after the YOUR CHOICE? message, the cursor will flash, alternating with the character 1. Press the 2 key (and then the ENTER key).

STEP 6
The following message will appear on your screen:

> SELECTIVE (Y/N)?

Since you want to copy the entire contents of the original disk, press the N key (and then the ENTER key).

STEP 7
A new message will ask you which drive you have the master disk in:

> MASTER DISK (1-3)?

Since you are using one disk drive, press the 1 key (and then the ENTER key).

STEP 8
The message

> DISKNAME _ _ _ _ _ _ _ _ _ _

will appear on the screen. Type the name of the original (master) disk, and then press ENTER.

STEP 9
Now the computer will ask you in which drive you have the disk you want the copy made on:

> COPY DISK (1–3)?

Again, since you are using one disk drive, press the 1 key (and then the ENTER key).

STEP 10
Now the computer has a command for you:

> LOAD MASTER DISK

Respond to this command by putting the original disk into the drive. Then press the FUNCTION −6 key combination (to tell the computer to PROCEED).

STEP 11
You will hear some whirring of the disk drive, and the red light on the drive will be lit. Then the light will go out and the message

> LOAD COPY DISK

will appear on your screen.

Take the master disk out of the drive and insert the copy disk (the one you just initialized). Then press the FUNCTION −6 key combination (to tell the computer to PROCEED).

Repeat steps 10 and 11 several times to copy all of the information from the original to the copy disk. The screen will display the next step while the disks are whirring; do not do it until the red light on the drive goes out.

STEP 12
When you finish, the message

> COMMAND COMPLETE
> PRESS PROC'D, REDO, OR QUIT

appears on the screen. If you want to work on the program, press the FUNCTION −6 key combination to PROCEED. If you want to try copying it again, press the FUNCTION −8 key combination to REDO. If you want to stop, press the FUNCTION and = / + key combination to QUIT.

CATEGORIES OF SOFTWARE

Because the TI-99/4A is designed to be a home computer, most of the software for it is aimed at the home user. Software can generally be categorized into about four groups, based on its uses: games/entertainment, education, home/business management, and computer languages.

Entertainment and educational software for your computer exists primarily in cartridge form, although many educational programs are available on floppy disk. Home finance management is also a popular application and is available in various forms. Business applications are possible using your TI-99/4A; limited word processing, financial accounting, investment tracking, and financial projections can be performed with appropriate software, which is available primarily on disk.

RECOMMENDED GAMES/ENTERTAINMENT SOFTWARE PROGRAMS

The Attack is an arcade-style game with fast color graphics. *The Attack* places you at the helm of a spaceship, and you must destroy alien ships by firing missiles while avoiding collisions at the same time. This game is recommended entertainment for all ages.
Format: Cartridge
Options needed: Joysticks
Supplier: Texas Instruments

Car Wars is an arcade game of skill. In *Car Wars,* you must play against the computer. You are forced to maneuver your car around a racetrack while avoiding obstacles in the road. *Car Wars* can be played at various skill levels and can be played with or without joysticks.
Format: Cartridge
Options needed: None
Supplier: Texas Instruments

TI Invaders is a single-player game that pits you against waves of alien invaders, rather like the action in the popular *Space Invaders* arcade classic. You have a supply of missiles that you must use to defend your base against the attacking forces. *TI Invaders* can be played with or without joysticks.
Format: Cartridge
Options needed: None
Supplier: Texas Instruments

Strike Force 99 is a space game in which you must pilot your starship along a narrow channel of the Cyrolian death ship to destroy it before it has the opportunity to destroy your home planet. You must simultaneously deal with attacking enemy fighters during your mission. The program features impressive three-dimensional graphics.
Format: Cassette
Options needed: Joysticks, TI Extended BASIC, Cassette recorder
Supplier: Moonbeam Software, 2 Bridge St., Northampton, MA 01060

ZAXXON is one of the most popular arcade games developed to date which is available for your TI-99/4A. *ZAXXON* creates a three-dimensional playfield in which you must pilot your fighter—climbing, diving, and firing at enemy ground targets—as the enemy fights back with a barrage of missiles and gunfire. The realistic control of the fighter and the three-dimensional graphics technology behind *ZAXXON* make this game a must.
Format: Cassette or disk
Options needed: Joysticks, Cassette recorder or disk drive
Supplier: Datasoft, Inc., 9421 Winnetka Ave., Chatsworth, CA 91311

