

THE MACMILLAN

**EASY HOME COMPUTER SERIES**

# THE COMMODORE 64 USER'S GUIDE



**THE ONLY MANUAL YOU NEED TO UNDERSTAND  
& GET THE MOST OUT OF YOUR HOME COMPUTER**

**HOW TO SET UP AND OPERATE THE COMMODORE 64**

**HOW TO EXPAND YOUR SYSTEM THROUGH ADD-ONS**

**A CONSUMER GUIDE TO THE BEST SOFTWARE**

**GLOSSARY OF KEY TERMS AND ADVICE ON SERVICING**

Text by Jonathan Sacks, with Mark Andrews. Edited by Roger C. Sharpe

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**— USER'S GUIDE —**

**Text by Jonathan Sacks**  
**with Mark Andrews**  
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*A computer for people of all ages, the Commodore 64 has a variety of family programs, such as the video game Tooth Invaders that teaches oral hygiene.*

# INTRODUCTION

Who would have imagined, even five years ago, that *you* would have a computer in *your* home? Even now, as home computers become increasingly popular, readily available, and easily affordable, there are many people who can't understand why anyone would own one.

Those people have a great deal to learn about computers. Like other technological innovations, including the automobile, airplane, and television set, computers have the capacity to enrich our lives.

They can save us time, increase our productivity and give us great pleasure. We can play games, write letters and reports, keep records, sort huge volumes of information, hookup to data banks and rapidly gather information not otherwise available without extensive research, and send electronic mail. There are, of course, many home computers capable of doing all these things, and more. But few are as special as the Commodore 64.

The 64 is a versatile and powerful home computer, capable of doing things that many models costing twice and three times its price can't. It boasts high-resolution graphics, one of the best music synthesizers in the industry, and a whopping 64K of programmable memory.

The 64 is manufactured by Commodore Business Machines, Inc., a Pennsylvania-based company which, surprisingly enough, began as a New York typewriter repair shop. The company has come a long, long way. In addition to manufacturing the Commodore 64 and its baby brother, the VIC-20, Commodore Business Machines also produces more powerful business computers and recently organized a new software division that designs and markets programs written to operate on Commodore machines—including many new programs for the Commodore 64.

The price of computers has been dropping lately, and Commodore has been an important part of that trend. Because the

## 2 INTRODUCTION

company manufactures its own electronic circuitry, it has more control than most companies over its costs. In less than a year, the retail price of the 64 dropped from \$595 to under \$300, and the unit can currently be found discounted for under \$200. This has to be the best value in the computer market today!

But Commodore isn't done yet. The manufacturer has announced plans to market a *portable* version of the 64 (tentatively called the Executive 64) that will include a built-in six-inch monitor with a 40-column by 25-line display. It will be a Commodore 64 that can be carried about like a small suitcase, reportedly utilizing the same programs, color and sound capabilities.

This is a book for people who have, or are thinking about, pur-



*The Commodore 64's potent portable version has a 6-inch color monitor and a built-in single-disk drive. Called the Executive 64, it is slated for release in 1984.*

chasing the Commodore 64—in either the original or portable version. It was written because computers, as everybody who has ever played with one knows, are complex creatures. They take getting used to, and if you're new to them, you need a friendly tour guide.

In this book, we will show you how to best use your Commodore 64 for work *and* for play. We'll ease you through the jitters experienced by all new computer owners by guiding you, in plain English, through setting up your system. Then we'll tell you how the 64 works and why it works the way it does. We'll give you some ideas about the kinds of things you can do with your Commodore, and let you in on some secrets guaranteed to make your work and play on the 64 simpler and faster.

We'll discuss and review the different accessories that are available for your 64, such as printers for producing documents and modems for computer-to-computer telecommunicating.

One entire section of this book is dedicated to telling you what kinds of programs are available for your 64, and we review by name many of the popular programs you might have heard about.

There's much to learn about the Commodore 64, but first let's talk about computers in general so that you'll become more familiar with the language used on the following pages.

In computerese, the machinery is known as *hardware*. This includes your Commodore 64, the main unit with the typewriter keyboard. There is also other hardware that can be connected to the main unit, such as cassette recorders and disk drives to store information, and printers to transfer onto paper what you see on the screen. These add-ons, which enable your computer to do tasks it otherwise couldn't do, are called *peripherals*.

When you purchased your Commodore 64, you might have also selected some programs, such as games or word processing, to run on the machine. As a generic category, programs are collections of information and computer instructions, all stored magnetically on tape, disk, or in micro chips. Programs make the computer do what you want it to do, whether it's playing games, adding numbers or a thousand other things. In the language of computers, programs are also called *software*.

For now, what's important to remember is that it takes *both* hardware and software to make a computer system operable. The

#### 4 INTRODUCTION

software you buy must be specifically designed—or “configured”—to run on your type of computer. That’s no problem if you own a Commodore 64, since there’s a wealth of software out there that will turn it into a very powerful tool. And what you’re about to read should convince you even more that you’ve selected a very special home computer system.



*The Commodore 64 with the Commodore model 1701 color monitor and an 80-column graphics Plotter Printer.*

# 1 SYSTEMS ANALYSIS

When it was first announced that Commodore Business Machines was going to release a more powerful version of its very popular VIC-20, the computer world was stunned. Rumor had it that the new machine would have a full 64 kilobytes of user-addressable memory—more than *twice* that of the VIC and it would sell for under \$1,000! (A kilobyte is 1,024 bytes, and a byte is equivalent to a single written character. So 64K means room for over 64,000 characters in working memory, a significant amount for a home computer. For more on bytes see Chapter 2, “Tech Talk.”)

Many computer critics and electronic experts took a wait-and-see attitude, certain that even Commodore—with its long history as a leader in the manufacture of small computers—could never produce such a powerful machine at such a low price.

But Commodore did it, and the 64 burst onto the scene and collected rave reviews. Not only did it have the ability to store more than 64,000 characters in user memory, but the 64 also had 16-color graphics, a comfortable full-sized keyboard and sound capabilities that surpassed absolutely everything in its league.

There was only one problem. In the beginning, little software was available to take advantage of the 64's power. In fact, there was none at all. Commodore, however, promised, that it would support the machine. But, in the early months, only those willing to write programs themselves could do much with the 64.

As the months passed, retailers and purchasers remained skeptical that there would *ever* be any software for the mighty Commodore 64. Major retail outlets shunted the machine aside, opting instead to sell far more expensive, and often less power-

ful, products that at least had software support.

It's now no secret that Commodore kept its promise. During 1983, hundreds of programs were released for the 64. And scores more are being introduced almost weekly.

Recently, none other than Atari announced it would begin marketing its own software for the Commodore 64. And now that the Commodore 64 is well supported, computer users have realized that there is no better computer value in the world today.

### **INSIDE THE COMMODORE 64**

There's more to the 64 than meets the eye. On the outside, it seems simple enough with a heavy-gauge brown plastic case and a typewriter-sized keyboard featuring several extra keys. However, if you were to open the case (*don't*), you would discover that the entire computer, including all the electronic intelligence and everything that makes it work, resides on a single green integrated circuit board.

On that board is a 6510 microprocessor (the 64's brain). The board also contains 20 kilobytes of ROM (read-only memory) which are host to the system's BASIC language, its operating system and its character set; and integrated-circuit chips that give the 64 its special music and graphics capabilities. For those of you who have to know everything, the graphics chip is called the 6567 Video Interface Chip, and the sound chip is called the 6581 Sound Interface Device, also known as SID.

Both chips are very special parts of the 64. The 6567 chip gives the machine breathtaking video abilities. With a color TV or monitor, the 64 can display graphics in 16 colors: black, white, red, cyan, purple, green, dark blue, yellow, orange, brown, light red, light gray, medium gray, light green, light blue, and dark gray. The colors can be used both on characters as well as for background color.

The 6567 also controls something called *sprite* graphics. Technically speaking, they're large programmable characters, 24 × 21 dots, that can be any shape you like and can be moved around the screen. This is done using what is called memory mapped display, which means that you pick a point on the screen and turn it either on or off.

You give each sprite a shape, color and a location by coordinate. You can make them bigger, at the expense of resolution, and you can make them multicolored.

Sprites can cross over one another or crash into one another, so they're great if you're designing video games. But there is one catch. To use sprites, you either have to buy special programs or know how to program your 64.

*The Commodore 64 User's Guide*, which is included with the 64, will teach you how to program sprites, and later in this book, we will suggest and review programs that will make using the Commodore's graphics much easier.

If the 64's graphics abilities are stunning, its musical abilities are incredible. The SID chip allows the 64 to be a musical instrument, and much, much more.

It has three independent voices, each of which can sound like a different instrument—from woodwinds to strings, organs and pianos. Each voice has an eight octave range and you can control attack, decay, sustain and release.

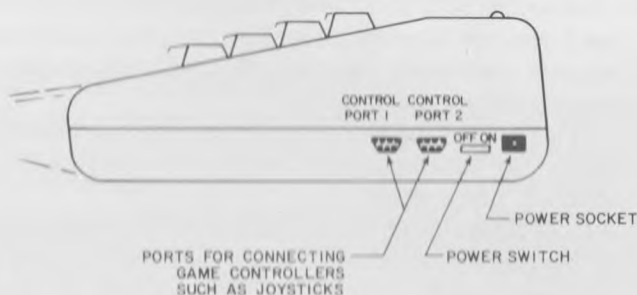
For the non-musical 64 owner, attack is the rate at which a note rises from silence to peak volume; decay is the fall from peak volume to sustained volume; sustain is the level of sustained volume; and release is the rate it falls from sustained volume to silence.

As you can imagine, being able to control all that—in three voices of your choice and over a span of eight octaves—gives you incredible musical punch.

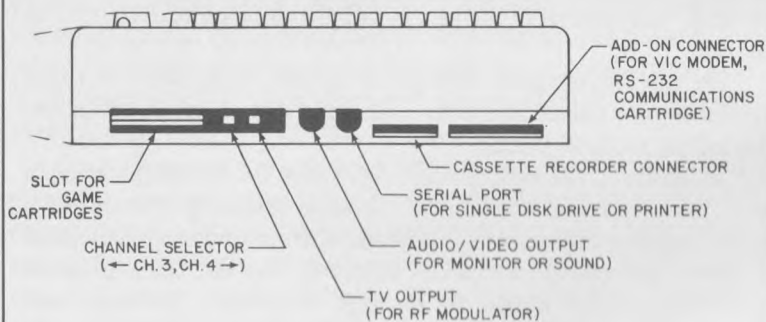
In addition, the synthesizer offers four waveforms; a smooth and flutey triangle waveform; a brassy sawtooth waveform; a pulse (squared-off) waveform adjustable from tinny to hollow; and a noisy waveform. Properly directed, the SID can produce everything from music to hissing, screeches, screams and thunderous rumbles. But again, the only way to do any of this with your 64, right out of the box, is to program the machine yourself. Fortunately, for the many who are not interested in programming, there are also pre-written programs for sale that allow easy access to SID.

Now that we know what makes the 64 work, let's talk about how to set up the machine and then take a closer look at its features.

### Right Side of the Console



### Rear Panel



## GETTING STARTED

The first thing to do after bringing your Commodore 64 home is to find a place to put it. Not just *any* place but the *proper* place to put it. There are several important considerations.

First, it's best to have a permanent place for your computer. It can be quite frustrating to have to set up your system every time you want to work with it, and it is equally frustrating to have to take the system apart when you're finished working.

Exactly where you put the computer is more important than you might think. As you expand your system it will require more and more space. And remember, it isn't just the matter of having enough room for the computer itself. Whoever is working on it will all require space, for such things as documents, manuals and other resource materials.

You will also need to be close to electrical outlets. It's amazing how many outlets a computer system requires. Finally, if you ever plan to connect your computer to outside databanks such as CompuServe, you will have to be near a telephone outlet.

Once you have chosen a location for your 64, it's time to set it up. Just take the computer out of the box, but *do not plug it in*. Included with the main unit there should be: (1) a power supply unit, which is a black box with a standard electrical plug and cable; (2) a silver switchbox with antenna leads for connection to a television set or monitor; and (3) a video cable.

How you proceed from here will depend upon what peripherals (hardware accessories) you might have purchased. We'll get to that later.

The first thing you must do to set up your computer is to attach a display screen. You have two choices, either a television set or a monitor. The latter generally have superior display but are far more expensive than televisions, and the difference might not be that critical depending on how you intend to use your 64.

### **Connecting the 64 to a Television Set**

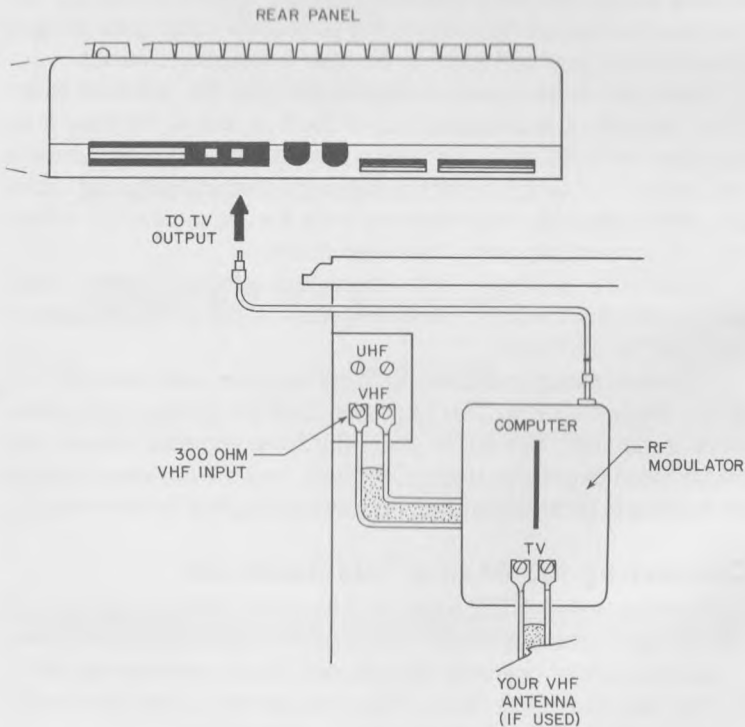
1. Disconnect your VHF Antenna from your television and attach it to the "antenna input" terminals on the top of the silver switchbox (the one with the antenna leads coming out of it).
2. Plug one end of the video cable into the television jack on the rear of the computer behind the + (plus) key.

- The other end of the cable connects to the silver switchbox, which is then attached to the VHF antenna on the back of your television set.

*Note: Be certain that you connect the box to the VHF and not the UHF connection.*

- On the rear of your computer, to the left of where you connected the video cable, you will find a channel selector that gives you a choice between channels three and four (switch left/channel three; switch right/channel four). Turn on the television set (remember to plug it in if you haven't already) and choose the one of those channels that has the least signal interference. **DO NOT TURN ON THE COMPUTER YET.** Leave the television on that channel and set the switch on the back of the computer to the same channel.

### Connecting the 64 to a TV



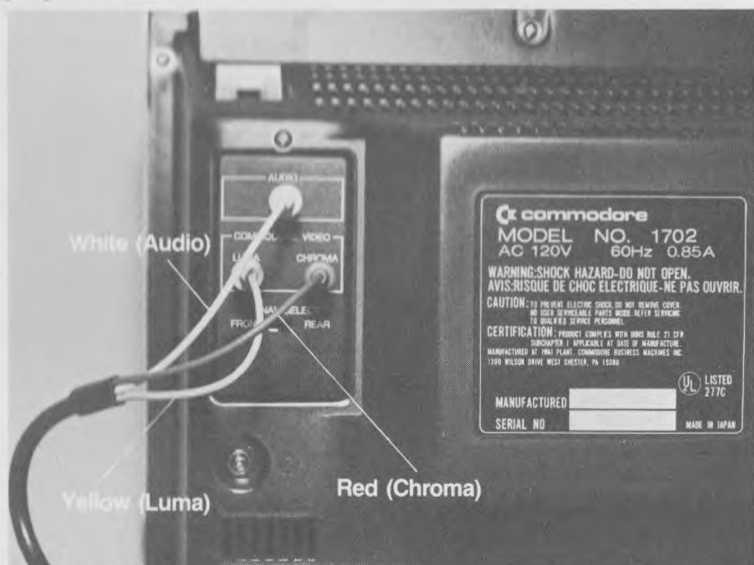
If you have a new television set that uses a round antenna connector (cable type) instead of the flat connector, you will have to purchase a 300-ohm-to-75-ohm converter at a hardware or electronics store, and connect the silver box to the converter, before you can connect the 64 to a television.

### Connecting to a Monitor

A monitor will connect to the audio/video port of the computer, which is to the right (as you face it) of the television connector. This port provides a composite video signal which gives a sharper image on the screen.

To connect a monitor, you will need a five-pin DIN connector. The precise configuration of the cable will depend on the type of monitor you purchased, so it is a good idea to get specific information from the dealer when you buy the monitor.

Appendix 1 of the *User's Guide* supplied with the 64 has the "pin outs" of the computer's port. This will tell you what signals come from what pins, so your dealer can supply you with the proper cable.



Connecting color-keyed plugs to a monitor

### **Connecting to a Commodore C2N Datasette**

The Datasette plugs into the cassette interface port directly behind the number keys 4, 5 and 6. Line up the cable with the slot and push it in. Do not use too much force.

### **Connecting to a Commodore 1541 Disk Drive**

If you are using a Commodore disk drive, it's important that you purchase the drive called VIC-1541 and *not* the drive called VIC-1540.

Although it's possible to get the 1540 drive to work with the 64, it's complicated and undependable. So it's best to stick with the 1541 drive. You must connect two wires to make your 1541 disk drive operational. One attaches the drive to the computer, and the other to give the drive electrical power.

Find the cable socket on the disk drive (it is right above the fuse) and plug one end of the disk cable (supplied with the drive) into that socket. Then plug the other end into the serial slot behind the number keys 7 and 8 on the rear of the Commodore 64 main unit.

Now, plug the disk drive power cord into an a/c outlet. Once that is done, you can turn the disk drive on.



*The 64 easily connects to the model 1541 disk drive via a single cable.*

## ***If You Are Connecting a Printer***

There is something *very* important to know about printers, and it cannot be stressed enough.

*Not all printers work with all computers!*

The function of making a printer work is a matter of both software and hardware. First, the printer must be able to properly interface with your Commodore 64. Then, your software—be it graphics, game or word-processing software—must be able to address that type of printer. And finally, someone must figure out how the cable that connects the printer to the computer can be properly configured so that the messages sent from the computer are received in the right place by the printer.

The different types of printers that interface with the Commodore 64 are discussed in the upcoming chapter, "Peripheral Visions." If you haven't purchased a printer yet, read this section before you do!

If you have purchased a printer, how it connects to the 64 depends upon what type of printer you have. If you are using a Commodore printer like the VIC-1515, it connects to the serial port on the back of the computer behind the number keys 7 and 8. But wait!

If you have a disk drive, you have already connected it to the serial port. Now what?

Well, now you have to do something known as "daisy chaining."

Leave the disk drive connected, and connect the printer cable to the empty slot in the back of the disk drive.

On the back of Commodore printers you will find a switch that can be flipped to one of three positions: "4," "5" or "T."

The "T" position tests the printer. The other two positions identify the printer as either device 4 or device 5. When you tell your 64 to print, you have to give it a device number to send the message to. For the sake of argument, flip the switch on the printer to #4. From now on, when you want to print something, you will send the information to device #4.

Now that everything is connected, it is time to power up. On the right side of your computer you will find a rocker switch. Make sure everything is plugged in, then turn it on.

## Power On

If you did everything correctly, you should see the following messages when you turn on your computer:

```
****COMMODORE 64 BASIC V2****  
64K RAM SYSTEM 38911 BASIC BYTES FREE  
READY
```

The message is the 64's way of saying hello. It also tells you something about how the 64 works.

When you turn on your machine, it goes directly into the BASIC programming language, which is permanently stored in the computer's ROM (read-only memory) chips. (BASIC stands for "Beginner's All-Purpose Symbolic Instruction Code," a language for telling your computer what operations to carry out.) It is there forever, and if you are a programmer, you can start telling the Commodore 64 what to do right now.

The number 38911 is the number of unused spaces in the 64's RAM (random-access memory), that part of the computer that remembers what *you* have put into it (something you write, or a program you have purchased).

RAM is volatile, meaning that whatever you put into it will only stay there as long as the computer is turned on. When you turn it off, the information disappears. That is why it is important to have a cassette deck or a disk drive if you intend to save information you put into the machine.

As you can see, even though the computer has 64K of RAM (enough to hold more than 65,500 characters), only part of it is free for you to use. The rest is used by some of the 64's functions.

When you "load" a program into your 64 (a game or a word-processing program, for example), it is transferred from the tape or disk into the RAM where the computer can use it. Loading uses up some of the RAM but leaves part of it for you, which is important if you are using the computer as a word processor because you need to store your work, at least temporarily. That is why on many word processing programs for the 64, documents can only be eight or so pages long. The program uses up the rest of the RAM, and there's just no more room.

Fortunately, documents or *files* can be strung together, so you

**ROM**

All computer memory is divided into two parts, ROM and RAM. ROM stands for read-only memory. ROM can be “read” by the computer, but you can’t “write” anything into it or change it in any way. ROM is permanently written into the computer chips at the factory.

Well, ROM tells the computer what to do and how to do it when you first turn on the machine. ROM runs a quick test to see that everything is connected and working, then tells the computer’s central processing unit (the CPU) what to do next.