Indoor Soccer is playable with one or two players. *Indoor Soccer* simulates a five-person soccer game. You control the players and you are able to shoot, pass, intercept, save, and perform tackles. An instant replay of each score can also be displayed on the screen.
Format: Cartridge
Options needed: Joysticks
Supplier: Texas Instruments

HINTS ON BUYING EDUCATIONAL SOFTWARE

If you plan to use your computer as an educational tool, you may already have purchased educational software aimed at a particular subject. But beyond that you may have the same questions that many other new computer owners have about educational software: What is available? What can it do? How do you decide what kind to buy?

Most educators agree that educational software can aid in the learning process; computers are particularly effective in providing remedial help aimed at specific subjects. While most software packages on the market offer repetitive drill in a particular subject, other types of software can also aid the student who quickly grows bored with subjects that he or she has mastered. When this type of student is allowed to experiment with simulations and learning games on the computer, advanced concepts sink in more readily. In addition, the cost of the computer and software is usually less than the cost of a few months of private tutoring. Therefore, there are many advantages to purchasing educational software for your computer.

A good educational software package will go farther than simply "turning the pages of a book" in an electronic fashion. The learning objectives should be clear with any software package that you're considering. The learner should know what the software is intended to teach. There should be clear documentation (instructions) for the use of the software. Before you buy, ask to see the software in operation and look for software that appears to *teach* (as opposed to just presenting drills). The software should also provide positive reinforcement if the answers are correct and should never be overbearing on negative reinforcement for wrong answers.

The software should be *user-friendly*; the age group for which it is targeted should be able to use the program without constant assistance. If young children are the users, the information that's presented should match the child's reading level. This may seem like an obvious point, but there are software packages on the market that ignore this rule.

RECOMMENDED EDUCATIONAL SOFTWARE PROGRAMS

Early Learning Fun proves that, in many cases, children aren't too young to begin the learning process with the aid of a computer. Designed for children ages 3 through 6, *Early Learning Fun* familiarizes young children with numbers, letters, shapes, and counting and sorting.
Format: Cartridge
Options needed: None
Supplier: Texas Instruments

Addition/Subtraction 1 and **2, Multiplication 1,** and **Division 1** is a series of educational software developed for Texas Instruments by Scott, Foresman and Company, a major educational publisher. It is a series of quality educational software, structured for various levels of learning. Each of these software packages provides exercises to teach the basic concepts, followed by practice in the specific area. **Addition/ Subtraction 1** and **2** are for grades 1 and 2, **Multiplication 1** is for grades 3 and 4, and **Division 1** is for grades 3 through 5.
Format: Cartridge
Options needed: None, but speech synthesizer is recommended
Supplier: Texas Instruments

Speak and Spell operates like the popular TI *Speak and Spell* learning aid. The program teaches elementary school children the correct pronunciation and spelling of words. The program aids in pronunciation by using the speech synthesis capabilities of the TI-99/4A.
Format: Disk
Options needed: Speech synthesizer
Supplier: Texas Instruments

Early Reading also makes use of speech synthesis capabilities to introduce reading skills to preschool and early elementary school children at an early age. Color graphics and action figures are combined with the use of sound to maintain the attention span of younger children.
Format: Cartridge
Options needed: Speech synthesizer
Supplier: Texas Instruments

PLATO Courseware is a comprehensive series of educational software aimed at students in grades 3 through 12. The series covers all basic skills (reading, grammar, and mathematics) for grades 3 through 8, and math, reading, writing, grammar, social studies, and science at the high school level. PLATO Courseware packages are designed for the TI-99/4A owner who wants to make a long-term investment in quality educational software. But before you can use PLATO

Courseware, your computer must be equipped with a memory expansion card, a disk drive, and a PLATO interpreter disk.
Format: Cartridge and disk combination
Options needed: TI Peripheral Expansion System, memory expansion card, disk drive with disk controller card
Supplier: Control Data

Key To Spanish is a package which includes four software cartridges, four audio cassettes, and an instructional manual, all contained in a three-ring binder. *Key To Spanish* concentrates on words and phrases commonly found in day-to-day Central and South American Spanish. Lessons and word games are programmed into the software cartridges. The audio cassettes, under computer control, provide positive reinforcement of the proper pronunciation of Spanish.
Format: Cartridge, with audio cassettes
Options needed: Cassette recorder
Supplier: Texas Instruments