The programs in ROM are always there, whether the power is on or not. And this is all you’ll ever need to know about it.

**RAM**

RAM—random-access memory—takes over where ROM leaves off. RAM is where we do our reading and writing and arithmetic. We “load” programs into RAM either by typing them in through the keyboard, or instructing the computer to read them from a floppy disk. These programs, in turn, will tell the computer what to do.

One of the most important things to remember about RAM is that *it’s erased every time the power is shut off!* RAM is your workspace inside the computer. Information can be written on or read from RAM in as little as a millionth of a second. Obviously, the bigger your RAM memory is, the bigger your workspace.

This is why people want more memory. Instead of, say, editing one page of the Great American Novel at a time, with more working memory, you can edit a whole chapter. With enough working memory, you could edit the entire manuscript at once.

Remember, though, should your precocious cat pull the computer’s cord out of the socket, all of the novel will vanish from the computer’s working memory. (You soon learn to store on a floppy disk each few hundred lines you write, to minimize the chance of losing them if RAM is erased?)

could, if you wanted, write 100 or even 200 or 300 pages on your 64.

Look at the screen message again.

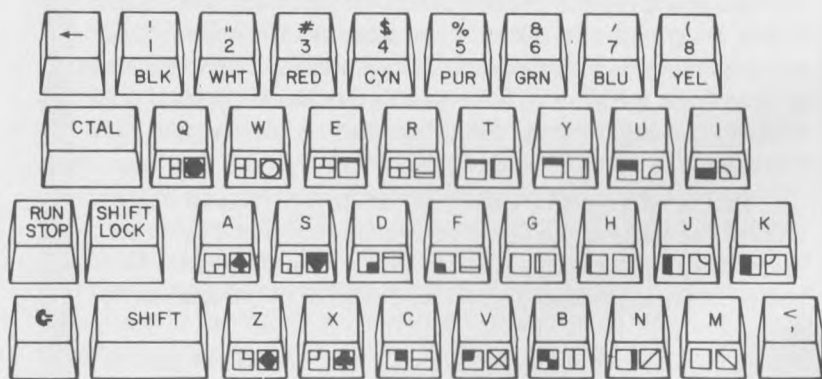
Directly under the "R" in ready, you will notice a little rectangular light. This is called a *cursor*. The cursor shows you where you are on the screen. If right now you tap the A key, an A will appear where the cursor is and the cursor will move one space to the right.

Now tap the key marked INST/DEL at the upper right of your keyboard. The cursor moves back one space, and the A disappears.

### THE COMMODORE 64 KEYBOARD

The time has come to learn a little about your 64 keyboard. You'll notice that the 64 has a number of odd-looking characters on its keyboard. If you're accustomed to a standard IBM Selectric keyboard, it might take you a while to get used to the 64.

There are 66 keys on the computer, four of which—on the right hand side—are programmable function keys. This means that these keys can be set to perform special functions in certain programs, thus making operation of the 64 far simpler.



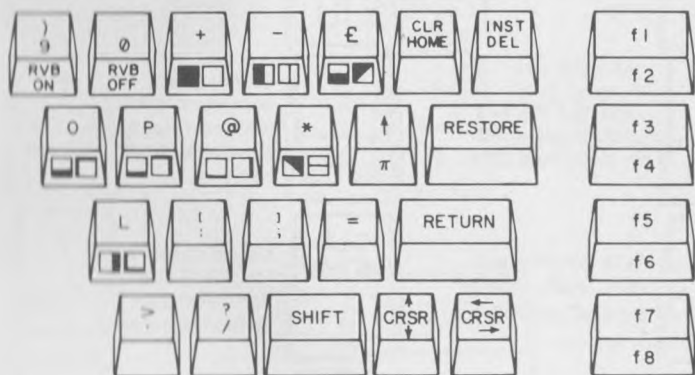
For example, in a game program one of the function keys might be used to launch a rocket. In a word-processing program, a programmable function key might scroll the screen (move the displayed lines up and down on the screen).

You will notice that these keys, and all others on the 64, can be operated in either a shifted or unshifted mode. So in reality, there are *eight* programmable function keys, since the same key can be programmed to do different things when it is shifted or unshifted.

There are a few other special keys on the 64 which also deserve your attention. Two cursor keys, below the return key, move the cursor, that little block of light, around the screen in four directions, (indicated by arrows). One key moves the cursor vertically, either up when shifted or down when not, and the other moves the cursor horizontally, left when shifted and right when not shifted.

These are important keys, because the cursor tells you where you are on the screen. In the upper right hand side of your keyboard you'll find two other important keys. One is marked CLR/HOME, while the other, right beside it, is marked INST/DEL.

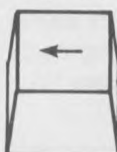
CLR/HOME, when unshifted, moves the cursor to its "home position" in the upper left hand corner of the screen without remov-



*A close-up of the Commodore keyboard.*

## KEYBOARD DICTIONARY

## Top Row



Left arrow image.



With CONTROL key gives yellow. With Ⓞ gives very light gray.



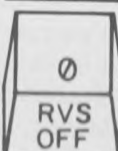
With CONTROL key gives black. With Ⓞ key gives orange.



With CONTROL key gives reverse letters (such as black on white).



With CONTROL key gives white. With Ⓞ key gives brown.



Number zero. With CONTROL key turns off reverse letters.



With CONTROL key gives red. With Ⓞ gives pink.



Addition sign.



With CONTROL key gives baby blue. With Ⓞ gives dark gray.



Subtraction sign.



With CONTROL key gives purple. With Ⓞ gives light gray.



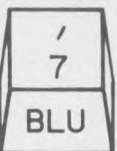
Ⓞ key gives symbol on front left. SHIFT key gives symbol on front right.



With CONTROL key give green. With Ⓞ give light green.



Moves cursor to top left of screen. With SHIFT key, clears the screen.

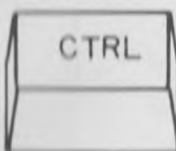


With CONTROL key gives blue. With Ⓞ gives light blue.



Moves cursor backward, deleting characters. With SHIFT key creates spaces so you can insert new words.

Second Row



CONTROL key. Used in tandem with other keys for special tasks.



⌘ key gives symbol on front left. SHIFT key gives symbol on front right.



With CONTROL key, scrolls down the screen.



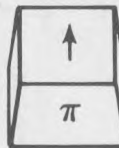
⌘ key gives symbol on front left. SHIFT key gives symbol on front right.



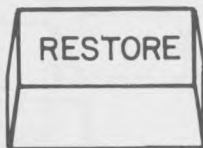
With CONTROL key gives white letters.



Multiplication sign.



Up arrow for exponents. With SHIFT key gives symbol and value of PI.



With RUN/STOP key restores original screen.

⌘ is the symbol for the Commodore key.

## KEYBOARD DICTIONARY

## Third Row



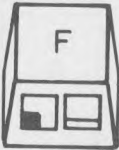
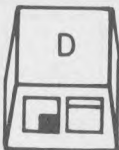
Stops a program. Used with SHIFT key loads from tape. With RESTORE key, goes back to original clear screen.



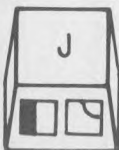
Locks all alphabet keys into caps (when in the upper/lower-case mode, obtained by hitting ⌘ and SHIFT keys in tandem).



⌘ key gives symbol on front left. SHIFT key gives symbol on front right.



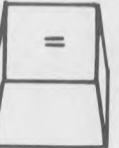
⌘ key gives symbol on front left. SHIFT key gives symbol on front right.



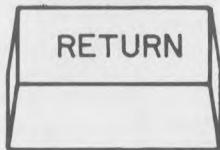
Left square bracket. Colon.



Right square bracket. Semicolon.



Equal sign.



Enters instructions into memory.

⌘ is the symbol for the Commodore key.

Bottom Row



COMMODORE key (⌘). Gives left front symbol on many keys. With SHIFT key gives lowercase letters.



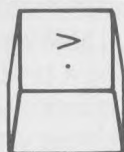
⌘ key gives symbol on front left. SHIFT key gives symbol on front right.



Gives uppercase letters, when in the lowercase mode (see the ⌘ key above). In the uppercase mode, gives the front right symbol on many keys.



Less than. Comma.



Greater than. Period.



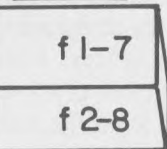
? is abbreviation for PRINT command. Slash (/) means division.



Moves cursor down. With SHIFT key, moves cursor up.



Moves cursor to the right. With SHIFT key moves cursor left, backward.



Programmable function keys.



⌘ key gives symbol on front left. SHIFT key gives symbol on front right.



⌘ key gives symbol on front left. SHIFT key gives symbol on front right.



ing any images that might be present on the screen. If you shift this key, it will still move the cursor to the home position, but at the same time you'll also clear the screen of any subject matter.

The other key, INST/DEL, when unshifted, will move the cursor back one space, erasing the character that you had previously typed. Shifting the key, however, will allow you to insert information in a line, effectively moving everything in front of the insert forward and out of your way.

Just below the CLR/HOME and INST/DEL keys you will find a large key marked RESTORE. This key does what you might imagine—it restores the computer to the condition it was in before you changed things with a command or program.

On the left hand side of the keyboard, diagonally above the shift key, is a key marked RUN/STOP. Unshifted, the key tells the computer to stop doing what it's doing and is most frequently used to end a program. If you shift the RUN/STOP key it will tell the computer to begin loading a program from a cassette.

What hasn't been mentioned so far is one key that's obviously not found on a standard keyboard, but is very important to the operation of the 64. It's located in the lower left hand corner of the keyboard, and is marked with the Commodore logo.

Now take a look at the main keyboard. It's the standard layout of letters and numbers you usually see on a typewriter keyboard, however there are also strange characters on the *front* of each key. They are there because your Commodore 64 keyboard is really two keyboards in one—a regular keyboard and a graphics keyboard. The latter allows you to display on your screen graphics (designs and shapes) that can be arranged into patterns and pictures.

When you first turn on your 64, it will be in an upper-case/graphics mode. Everything you type is in capital letters, and when you use the shift key, the graphics character on the *right* front of the key you press will be displayed.

By depressing that COMMODORE KEY we mentioned earlier, and the shift key at the same time, the display will change to upper and lower case letters. Now, by holding down the COMMODORE KEY while you press another key, you will get the graphic symbol that is on the *left* front of that key.

The COMMODORE KEY has another important function.

Remember we said the 64 has the ability to generate 16 colors. If you look at the keyboard, you will see that half of those colors appear on the front of the number keys 1 through 8. Holding down the Commodore key and pressing each of the eight number keys will give you different colors: orange, brown, light red, dark gray, medium gray, light green, light blue and light gray. The other 8 colors can be obtained using the control key (CTRL) in tandem with the number keys, which is the next topic discussed below.

### ***Adding Color to Your Life***

On the left side of your keyboard, next to the letter Q, you will find a key marked CTRL. This is the control key, and it is held down while pressing another key when you want to give the computer an instruction.

Now, hold the control key and tap the number 7. Nothing, right.

Wrong! Something happened to the computer. You just didn't see what happened. But if you tap any character now, it will be blue.

If it isn't, adjust the color on your television or monitor until it is, because as you can see the 7 key is supposed to generate the color blue.

If you hold down the control key while pressing other number keys, you will get other colors as marked on those keys. If you want to paint a green line, press CTRL and hold down the number 6 key. Then hold down the space bar at the bottom of the keyboard.

To blank the screen and set everything back to normal, hold down the shift key and tap CLR/HOME (the next to last key in the number row). You can also press the RUN/STOP key and then the RESTORE key. That will return the screen to the way it was before you did anything to it.

Now let's try something else.

Type the following, putting your own name in the blanks:

PRINT "MY NAME IS ----"

Then tap the RETURN key.

Your Commodore 64 screen should say:

MY NAME IS (and your name)



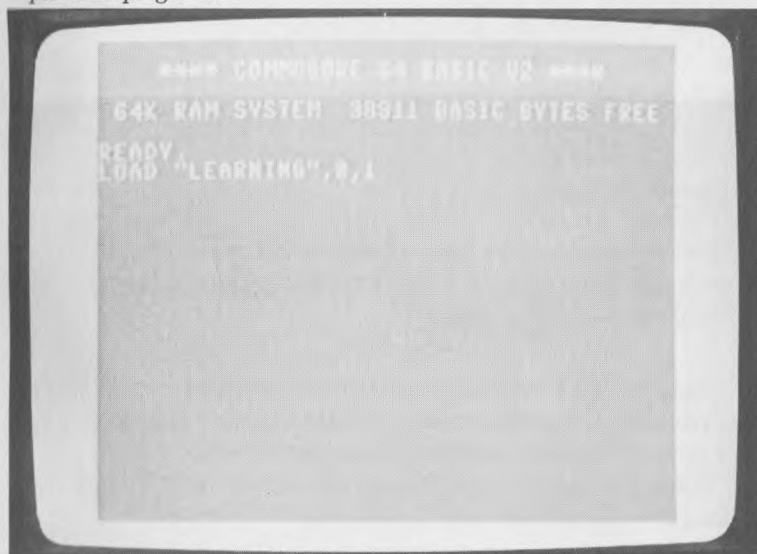
*Inserting a game cartridge into the back of the 64 console.*



*Inserting a disk into the model 1541 disk drive (label up, the oblong "reading" slot forward).*



*Opening screen of the 64 provides an immediate opportunity to write simple basic programs.*



*Commands must be typed in for loading Commodore 64 software programs.*

You have just written a simple BASIC program. PRINT tells the computer to display whatever is inside quotation marks. Try the command with anything. It will work!

The purpose of this book is not to teach you how to program, but rather to show you how to get the most from your 64. If you are interested in programming, there are several fine publications that will help you to learn how (see Chapter 7, "Readouts").

To use your Commodore 64 with programs you have purchased, you must first load the program into the machine. How you do this depends upon the type of program you have: cartridge, cassette, or disk.

If you have a program on cartridge, it plugs directly into the cartridge slot on the rear of your machine. First, *turn your Commodore 64 off!* It must be *off before* you insert a cartridge or you will ruin the cartridge and maybe the machine.

Then insert the cartridge into the cartridge slot on the back of the machine directly behind the power light that indicates whether the machine is off or on.

After the cartridge is in place, you may turn your computer back on again. The program on the cartridge is loaded into the machine automatically. Simply follow the program directions (in other words, do whatever you have to do to get started), and you're on your way.

It is a little more complicated to load programs from cassette and disk. To load a program from cassette, turn on your computer and insert the tape, making certain it is rewound on the side you want to load. Pressing the shift and RUN keys loads and executes the first program. If you want a program other than the first program on the tape, type the following message, entering the name of the program in the blanks:

```
LOAD "-----"
```

Your computer will ask you to press the PLAY button on the tape recorder. Then the screen will blank and a message will appear telling you the search for the program is underway.

When the program is found, the screen will display the message:

```
FOUND (PROGRAM NAME)
```

Now you must actually load the program into memory. You

do this by depressing the COMMODORE KEY which is on the lower left-hand corner of your keyboard.

Then the screen will go blank again and you will get the message:

LOADING

After a few moments the screen will say

READY

Then type RUN and tap the carriage return, and your program will execute.

To load a program from a Commodore disk drive, you must type the following message, inserting the program name in the blank:

LOAD "-----",8

The 8 is the code that tells your 64 to go to the disk drive, so it knows to look for the program on the disk.

Tap RETURN, and the disk will whirl for a while.

Then the screen will display:

SEARCHING FOR (PROGRAM NAME)

LOADING

READY

Once again, you must type RUN and hit a carriage return and the program will execute.

*Note: Loading programs from drives made by companies other than Commodore may require special procedures. Check the manual that comes with your drive or interface card!*

*Additional information on cassette and disk drives can be found in Chapter 3, "Peripheral Visions."*

## 2 TECH TALK

**N**ot everybody cares about how a computer works. But some people do, and if you're one of them, this chapter is for you.

Maybe you read some article somewhere that piqued your interest. Maybe you wondered just *what* was on that cassette tape or floppy disk that made your computer do the things it did. Maybe you're just curious.

Because you don't have to know how a computer works to operate one, any more than you have to know how an engine works to drive a car. If terms like ROM and RAM irritate you and binary numbers aggravate you, forget them. You needn't bother yourself about these things.

If, on the other hand, you are interested in figuring out some of this computer jargon, read on.

### **THREE PARTS OF YOUR 64**

Every computer has three main parts: the central processing unit (CPU), a memory and some input/output devices (I/O) like disk drives, monitors, cassette recorders, and keyboards.

Your Commodore 64's central processing unit, as mentioned earlier, is a 6510 chip designed and manufactured by Commodore. It is similar to the 6502 chip that is used in the Apple IIe, as well as in computers manufactured by Atari and Ohio Scientific.

Your computer has memory divided into two parts: random-access memory (RAM), and read-only memory (ROM).

The primary input device on your Commodore is its keyboard. The primary output device is its monitor.

When your computer runs a program, there is constant interaction between the 6510 processor and its memory banks—both RAM and ROM.

ROM is your Commodore's permanent memory. It was installed in the computer in the factory, and it never gets erased, even

when the power goes off. Without the ROM, your computer wouldn't do anything, because the biggest block of memory in your Commodore's ROM is the operating system.

Your computer's operating system, or OS, is what makes it do all the things you expect it to do, such as accepting input from the keyboard and displaying characters on the screen.

RAM is your computer's main memory. In your Commodore 16, it is contained in four, switchable 16K chips.

It is the RAM that holds both the program you are currently using and any information you are currently working with. The more RAM you have, the more data you can enter. RAM is *volatile*, that is, it can be altered or erased.

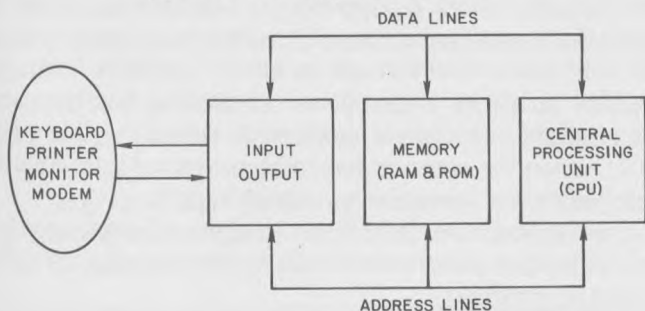
When you turn your computer on, the block of memory reserved for RAM is similar to a blank sheet of paper. And when you turn your computer off, whatever was put into the RAM disappears. That's why most programs used in computers have to be loaded into memory from storage devices whether they be cassettes or disks, each time you turn on the computer.

After you've written a program, you also have to store it somewhere so it won't be lost when you turn your computer off.

Visualize your computer's RAM as a wall of post-office boxes, a grid in which each cell is a compartment. Each cell in your computer is called a *memory location*, and each memory location can be thought of as a single post office box.

Each memory location in a computer, like each box in a post office, has an individual and unique address and can be given a single number. Each number stored in a memory location can represent one of three things: (1) the stored number itself; (2) a

### How Your Computer Works



code representing a typed character; and (3) a machine language instruction.

To avoid confusing the computer, programs are usually stored in a different part of its memory from text or data.

If your computer goes to a memory location and finds a number that equates to just a number, then the computer must be told what to do with the number it finds. If the number is a code representing a typed character, then the computer must be told how the character is to be used. And if the number is to be interpreted as a computer instruction, then the computer must be told that, too.

To tell the computer what to do, programmers write long lists of coded instructions called *programs*.

If your computer goes to a specific memory location and finds a program instruction there, it will do whatever the instruction tells it to do, and it will then move onto the next instruction. It will keep doing that, at lightning speed, until it finishes running a program.

There are countless varieties of computer programs. Your Commodore's ROM has the BASIC language built-in, so that you don't need any special software to begin programming immediately. Later in this book we will discuss other programming languages available for the Commodore, as well as suggest books and publications that will help you learn how to program.

Computer programs can be written in many languages. BASIC, an acronym for "Beginner's All-purpose Symbolic Instruction Code," is the programming language most widely used by computer owners. Other popular languages available for your Commodore 64 include COBAL, FORTH and PASCAL.

Interestingly enough, a computer can't understand any of the languages that programs are usually written in. A computer can actually only understand a single language—*machine language*.

Machine language is composed of nothing but numbers. When a program is written in some other language—like BASIC or PASCAL—then the program has to be converted into machine language before the computer can understand it.

To convert programs from these "high-level" languages into machine languages, programmers use software packages called *interpreters* or *compilers*.

## **BITS AND BYTES**

If you never use your Commodore 64 for anything but running prepackaged programs, then you'll probably never need to learn something as esoteric as binary numbers.

But if you ever intend to learn to program, a knowledge of binary numbers can be pretty helpful. And even if you never write a program, knowing how binary numbers work will help you understand many computer-related topics, such as the difference between 8-bit computers which include the Commodore 64 and the Apple IIe, versus 16-bit machines like the Apple Lisa and IBM PC.

Binary numbers, as you may already know, are numbers consisting of solely ones and zeroes. They are the *only* kinds of numbers your computer—or any computer—can understand.

To a computer, a switch is on or a switch is off; an electrical signal is there or it isn't. That is how a computer works. That simple. A circuit is open or closed, on or off, charged or not. Big brain, huh?

Computer designers sometimes call this two-state logic. Mathematicians sometimes call it Boolean algebra.

In the binary system the digit 1 symbolizes the positive, a cur-

### **BINARY NUMBERS, OR IT'S EASIER BY TWOS**

In our decimal system, number columns are ranked by ten-fold increases:

The number 100, for instance, means one hundred, no tens, no ones.

1110 is one thousand, one hundred, one ten and no ones.

In binary numbers, each column to the left indicates a number twice as large as the number in the first column, like this:

**EIGHTS    FOURS    TWOS    ONES**

The decimal number 8 would be written as 1000 in binary:

One eight, no fours, no twos, no ones.

The great thing about binary numbers is that they can be represented completely by 1's and 0's, yeses and nos, unit electrical charges and zero charges, or switches opened or closed.

rent that's flowing, for instance, or a switch that's on. The digit 0 represents the negative, a current that's not flowing or a switch that's off.

Remember, that's all your computer understands. There is no number 2 in the world of computers. The only way to represent the number 2 in binary, is to take a one and move it one space to the left, and follow it with a 0. Like this: 10.

That might look like a *ten* to you, but to a computer it isn't. 10 is *two*, 11 is *three*, 100 is four, 101, five and 110 is six in the binary thinking of a computer.

When ones and zeroes are used to express binary numbers in this way, they are called *bits*.

A group of eight bits is called a *byte* and a group of four bytes is called a *nibble* (sometimes spelled nybble). And a group of 16 bits is called a *word*.

Binary numbers look very odd when you first encounter them, but after you've been around them for a while you begin to notice certain patterns.

In the binary system, for example, every number that ends in zero is twice as large as the previous round number. In other words, it is the square of the previous round number.

Look:

00000001 =	1	00010000 =	16
00000010 =	2	00100000 =	32
00000100 =	4	01000000 =	64
00001000 =	8	10000000 =	128

Here are two other numbers that might be worth remembering.

11111111 =	255
11111111 11111111 =	65,535

The number 255 is noteworthy because it is the largest 8-bit number there is. It is called an 8-bit number because it has eight places in binary notation. And since eight bits are known as a byte, 255 is also the largest number that can be represented as a byte in the binary system.

The number 65,535 is the largest 16-bit number—the largest number that can be called a *word* in the binary system.

What does all this matter? Well, it actually matters a great deal.

Remember the Commodore 64's 8-bit 6510 microprocessor? It is designed to handle binary numbers up to 8 places long, but no longer. It can only handle 8 bits of data at one time.

So, it can't perform calculations on numbers larger than 255—and it can't even perform calculations with a *result greater than 255!*

Obviously, this places some severe limitations on the ability of the Commodore 64—and other 8-bit computers like it—to perform calculations on large numbers.

Of course, there are ways to get around these limitations. But it isn't easy.

To work with numbers larger than 255, an 8-bit computer has to perform a convoluted operation. It has to break the number into 8-bit chunks, perform each calculation on a 8-bit number, and then patch all the numbers back together again.

If the result of the calculation is more than 8-bits long, things get even more complicated. That's because every *memory location* in an 8-bit computer—every cell in its RAM or ROM—is also an 8-bit register. So, to store the number in the computer's memory, you have to break it into two or more numbers and store it in two or more memory locations. Then, when you need the number again, you have to patch it together again.

If you've got all that, you can understand why 16-bit computers—like the IBM PC—can run faster than 8-bit computers. A 16-bit computer can work with binary numbers up to 16 bits long, and so can handle numbers up to 65,355 in single chunks. An 8-bit computer can do that only with numbers up to 255.

Because of the way their memory locations are laid out, 16-bit computers can also keep track of much more data at one time than 8-bit computers.

There's a lot more that could be said about 16-bit computers. But since the Commodore 64 is an 8-bit computer, there's no reason to discuss 16-bit computers any more right now.

PEEKs and POKEs are two terms commonly used in the literature about the Commodore 64. PEEKs and POKEs are a way that you can program your 64 to play music or display graphics.

If you are not a programmer, you might not have much use for them at first. But the more you understand your computer—especially if you read this far and you're interested in pro-

gramming—the more useful you will find PEEKS and POKES.

Simply put, a POKE command places a value into a given memory location, and a PEEK command returns the value stored in that location—letting you see what's there.

What happens when you POKE a number into a particular location depends entirely upon what the location is. In some locations all that will happen is that the number you POKED will be stored in the location.

In other locations, you might change the color at a specific point on the screen. Or you might make a sound.

If you want to try POKEING, type the following message into your 64 (make sure the screen displays READY):

```
POKE 53281,10
```

Nothing happened yet, right? Now, hit the return key.

What probably happened is that the background color of the screen turned light red. It did that because the location you POKED the number into is the location that controls the background color of the screen. And the number 10 represents the color light red.

# 3 PERIPHERAL VISIONS

If all you want to do on your 64 is to play games or draw pictures, and if you never want to save anything you've done, then take your computer out of the box, connect it to a television set, and you'll be ready to go.

But chances are that you will want to take advantage of the many things the powerful 64 can do. In order to use the computer to its fullest potential, you will want to add accessories—called peripherals in computerese—to expand the system's capabilities.

Peripherals are hardware items that connect to the main computer, giving it added dimensions. You can add all types of peripherals, from monitors and printers to cassette and disk drives. Just think of them as you would components for a stereo system. Some, such as a monitor or a television screen, are as necessary to a computer system as speakers are to a stereo system.

Others, including disk drives, give an added flexibility, the same way a turntable or tape deck gives an added dimension to a stereo system.

Obviously there are some peripherals that are more important than others and there are some that, although not absolutely necessary, are nice to have.

For example, if you want to save information you must have a cassette or disk drive to store data magnetically.

A cassette—or Commodore's Datasette—is just fine for this task. However, saving and retrieving information from a cassette tape is time consuming. A disk drive, on the other hand, is many times faster than a cassette drive, but disk drives are also many times more expensive than cassette drives. And the diskettes that go into the drive are more expensive than recording tape.

If you are someone who demands your computer operate as fast as possible, and you can afford the price, you should probably get a disk drive. If you are patient and can tolerate the waiting involved with using a cassette, then there is probably no reason—now, anyway—to spend money on a disk drive.

There are many other types of peripherals that you may or may not want, depending upon what you plan to do with your Commodore 64. These include modems, game controllers, operating systems, added memory and more.

In the next several chapters we will take a look at the peripherals that are likely to interest you.

## **YOUR COMPUTER'S SCREEN GEM**

The most important peripheral for any computer is a screen to display text and graphics. There are two ways of doing this with your Commodore 64: on a television or on a monitor. Video monitors are sometimes referred to as CRTs (cathode ray tubes).

The primary differences between the two—besides price—are that a television set has a tuner and a monitor does not, and that a monitor often can give much higher resolution picture than a standard TV.

A tuner is the part of a television set that converts broadcast signals into video signals. Since a monitor is made specifically to connect to a computer, it doesn't need to receive broadcast signals, and so it has no need for a tuner.

Monitors are made with video inputs designed to accept straight video signals. Television sets are made to accept radio frequency inputs (RF), which receive broadcast signals from television antennas.

Your Commodore 64 has what is called an RF modulator, which alters the signal the computer sends out so that it can be interpreted by a television set. It converts the 64's composite video signal into a TV signal. If you connect your 64 to a television, following the instructions at the beginning of this book, it will work just fine.

There's even some good news about how well your 64 will work with a television set.

Some early models of the 64 suffered from RF interference,



*The model 1701 color monitor from Commodore offers clarity and brilliant picture quality.*

which distorted the image on the TV screen. Once this was discovered, to correct the problem, Commodore added aluminized cardboard shielding over the circuit board, and a metal plate underneath it.

### ***Tuning in to Monitors***

Monitors, because they are specifically designed to operate with the signals sent from computers, often give better resolution. That means the image on the monitor is sharper, brighter and better defined, than it would be on a TV.

The tuner in a television set is prone to interference, from local stations as well as from stray signals that may be generated

by your computer. And when the RF modulator translates the composite video output into a broadcast signal, a little something is lost.

Through it's audio/video port on the back of the computer, the 64 can put out pure video signals and a video monitor can accommodate these signals which is why you get a clearer display. There are two separate outputs called chrominance and luminance.

If you were to attach a monochrome monitor—one that displays only one color (for example, a black and white television)—you would only need the luminance signal. That signal controls brightness or darkness of the screen.

Monochrome monitors offer excellent resolution of characters, and if you only intend to do word processing and such on your 64, this would be the type of monitor for you.

These monitors come in a variety of colors, the most common being green, followed by those featuring amber screens. There are countries in Europe that only permit amber monitors in office environments, claiming they cause less eyestrain.

There have been ongoing debates, over the past several years, about what color monitors are best. The only way for you to decide is to look at the various monitors yourself.

There are many good monochrome monitors around that will connect to the 64. They usually range in price from less than \$100 to around \$300. Among the best are those made by Amdek, Taxan and NEC. One interesting monochrome monitor is called the Gorilla, from Leading Edge, which is a green-screen model for less than \$100.

If you intend to work with anything besides words and numbers, it would be a pity to connect the 64 to a monochrome screen, because you wouldn't be able to take advantage of the computer's 16-color graphics. Color monitors are considerably more expensive than monochrome monitors, however, starting at about \$300 and going up from there.

For color output, you must get both the chrominance and luminance signals from the computer to the monitor.

This isn't quite as simple as it sounds. To connect a color monitor to the Commodore 64, you must have a special five-pin cable—a DIN cable, to be precise—that plugs into the back of the

64. The pins on the DIN cable have to be specially configured so that the chrominance and luminance go from your computer to the right place in the monitor.

Exactly how this cable is configured will depend upon what kind of monitor you are connecting.

The drawing on page 8 indicates the various connections on your Commodore 64, including an audio/video output. On page 9, the photograph shows the back of a Commodore Video Monitor and how to correctly connect your 64.

Use caution when purchasing a monitor. Not all monitors will work properly with the 64 without a lot of headaches.

Rather than take chances, make the salesman connect the monitor you want to the 64 *before* you buy.

One monitor that connects easily to the 64 is Commodore's own 1701 Video Monitor. Discounted to under \$300 of late, it has *two* different ways it can be connected to your computer.

A connection on the front of the monitor accepts the standard composite video and audio signals. On the rear of the monitor is a special connection that separates the luminance signal, producing stunning color separation. To connect the 1701 to the rear of the 64 you will have to get a special, custom-made cable.

If you don't want to spend the money for a special monitor, there's a peripheral that *might* improve the display on your television screen so that it looks almost as good as a monitor.

Called the Video Improvement Device (VID), it plugs into the video cable output. The VID seems to markedly improve screen resolution on many—but not all—televisions. You might write, or call the manufacturer, Computer Accessories, 1135 Columbus, Bakersfield, CA., (805) 872-4488, to find out how they do with the type of television you're using.

## **A PRINTER PRIMER**

It's a common practice for new computer buyers to delay the purchase of a printer. They assume they just don't need to put what they have *in* their computer *onto* paper.

They quickly find out they're wrong.

If you do any word processing—typing letters or reports or even the novel you've been planning to write—you'll find that the

urge to be able to transfer what you've done onto paper is almost overwhelming.

And, with many of the other things you do on a computer, like financial calculations or record keeping, you will find it essential to have some kind of copy you can take with you.

There's another reason to have a printer. A computer screen is only a window on a larger body of material. For example, if you have written an eight-page letter, you can only see a small part of it at any given time on a computer screen.

So, if you want to look at the whole thing at once, you will have to print the letter out onto paper.

Choosing the right printer can be pretty confusing. There are many different models available, and there are several things a buyer should look for.

One is the quality of the print. It varies widely, so make sure you see an example of the type from a particular printer before you buy it.

A second matter of interest to the printer buyer should be the speed at which the printer does its job. The range goes all the way from about 10 characters per second to well over 150 characters per second.

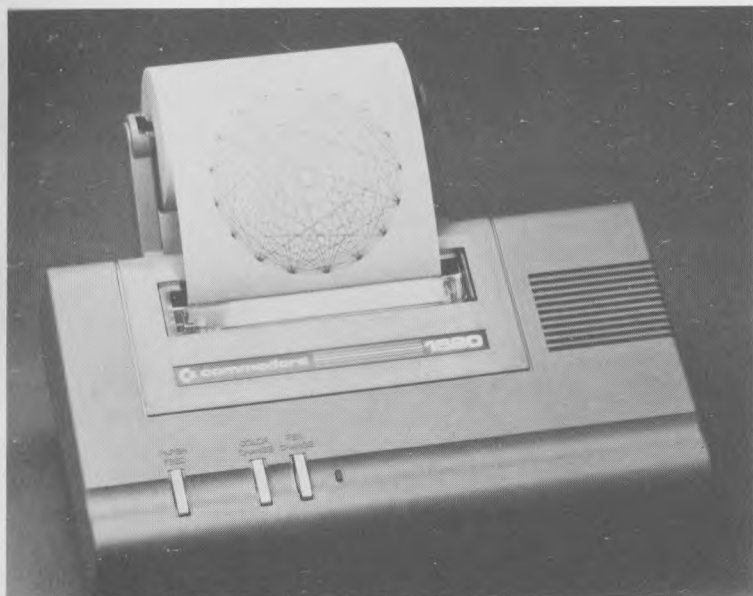
Even 10 characters per second is faster than a typist could go, but it takes forever to print out a 200-page document at that speed. If all you ever plan to do is generate single pages, slow printers are fine. If you plan to generate long documents, you will want added speed.

Perhaps it is too obvious to stress, but the general rule is that the faster a printer prints and the better the quality of the type, the more expensive it is.

There's another important thing to know about printers—not all of them will work with your Commodore 64.

In fact, the only printers that will work with the 64 just as they are when they come out of the box are those made by Commodore for use with your 64. These include the 1525 printer (under \$300) and the 1526 printer (under \$400). Both are dot-matrix printers that produce documents up to 80 columns wide (explained below.)

There are two problems associated with hooking-up other brands of printers to your 64. First the printer has to be able to understand the messages the 64 sends to it, and second it has to



*The Commodore 1520 Plotter Printer allows you to create bar charts and graphic illustrations with four available colors.*

have a way of connecting to the Commodore.

A number of companies make interface cards that permit you to connect other printers to the 64. One very popular one is the Card/Print B by Cardco (approximately \$50), but there are others ranging in price from \$50 to \$120.

Once you connect the interface card, many—but not all—printers will work with your 64. A good rule is to try it before you buy it.

Computer printers are generally categorized by the way they print. There are several types of printers, including thermal printers, dot-matrix printers, daisy wheel printers and printer-plotters.

### ***Thermal Printers***

Thermal printers are generally the least expensive printers on the market. They don't have type wheels and they don't print by impact.



*Getting graphic with Alphacom's model 42, 40-column thermal printer.*

Rather, a thermal printer uses heated needles to print letters. Each letter is made of a series of dots, and the needles arrange the dots in the proper configuration, so they look like letters.

Because of the way they print, thermal printers have to use special paper that reacts to the heat in the pins. Paper for most thermal printers comes in a continuous roll.

As the thermal printer prints, the "head"—the part of the machine that pushes the heated needles against the paper—moves across the page. Each letter is printed individually.

Most thermal printers have a width of 40 columns—just like the standard screen of the Commodore 64. They operate very quietly, almost noiselessly, because there is little pressure exerted by the pins.

You can get a good thermal printer for \$150 or less. One of these is the Gemini STX-80 which retails for under \$200. It is an 80-column printer, which means it can generate full-width pages (the average typewritten page is 60 columns wide).

A less expensive alternative is the Printex, which prints in a 40 column width and sells for under \$150. Two other well-known manufacturers of thermal printers are Axiom and Alphacom.

There are some reasons that thermal printers are not as good as other printers for some purposes. The type quality isn't always good, the special heat-sensitive paper is expensive, and finally, heat-sensitive paper deteriorates. So if you need correspondence quality documents, or if you plan to keep documents filed away for years, a thermal printer is not for you.

However, if all you want to do is print documents that will be read and discarded, not saved for years, and if you can live with the appearance of printing on heat-sensitive paper, thermal printers are the best bargain on the printer market.

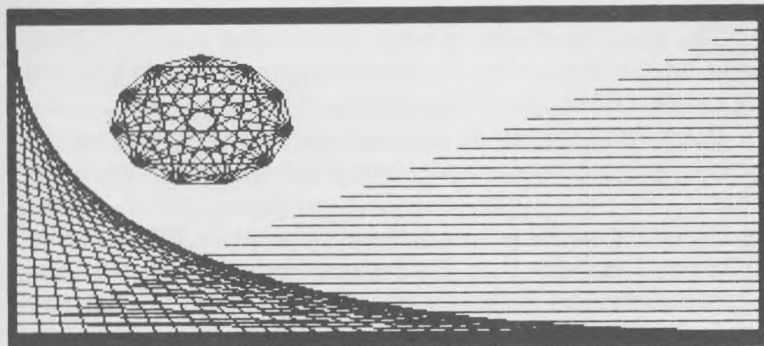
### ***Dot-matrix Printers***

Dot-matrix printers, like thermal printers, use needles to print letters made up of small dots. But unlike thermal printers, dot-matrix printers make their mark by striking a ribbon like a regular typewriter.

For speed in computer printing, it's hard to beat a good dot-matrix printer. (Some new printers, called ink-jet printers, are faster—but they're fantastically expensive.)

What the type looks like from a dot-matrix printer depends upon how dense the matrix is. The more needles per inch, the blacker and heavier the characters are. The fewer needles, the lighter and less-formed the characters are.

Most people who use computers quickly become accustomed to characters formed from dots, and after a while they don't even notice that the letters don't look the same as they would if they



*Bit-image graphics from an Epson printer.*

were typed on an IBM Selectric. But people who aren't used to computers sometimes find this style of type aggravating. However, the printing produced by dot-matrix printers has now become acceptable for both business and personal correspondence.

Because of the way they use needles to form characters, both thermal and dot-matrix printers can print pictures. Daisy-wheel printers, which use formed letters like those on a typewriter, cannot print graphics. This is something to consider when getting a printer for your 64 because so much of what you do might involve graphics.

The single largest manufacturer of dot-matrix printers in the world today is Epson, which is a division of the same company that makes Seiko watches. Epson printers, which vary in print quality and size, begin at about \$500.

Other well-known manufacturers of dot-matrix printers include Okidata, Star Micronics, Mannesman Tally and C. Itoh. Star makes a dot-matrix printer called the Gemini-10 that is exactly like the Epson printer—but costs much less. Another bargain printer worth looking for is the Gorilla Banana by Leading Edge. It can be purchased for under \$300.

### ***On the Daisy Wheel***

When you hear references to “letter-quality printers,” computer people are usually referring to daisy-wheel printers, which print formed characters by striking a ribbon with a solid piece of type.

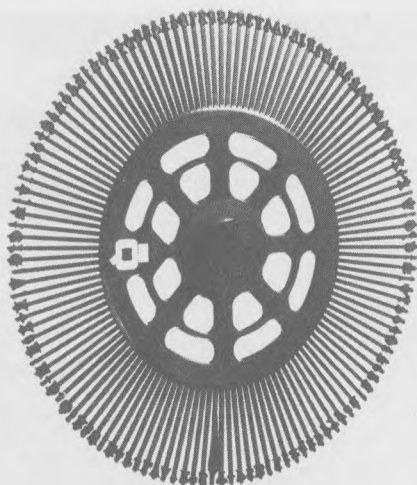
The elements of a daisy-wheel printer that hold the letters, are like the strikers on an old typewriter, except that they extend from a central hub, looking somewhat like the petals of a daisy.

Daisy-wheel printers *do* produce beautiful type, but unless you are in a business that demands sharp print, they aren't worth the price.

Good daisy-wheel printers sell for well over \$1,000, and some cost more than twice that. But recently there has been a trend toward lower prices, and some adequate daisy-wheel printers now retail for under \$600.

There are inexpensive daisy-wheel printers around, by Smith

*The Qume 130-character daisy wheel, available in a variety of type styles, prints letter-perfect characters.*



Corona and Brother, but they are exceedingly slow (less than 20 characters per second).

There are two other types of printers you might encounter: ink-jet printers and printer plotters. Both are designed for special purposes.

Ink-jet printers can spray multicolored images on paper with tiny jets of ink. Good ones cost many thousands of dollars.

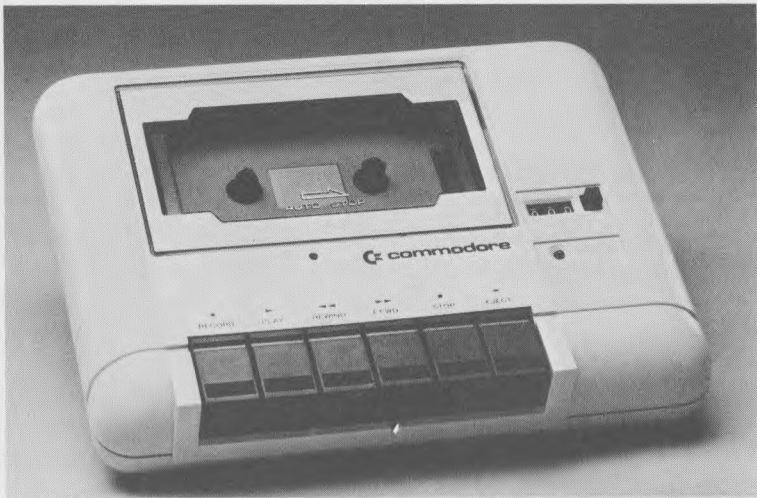
Printer-plotters actually draw pictures on paper with color pens. Commodore makes a printer plotter, called the 1520 printer plotter, which can create bar and pie charts and graphic illustrations. It retails for under \$200.