Speech Editor is a software package that allows you to directly use the speech capabilities of the TI speech synthesizer. This option can be particularly useful for the visually impaired, as it lets you send spoken words, sentences, or phrases to the speech synthesizer. The *Speech Editor* package includes about 300 pre-programmed words from which you can choose. It does not allow you to use words that are not already in the program. The words that are to be spoken by the speech synthesizer are typed in at the keyboard.
Format: Cartridge
Options needed: Speech synthesizer
Supplier: Texas Instruments

RECOMMENDED HOME/BUSINESS MANAGEMENT SOFTWARE PROGRAMS

Household Budget Management is designed to let the average household track a family budget and maintain income and expense records. The program creates a budget that you can maintain on a month-to-month basis, and it will display and print (with optional printer) tables and charts that reflect your expense patterns.
Format: Cartridge
Options needed: Cassette recorder or disk drive
Supplier: Texas Instruments

Personal Recordkeeping is a data base management (or *electronic filing*) system for the TI-99/4A. It allows you to create a filing system and retrieve and update information within the system at any time. You can use it for various home or small business tasks, such as inventory rec-

ords, medical or dental records, tax or insurance information, and address lists.
Price: About $50
Format: Cartridge
Options needed: Cassette recorder or disk drive
Supplier: Texas Instruments

TI Writer is a word processing program designed for the TI-99/4A. Using *TI Writer*, you can create letters, documents, and forms on your screen and then produce error-free text on a printer connected to your system. *TI Writer's* features include text insertion and text deletion from any point within the document, automatic paragraph indent, underlining, block movement of text, and reformatting of documents.
Format: Cartridge
Options needed: Peripheral Expansion System, disk drive with disk controller, 32K memory expansion card, printer
Supplier: Texas Instruments

TI-Count Business Series is a series of six accounting programs contained on floppy disk. The programs include *General Ledger*, *Accounts Payable*, *Accounts Receivable*, *Payroll*, *Inventory*, and *Mailing List*. Information that is entered into the *General Ledger* is automatically updated in the *Accounts Payable*, *Accounts Receivable*, and *Payroll* files.
Format: Disk
Options needed: Extended BASIC Cartridge, Peripheral Expansion System, disk drive with disk controller, RS-232 interface card, and printer (32K memory expansion card and second disk drive are recommended but not required)
Supplier: Texas Instruments

COMPUTER LANGUAGES
If you plan to learn advanced programming, you will want to consider purchasing additional computer programming languages for your system. Computer languages add to the flexibility of programming your computer. Each programming language has its strengths, and different languages are designed for specific tasks.

TI Extended BASIC is an upgraded version of the TI BASIC that is built into your computer. While the standard version of BASIC can be used for many programming tasks, the Extended BASIC option will allow the use of many additional programming functions. Features that are added by the use of Extended BASIC include the following:

- Multiple program statements on a single line
- Immediate execution of IF–THEN statements
- Use of the RUN command within a program
- Ability to merge multiple programs

- Built-in error handling
- Support of the TI Peripheral Expansion Unit
- Support of *sprite* graphics (moving graphics shapes) for detailed animation

Of all of the features offered by Extended BASIC, the feature you are likely to find most helpful in programming is the use of multiple statements on a single program line. Most personal computers use a variation of Microsoft BASIC, a language patented by Microsoft Corporation. Microsoft BASIC supports multiple statements on a single line, so that a command line of a BASIC program could look like this:

10 PRINT "HELLO": PRINT "MY NAME IS":
PRINT "COMPUTER."

When you are using normal TI BASIC, you cannot use multiple statements on a single line. So that same program would be written as:

10 PRINT "HELLO"
20 PRINT "MY NAME IS"
30 PRINT "COMPUTER."

Since many books that list sample BASIC programs make use of multiple statements on a single line, you may find that extensive rewriting of these programs is necessary before you can use them with TI BASIC. You will be able to use such programs with less redesign if you use TI Extended BASIC. The use of multiple statements on a single line also consumes less of your computer's memory, allowing the use of longer BASIC programs.
Format: Cartridge
Options needed: None
Supplier: Texas Instruments