## **IN COLD STORAGE**

To most computer users, some sort of storage device is an absolute essential. Remember we said in our discussion of your 64 that it can only remember things in its RAM until it's turned off? After that, information has to be reloaded.

That is why you need a mass-storage medium. Mass-storage mediums are used to store texts, data and programs that you or someone else has written. This data can then be loaded into your computer's working memory so you can use it.

Look at it this way. If you were to write a letter to a friend



*The Commodore 1530 Datasette recorder and player lets you easily store and retrieve programs. It plugs directly into the computer console.*

on a Commodore 64, it would be there only while the computer was on. Once you turned the computer off, the letter would be gone.

That would be fine if you had a printer and wanted to make only one copy of the letter. But suppose you wanted to save it in your computer, keep it for a while, and maybe change it later on before printing it out. The only way you could do that would be with a mass-storage device.

There are two main varieties of mass-storage devices that can be used with the Commodore 64—cassette drives and disk drives.

A cassette drive is nothing but an ordinary cassette tape recorder hooked up to a computer. But instead of recording voices or music, it records data. Cassette machines record data magnetically, the same way they record music.

A disk drive does the same thing, but in a different way. The disk looks like a little record. It's made out of the same material as recording tape, but is shaped differently. Because of its shape, a disk is much faster than a cassette tape for storing and retrieving information.

Because the disk is flat, the heads of the disk drive can move back and forth across it to find and store information. That is

many times faster than a cassette recorder can wind a tape across its electronic head.

In terms of cost, disk hardware is much more expensive than a standard cassette recorder. And for that reason, many people use cassettes instead of disk drives.

You can't use just any cassette recorder—or, for that matter, just any disk drive—with the Commodore 64. Once again, the mass-storage unit must be one that can be connected properly to the computer—or *interfaced* with it, to use a computer term.

If you are considering using cassettes with your computer, Commodore makes a cassette drive called the C2N Datasette that is specially designed to work with the 64. It sells for about \$75.

If you would rather use another kind of cassette recorder, you will have to purchase an interface that connects the recorder to the 64. There are many available. One, by Cardco, sells for about \$35.

If you decide to buy a tape recorder other than the C2N Datasette, remember that it must be a monophonic (one-channel) recorder. A stereo tape recorder will not work with your 64.

Once you have connected a cassette recorder to your 64, you will have to know how to load and save programs.

To load a program from tape, rewind the tape from the beginning and type the following message, substituting the program name in the blank space between the quotations:

LOAD "-----"

After you press return, the computer will tell you to press the *play* button on the recorder. After the computer tells you it has located the program you are looking for, depress the Commodore KEY (the key bearing the Commodore logo); this will start the program. (If you cannot remember the name of the program, simply type LOAD and the first program will be loaded into the memory; continue with the rest of the above instructions.)

## **A DISK DRIVE DISCUSSION**

If you plan to connect a disk drive to your Commodore 64, it is best to stick with the Commodore 1541 disk drive, which was specially designed to operate with the 64 machine.

Although it is possible to connect other disk drives to the com-

puter using an interface, the 1541 should be fine for most purposes.

Commodore disk drives are unlike many others on the market. They are "smart" drives, with the disk operating system (DOS) built into them. That means the drive can function independently of the computer to perform certain disk maintenance functions.

The 1541 uses standard 5¼ inch floppy diskettes, which are about the size of a 45-rpm record, and can hold up to 170,000 characters each.

Diskettes are packaged in a protective cardboard sleeve. They remain in that sleeve for life, and should *never* be removed. The entire sleeve slips into the disk drive. The sleeves are designed to protect the disk the same way the plastic casing around a cassette tape protects the tape.

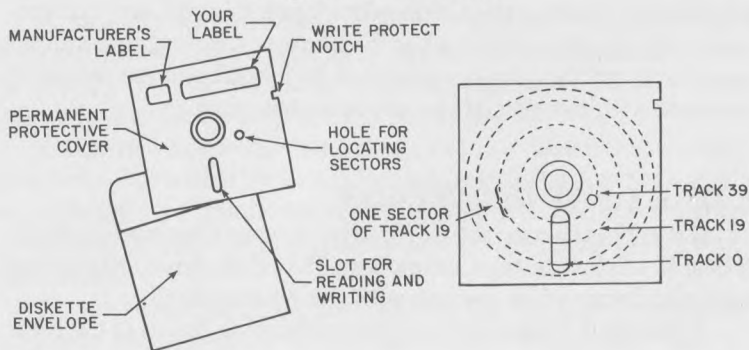
In the center of each disk sleeve you will see a slot through which a strip of the disk itself shows. This is so the disk drive can contact the disk and read it.

DO NOT HANDLE THE DISK ITSELF.

Handle disks only by the protective sleeve, and handle them carefully. They will not tolerate bending, folding, mutilating or even pressure from a ball point pen. Keep them out of direct sunlight and away from drooling dogs and nosy children. If you do, they will last for months and maybe years.

A disk is always loaded into a disk drive with the label side up. On the left side of the disk you will see a notch, called the write

### Diagram of a Diskette





*The model 1541 external 5¼-inch floppy diskette recorder and player offers high-speed and increased capacity for storing or playing back programs and data.*

protect notch. If this notch is not on the left side of the disk as you slip it into the disk drive, the disk is upside down.

Follow the directions in Chapter 1 of this book for installing a disk drive. Once the drive is connected, you will need to know how to load and store information.

To load programs from a disk, type the following message, substituting the name of the program you want for the blank space between the quotation marks:

LOAD "-----,8"

The number 8 tells your computer to go to device 8, which is the disk drive. After you hit return, the disk drive will begin working and the display will show:

SEARCHING FOR (program name)

LOADING

READY

Type RUN, and the program will be ready to go.

Want to know a trick?

Pay attention, now, because if you use a Commodore disk drive, what we're going to say now could save you a great deal of time.

When you bought your disk drive, it came with a diskette that had some technical-looking programs on it.

You probably ignored them, didn't you?

Well, if you load one of those programs, every time you are about to use your disk drive, you will save yourself great amounts of time.

How? If you own a disk drive, you can find out how right now.

Put that disk, called *DOS SUPPORT*, into your disk drive. Then type this message:

```
LOAD "*" ,8
```

Next hit the return key. Then type RUN.

Now, until you turn the drive off again, you can quickly load and execute programs.

All you have to do to load a program is type / (the symbol found under the question mark on the keyboard), and then the name of the program. It will load and execute.

If you want a directory of the disk, type /\$.

Do you want to *format* a disk (make it ready for the 64 to use)? With the 64 you can't just use a disk right out of the box, you know. You have to get it ready first by formatting it.

Put a blank disk into the drive. If you hadn't used our little program (and when you don't), you will have to do this to format a disk:

First type

```
OPEN 15,8,15
```

Now hit the return key [R]. Then type:

```
PRINT#15, "NO:MYDISK,20"
```

Hit [R].

When the disk is done whirling you will have to initialize it by typing

```
PRINT#15, "10"
```

Hit [R].

To format a disk after loading the program from *DOS SUPPORT*, type

```
≥NEW
```

That's a little easier, right?

There is one other type of mass storage device, recently available, that might be of interest to users of the Commodore 64. Called stringy-floppies, these are said to be economical alter-

natives to disk drives. These are, in essence, high-speed cassette recorders. They are said to be faster than disk drives on some kinds of functions, slower on others.

There are just a couple on the market at this time. One to look for is the ESF-20/64 by Exatron. It sells for under \$100.

## **A MODE OF COMMUNICATION**

You don't have to have a modem to enjoy your Commodore 64, but it sure helps.

A modem, which stands for *modulator/demodulator* is your computers way of connecting to the rest of the world. It's a device that allows your computer to communicate with others computers over the telephone lines.

Later on in this book, we'll discuss at length the types of things you can do with a modem. Suffice it to say, that you can access a universe of information, information that was never at your fingertips before.

With a modem as a peripheral you can use your computer to get the latest news and stock reports, you can research hundreds of subjects, and you can communicate with other computer owners via electronic mail.

Because your Commodore 64 doesn't send out the standard ASCII character set—the character codes sent out by many other computers—you must use a special Commodore modem that translates the messages from your Commodore into the standard communications codes, or you must buy a modem interface that handles the job for a non-Commodore modem.

There are two varieties of modems: acoustic and direct connect.

An acoustic modem is a rectangular device about the size of a standard checkbook. On top it has two rubber-rimmed cups. To use an acoustic modem, you first dial the number you are contacting, and then wait for a high-pitched tone that tells you the computer at the other end of the line is waiting to talk. You then place the handset of your telephone into the cups of the modem. When a "ready" light on the modem turns on, your computer is ready to start sending and receiving data.

The second form of modem is called direct connect. It plugs



*The Commodore 1650 is a 300-baud, direct-connect, automatic modem featuring auto answer and auto dial.*

directly into your computer at one end and into your telephone at the other. Because direct connect modems require no other coupling, they are both more convenient and more dependable than acoustic modems. Also, with a direct connect modem there is less chance of outside interference with data communications.

Your Commodore 64 generally uses a 300-baud modem, which means it will communicate with another computer at the rate of about 30 characters per second. You will also need special "terminal software" so your computer can communicate. Many times, the software is supplied with the modem designed for your 64.

Commodore manufactures two modems specifically for your 64. Both plug into the cartridge port of your computer and connect directly to a telephone. Both come with ready-to-use software.

The VICmodem sells for under \$80. A new auto-answer/auto-dial modem, which permits your computer to dial telephone numbers and so does away with the possibility that *you* will dial a wrong number, sells for about \$120.

It's possible to hook other modems to the Commodore 64, but there's no reason to consider it. Other modems—with the sole ex-

ception of the HESmodem, a copy of the VICmodem—are more expensive and are more difficult to connect.

In this case sticking with the Commodore product is the best idea.

## **ADD-ON ATTRACTIONS**

Many peripherals for the Commodore 64 plug into ports and expand the capabilities of your machine.

Some of this equipment is highly technical, and requires some real computer knowledge to be very useful. These esoteric devices include components that can enable you to modify your 64 so that it emulates other Commodore machines, or so that it can use disk drives and peripherals designed for Commodore business machines.

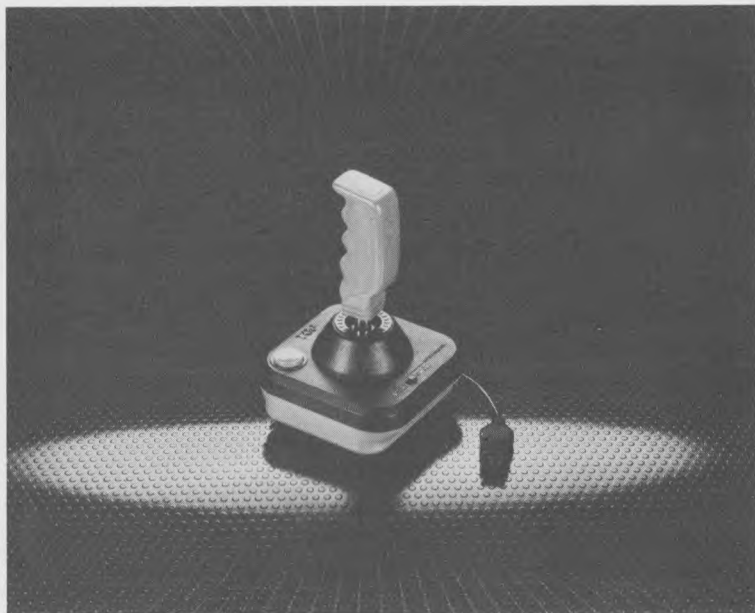
There is a digital-line input module called the BUSSTER A64 that is a self contained IEEE BUS compatible device. But there are also many expansion peripherals that might be of interest to a broad base of Commodore 64 users.

Plug-in expanders such as the Cardboard 5 from Cardco expand the capabilities of your cartridge slot. The Cardboard 5 turns your single cartridge slot into *five* slots, which can be switched on or off. So you can have instant access to five cartridges, without plugging and unplugging. The Cardboard 5 sells for under \$70. Other slot expanders range in price from \$70 to \$150.

If you feel you need a numeric keypad for your Commodore 64, the kind accountants are accustomed to using, you can get them, too, for about \$90. Or how about a box that allows you to hook your computer up to a stereo set? The Sound Box from Human Engineered Software, sells for about \$15.

If you ever think you'll want to operate your 64 while you're cruising down the road, a company called Random Access Marketing may have just the thing for you. The company is planning to sell something called the Powermaster, which will let you power the Commodore 64 off of your car cigarette lighter.

As you can see there is no end to the variety of peripherals available for your Commodore. Additionally, there are items like light pens and graphics tablets for drawing, and surge suppressors for protecting sensitive microchips from power surges.



*Connecting a Wico joystick to the 64 console for game play control.*

With a light pen, you can draw a picture on a video screen and automatically store it in your computer's memory.

A graphics tablet lets you draw on a "pad," which then transmits what you've drawn to the computer's screen. One popular one, the Koala pad, is a popular peripheral for Apple computers and is soon to be released for the Commodore 64. It is expected to sell for under \$100.

For you game players there are all sorts of controllers out there that will help you play better. There are three basic kinds of game controllers: joysticks, paddles and trackballs.

Joysticks, modeled after the airplane joysticks, are the most popular of the game controllers. Any joystick that can be used with Atari computers and video games will also connect to a Commodore 64. This gives you a wide variety of very popular joysticks.

Paddles are hand controllers with rotary knobs that can move onscreen objects only in a straight line.

A trackball is a tabletop game controller with a round ball sticking out of the top. A track ball can move a cursor or player in any direction with great accuracy.

Well-known manufacturers of game controllers include Wico, Kraft, TG Products—and, of course, Atari.



*Rocklan's Un-Roller game controller features a fire button and trackball:*

# 4 SOFTWARE SIGHTS

As you already know, your Commodore 64 is a sophisticated computer with the potential to do all types of amazing things. But before it does *anything*, you have to tell it what you want it to do.

The set of directions that tells your computer to do something is called a *program*. A program is to a computer what a record is to a record player. The record player has the potential to play Brahms or the Rolling Stones. But it won't play anything until you put a record on the turntable.

Your Commodore computer has the potential to play games or add numbers or make pretty pictures. But again, until you load a program, it won't do any of those things.

To make your Commodore 64 say hello, for example, you would type into the keyboard: PRINT "HELLO" and then hit the return key. The computer will immediately display the word HELLO on its monitor. It does that because you told it to. You wrote a program made up of a single instruction!

Of course, you will want your 64 to do more than print the word HELLO on the monitor. Perhaps, for example, you would like to play a game.

Telling your computer to play a game is obviously far more complex than telling it to say hello. If you don't know how to program, it would take you weeks, maybe months, to become proficient enough to write a simple game. If you're planning on playing complicated games, with lots of colors and moving objects, for example, it will probably take you months, if not years to figure out how to write one.

There was a time, back in the early days of home computers, when you had no choice but to write programs yourself. Fortunately, things have changed.



*Software for the Commodore 64 is available on disks and cartridges.*

Now, instead of writing your own programs, you can purchase programs designed and written by someone else. In the computer business, these packaged programs are called software, and there is software available to make your computer do just about anything you would ever want it to do.

You can buy programs for your 64 in three forms—as plug-in cartridges, on cassette tapes or on floppy diskettes.

Cartridges are nice because they don't need to be *loaded*. Once they are plugged into the 64 console, they come on, or “boot up,” as soon as the computer is turned on. But they offer no opportunity for storage, so you will need a cassette recorder or a disk drive if you plan to save what you do. Programs on cassette tend to be less expensive than those on floppy disks, and the cassette drive is unquestionably less expensive than the floppy-disk drive. Floppies are faster, but the cost of the disks and drive may turn you away.

There's some very good news about software for the 64. No matter what format you get it in, it's readily available, there's lots of it and, compared to what's offered for many other machines, it's cheap.

Software can turn your 64 into a sophisticated video game machine, or into a business tool that does accounting and filing, or into a high-tech typewriter that helps you produce letter-perfect documents. With the proper software you can figure out your income taxes, learn to type, balance your checkbook, keep track of recipes and teach young children how to add and subtract. And that's just a start!

What software you buy will depend only on your desires and your budget.

A word of advice about buying software. Manufacturers often promise all sorts of things, and the packaging is designed by professionals whose sole aim is to entice you, the buyer, into spending your money.

To avoid disappointment, work extensively with any software you intend to purchase *before* you take it home. Make certain that the program does everything you want it to. If you are in a store that refuses to let you try the software before you buy it, leave.

It would be impossible in a book this size to review every single piece of software available for the Commodore 64. Instead, we will look at categories of software, discuss what to look for, and suggest some program in each category that might be of interest to you.

Most software can be divided into four general categories:

1. Entertainment
2. Education
3. Business and Home Management
4. Computer-related software (including programming languages, telecommunications software, sound and graphics packages).

On the following pages we will discuss what each of these categories of software offers, and we will take a close-up look at some of the programs that are available.

## **ENTERTAINMENT SOFTWARE**

There are lots and lots of reasons to buy a home computer, but experts say the real reason most people buy machines like the Commodore 64, is to play computer games.

And what's wrong with that? They are infinitely more chal-



*Arcade titles and original game designs from Commodore's own software library.*

lenging and interesting than most of the board games people were snapping up less than a generation ago. And, not surprisingly, many of the same companies that used to make board games are now making computer games. If you look around, you'll find plenty of computer game programs manufactured by Parker Brothers and Mattel.

According to the Yankee Group, a Boston-based market research and consulting company, games account for more than half of the software that is purchased by owners of low-priced computers (machines that sell for \$500 or less). And owners of more expensive computers seem to like games, too. Entertainment software makes up a full 15 to 20 percent of the prepackaged programs purchased by owners of personal computers that cost more than \$500.

There are two main types of computer games; games of action and games of adventure.

Action games are modeled after arcade video games. There

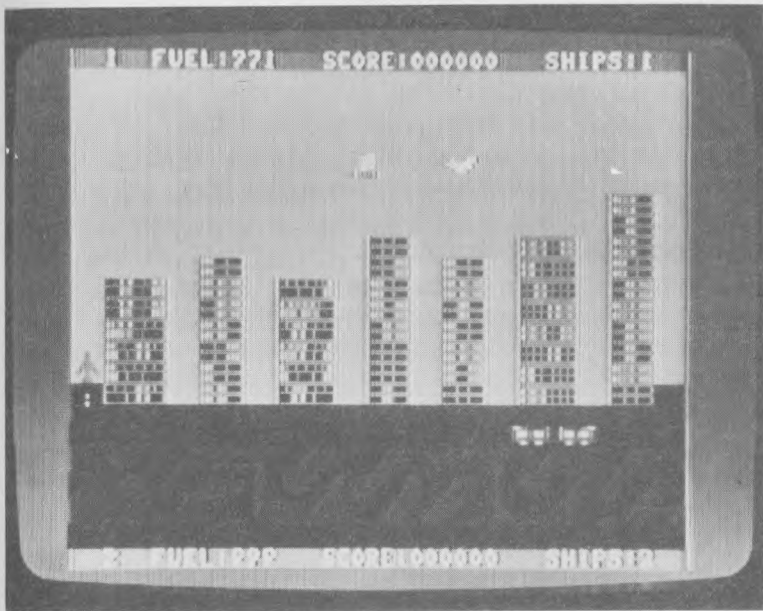


*Creative Software's Astroblitz delivers coin-op style entertainment.*

is lots of quick motion and often some sort of violent activity. The first computer action game dates back to 1972, when Nolan Bushnell, one of the founders of Atari, created a game called *Pong*, an electronic Ping-Pong game, in which players used rectangular paddles to bat a little spot of light around a television screen. The players used hand controllers with little knobs on top, and the controllers soon came to be known as paddles, and today that's what they're still called.

Action games progressed quickly from miniature versions of sport to miniature versions of war, with games like *Space Invaders* and *Asteroids* moving out of the arcades and into the homes. Today there are scores of action games for the 64, with themes as diverse as fighting spaceships and getting a frog across the street alive. Many are very much like the games in the arcades, and some seem even better. They all share one thing—your reflexes better be good, or you'll be in trouble.

One arcade favorite that is available for the 64 is *Frogger* by



*Save New York is a challenging video game creation from Creative Software.*

Sierra On-Line. If you're unfamiliar with the game, you're in for a real treat. You're a frog, and all you have to do is move across the street and a river five times.

Sounds easy, right? They all do at first. The problems come when you realize that the streets are filled with speeding cars and trucks and the river is crowded with crocodiles, snakes, otters and diving turtles.

You get across the street by avoiding the traffic, and you get across the river by jumping on logs or turtles or the stomachs of crocodiles. If the turtles dive or the crocs snap, though, you die.

*Frogger* is available on many home computers, but few do the game real justice. The 64, with its colorful graphics and music capabilities, does. The frogs look froggy, the logs loggy, the crocodiles deadly.

When you start the game you must first choose the four keys that will represent up, down, left and right. You can use a joystick instead if you have one.

Once the program is started you will be greeted by the *Frogger Theme*, *Yankee Doodle Dandy* and *Old MacDonald Had A Farm*. A regular music festival.

There are other sounds—frog hopping and frog jumping and frog splashing—that go along with the game. By hitting the F7 key, you can freeze the action while you take care of other business.

*Frogger* retails for under \$35.

*Fast Eddie*, by Fox Video Games is a popular action game in which the player moves a barrel-shaped fellow up and down ladders. The goal is to collect prizes which float near the ceilings of the first four floors of a building. By touching the fire button on a joystick you can make Fast Eddie jump to catch a prize. After he collects nine prizes, Fast Eddie has the opportunity to move to a new screen and new prizes by capturing a key that appears above High Top, a character living on the fifth floor.

But it isn't as easy as it sounds. The Sneakers, little dancing semicircles with eyes, guard the prizes. If they catch Eddie, he's done for. You start each game with four Fast Eddies. If you lose



*Juice!* is a new strategy game from Tronix, as is the home version of Konami's arcade hit, *Pooyan*, from DataSoft.

them all, you lose. *Fast Eddie* has eight levels, and each level has five screens. All in all, a most trying experience.

*Kickman* is adapted from the Bally/Midway arcade game of the same name. In this game the player controls a clown who rides through city streets on a unicycle. In the clown's world, balloons fall from the sky. The player gets points by catching the balloons, which stack up on his head. Every so often Mr. Pac-Man, yes, Pac-Man, drops from the sky and gobbles up the balloons balanced on the clown's head.

Catching the balloons is easy—at first. But the longer you play, the faster the balloons fall. If you miss a balloon you can kick it up into the air for another chance to catch it. But then the balloons you are trying to catch pile up and...well, it could make you say some things you shouldn't. *Kickman* comes from Commodore and retails for less than \$40.

Another fun example of an action game is *Choplifter*, from Broderbund Software. This is a war game of sorts that many believe was based on the Iranian hostage crisis. In *Choplifter* your task is to fly a helicopter to the rescue of hostages, while fending off jet fighters and tank fire.

The game features 3-D graphics, and the hostages look *very* human. If a bomb hits the hostages, or you land your chopper on them, they die. This game is challenging, but a little too violently graphic for young children.

One special game for younger children is *Tooth Invaders*, also from Commodore. In this game an evil little thing called D.K. spreads plaque on your teeth (well, on the teeth on the video display, anyway). The player must floss and clean the teeth before they fall out, and as each tooth is cleaned, it glows and changes color. When all the teeth are cleaned, a shower of flouride rains down from the heavens. Dentists and dental-bill payers will love this one.

There are, as was mentioned earlier, literally hundreds of action games available for the 64. If you have a favorite, check your local Commodore supplier to see whether it is available for the 64 and if he carries it. You might also check one of the publications that list software available for the 64. A list of those publications appears in Chapter 7, "Readouts."

Adventure games have been experiencing a blossoming

popularity of late and are now as common, and as well-loved, as action games.

Adventure games are slower moving than action games and tend to take less of a physical toll on those organs affected by spurts of adrenalin. They require less manual dexterity but a great deal more mental agility, and they can offer a quick lesson in frustration. But the challenge is always great, and the thrill of succeeding is indescribably wonderful.

In adventure games, the computer—using text, graphics or both—leads the player on a quest, usually of grand scale. In some adventure games the screen display consists only of text. The computer—in simple English—describes scenes and situations, and the player, through the keyboard, tells the computer to handle each situation. Other adventure games illustrate the scenes with video pictures and the player moves by using the keyboard or a game controller like a joystick.

One important difference between action games and adventure games is that the latter often takes much longer to play. Sometimes it can take hours, and even weeks, to finish an adventure game.

It is amazing what the human mind can comprehend. Some of the people who write adventure games must spend months just creating the idea. One has to wonder what great things these minds could do if they applied themselves, say, to medicine or even automobile design.

In text adventures, the user becomes involved in a story. The computer screen might read "You are in a house with no windows. There is a trap door in the middle of the living room floor."

What do you do? Open the door, you say? Not until I get out of here!

In these text games you move about, and you encounter all manner of strange things, usually while you search for some treasure. You are frequently attacked, usually lost and sometimes killed. You are always challenged and occasionally frustrated beyond your capacity for frustration.

The type of adventure game that utilizes the computer's graphics capabilities along with directions, gives you a visual image of your quest, as well as text, as you go along. The idea is exactly the same as that of the text only games, with an added



*Epyx offers a diverse array of game and educational software.*

dimension that some people like and some people don't really care too much about.

Great adventure games abound. Two favorites are *Zork* (by Infocom) and *The Temple of Apshai* (by Epyx).

In both you explore unknown depths in a world filled with foreign people and objects. *Zork*, however, seems to be set sometime in the present in a mystical magical kingdom, while *Temple* hearkens to the bygone days of dragons and knights.

The idea is to survive all the pitfalls in these games and to find a treasure. There are few people around who have ever done that.

It is virtually impossible to explain what goes on during an adventure game. If you're interested, go on down to your nearest Commodore dealer and plug one into a 64. But make sure you've taken care of everything else you planned to do first. You will probably stay until closing time.

## **EDUCATIONAL SOFTWARE**

Educational software is available to teach virtually every subject from typing to math and then some. And as educators across the nation have learned, computers can be powerful teaching tools. They are patient, specific and don't get bored by repeating the same task over and over and over again.

Machines like the 64, with its sound and video capabilities, can make even the most mundane tasks exciting.

The best educational programs are interactive—the computer asks the user a question and then waits for an answer. If the answer is wrong the computer politely offers the user a chance to try again. Educational programs for children tend to include a lot of graphics and, often, sound. Learning can become as much fun as playing a video game.

Programs for adults have the same potential, although extensive graphics can slow things down so much that an adult gets bored. Remember the rule of buying software: try it *before* you buy it. Just because a package says it will teach your child math or typing, doesn't mean it will do it well.

Educational software is available for the 64 from many different sources, including the Raymac Software Group of Boulder Creek, CA; Logos Software of Santa Barbara, CA; and Commodore, through its new software division. For very young

children, there is a magnificent little program called *Hey Diddle Diddle* by Spinnaker, a company that says one of its purposes is to provide games that teach children to think rather than to destroy.

In *Hey Diddle Diddle* four lines of a nursery rhyme appear, along with a graphics display that slowly takes form. Next comes some upbeat music that will capture the attention of anyone from one to ninety-one. Children can learn to read the rhymes, and later, to unscramble them and put them in their proper order. For an added challenge, you can add a timer. The game is recommended for children from three to ten, and is available on disk for under \$30.

Commodore has announced a whole line of educational software, including mathematics drills, English lessons with word games and poetry, geography, and science. Many of the programs include short tests. The company has long been in the educational market, and there are Commodore computers in many schools nationwide. For information on Commodore programs contact your dealer or Commodore.

*Learn basic programming skills and computer techniques with CoCo from ISA Software.*





*There's check recording, sorting and balancing: a game for developing algebra skills and a practical guide to basic programming from TIMEWORKS.*

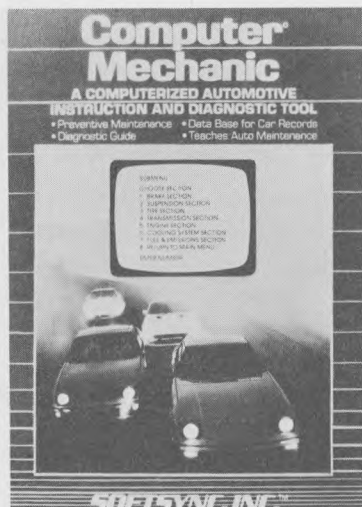
The Programmers Guild has a series of educational tapes for the 64. One called *Sea Word* is typical. It gives the player scrambled words and asks that the words be unscrambled to defeat a sea serpent. It turns learning into a video game in a very effective manner.

For adults there are educational programs that will teach everything from languages to typing. The importance of typing—for both adults and children—cannot be stressed enough. The main way that humans and computers interact is through typewriter keyboards. The faster you type, the faster you and your computer can communicate.

There are several good typing programs available for the 64. One, called *Mastertype* has missiles and spaceships, again making the learning process into a video game.

Remember that in the beginning of this chapter it said there are programs to teach just about anything? Well, how about a program that teaches you to fix your car. It's a veritable shop class on cassette or disk.

The program is called *Computer Mechanics* by Softsync, and



*Softsync brings 64 owners two programs for maintenance procedures as well as financial planning and record keeping.*

it deals with such mechanical mysteries as changing oil, rotating tires and tuning engines.

It has a menu screen which includes a section on diagnosing problems, which leads to a section on repairing the problem after it has been identified.

There is also a section that keeps a track of maintenance schedules for scores of cars, as long as they are American made. If it saves one trip to the auto mechanic, it pays for itself.

It is important when purchasing an educational program to go through the various levels of the process to make certain that each teaches effectively. Sometimes, especially for adults although it is also true in children, the "game" becomes boring after just a few tries—and well before the lesson is learned.

## **HOME AND BUSINESS SOFTWARE**

Almost anything you can do with a pencil and a sheet of paper can be done better and more quickly with a computer.

Do you keep a lot of recipes? Your 64, with the proper program, can help you sort them and find the right one instantly, with software known as a data base.



*Using the Commodore 64 for home budget management.*

Do you need to keep track of household finances? A software package called *Home Accountant* will help you do that better than you ever did it before. And, if you want to write letters, term papers, reports or books, any number of word-processing programs will make your job easier.

The problem with all software is picking the program that best suits your needs. The solution is simple; when you are purchasing home and business software: first define what it is you want to do, and then find a program that does it.

In computerese, a system that files information is called a *data-base manager*.

The kind of information that you used to keep on three-by-five file cards is the kind of information you would keep on a data-base manager, which is also known as an electronic filing program.

The big difference is that the computer does the filing and cross-indexing. In other words, if you are keeping a file of recipes, and you have fifteen recipes for apple pie you may also have a sort-

ing problem. Suppose you want just one of the apple pie recipes, the one of those recipes given to you by your friend Mrs. Smith? With three-by-five cards, you thumb through until you find it. With a computer data-base manager, you tell the computer to find the apple pie recipe given to you by Mrs. Smith, and it does. It will also, if you like, give you every recipe Mrs. Smith ever gave you, or every recipe using apples! Pretty amazing.

When you add any item to a data-base manager it is alphabetized and stored in precisely the correct spot. Retrieving information is usually a matter of tapping a few keys.

There are, of course, many business applications for data-base managers. They are capable of sorting and re-sorting anything—names, zip codes, addresses—and so are excellent for making lists. All kinds of lists, mailing lists, lists of top salesman, of top prospects, of companies purchasing your product in any given month or lists of sources of a product. And the list of data-base manager applications goes on and on.

It is important to watch out for some features that might be missing in a data-base manager. Make sure it will interface with your printer and/or your word processor if you are using it for mailing lists and form letters. Make sure you understand its limitations. And, watch it work. Some data-base managers can be maddeningly slow.

There are several data-base managers available for the 64. One good one is called *Flexfile 2.1*. (The 2.1 is the version of the program. For reasons not known to mortals, programmers tack these numbers at the end of their programs all the time. Don't worry about them.)

If you have a disk drive the *Flexfile* will allow you to store a thousand 127-character records—an awful lot of apple pie recipes and a good-sized mailing list, it retails for a little over \$100.

Other recommended data-base programs include Mirage Concepts' *Database Manager* (under \$100) and Delphi's Oracle (under \$150).

You may be able to save money if all you need is a program that generates a mailing list and/or mailing labels. There are perhaps fifteen different mailing list managers available for under \$40. Among the ones to consider are *Totl. Label 2.6* (there's that silly number at the end again), \$24 on disk and \$20 on tape;

*Mail Now*, by Cardco, under \$40 on disk; and Data Equipment Supply's *64 Mailing List*, \$30 on tape and \$35 on disk.

Home computers have many applications in business, and certainly one of the most useful programs available for business applications is the *spreadsheet*.

An electronic spreadsheet, (as those used on computers are called), is a tool that takes numbers, in columns and rows arranged in a gridlike pattern, and deals with them any way you tell it to. It might add rows one through five, subtract row six, divide the sum of rows one through five by row seven. It's hard for some people to imagine what you would ever do with a spreadsheet, but those who use them have found them convenient tools.

Spreadsheets are not only good for business. They can, prop-



*PractiCalc 64 is a spreadsheet package from Computer Software.*

erly designed, be quite helpful at home, especially in setting up the family budget and keeping track of expenses.

One very nice feature of electronic spreadsheets is that once the user enters a formula, the program *remembers* the formula, forever, unless, of course, the user changes it. So if one of the numbers in one of the rows or columns changes, the spreadsheet recalculates automatically everything that involves that number. That can only be a godsend to bookkeepers and accountants everywhere.

Because of that single feature, spreadsheets are wonderful when it comes to projections. If, for example, you have worked out a budget at a certain income level, and you wonder how the numbers would change if your income went up 20 percent (as we all hope), then you simply enter that new figure and the spreadsheet recalculates all the way through the document.

There are also spreadsheet-type programs that are pre-programmed for certain duties, like keeping the household budget or calculating car costs or analyzing loans. These programs are nice because they save you the work of entering the formulas. But they are more limited than a plain spreadsheet because they cannot be reprogrammed to do other things.

One powerful general spreadsheet program for the 64 is *Calc Result* by Handic Software of Sweden, selling for under \$150. *Calc Result* is 63 columns across by 255 rows down and 32 pages deep. You create a format—called a template—which can then be applied to each of the following pages.

*Calc Result* offers both menus and help screens to make the task of configuring a spreadsheet easier. And, help screens are available in English, German and French, so you can learn a little of a foreign language while you're working.

During use, the program displays a status line that tells you where your cursor is located, the type of information you are entering in a specific area (label or numeric), the actual contents of that area, the method of calculation and the memory remaining.

If you're having a problem, pressing key F5 gives you a help screen and a menu of options. The program comes with a good manual *and* tutorial. It is distributed by Computer Marketing Services, Inc., 300 W. Marlton Pike, Cherry Hill, NJ 08002.

*Home Accountant* by Continental Software (under \$50) keeps

track of all monthly income and spending, prints balance sheets and net worth statements, creates graphs, does financial forecasting and reconciles bank statements.

The program requires extensive setting up, which can take hours, but once you've entered the information you never need to do it again.

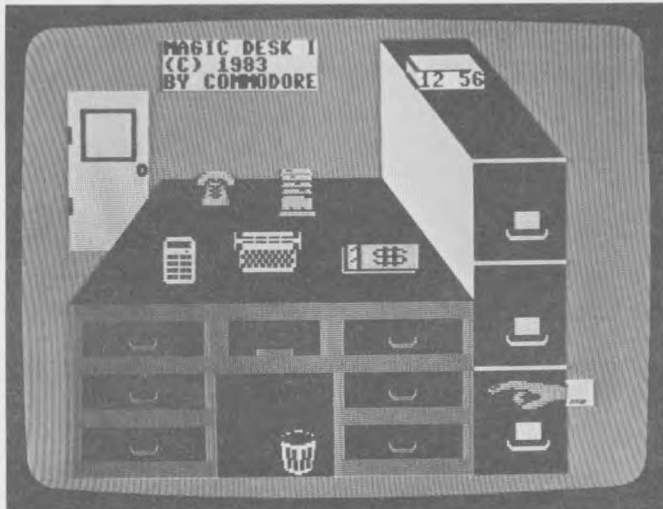
It makes some unpleasant tasks of everyday life—like balancing the checkbook—a whole lot easier if not more pleasant. When you balance your checkbook the program prints "YOUR CHECKBOOK RECONCILES ... CONGRATULATIONS," which makes you feel good even if the balance is in the single digits.

### THE MAGIC TOUCH OF COMMODORE'S MAGIC DESK

Commodore's *Magic Desk* program is a business-oriented software package billed by its manufacturer as an answer to Apple's \$10,000 Lisa computer system. A plug-in cartridge for the Commodore 64, the *Magic Desk* program is designed to be used with a mouse, a track ball or a joystick.

Although the *Magic Desk* is available for less than \$100, it does share some features with the higher priced Lisa. Both systems are designed to be operated using pictures instead of words. Computer owners are presented with "menus" showing common objects that you would ordinarily find around the office. You can then manipulate these objects on screen with a hand controller. And, by doing this, you can instruct the systems to perform specific tasks.

Insert a *Magic Desk* cartridge into your Commodore 64, turn the computer on, and what you'll see is a color picture of the interior of an office. In the middle of the screen you'll find a desk, and on top of the desk you'll see a typewriter, a calculator, a financial ledger, a telephone, and a rotary card file. In addition, there's a filing cabinet standing alongside the desk



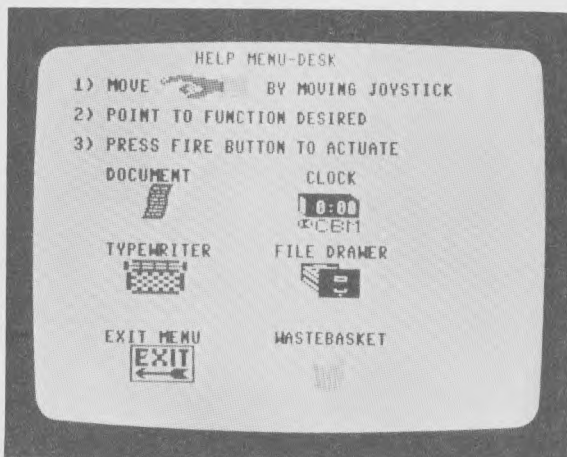
*The opening screen of Commodore's multipurpose Magic Desk*

and a digital clock atop it. Under the desk there's a waste basket, and hovering over the desk you'll find a picture of a hand.

Using a simple joystick and a joystick trigger button, you can pick up a sheet of paper with the hand and then move the document anywhere on the screen. Carry it to the typewriter, hit the fire button, and the program will become a word processor. Move the paper over the filing cabinet, press the trigger, and you can save the document on a disk (or you can load a document into the computer's memory from a disk, if what you want to do is retrieve a file).

There are three drawers in the filing cabinet on the *Magic Desk's* screen. Each drawer can hold up to 10 files, and each file can hold up to 10 pages. You can give each file any title you like. You can look at the names of files any time you like, and you can pull any file out of any stack you happen to be viewing. You can move pages that you've typed from one file to another, and you can copy information from one file to another.

All of the files are stored on disks, so you need a disk drive to operate the *Magic Desk* program. If you have a printer, you can print out information, too.



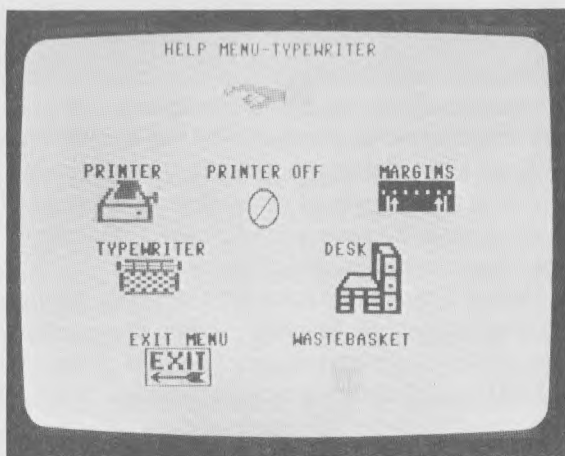
*Simplified graphically enhanced directions using the Magic Desk.*

When the *Magic Desk's* word processor is running, the screen display looks just like a piece of white paper in a typewriter. Across the bottom of the screen there's a realistic-looking paper gauge with tab stops numbered and marked. And in the center of the gauge there's a U-shaped indicator that shows you where the next letter you type will be.

The word processor works like a typewriter, too. As you type, the "paper" on the screen moves along from right to left, just like a real sheet of paper would. And the screen—which can display only 40 characters per line on a Commodore 64—works like a window that can be moved around over the paper you're typing.

When you've finished typing a document, you can file it. Or, if you like, you can throw it away. To discard a sheet of paper, you simply move it down to the wastebasket under the desk, hit the trigger button, and the document's gone.

The program's realism doesn't stop there. The digital clock on top of the filing cabinet actually works. Move the onscreen hand up to the clock, press the fire button on your joystick, and you can set the clock. It will then start running, and will keep on keeping time until you turn off your Commodore or stop using your *Magic Desk* program.



*Typewriter-based operations are aided with visual symbols.*

# 5 INFORMATION STATIONS

There's a universe out there waiting to be tapped, a universe of information and fun. And it's only as far away as your telephone.

By connecting your computer to the telephone—telecomputing—you can have access to things you've only dreamed of.

You can tap into data banks that store information as varied as stock market prices and consumer taste tests. You can send messages to business associates and friends. You can hook into large mainframe computers and bring their computing power right into your home. You can "download" (copy) programs from a main computer to your computer and be billed later, rather than having to waste the gas to go to your local computer store.

To communicate through the telephone lines a computer requires a device called a *modem*, which stands for modulator/demodulator.

A modem takes the data that is sent from a computer in the form of electronic signals, and converts it into audio tones. The tones go through the telephone lines, and the modem on the other end hears them and converts them back into electronic signals. This is similar to the way your Commodore 64 saves and loads information on a cassette recorder, although that is done at a different speed and over a shorter distance.

The speed of a modem is measured in baud, which basically means the bits per second that the modem transmits. Standard modems are 300 baud (these transmit about 30 characters per second) and 1200 baud (120 characters per second). With your Commodore 64, you will use a 300-baud modem.

Modems were discussed in Chapter 3, "Peripheral Visions." But let's cover some of the ground again.



*The model 1600 VICMODEM Telephone Interface cartridge allows you to bring telecommunications services such as CompuServe into your home.*

There are two kinds of modems for your Commodore 64: acoustic modems and direct connect modems.

Acoustic modems fit onto the telephone handset. Rubber cups slide tightly over the earpiece and mouthpiece of the phone, shutting out interference.