TI Logo brings simplicity in programming to all ages. Logo is more than a language; it is also a learning environment based on a philosophy of education. Logo's underlying design is to create a computer-based environment that allows learning to occur in a natural manner. TI Logo is an excellent learning resource for young children; it lets children communicate with the computer by using a language that is easily understood. With commands like TELL TURTLE FORWARD, SETCOLOR BLUE, and CARRY TRUCK, children can explore the basics behind math and science without realizing that they are doing so. If you plan to use your computer as a learning aid, TI Logo will prove to be a worthwhile investment. Many of the nation's elementary schools are now using a version of Logo in computer literacy programs.
Format: Cartridge
Options needed: Memory expansion card
Supplier: Texas Instruments

TI Logo II is an updated and refined version of TI Logo. There are enhanced commands available in the programming structure, as well as printer capability using the optional RS-232 interface card. TI Logo II also provides on-screen *sprites* (moving graphics shapes) that are larger in size than the original sprites, as well as music.
Format: Cartridge
Options needed: Peripheral Expansion System, memory expansion card
Supplier: Texas Instruments

UCSD Pascal is an efficient, structured programming language. Developed at the University of California at San Diego, UCSD Pascal uses English-like statements in commands. Unlike BASIC, Pascal program routines are written in a specific and orderly manner; hence, the name *structured programming*. UCSD Pascal is less complex than assembly language programming (which we discuss next) and is faster than BASIC in its operation. The UCSD Pascal Compiler will require that a *P-Code* card (a circuit board) be added to the Peripheral Expansion System.
Format: Disk
Options needed: Memory expansion card, P-Code card, Peripheral Expansion System, disk drive with disk controller
Supplier: Texas Instruments

Assembly Language
Many programming enthusiasts want to use assembly language programming on their computers. Assembly language programming is an advanced form of programming that uses complex instructions to perform commands. It is a language that is considerably more difficult to master than BASIC or Logo. In return for its complexity, assembly language offers greatly increased speed in program operation.

You can develop assembly language software by using the TI-99/4A UCSD Pascal Development System Software. This is a software package available from TI that requires a disk drive and a memory expansion card.

The assembly language routines that you can develop with this system can maintain full control of hardware interfaces, including the video display processor, disk drives, and RS-232 interface connections. TI Extended BASIC also supports the use of assembly language programs by allowing the programs to be linked with BASIC commands.

Assembly language programming is not for the novice user; however, if you need the programming advantages offered by assembly language, you can equip your system with the TI UCSD Pascal option.

YOUR COMPUTER'S NETWORK

Now that you're undoubtedly feeling more confident about using your TI-99/4A Home Computer, you may be ready to press on, to learn more about how you can use your computer. If so, you'll want to consider going far beyond your home, reaching out to tap the network of information that exists in the home computer world. There are hundreds of thousands of other owners of TI-99/4A computers, and many of them have discovered uses for their computers that may surprise you. There are also computer magazines that you can read to keep informed and information utilities which you can connect to by using a telephone modem.

99ER HOME COMPUTER MAGAZINE

In the area of resource magazines, you'll find *99er Home Computer Magazine* to be a valuable journal. Designed for users of Texas Instruments home computers, this monthly magazine features tutorial articles, a section on the Logo programming language, and a section devoted to games. Write to *99er Home Computer Magazine*, P.O. Box 5537, Eugene, OR 97405.

INFORMATION NETWORKS

By equipping your system with a telephone modem, you can connect to other computers over telephone lines and gain access to information services that provide all kinds of information —from the latest news and stock market quotes to games, restaurant reviews, airline schedules, and electronic mail. For an hourly charge that ranges from under $5 to well over $70 (depending on the type of service and the time of day that you call) you can make use of information services that may have just what you're looking for. Three of the more popular services are The Source, CompuServe, and Dow Jones News/ Retrieval Service.

The Source (a *Reader's Digest* company) bills itself as "America's Information Utility." The Source offers an extensively categorized bulletin board where you can read (or post your own) electronic messages. The Source provides excerpts from 30 major magazines, the Commodity News Service, current and historical stock information, and the ability to send Western Union mailgrams from your keyboard. The United Press International news service and excerpts from *U.S. News and World Report* are also provided by The Source.