Direct connect modems skip the handset and plug directly into the telephone. They are generally considered better because there is less chance of interference from room noise.

Commodore's VICmodem and new Automodem are examples of direct connect modems.

Even with a modem, a computer is not ready to communicate over the telephone lines.

It must have a special program that gives it *parity* with the computer at the other end of the line. The computers have to be speaking the same language, sending data that each can understand.

In the case of the Commodore 64, the software used for telecommunications is usually called terminal software, because it turns the 64 into a remote terminal of a distant computer. The intelligence of the computer is essentially turned off and the computer momentarily becomes a monitor attached to the distant computer.

When this happens, everything you type into your computer appears both on your screen and on the screen of the computer with which you are communicating. And it works the other way, too—anything typed on the other computer's screen appears on your screen.

The terminal program makes it possible for your computer to talk with mainframes, IBMs, Ataris and many other computers. It is, in effect, an interpreter.

Once you hook a computer up to a modem and you load the proper terminal software (which is supplied with Commodore modems), you'll be astounded at what you can do.

At one major metropolitan newspaper, for example, several reporters purchased computers, modems and terminal software.

At about the same time the newspaper's library went on-line so that its bureaus around the state could access information from the computer terminals in their offices. The newspaper itself was already computerized—all writing and editing was done on computer terminals.

With their modems and home computers, the reporters found they could access the library *and* send their stories directly into the newspaper's main computer, where editors could edit them and get them ready for publication.

Now, several of the reporters are researching and writing stories and sending them into the office without ever leaving their homes!

There are people who say that what happened at that newspaper is the direction of the future. Because so many

businesses are now computerized, and because so many people are buying computers, it may be possible for many of us to go to work without ever going to the office.

Think of the savings, in gasoline and in time, if people don't need to commute from their homes to their offices.

The potential for telecomputing is awesome. There are already many people who are using their home computers to shop, get weather reports and to read the latest reviews.

Futurists say that within just a few years, we may do many other things—from paying bills to banking to reading newspapers and magazines—all on our home computers. But there's no need to wait. Telecomputing is a reality right now.

Currently there are two general types of information centers to which you can hook your computer by telephone: bulletin boards and data banks (also called information utilities).

## **BULLETIN BOARDS**

Bulletin boards (often abbreviated BBS in computerese) are information-sharing centers, often operated by users groups and computer stores. A BBS can have all sorts of information, from tips on computer use to information on sales at local stores; from classified ads, to general gossip. Each BBS has its own separate and distinct personality, usually quite similar to the personality of the *sysop*, the system operator. Many of these systems permit callers to leave messages, either personalized or general.

Bulletin boards are usually free, although there may be a charge for leaving messages like want ads, and, of course you have to pay the phone company for the call. In addition, you'll find that BBS often provides libraries of software, frequently written by users of the BBS, that can be downloaded free or for a small charge.

answer/auto-dial modem, which is then left switched on for certain hours of the day.

The BBS has a program that allows the computer to communicate with callers. Precisely what that communication will be depends on the type of bulletin board you've interfaced with.

BBS are as varied as humanity. There are boards that offer news on computers; boards for science fiction fans; boards for CB

**Calling All 64's**

Many BBS are run by individuals, so they often are here today gone tomorrow. For information on BBS, keep up through Commodore magazines (see Chapter 7, "Read Outs").

Here is a list of Commodore bulletin boards.

*Colorado*

Front Range Bulletin Board  
(303) 223-4305 (Fort Collins)  
all day every day

Kansas City PET User Group  
Bulletin Board  
(816) 257-2502  
all day every day

*Illinois*

Commodore Public Bulletin  
Board System  
(312) 397-0871 (Chicago)  
all day every day

*Texas*

RPCC  
(214) 996-6808  
all day every day

*Video King*

(312) 674-6502 (Chicago)  
all day every day

*Utah*

Commodore Utah  
Bulletin Board  
(801) 277-3913  
(Salt Lake City)  
all day every day

*Indiana*

AVC Computer Center  
Bulletin Board  
(317) 255-5435 (Indianapolis)  
all day every day

*Washington*

Northwest Commodore  
User Group Bulletin Board  
(206) 743-6021 (Edmonds)  
all day every day

*Massachusetts*

MASSPET Bulletin Board  
(617) 824-4878 (Boston)  
7 p.m. to 9 a.m. M-F, 24 hrs.  
on weekends

*Wisconsin*

C.U.S.S.H  
(414) 554-9520 (Racine)  
all day every day

*Missouri*

Commodore Communications  
(314) 625-4576 (St. Louis)  
all day every day

*Wyoming*

Southeast Wyoming  
Commodore Bulletin Board  
(307) 637-6045  
all day every day

lovers, as well as many other fields of interest. There are even X-rated boards because some like it hot.

## **DATA BANKS**

Data banks are usually operated by corporations, and they are operated for profit. You are charged for the time you spend hooked up to the data bank, and you are also charged a membership fee.

For most personal computer services, the sign up fee ranges from approximately \$35 to \$100. Connect charges run from about \$5 an hour in the middle of the night, to \$25 an hour at more popular times. Charges can be billed to major credit cards.

When you join a data bank you will be given a telephone number to call and a password that will allow you access to the bank. The password also identifies you so that the computer can keep track of the time you spend on-line—and send you a bill.

The challenge of data banks is not finding one, but choosing one from the many and then figuring out how to get the most of it.

There are several excellent data banks, and all will be glad to send you brochures that outline their services and prices. In many areas, most can be reached by dialing a local telephone number. In some rural areas, it might be necessary to reach the data bank through a long-distance network like Tymnet, which charges from \$2 to \$3 an hour, added to the hourly fee of the data bank.

The most popular ones include The Source, CompuServe and Delphi, but don't overlook BRS/After Dark and the Knowledge Index if you plan to do serious research. For business and financial information, the Dow Jones News/Retrieval Service is tops. And if you want to do some shopping by computer, get in touch with Comp-U-Store in Stamford, Connecticut.

Comp-U-Store offers data bases of items for sale from a variety of sources. Subscribers can search the data bases for specific items, compare prices and order what they choose by computer. Billing is done through a major credit card.

This illustrates a major advantage of telecomputing. By using your computer, you can pick your way through enormous quantities of information, choosing only that information which interests you.

For example, if you want to read everything written on the United Press International wire about a certain football team, you could tell the computer to search only for those stories, skipping over the thousands of other stories the wire carried.

But wait, there's more. There's a special treat for Commodore users who telecommunicate.

CompuServe, one of the big data banks, has a special bulletin board just for users of Commodore machines. To access the board, you must first join CompuServe. You must also, as mentioned earlier, have a modem and a terminal program. Once you have those things, getting into the Commodore BBS is easy. Call CompuServe. If you don't know the local number, call 1-800-848-8199 for information.

After you've joined CompuServe, this is what you do. When you reach CompuServe, the computer will answer with a high-pitched tone. If you are using a VICmodem, you must unplug the coiled telephone cord from the handset and plug it into the back of the modem. This is not necessary with an Automodem.

Make sure your modem is set to "OO" for originate, which means you dialed the call.

Type a "Control-C" by holding down the CTRL key and tapping the C. The CompuServe computer will request your user ID and password.

Again, if you are using a VICmodem, the ID and password are part of the VICmodem package, which comes with a free hour of time on CompuServe.

If the connection has been made properly, the CompuServe main menu will appear on your screen. This gives you several options, each of which leads to another menu.

Choose the "Personal Computing" option from the main menu, and follow the instructions to get the Commodore SIG bulletin board.

There is a trick that will make this all quicker if you want to go directly to the Commodore board. Instead of fooling around with the menus, type GO CBM 1 after you sign onto CompuServe. This will take you directly to the board.

Once you've reached the Commodore board, you'll be greeted by another menu, which will give you all sorts of choices. You select one from the menu, which will give you an introduction.

You will find that the Commodore BBS has a special section for users of the 64, which you would be wise to check. Take your time when you begin. There's an awful lot to learn.

The more you use CompuServe or any other data bank, the more adept you will become at moving around within the structure. It takes time at first, and at the \$5 an hour it costs to hook into CompuServe, time is of the essence.

But you will have to accept that only experience will aid you in your quest for information. The more you use any data bank, the less time it will take you to gain the information you are after and the less it will cost. Again, you must pay the phone company's charges, too.

*Note: All the costs mentioned here are "as of press time" for this book and could be different. Use them only as a guide.*

Here is a list of popular Data Banks:

COMPUSERVE

5000 Arlington Center Boulevard  
P.O. Box 20212  
Columbus, Ohio 43220  
(614) 457-8650

The initial, one-time connect fee to CompuServe costs \$19.95 and connect time ranges from \$5 an hour in the evenings to \$22.50 during the prime business hours.

CompuServe is a full-service information utility, offering home services such as electronic mail, bulletin boards and special interest groups. As we already mentioned, there is a special bulletin board for Commodore users and for users of the Commodore 64.

A very popular feature of CompuServe is the Citizen's Band simulator, which allows users to treat their computers like electronic radios and talk to whomever is on the air.

CompuServe also offers a software exchange.

DELPHI

General Videotex Corp.  
377 Putnam Ave.  
Cambridge, MA 02139  
(617) 491-3393

A subscription, that is the one-time hook-up fee, to Delphi

costs \$49.95, which includes one free hour of connect time. On-line charges range from \$5 an hour at night to \$20 an hour during prime business hours.

Delphi, a new data bank, offers a large research library with a 20,000-entry encyclopedia, an advice service on a wide range of topics and the ability to run subscriber polls. Delphi also offers electronic banking and is one of the first data banks to do so.

BRS/AFTER DARK

BRS

1200 Route Seven

Latham, NY 12110

(518) 783-1161

The initial fee is \$50 for BRS/After Dark, and connect charges range from \$6 to \$20 an hour. There is a minimum charge of \$12 per month.

BRS offers extensive data bases on education, the social sciences and humanities, energy and environment, medicine and business. There is an on-line encyclopedia with sophisticated searching capabilities.

KNOWLEDGE INDEX

Dialog Information Services

3460 Hillview Avenue

Palo Alto, CA 94304

(800) 528-6050

There is a one-time membership fee of \$77, plus \$24 per hour on-line charges on the Knowledge Index. The service is available from 6 p.m. to 5 a.m., Monday through Thursday; from 6 p.m. to midnight on Friday; from 8 a.m. to midnight on Saturday; and from 3 p.m. to 5 a.m. on Sunday.

Dialog is one of the largest data banks in the country and the Knowledge Index is their offering for small computers. It is bibliographic, searching through hundreds of magazines, newspapers, journals and book entries. Users can order hard copies from the service. Data bases include agriculture, *Books In Print*, computers, software, Standard & Poor's, education, engineering, government publications, *Magazine Index*, medicine, pharmacology, newspapers and psychology.

THE SOURCE

Source Telecomputing Corporation

A subsidiary of the Reader's Digest Association

1616 Anderson Road

McLean, VA 22102

(800) 336-3366

(703) 734-7500 in Virginia

It costs \$100 to join The Source, and connect charges range from \$5.75 from midnight to 7 a.m., to \$20.75 for prime time during the week. There is a \$10 minimum monthly charge, and a quarterly fee for each connection.

The Source has a mind-boggling listing of services, and it is extremely popular. A partial listing from a recent brochure includes: astrology, barter-trade network, business and finance, restaurant reviews, Comp-U-Store, financial market reports, management services, media general stock analysis, movie reviews, and on, and on, and on, and on.

# 6 GROUP ENCOUNTERS

**D**id you know that there are places where you can get literally hundreds of useful programs, free? These are the same places you can get advice about operating your Commodore 64, information about accessories for your computer, and ideas of different ways to use your 64. And, you can make new friends while you're doing it.

The place where all this—and much more—happens is at a meeting of a computer users' group. It's a club of sorts, where a collection of people, who use computers, gather and meet. In many cases, but not all, the club members all use the same computer, such as the Commodore 64. In some groups, users of any computer are welcome, and hobbyists share ideas and information about many different brands of machines.

Users groups began back in the mid-1970s, when there weren't all that many computer users around. The members were united by a general interest in computers. In those days, when computers were far rarer and less familiar, users' groups were often the only place hobbyists could go for information and advice.

Today, of course, there are many books on computers as well as numerous computer stores with knowledgeable and helpful salespeople.

But they still don't take the place of users' groups.

Users' groups do more than offer a place for people of like mind to get together and discuss their machines.

Many maintain libraries of free software in the public domain,

organize flea-market sales of equipment, and have telephone numbers users can call if they need help.

The primary purpose of users' groups, however, remains to share information, person to person, about computers.

Many groups hold their meetings informally, but many more are highly organized. Some have regular lectures and demonstrations, some produce monthly newsletters packed with information. There are usually tips from users, as well as advertisements (paid *and* classified).

Often, computer companies will rely on users' group newsletters to convey information—like hardware updates or new software releases—to people who use their computers.

Some users' groups pool their resources and make bulk purchases of hardware, software and peripherals, often saving their members hundreds of dollars a year. And many users' groups go on-line with electronic bulletin boards, giving users instant access to other people who use similar computers.

How do you find a users' group?

Well, you can start right here. On the following pages we have listed as many Commodore users' groups as we could find.

There are users' groups being formed every week, so if you don't find one in your area, check with your local computer stores to see whether one exists.

If not, why not start a users' group yourself?

A good place to begin would be at your local Commodore retailer. They probably know other people who use the 64 and who would be interested in getting together.

Contacting several of the established users' groups listed on the following pages is also a good way of finding out how they got started, and how they survive.

Many will be glad to share information with you and give you a helping hand getting organized.

### *Alabama*

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Huntsville PET Users' Club  
9002 Berclair Rd.  
Huntsville, AL 35802  
Meets every second Thursday.

### *Alaska*

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COMPOOH-T  
c/o Box 118  
Old Harbor, AK 99643  
(907) 286-2213

*Arizona*

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Cataline Commodore  
 Computer Club  
 2012 Avenida Guillermo  
 Tucson, AZ 85710  
 Meets first Tuesday of every  
 month at the Metro  
 Computer Store

ACUG  
 c/o Home Computer Service  
 2028 W. Camelback Road  
 Phoenix, AZ 85015  
 (602) 249-1186  
 Meets first Wednesday of  
 each month.

Arizona VIC 20/64  
 Users' Club  
 232 W. Ninth Place North  
 Mesa, AZ 85201

*Arkansas*

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Commodore/PET Users' Club  
 Conway Middle School  
 Davis Street  
 Conway, AR 72032

Booneville 64 Club  
 c/o A.R. Hederich  
 Booneville Elementary School  
 401 W. 5th Street  
 Booneville, AR 72927

*California*

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Commodore Users' Club  
 1041 Foxenwoods Drive  
 Santa Maria, CA 93455  
 (805) 937-4106

SPHINX  
 7615 Leviston Ave.  
 El Cerrito, CA 94530  
 (415) 527-9286

San Diego PUG  
 c/o D. Costarakis  
 3562 Union Street  
 San Diego, CA  
 (714) 235-7626

Jurupa Wizards  
 4526 Kingsbury Pl.  
 Riverside, CA 92503

The Commodore Connection  
 2301 Mission Street  
 Santa Cruz, CA 95060  
 (408) 425-8054

San Fernando Valley  
 Commodore Users' Group  
 21208 Nashville  
 Chatsworth, CA 91311  
 (213) 709-4736  
 Meets second Wednesday of  
 every month

VACUUM  
 277 E. 10th Ave.  
 Chico, CA 95926  
 (916) 891-8085  
 Meets second Monday of  
 every month

South Bay Commodore  
 Users' Group  
 1402 W. 218th Street  
 Torrance, CA 90501

Slo VIC-20/64  
Computer Club  
1766 Ninth Street  
Los Osos, CA

The Diamond Bar R.O.P.  
Users' Club  
c/o Rincom School  
2800 Hollingworth  
West Covina, CA 91792  
(213) 965-1696

Commodore Interest Assoc.  
c/o Computer Data  
14660 La Paz Drive  
Victorville, CA 92392

Humboldt Commodore  
Group  
P.O. Box 570  
Arcata, CA 95521

Napa Valley Commodore  
Computer Club  
c/o Liberty Computerware  
2680 Jefferson Street  
Napa, CA 94558  
(707) 252-6281

S.D. East County C-64  
Users' Group  
6353 Lake Apopka Place  
San Diego, CA 92119  
(619) 698-7814

*Colorado*

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VICKIMPET Users' Group  
Four Waring Lane  
Greenwood Village  
Littleton, CO 80121

Colorado Commodore  
Computer Club  
2187 S. Golden Court  
Denver, CO 80227  
Meets the second  
Wednesday of each month

*Connecticut*

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Commodore Users' Club  
Wethersfield High School  
411 Wolcott Hill Road  
Wethersfield, CT 06109

New London County  
Commodore Club  
Dolittle Road  
Preston, CT 06360

*Florida*

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Jacksonville Area  
PET Society  
401 Monument Road #177  
Jacksonville, FL 32211

PETS and Friends  
129 NE 44th Street  
Miami, FL 33137

Bay Commodore Users'  
Group  
c/o Gulf Coast Computer  
Exchange  
241 N Tyndall Parkway  
P.O. Box 6215  
Panama City, FL 32401  
(904) 785-6441

64 Users' Group  
108 Anglewood Drive  
Brandon, FL 33511  
(813) 685-5138

Meets third Friday of  
each month

*Idaho*

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Commodore 64/VIC 20  
Users' Group  
Martin Marietta  
Aerospace Corp.  
P.O. Box 5837, MP 142  
Orlando, FL 32855  
(305) 352-3252/2266

GHS Computer Club  
c/o Grangeville High School  
910 South D Street  
Grangeville, ID 93549

Commodore Users'  
548 E. Center  
Pocatello, ID 83201  
(208) 233-0670

Gainesville Commodore  
Users' Group  
Santa Fe Community College  
Gainesville, FL 32602

Eagle Rock Commodore  
Users' Group  
900 S. Emerson  
Idaho Falls, ID 83401

Commodore Computer Club  
P.O. Box 21138  
St. Petersburg, FL 33742

*Illinois*

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*Georgia*

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Bldg, 68 FLETC  
Glynco, GA 31524

VIC 20/64 Users' Support Group  
c/o David R. Tarvin  
114 S. Clark Street  
Pana, IL 62557  
(217) 562-4568

VIC-tims  
P.O. Box 467052  
Atlanta, GA 30346  
(404) 922-7088

Rockford Area PET Users' Group  
1608 Benton Street  
Rockford, IL 61107

*Hawaii*

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Commodore Users' Group  
of Honolulu  
c/o PSH  
824 Bannister Street  
Honolulu HI  
(808) 842-2088

Commodore Users' Club  
1707 E. Main Street  
Olney, IL 62450

Chicago Commodore 64  
Users' and Exchange Group  
P.O. Box 14233  
Chicago, IL 60614

The Commodore 64 Users'  
Group  
4200 Commerce Court,  
Suite 100  
Lisle, IL 60532  
(312) 369-6525

Oak Lawn Commodore  
Users' Group  
The Computer Store  
11004 S. Cicero Ave.  
Oak Lawn, IL 60453  
(312) 499-1300

The Kankakee Hackers  
RR #1, Box 279  
St. Anne, IL 60964  
(815) 933-4407

Indiana

PET/64 Users'  
10136 E. 96th Street  
Indianapolis, IN 46256  
(317) 842-6353

Northern Indiana  
Commodore Enthusiasts  
927 S. 26th Street  
South Bend, IN 46615

Commodore Users' Group  
1020 Michigan Avenue  
Logansport, IN 46947  
(219) 722-5205

Computer Workshop  
VIC 20/64 Club  
282 S. 600 W.  
Hebron, IN 46341  
(219) 988-4535

The National Science Club of  
America  
Commodore Users' Division  
7704 Taft Street  
Marrillville, IN 46410

Iowa

Commodore Users' Group  
114 Eighth Street  
Ames, IA 50010

Quad City Commodore Club  
1721 Grant Street  
Bettendorf, IA 52722  
(319) 355-2641

Commodore Users' Group  
965 Second Street  
Marion, IA 52302  
(319) 377-5506  
Meets third Sunday of each  
month

Siouxland Commodore Club  
2700 Sheridan Street  
Sioux City, IA 51104  
(712) 258-7903  
Meets first and third Monday  
of each month

Commodore Computer Users'  
Group of Iowa  
Box 3140  
Des Moines, IA 50316  
(515) 263-0963 or 287-1378

*Kansas*

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Wichita Area PET Users'  
Group

2231 Bullinger  
Wichita, KS 67204  
(316) 838-0518

Kansas Commodore  
Computer Club  
101 S. Burch  
Olathe, KS 66061

Commodore Users' Group  
6050 S. 183 Street W.  
Viola, KS 67149

*Kentucky*

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VIC Connection  
1010 S. Elm  
Henderson, KY 42420

*Louisiana*

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Franklin Parish Computer  
Club

#3 Fair Ave.  
Winnisboro, LA 71295

NOVA  
917 Gordon Street  
New Orleans, LA 70117  
(504) 948-7643

*Maryland*

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Association of Personal  
Computer Users  
5014 Rodman Road  
Bethesda, MD 20016

House of Commodore  
8835 Satyr Hill Road  
Baltimore, MD 21234

VIC and 64 Users' Group  
The Boyds Connection  
21000 Clarksburg Road  
Boyd, MD 20841

Rockville VIC/64 Users'  
Group  
13013 Evanstown Road  
Rockville, MD 20853  
(301) 946-1564

The Compucats' Commodore  
Computer Club  
680 W. Bel Air Ave.  
Aberdeen, MD 21001  
(301) 272-0472

*Massachusetts*

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Commodore Users' Club  
Stoughton High School  
Stoughton, MA 02072

Masspet Commodore Users'  
Group  
P.O. Box 307  
East Taunton, MA 02718

Raytheon Commodore Users'  
Group  
Raytheon Co.  
Hartwell Road, GRA-6  
Bedford, MA 01730

Commodore 64 Users' Group  
of the Berkshires  
184 Highland Ave.  
Pittsfield, MA 01201

*Michigan*

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Commodore Users' Club  
32303 Columbus Drive  
Warren, MI 48093

Commodore Users' Group  
c/o Family Computing  
3947 West 12 Mile Road  
Berkley, MI 48072

West Michigan VIC 20-64  
Users  
1311 Portland NE  
Grand Rapids, MI 49505  
(616) 459-7578

Commodore Users' Group  
c/o Eaton Rapids Medical  
Clinic  
101 Spicerville Highway  
Eaton Rapids, MI 48827

Commodore Computer Club  
4106 Eastman Road  
Midland, MI 48640  
(517) 835-5130

VIC/64 PET Users' Group  
8439 Arlis Road  
Union Lake, MI 48085

*Minnesota*

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Twin Cities Commodore  
Computer Club  
6623 Ives Lane  
Maple Grove, MN 55369  
(612) 424-2425

*Missouri*

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KCPUG  
5214 Blue Ridge Blvd.  
Kansas City, MO 64133  
(816) 356-2382

Mid-Missouri Commodore  
Club  
1804 Vandiver Drive  
Columbia, MO 65201  
(314) 474-4511

*Montana*

---

Commodore Users' Club  
1109 West Broadway  
Butte, MT 59701

*Nevada*

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Las Vegas PET Users  
Suite 5-315  
5130 E. Charleston Blvd.  
Las Vegas, NV 89122

*New Jersey*

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Amateur Computer Group  
18 Alpine Drive  
Wayne, NJ 07470

South Jersey Commodore  
Computer Users' Club  
46B Monroe Park  
Maple Shade, NJ 08052  
(609) 667-9758

L&M Computer Club  
VIC 20 & 64  
4 Clinton Street  
Tully, NY 13159  
(315) 696-8904

Parsippany Computer Group  
51 Ferncliff Road  
Morris Plains, NJ 07950

Commodore Users' Group  
1 Corwin Place  
Lake Katrine, NY 12449

*New Hampshire*

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Northern New England  
Computer Society  
P.O. Box 69  
Berlin, NH 03570

VIC 20/Commodore 64  
Users' Group  
31 Maple Drive  
Lindenhurst, NY 11757  
(516) 957-1512

*New Mexico*

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Commodore Users' Group  
6212 Karlson NE  
Albuquerque, NH 87113  
(505)821-5812

New York Commodore  
Users' Group  
380 Riverdale Drive, 7Q  
New York, NY 10025  
(212) 566-6250

*New York*

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Capital District 64/VIC 20  
Users' Group  
363 Hamilton Street  
Albany, NY 12210  
(518) 436-1190

Hudson Valley Commodore  
Club  
One Manor Drive  
Woodstock, NY 12498

*North Carolina*

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Commodore Masters  
25 Croton Avenue  
Staten Island, NY 10301

Amateur Radio PET Users'  
Group  
P.O. Box 30694  
Raleigh, NC 27622

Rockland County  
Commodore Users' Group  
14 Hillside Court  
Suffern, NY 10901  
(914) 354-7439

Microcomputer Users' Club  
Box 17142 Bethabara Sta.  
Winston-Salem, NC 28092

Ohio

Dayton Area PET User  
Group  
933 Livingston Drive  
Xenia, OH 45385  
(513) 372-2052

Central Ohio PET Users'  
Group  
107 S. Westmoor Ave.  
Columbus, OH 43204

Chillicothe Commodore  
Users' Group  
P.O. Box 211  
Chillicothe, OH 45601

Licking County 64 Users'  
Group  
323 Schuler Street  
Newark, OH 43055  
(614) 345-1327

Oklahoma

Southwest Oklahoma  
Computer Club  
P.O. Box 6646  
Lawton, OK 73504  
Meets first Sunday of each  
month

Tulsa Area Commodore  
Users' Group  
Tulsa Computer Society  
P.O. Box 15238  
Tulsa, OK 74112

Oregon

NW PET Users' Group  
2134 NE 45th Avenue  
Portland, OR 97213

Pennsylvania

Penn Conference Computer  
Club  
c/o Penn Conference of SDA  
720 Museum Road  
Reading, PA 19611

Glen Schwartz  
807 Avon  
Philadelphia, PA 19116

Gene Planchak  
4820 Anne Lane  
Sharpsville, PA 15150  
(412) 962-9682

Westmoreland Commodore  
Users' Club  
c/o DJ & Son Electronics  
Colonial Plaza  
Latrobe, PA 15650

Commodore Users' Club  
3021 Ben Venue Drive  
Greenburg, PA 15601  
(412) 836-2224

G.R.C. Users' Club  
300 Whitten Hollow Road  
New Kensington, PA 15068

NADC Commodore Users  
Club  
248 Oakdale Avenue  
Horsham, PA 19044

Commodore User Club  
Metro Computer Center  
1800 Dayton Blvd.  
Chattanooga, TN 37405

*Rhode Island*

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Irving B. Silverman, CPA  
160 Taunton Avenue  
East Providence, RI 02914

Newport VIC/64 Users Group  
655 Hernandez Street  
Newport, RI 02840  
(401) 849-2684

*South Carolina*

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Beauford Technical College  
c/o Dean of instruction  
100 S. Ribaut Road  
Beauford, SC 29902

*South Dakota*

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PET User Group  
515 South Duff  
Mitchell, SD 57301  
(605) 996-8277

VIC/64 Users Club  
203 E. Sioux Avenue  
Pierre, SD 57501  
(605) 224-4863

*Tennessee*

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Nashville VIC Users Group  
American Computer Store  
1004 Eighth Avenue S  
Nashville, TN 37203  
(615) 242-8592

*Texas*

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CHUG (Commodore Houston  
Users Group)  
8738 Wildforest  
Houston, TX 77088  
(713) 999-3650

Corpus Christi Commodores  
3650 Topeka Street  
Corpus Christi, TX 78411  
(512) 852-7665

Commodore Users Group  
5326 Cameron Road  
Austin, TX 78723  
(512) 459-1220

64 Users Group  
2421 Midnight Circle  
Plano, TX 75075

*Utah*

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The Commodore Users Club  
742 Taylor Avenue  
Ogden, UT 84404

Northern Utah VIC & 64  
Users Group  
P.O. Box 533  
Garland, UT 84312

The Utah Commodore Users  
Group  
652 W. 700 North  
Clearfield, UT 84015  
(801) 776-3950

*West Virginia*

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Personal Computer Service  
P.O. Box 1301  
Charleston, WV 25325

*Virginia*

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Dale City Commodore Users  
Group  
P.O. Box 2004  
Dale City, VA 22193  
(703) 680-2270

*Wisconsin*

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SEWPUS  
c/o Theodore Polozynski  
P.O. Box 21851  
Milwaukee, WI 53221

Tidewater Commodore  
Users Group  
4917 Westgrove Road  
Virginia Beach, VA 23455

Waukesha Area Commodore  
Users Group (WACUG)  
256 W. Broadway  
Waukesha, WI 53816  
(414) 547-9391

Commonwealth 20/64 Users  
Group  
1773 Wainwright Drive  
Reston, VA 22090  
(703) 471-6325

Commodore User Group  
1130 Elm Grove Street  
Elm Grove, WI 53122

Commodore 64 Software Ex-  
change Group  
P.O. Box 224  
Oregon, WI 53575

\* *Washington*

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NW PET Users Group  
2565 N. Dexter 3203  
Seattle, WA 98109

*Puerto Rico*

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CUG of Puerto Rico  
RFD #1 Box 13  
San Juan, PR 00907

PET Users Group  
c/o Kenneth Tong  
1800 Taylor Ave N102  
Seattle, WA 98102

*Canada*

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Central Washington Com-  
modore Users Group  
1222 South First Street  
Yakima, WA 98902

Toronto PET Users Group  
381 Lawrence Avenue West  
Toronto, Ontario, Canada  
M5M 1B9  
(416) 782-9252

# 7 READOUTS

**B**ecause there are so many users of the Commodore 64, there is a great deal of information on the machine that's available. This information, however, is primarily in the form of magazines—some dedicated solely to Commodore products, and others of a more general nature that have frequent articles about the 64 and other Commodore computers.

Books about the 64 generally deal with programming, and range from books for the beginners to those for the advanced programmer. Many offer sample programs that can be typed into your machine and used right away.

## BOOKS

*101 Programming Tips and Tricks for the Commodore VIC 20 and Commodore 64* (\$8.95; ArcSoft Publishers, P.O. Box 132, Woodsboro, MD 21798).

This book offers just the information you would expect—tips to make programming on those two Commodore computers simpler and more fun. The book includes programs listings.

*The Elementary Commodore 64*, by William B. Sanders (\$14.95; Datamost Inc., Chatsworth, CA).

A great book for people starting out on the 64 who want to learn to program. It is written in simple English and carries the user from turning on their computer for the first time through some fairly complex programming functions.

*The Commodore 64 Programmer's Reference Guide* (\$19.95; Howard W. Sams & Co., Inc., Indianapolis, IN).

This book is for anybody who intends to do any serious programming on the 64. This has it all, from BASIC to machine language. It even includes a schematic of the 64. Everything is mapped and explained. But the book is highly technical and of little use to beginners.

*Using the Commodore 64 in the Home*, by Hank Librach and Bill Behrendt (\$10.95 paperback; \$16.95 hardcover; Spectrum/Prentice Hall, Englewood Cliffs, NJ).

If you want to know the kinds of things a computer can do to make life easier in the home, and if you like to program, this is a fine book that offers programs and advice on using your Commodore 64 as a home management tool.

*Commodore Software Encyclopedia*, 3rd edition (\$19.95; Howard W. Sams and Co, 4300 W. 62nd Street, Indianapolis, IN).

This could be the single most valuable book available for the 64. It lists everything you could imagine and more. The one problem is that software is being developed so rapidly for the 64, the book is probably obsolete the day after it is published. But if you are wondering whether there is a program for your Commodore 64 that will make it do this or that, get your hands on a copy of this book and you will have a pretty good idea.

## **MAGAZINES**

The Optimizer 64

#1 2929 Commercial Drive  
Vancouver, British Columbia  
Canada V5N 4C8

This relatively new publication is especially for users of the Commodore 64. It is full of listings and technical articles and the people involved seem knowledgeable and determined. The Optimizer 64 promises to be an important publication for 64 users.

### COMPUTE!'S GAZETTE

Compute! Publications, Inc.  
505 Edwardia Drive, Greensboro, NC 27409

COMPUTE!'s Gazette is specifically directed at users of the Commodore 64 and the VIC 20. Their standard articles range from reviews, listings, games, education and home applications to programming. Each issue includes programs written by 64 users which can be copied and used by readers.

### COMPUTE!

Address same as for COMPUTE!'S GAZETTE

COMPUTE! is similar in concept to the COMPUTE!'s Gazette, but is directed at a more general audience. The magazine frequently publishes articles relevant to users of the 64.

MICROCOMPUTING

80 Pine Street  
St Petersburg, NH 03458

This is a general interest computing magazine that prints numerous articles specific to the Commodore 64. It is especially good on peripherals and programming.

COMMODORE, the Microcomputer Magazine

Commodore Business Machines  
1200 Wilson Drive  
West Chester, PA

Published bi-monthly by Commodore, this magazine is, of course, dedicated solely to Commodore products. There is a great deal of information in every issue that could be of interest to 64 users, but some of it is very technical in nature. Departments include: Commodore news; business, programmer's tips and a user's department.

COMMODORE POWER PLAY

Address same as for COMMODORE, the Microcomputer Magazine

Power Play is a less technical magazine, for users of Commodore computers, dealing more with the entertainment side of computing. Regular features include software reviews, programming for beginners, home applications, telecomputing and new product reviews. It is published four times a year and includes program listings.

INFO 64

P.O. Box 958  
Auburn, WA 98002

Published quarterly, this magazine offers a fairly comprehensive list of software and hardware peripherals available for the Commodore 64. There are product reviews, price lists and a vendor roundup that lists names and addresses of distributors/manufacturers of products for the 64. There's also a Kludge Corner for getting around inside the 64 to make it do what you want, and hints on how to get better performance from your machine.

# 8 SMALL BYTES

**T**here are people who think that a computer is like an automobile. If it doesn't work, pop the hood and figure out what went wrong.

Well, that's fine if you know what you're doing. Which is to say that's fine if you are trained to repair computers or if you are an electronics engineer. But the simple truth is that most of us are not technicians or engineers, and so we are *not* qualified to do repairs at home.

If you look at the guts of your 64, as we did earlier in this book, you will find that things don't look that complex. But before you start fidgeting, remember this: **IF YOU OPEN THE TOP OF YOUR MACHINE AND START FIDGETING WITH THE IN-NARDS, YOU WILL VOID YOUR WARRANTY.** As long as you know that, the decision as to whether or not to attempt home repairs is strictly up to you.

The best advice is that if you have something wrong with your computer, take it to somebody who knows how to fix it. In the long run you will have far less heartache than if you attempt to patch things yourself.

The basic philosophy behind computer repair is that if something has stopped working, replace it, and this is best done by someone who is properly trained.

The hard part, of course, is not replacing a single chip. A child could do that. The difficulty lies in identifying what is wrong while avoiding electrocution.

There are many ways that you, the computer user, can ensure that your computer will give you years of trouble-free operation. That is because microchips tend to either fail early or last for a long time.

So, how do you make certain your machine will give you trouble-free operation, well, there are a number of ways.

First, set up your system carefully. Make sure everything is properly connected.

Next, leave your computer on for at least several hours when you first get it home—many technicians recommend leaving the machine on for seven days straight.

This is called “burning in.” If something is wrong with your computer, it will probably become apparent during this period, while the machine is still under warranty.

Finally, treat your machine well. Computers do not like certain things, among them moisture, dirt and sudden surges of electricity.

Moisture is simple enough. Don't take your computer into the bathroom with you. Don't leave it on kitchen counters. And *be careful when you're drinking a beverage.*

That may sound stupid, but technicians report that the most frequent cause of catastrophic damage to a computer is caused by spilled coffee or cola. Keyboards do not tolerate such human error well. If you must drink while computing, keep the glass a safe distance from the computer. If you don't remember we told you so.

Protect your machine from dust. Get a dust cover, especially for sensitive disk drives if you have them. This goes for software (tapes, disks and cartridges) too. Don't leave them where they will get dirty and abused.

You have to protect your machine from electrical jolts. It is wise to touch a metal object before touching your machine, to release static electricity. Static electricity, harmless to you, can be fatal to computer microchips.

Also it is wise, though not essential, to protect the computer from surges in line voltage. Power companies do not put out a steady voltage. Surges, brown-outs and blackouts can all harm sensitive electronics.

There is no absolute solution to this problem short of a battery backup, which can cost thousands of dollars, but there are ways to protect yourself:

- Do not compute during thunderstorms. Thunderstorms frequently result in surges of electricity, and in blackouts. If there is a thunderstorm in the area, wait until it passes to do your computing.

- Turn off your machine if a blackout occurs unexpectedly. When power comes back on, there might be a surge that will damage your circuitry.
- If you can afford it, purchase a surge protector. These are widely available for under \$50, and it could be the best investment you ever made. Surge protectors go between your computer and the wall outlet. If there is a surge of high voltage, they stop it, either by blowing like a fuse, or by resetting like a circuit breaker. There are surge protectors that are only good for one surge. After that, they are blown (like a fuse) and can't be used. They aren't worth the price. Get one that has a changeable fuse or that can be reset.

And what if you turn on your computer one day and it doesn't work?

First check the obvious. Are all the wires properly connected? Is the computer plugged in? Push all connections tight, just to make sure. Remember, while you are checking all the plugs, leave your machine off. Turn it back on only after you have finished juggling all the wires. If the machine still doesn't work, call an authorized repair service to see what pieces of your set up you should bring with you when you take your computer in to the repair shop.

If a program is not executing as it should, reload it. Sometimes, for no apparent reason, programs don't load as they should.

If you have continued problems with a program, don't panic. More often than not such problems are software, not hardware, related.

One easy way to tell is to take the program to a friend's house or to the local computer store. Try to run it on a different machine. If it doesn't work, the software is bad.

If you determine there is something wrong with your machine, you have only one choice: take it to an authorized Commodore repair facility. There, a technician will either repair or replace your machine, or it will be sent back to Commodore for repair or replacement.

Because all of the 64's electronics are on a single board, it is not uncommon for technicians to replace the entire board. It is less labor-intensive and therefore often less expensive.

# 9 WORD FOR THE WISE

**I**f the strange words have scared you off from computers, this section is for you. First of all, you're not alone. The new technology has brought with it an entirely new language to learn. But you can become more comfortable and knowledgeable just by taking note of the necessary fundamental vocabulary and terms you'll be encountering as we become a more computerized society. Below are your building blocks to a world of computer literacy.

**Access.** To read or get information, often from memory.

**Access time.** The time between calling for and receiving information from storage.

**Accumulator.** A microprocessor memory register that temporarily stores the results of arithmetical operations.

**Acoustic coupler.** Lets the computer send and receive information through a telephone's handset. It first converts signals from the computer into audible tones.

**Add-on.** Attaching circuitry or components to increase memory capacity or improve a system's performance in some other way.

**Address.** An exact place in a computer's memory that stores information, represented by a name, a label or a number.

**Address bus.** A communication line inside a computer along which the memory locations of data are sent.

**Algorithm.** A step-by-step procedure required to solve a problem. The algorithm is translated into computer language by the programmer.

**Alphanumeric characters.** Symbols including alphabet letters, numbers, punctuation marks and mathematical symbols.

**AppleSoft BASIC.** A particular dialect of the BASIC programming language.

**Applications software.** Programs designed to perform specific tasks, such as games, educational programs, payroll programs or spreadsheets.

**Arithmetic/logic unit (ALU).** A microprocessor register that performs arithmetic and logical operations.

**ASCII.** Acronym for American Standard Code for Information Interchange. Translates 128 keyboard symbols and control instructions into 7-bit binary combinations. Is the most common encoding system for English language alphanumeric.

**Assembler.** A computer program that translates assembly-language programs into the binary-coded machine language all computers use.

**Assembly language.** A low-level, symbolic programming language easier to use than machine language but not as easy as high-level language. Usually expressed in two- or three-letter combinations that are easily memorized.

**Asynchronous transmission.** The sending of information one byte at a time, with a start bit and a stop bit surrounding each character. Simplicity and reliability make this method desirable.

**Auxiliary storage.** Mass storage of data on media other than the computer's main memory.

**Backup.** Copying a set of data, such as a file, onto another storage medium in case the original is lost or damaged.

**Bank switching.** A method of moving data back and forth between a computer's memory and an external memory bank.

**BASIC.** An acronym for Beginner's All-purpose Symbolic Instruction Code, a high-level computer language designed for beginners. Because of its simplicity, BASIC quickly became the most common microcomputer language.

**Batch processing.** The collecting of input items over time, and the grouping and processing of them at once. An internal computer function. There is no interaction between the operator and the computer.

**Baud.** A unit of information transfer. In microcomputers, the Baud is defined as one bit per second.

**Baud rate.** The rate at which information is transferred. For instance, a 300 Baud rate is 300 bits per second.

**Benchmark program.** A program designed to be "typical" so that a user can run it through different computers to compare their

characteristics and capabilities.

**Binary.** A number system that uses only two digits, 0 and 1, to express all numeric values. *See digital computer.*

**Bit.** The basic unit of computer memory. Bit is a binary digit and can have a value of either 1 or 0.

**Black box.** A piece of equipment viewed only in terms of its input and output, ignoring how it performs its tasks or what it is made of.

**Block.** A group of records treated as a unit because of their positions next to each other in memory.

**Bootstrap.** A process where built-in instructions are used to load other programs.

**Bubble memory.** A solid-state memory capable of storing large amounts of information in an extremely small area.

**Buffer.** A temporary storage area for computer data. A buffer is often used to compensate for differing speeds between devices—for example, between a computer and a printer.

**Bug.** A problem that prevents the computer from performing correctly, or at all.

**Byte.** A group of eight bits (or a memory cell that can store eight bits) usually treated as a unit. It takes one byte to store each letter of information. For instance, the four-letter word *love* requires four bytes of memory.

**Calling sequence.** Instructions linking going to and from program subroutines.

**Canned software.** One or a series of programs ready to run without having to be altered. Many of these programs are copy-protected so changes are extremely difficult to make if not impossible.

**Carrier wave.** A broadcast wave that carries a radio or television signal.

**Cartridge.** A 2x3x3/4-inch plastic box that contains ROM software such as BASIC. Cartridges are commonly used for home video game player machines.