The Source offers a special edition of its service (at no extra cost) known as TEXNET. TEXNET is offered to owners of Texas Instruments TI-99/4A Home Computers. In addition to all of the normal services provided by The Source, TEXNET subscribers have access to special features of interest to TI-99/4A computer users. These special features include a TI Software Exchange that offers hundreds of free programs, a TI Software Directory, and an updated listing of all TI users' groups. While over 60 games are also available, you'll find that The Source is generally a business-oriented service.

If you prefer the more entertaining side of things, you may want to consider The Source's main competitor, CompuServe. Like The Source, CompuServe offers financial information (including the Commodity News Service and stock quotes); it also provides access to the Associated Press news wires. Unlike The Source, CompuServe is available in the evenings and at night only. CompuServe serves primarily the computer hobbyist and recreational user, with features that range from its large group of on-line computer clubs to its CB simulator that allows you to carry on conversations with people throughout the nation. An on-line encyclopedia and electronic banking are also available.

The Dow Jones News/Retrieval Service is an information service that, as its name implies, leans heavily toward news and detailed financial data. It provides information about thousands of companies scattered across many industries. Excerpts from United Press International and the *Wall Street Journal*, current and historical stock quotes, and information regarding corporate earnings abound on this service. In the recreational area, the Dow Jones News/Retrieval Service has begun carrying movie reviews and sports updates.

Use of these types of information sources can quickly become habit-forming. If you take the time to browse through the offerings, you'll find something new each time you *log on* (hook up) to your information utility.

You need to subscribe and pay the fee to a network to be able to use it. The Source and the Dow Jones News/Retrieval Service are available at most computer stores. TEXNET is available through The Source at no additional charge. CompuServe is available at all Radio Shack Computer Centers.

PRIVATE ELECTRONIC BULLETIN BOARDS

Another way to get information via your computer and modem is through private (free!) electronic bulletin board systems. Electronic bulletin boards have been set up in most large cities across the U.S. You dial the phone number of the bulletin board, and your computer screen shows messages that other people have entered. You can also type in your own messages to be posted. Messages may be like short letters or questions addressed either to a specific person or to anyone who wants to answer. Some bulletin boards also display ads for people selling hardware or software. The person who runs the bulletin board system is called the *System Operator,* or *SYSOP.* The SYSOP will try to answer questions and keep the bulletin board running smoothly. The only cost of calling a bulletin board is the cost of the telephone call.

If you are interested in electronic bulletin boards, we are going to give you a telephone number to get you started. When you call this number, you will reach People's Message Systems, a computer bulletin board in Santee, California. It is a free bulletin board that allows computer users to call it and exchange messages. People's Message Systems also lists over 400 other active computer bulletin boards throughout the United States. You can display the list of active bulletin boards on your screen by calling People's Message Systems. The telephone number is (714) 561-7227.

ADDING A MODEM TO YOUR SYSTEM

A world of communications is available to you by connecting your computer to other computers by telephone. The features that networks such as TEXNET make available are truly exciting, but you'll need to keep in mind the actual hardware necessary to make the connection to the outside world.

You have to know what kind of communications connection is used by your computer. The TI-99/4A uses a connection that's known as an RS-232. To add RS-232 capability to your TI-99/4A, you'll need the Texas Instruments RS-232 peripheral interface adapter (or a similar peripheral interface adapter that is compatible with the TI-99/4A but is made by another company).

An *interface* is simply a type of adapter. The peripheral interface adapter will plug into the connector located on the right side of your TI-99/4A. You will also need a modem—the actual device that connects to your telephone. There are many different kinds of modems; some of the best ones for use with the TI-99/4A are discussed in Chapter 4. You'll want to review that section before you buy a telephone modem. The modem you buy must be attached to the RS-232 connector (the oval-shaped connector with 25 pins) that is located on the peripheral interface adapter.

Once you've inserted a peripheral interface adapter into your computer (or TI Peripheral Expansion System) and you've connected the modem to the RS-232 connector on the peripheral interface adapter, one more step remains before you can connect to the world. You must obtain software for your TI-99/4A that allows it to talk to other computers. The *TI Terminal Emulator II* is the software that you'll use for this task. It comes in the form of a plug-in cartridge. You simply insert it into your computer's cartridge slot (before or after turning the computer on). The software will then provide instructions on the screen that you should follow.

USING THE MODEM

When you have the peripheral interface adapter, modem, and software set up, you're ready to go. Simply dial the number of the other computer that you want to talk to, and when that computer answers, you'll hear a high-pitched tone from the telephone's earpiece. After you hear the tone, connect your telephone to your modem (following the instructions that were supplied with your modem). Then press the computer's ENTER key. The other computer will respond, usually with some type of welcoming message. From this point on, you can follow instructions and messages received from the other computer.

When you call any of the information networks we discussed earlier, it will ask you for a log-on or password—some sort of access code. When you subscribe to a network, you will receive a booklet that gives you complete log-on instructions.

USERS' GROUPS

You'll also want to consider the users' groups for the TI-99/4A. *Users' groups* are simply groups of people who share a common interest in a particular aspect of personal computers. Users' groups can be an invaluable source of ideas, tips, and answers when you're seeking advice, trying to get a program you've written to operate properly, or looking for new and interesting uses for your system.

Most users' groups meet on a regular basis, and the meetings are normally open to the public.

Low-cost or free software is often available through the users' groups. Most groups offer a disk-of-the-month or cassette-of-the-month to members, for a minimal cost. The disk or cassette usually contains public domain programs, often written by users' group members. In many cases, dues contributed by group members help pay for the cost of a group newsletter. And it's not unusual to find a 60-year-old businessman and a 13-year-old student working together at a users' group meeting to solve a problem.

The sharing of information that is a part of the users' group concept can be quite an experience to anyone who has never attended such a meeting before. Here is a list of users' groups. If there is a group in your area, you should definitely consider joining.

ALABAMA

Central Alabama 99/4A Users' Group
551 Larkwood Drive
Montgomery, AL 36109

Jasper 99/4A Users' Group
1F Northwood Townhomes
Jasper, AL 35501

TIBUG
709 Nytol Circle
Birmingham, AL 35210

Wiregrass 99 Users' Group
106 Harwood Place
Enterprise, AL 36330

ARIZONA

Arizona 99 Users' Group
4328 E. La Puenta Ave.
Phoenix, AZ 85044

Tucson 99/4A Users' Group
6816 E. Lulerne Drive
Tucson, AZ 85730

Yuma 99ers Users' Group
1573 E. Kuns Court
Yuma, AZ 85365

CALIFORNIA

Kings 99/4A Users' Group
229 West Birch
Hanford, CA 93230

L.A. 99ers Computer Group
P.O. Box 3547
Gardena, CA 90247

Orange County 99/4A Users' Group
1673 Chateau
Anaheim, CA 92082

San Francisco/South Bay 99er Users' Group
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Los Gatos, CA 95030

San Gabriel Valley 99/4 Users' Group
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West Covina, CA 91712

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Colorado 99/4A Users' Group
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Palatine, IL 60067

East Central Illinois 99 Users' Group
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Lincolnland 99 Computer Group
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Marion, IA 52302

Des Moines 99/4 Users' Group
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Des Moines, IA 50317

Northeast Iowa HC Users' Group
1421 Delta Drive
Cedar Falls, IA 50613

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Mid-America 99/4 Users' Group
P.O. Box 2505
Shawnee Mission, KS 66201

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Kentuckiana 99/4 Computer Society
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Louisville, KY 40222

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Baltimore Users' Group
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Worcester, MA 06103

New England 99ers
99 School Street
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Personal Computer Users
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Home Computer Users' Group
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St. Paul, MN 55112

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Kansas City, MO 64116

99/4 Users' Group of St. Louis
4127 Quincy
St. Louis, MO 63116

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Northern New Jersey 99ers Users' Group
P.O. Box 515
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SK 99 Users' Group
180 Haledon Ave.
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The Greater Randolph 99ers
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Leesburg, VA 22075

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CANADIAN GROUPS

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Toronto Home Computer Users' Group
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The 99/4 Program Exchange
P.O. Box 3242
Torrance, CA 90510

Young People's Logo Association
1208 Hillsdale Drive
Richardson, TX 75081

This User's Guide will lead you step by step through all phases of learning how to use your new computer: from setting it up, to learning what each key does, to expanding your system with peripherals. Specific exercises are included for each key on your computer's keyboard, plus easy-to-understand instructions and clear, colorful photographs. It also provides software buying recommendations and a guide to users' groups.

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