**Cassette drive.** A standard tape recorder used to store programs or data.

**Cassette.** A standard tape cassette.

**Cathode-ray tube (CRT).** The picture tube of a television set or a monitor. It's used to display computer output.

- Cell.** A place for a single unit of information in memory, usually one character or byte.
- Central processing unit.** The heart of the computer, containing the circuits that control the interpretation and execution of instructions.
- Chip.** A tiny piece of silicon treated to accommodate thousands of electrical circuits to form an integrated circuit.
- Clock.** A circuit in a computer that produces precisely timed electronic signals to ensure proper timing of the operations of all other circuits.
- Code.** Any system used to represent symbols (such as alphanumeric characters) with binary numbers.
- Compiler.** A program designed to translate a high-level language (such as BASIC or DOS) into machine language (1's and 0's) prior to execution of the program by the computer. This eliminates the need for translation each time the program is run.
- Computer.** An electronic device for juggling information, in either numeric or verbal form. A computer can receive and follow instructions to perform calculations or compile, select or correlate data. The primary differences between a computer and a calculator are that a computer can manipulate text, display graphics and make decisions.
- Computer-aided instruction (CAI).** Using computers in an educational process.
- Concatenation.** The connecting of two or more text strings to form a single longer string.
- Console computer.** A desktop computer with its own video screen.
- Control bus.** A communication line along which control data flows.
- Control information.** Information that controls functions of devices.
- CPU.** Central processing unit.
- CRT.** Cathode-ray tube.
- Cursor.** The little flashing square or bar on a video monitor that indicates where the next character will be displayed.
- Cursor tracking.** The manipulation of a cursor on a screen using a stylus and graphics tablet.
- Cycle time.** The time needed by a microprocessor to complete a

certain function in a program.

**Daisy wheel.** A print element used in some printers that resembles a wheel with "spokes" having a letter on the end of each one.

**Data.** Any and all items of information—numbers, letters, symbols, facts, statements—which can be processed or generated by computer.

**Data base.** An entire collection of data in a computer system that can be accessed at one time.

**Data bus.** A communication line that transports program data.

**Debugger program.** A program that helps a user locate and correct programming errors. The debugger stops an execution at points preselected by the user (break points). This makes inspection for errors more efficient, as the program can be tested a portion at a time.

**Decoder.** A program that translates coded signals.

**Degausser (bulk eraser).** A device used to demagnetize a magnetic tape.

**Demodulator.** A device that separates a TV signal from its carrier wave so that a TV picture can be produced. Demodulators are used in TV sets, but are not needed in computer monitors, since monitors don't receive broadcast signals.

**Digital.** A number system that uses 0 and 1 to represent variables involved in calculation. This means that information can be represented by a series of bits.

**Digital computer.** A computer that uses a series of electronic offs and ons to represent information. These offs and ons are converted to (or from) binary numbers. Microcomputers are digital computers.

**Directory.** Information on a floppy disk that tells the computer where on the disk a program is located. Directories also give the user easy reference to files. The command DIR will display the directory on the disk in the main disk drive.

**Disk.** A flat rotating circular sheet that's used to store bits of information.

**Diskette.** A flexible disk made of a plastic-like magnetizable material that's either 5¼ or 8 inches in diameter (about the size of a 45 RPM record).

**Disk drive.** An electromechanical device that stores information

on or recalls information from a disk.

**Disk operating system (DOS).** An operating system that must be present when disk storage is used. The functions of a DOS include keeping track of files, controlling space allocation, and saving and retrieving files.

**Documentation.** All of the available information about a particular computer, computer program or set of programs. It should include operating instructions, troubleshooting warnings, and labeling. The term usually refers to the printed form of this information in books or pamphlets.

**Dot-matrix printer.** A printer that forms symbols by the use of dots in a pattern. Letters are of poorer quality than those of letter quality printers but are typed faster, and the unit is less expensive.

**Double-density disk.** A disk that can store twice as much information as an ordinary (single-density) disk because of increased storage density.

**Double-sided floppy disk.** A floppy disk with two usable sides to increase storage capacity.

**Driver.** Instructions controlling peripherals and their connections with the CPU (central processing unit).

**Dual disk drive.** A floppy disk system using two drive mechanisms and recording heads, which yields such advantages as increased storage capacity.

**Dumb terminal.** A monitor-and-keyboard module that looks much like a microcomputer, but can be operated only when connected to a mainframe computer, since it cannot perform computer functions by itself. Dumb terminals are most commonly used to retrieve and receive information stored in a data base that is often located at a different location.

**Editor program.** A standard program (in ROM or external storage) that lets users enter corrections, insert or delete information, as well as move text, while inputting programs.

**Electronic mail.** Personal or business messages generated on a computer and transmitted via phone lines to another computer at a different location.

**Electrostatic printer.** A printer in which dry ink is melted onto an electrostatic charge placed on paper to form characters.

**Embedded command.** Text characters that do not appear on the screen or printout, but instead instruct a computer to perform

some task. Embedded commands are used in word processing and other applications. For example, the instruction may be to begin a new page.

**External memory.** Mass storage.

**Field.** One or more characters treated as a data unit.

**Field gap.** A space used at the end of a file to indicate to a computer system where the file ends.

**Firmware.** Unalterable, permanent programs or data stored in ROM.

**Fixed-head disk system.** A disk system that uses one head for each track of information on a disk. The positions of the heads are therefore fixed.

**Floating-point representation.** A system used for translating decimal numbers into binary numbers so they can be processed by a computer.

**Floppy disk.** A flexible plastic disk coated with magnetic recording material on which computer data may be stored; a diskette.

**Flowchart.** A programming aid that illustrates problem-solving procedures (algorithms) step by step. Standard flowcharts use geometrical shapes such as rectangles (for operations) or diamonds (for testing conditions), along with arrows to illustrate procedures clearly.

**Formatting.** Preparing a disk to accept information or preparing text for printout. Includes putting down data tracks on a disk; or setting margins, line and character spacing, and page length for printing.

**Full duplex.** In telecommunications, a two-way transmission mode.

**Glitch.** An undesirable variation in an electrical flow that can cause errors in a program or other failures in a computer system.

**Graphics.** The ability of a computer to show pictures, line drawings, and special characters on a video monitor or printer.

**Graphics tablet.** An electronic writing tablet used to convert shapes and drawings into the digital form needed for computer storage. As a special stylus is moved across the tablet (to trace drawings, for example), the shape shows up on a display screen and is entered into the system.

**Green phosphor.** The chemical giving the characters their green color on the background of video monitors.

**Half duplex.** In telecommunications, a one-way transmission mode.

**Handshaking.** A brief interruption in a program's execution so that a computer can perform some other task.

**Hard copy.** A copy of the computer's output printed on paper.

**Hard disk.** A rotating mass-storage device that uses a rigid disk made of a hard plastic-like material. It has many times the storage capacity of a floppy disk.

**Hardware.** All of the various physical components of a computer system: the computer itself, the printer, the monitor, etc.

**Head.** A device to magnetically read records or erase data on a disk, a tape or other magnetic medium.

**Heuristic.** A trial-and-error method of solving a problem.

**High-level language.** A computer language that uses simple English words to represent computer commands. For instance, the command RUN in BASIC tells the computer to run a program.

**High resolution.** The extent of detail offered in the graphics of a printer or video display.

**Horizontal scrolling.** Moving text or data horizontally on a display screen so more of it can be seen than what fits within the screen's width at any one time.

**Idle time.** An interval during which some or all of a system isn't being used.

**Impact printer.** A printer where ink is put onto paper by a hammer mechanism.

**Input.** To transfer data from the keyboard, a diskette or a cassette to RAM.

**Input/output (I/O).** The process of entering data into a computer or taking it out.

**Interface.** Where two systems meet and act upon each other.

**Interpreter.** A program that translates high-level language instructions into machine readable form while executing the high-level program.

**Iteration.** The repetition of a part of a program.

**Keyboard.** An input device, normally comprised of a standard typewriter-style set of keys and various special keys.

**Keypad.** An input device, usually consisting of keys for the numbers 0-9 and a period.

**Key stations.** The number of input terminals in a multiple-user system.

**Keyword.** In a computer language, a word that has a specific meaning and therefore cannot be used as a variable name.

**Kilo.** A prefix meaning 1000. It's abbreviated K, and for computers is overwhelmingly used as a handy approximation of  $2^{10}$  or 1024.

**Kilobyte.** 1024 bytes. Thus 4K of memory is about 4000 bytes of memory. (It's actually  $4 \times 2^{10}$  or 4096 bytes, but 4K is a convenient way to keep track of it.)

**Language.** When used in reference to computers, the same thing as human language. The only difference is that a computer language allows humans to communicate with a computer.

**Laser writer.** A printer in which electrostatically charged paper attracts dry ink powder to form images that are baked onto the paper. This method offers excellent quality and high speed, but at a high initial cost.

**Letter-quality printer.** A printer producing a complete character with each stroke, using a ball, daisy wheel or thimble element. The same as "line-quality" printer.

**Light pen.** A pen-shaped instrument that allows the user to "draw" on a display screen. The photosensitivity of the pen allows various coordinates to be inputted.

**Line feed.** A command that moves the printout onto the next line; also called a line break.

**LOGO.** A complete language simple enough for beginners yet sophisticated enough for advanced programming. Originally designed to teach programming to children, it focuses on drawing shapes using simple commands.

**Loop.** The repeating of a sequence of instructions in a program a given number of times.

**Low-level language.** A computer language at the machine-language level (a pattern of pure binary coding) or somewhat higher. A low-level language is neither simple nor obvious for a human being to read, understand or use. (Compare with *High-level language*.)

**Machine-dependent.** Capable of being used only on a particular machine.

**Machine language.** The lowest level language. It's a pattern of binary coding that tells the computer what to do.

**Magnetic media.** Devices that store data in the form of magnetic

impulses; includes disks and tapes.

**Mainframe computer.** A large, expensive computer generally used for data processing in large corporations, laboratories and government installations. Originally, the term referred to the extensive array of large rack and panel cabinets that held the extensive bulk of the early computers.

**Main memory.** Memory that is immediately accessible for programs and data storage; includes ROM and RAM.

**Mass storage.** Large capacity, secondary storage systems, such as recording tape and magnetic disks. Synonymous with external memory.

**Megabyte.** One million bytes.

**Memory.** The internal hardware in the computer that stores information for further use.

**Menu.** A list of commands appearing on the screen, from which you can choose. One menu sometimes leads to others. Programs using menus to present all their main commands and operations are called menu-driven programs.

**Microcomputer.** A fully operational small computer that uses a microprocessor and its central processing unit (CPU).

**Microprocessor.** A central processing unit contained on a single chip.

**Minicomputer.** A small computer based on large-computer technology.

**Minifloppy disk.** A floppy disk about 5¼" in diameter.

**Modem.** A *modulating* and *demodulating* device that enables computers to communicate over telephone lines.

**Modulation.** The altering of a signal to allow it to be broadcast. For example, a TV signal is modulated by being combined with a carrier wave.

**Module.** A plastic housing holding one or more memory chips which can be connected to a computer.

**Monitor.** A television receiver or CRT device used to display computer output.

**Monitor program.** A program that controls simple, frequently performed tasks such as inspecting or changing the contents of locations in memory, loading or storing programs, etc.

**Monochrome monitor.** A video monitor with a single-color display.

**Mouse.** A device that rolls on wheels and is used to move a cursor on a screen.

**Multiple key rollover protection.** A keyboard feature that stores typed characters temporarily when several keys are pressed almost simultaneously on a keyboard. Then, when a pause is detected, the characters can be printed. This technique prevents loss of data.

**Multiprocessor.** A computer with more than one microprocessor chip.

**Nesting.** Using hierarchical levels of programming instructions. These instructions are usually in subroutines.

**Network.** Computers, peripherals or terminals that are interconnected to communicate with each other. One type is a data-communications network, which basically supplies information to subscribers.

**Nonacoustic coupler.** Similar in concept to an acoustic coupler, but connects the computer directly to a telephone line without using the telephone headset.

**Object program.** A program that has been translated into machine language.

**On-line.** When a system and its peripherals are directly communicating with the central processing unit (CPU).

**Operating system.** A set of computer programs devoted to the operation of the computer itself, which must be present in the computer before applications programs can be loaded or expected to work.

**Operation code.** A command that identifies a specific operation to be carried out, such as MUL (meaning "multiply").

**OS.** Operating system.

**Output.** Information or data transferred from the internal memory of the computer to some external device, such as a CRT, a mass-storage device or printer.

**Overflow.** A number, produced through an arithmetic operation, that is too large for the computer's register.

**Overlay.** A technique used to utilize programs that are too large for a system's memory. One part of the program is executed, and additional routines are brought in later, taking the place of the program segment that is no longer needed.

**Packaged software.** Canned software—that is, software pro-

grams available as commercial products.

**Parallel interface.** A connection over which several bits move at the same time over different wires.

**Parallel processing.** An operation that runs two programs simultaneously with more than one central processing unit (CPU).

**PASCAL.** A powerful high-level computer language with modular structure, intended for business and general use. Named for French mathematician and philosopher Blaise Pascal (1623-62).

**PC.** Personal computer.

**Peripheral.** Any I/O device, for instance, a printer.

**PILOT.** An easy-to-learn, high-level language designed for use by novice computer users. Primarily intended for educational settings.

**Pin feed.** The pin apparatus of a printer which guides fan fold paper by its holes.

**Pixel.** The rectangular element used in combinations to form images on video display terminal screens. The more pixels, the sharper the picture.

**PLATO.** An educational system using computer timesharing, where students interact with the computer on an individual level.

**Plotter.** A peripheral that draws and produces output, such as drawings and blueprints, in permanent form.

**Port.** The connection for input/output between interfacing computers and peripherals.

**Printed circuit board.** An insulating board which contains a circuit and has transistors, resistors, diodes and other electrical components mounted on it.

**Printer.** A device for producing paper copies (*hard copy*) of the data output by a computer.

**Program.** An organized group of instructions that tells the computer what to do. The program must be in a language (like BASIC or PASCAL) the computer understands.

**Program counter.** A memory register in a central processing unit that stores the sequence of a program's instructions as they are executed.

**Program development cycle.** A definite sequence of steps involved in writing a program.

**PROM (Programmable read-only memory).** A memory cir-

cuit that can be programmed (unlike ROM) with an inexpensive programmer. It cannot be changed after being programmed.

**Prompt.** A message given by the computer to the operator to tell him there's an error or something he should do.

**Proportional spacing.** Compensation by a printer for the varying widths of letters, giving a better overall appearance.

**Public domain software.** Software with no copyright, allowing for free copying and exchanging.

**Random-access memory (RAM).** Read-write memory available for use in the computer. Through random access the computer can retrieve or deposit information instantly at any memory address. RAM is the computer's working memory area and its size (64K or 128K) largely determines the sophistication of the programs the computer can handle.

**Raster.** The horizontal lines on a video screen which are scanned and illuminated by the electron beam.

**Read.** The act of taking data from a storage device, such as a diskette, and putting it in computer memory.

**Read-only memory (ROM).** A random-access memory device that has permanently stored information. The contents of this memory are set during manufacture.

**Refreshing.** The constant regenerating of the information that decays or fades when left idle, such as the phosphor on a video screen. The image would fade if not for the electron beam.

**Registers.** Memory locations in a microprocessor in which information is processed.

**RF modulator (Radio Frequency Modulator).** A device that allows a computer-output signal to be modified for display on a television screen.

**RGB monitor.** An ultra-high-resolution color video monitor with separate inputs for red, green and blue video signals. Gives excellent color graphics but is expensive and requires a computer with special outputs.

**RPG (Report Program Generator).** A high-level language designed for business applications.

**Search and replace.** A word-processing program's ability to find and replace a given piece of information wherever it appears in the text.

**Sector.** Individual portions of a circular track on a disk, providing

easy retrieval of information by locating sector and track number. A typical sector contains 128 bytes.

**Serial (sequential) access.** The searching for data by going through information in the order it is stored on the disk. The slowest of all access methods.

**Serial interface.** A connection over which one bit moves after the other over the same wire.

**Smart terminal.** A peripheral, usually consisting of a combined video screen and keyboard, that has its own microprocessor and can therefore perform some computer functions. Its main role, however, is interfacing with a computer.

**Software.** The programs and data used to control a computer.

**Static memory elements.** Memory devices that retain their contents indefinitely (without refreshing) as long as power is provided.

**String.** A sequence of letters, numerals and other characters. String length refers to the number of characters a string contains.

**Structured programming.** A method of programming, using modules, that simplifies much of the aspects of programming computers.

**Subroutines.** A group of instructions within a program that are used several times, whenever needed.

**Synchronous transmission.** A method of sending and receiving information in which careful timing is needed for characters to be decoded. This method provides high speed but requires expensive equipment.

**System.** All of the various hardware components that make the computer usable—the computer, the printer, modem, disk drive, etc.

**Terminal.** A keyboard and CRT combined in one package, for both input and output. A printer that incorporates a typewriter-style keyboard is also a terminal when used with a computer, or a teleprinter when used or considered by itself.

**Thermal printer.** A device that uses heat and heat-sensitive paper to form characters. Advantages: low initial cost, ease in combining alphanumerics and graphics. Disadvantages: slow, average reproduction quality, high cost of paper.

**Timesharing.** An arrangement where a central processing system serves several users over phone lines.

**Touch terminal.** A terminal into which the user writes information by touching his fingers to a screen, rather than by using a keyboard.

**Turtle graphics.** Line drawings created in the LOGO programming language by moving the cursor. The term "turtle" is derived from the triangular cursor used.

**Typewriter interfaces.** Devices that allow a computer to employ a standard electric or electronic typewriter as a printer.

**User friendly.** Systems designed to be easily learned and operated by computer owners.

**User group.** An organized club or group of people who share hardware and software information for a particular brand of computer.

**Utility functions.** Programs for frequently used applications, such as file-to-file conversion, printing, etc.

**Vertical scrolling.** Moving text up or down on the display screen.

**VLSI (Very Large Scale Integration).** A chip that contains the equivalent of thousands of semiconductors (five times more than the 20,000 or so on a large-scale integrated chip, or LSI).

**Volatile.** Computer memory requiring current to retain information, such as random-access memory (RAM). The contents of RAM disappear when the power is turned off.

**Wafer.** Also "silicon wafer." A piece of silicon on which integrated circuits are made. The wafer is later cut into individual chips.

**Wait state.** The state a microprocessor is in when it is not processing data, i.e. when it has idle time.

**Warm start.** Returning the computer to its initial condition, without stopping the power. Data is cleared from memory when this is done.

**Winchester disk.** A hard disk with higher storage capacity and much shorter access time than a floppy disk.

**Word processing.** A special feature of a computer that allows you to manipulate text.

**Word processor.** A special computer program that helps you manipulate text. You can write a document, insert or change words, paragraphs or pages, and then print the document letter-perfect.

**Word size.** The basic unit of information. Word size is equal to a specific number of bits, and varies with the system used.

**Word wrap.** The automatic placement by a word-processing system of a word on the next line if it doesn't fit within one line.

**Write:** To store data on external media such as disk or cassette.

The expression *write to diskette* means that the information stored in the computer's memory is sent to the diskette, where it is stored.

**Write-protection.** A technique used to prevent the accidental erasure of information by writing over data on a disk or other storage medium. To write-protect a floppy disk, a user attaches a special tab to the jacket that covers a notch in the jacket.

## **HARDWARE VENDORS**

Amdek Corp. (Monitors) 2201 Lively Blvd., Elk Grove, IL 60007  
Bytewriter (Printer) 125 Northview Rd., Ithaca, NY 14850  
C. Itoh (Printers) 5301 Beethoven St., Los Angeles, CA 90066  
Comrex (Printers) 3701 Skypark Dr. #120, Torrance, CA 90505  
Diablo (Printers) 24500 Industrial Blvd., Hayward, CA 94545  
Epson (Printers) 3415 Kashiwa St., Torrance, CA 90505  
Hayes (Modems) 5923 Peachtree Industrial Blvd., Norcross, GA 30092  
Iron Interface Group (Cables) 3938 Meadowbrook Rd., Minneapolis, MN 55426  
Olivetti Irwin (Printers) 8301 South 180th St., Kent, WA 98031  
NEC Printers, Monitors) 1401 Estes Ave., Elk Grove Village, IL 60007  
Novatron (Modems) 18664 Oxnard St., Tarzana, CA 91356  
Practical Peripherals (Print Buffers) 31245 La Baya Dr., Westlake Village, CA 91362  
Quadram (Monitors) 4357 Park Dr., Norcross, GA 90093  
Qume (Printers) 2350 Qume Dr., San Jose, CA 95131  
Smith-Corona (Printers) 65 Locust Ave., New Canaan, CT 06840  
Transtar (Printers, Plotters) P.O. Box C-96975, Bellevue, WA 98009  
USI (Monitors) 71 Park Lane, Brisbane, CA 94005

## **SOFTWARE VENDORS**

Continental Software, 11223 Hindry, Los Angeles, CA 90045  
Digital Marketing, 2670 Cherry Lane, Walnut Creek, CA 94596  
Infocom, 55 Wheeler St., Cambridge, MA 02138  
Innovative Software, 9300 W. 110th St. #380, Overland Park, KS 66210  
MicroPro, 33 San Pablo Ave., San Rafael, CA 94903  
Microsoft, 10700 Northrup Way, Bellevue, WA 98004  
Oasis Software, 2765 Reynard Way, San Diego, CA 92103  
Resource Software, 330 New Brunswick Ave., Fords, NJ 08863  
Sierra On-Line, Sierra On-Line Bldg., Coarsegold, CA 93614  
Software Arts, 27 Mica Lane, Wellesley, MA 02181  
Spinnaker Software, 14 William St., Somerville, MA 02144

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JONATHAN SACKS regularly reports on computers and other contemporary topics for *The Miami Herald*. MARK ANDREWS is the editor and ROGER C. SHARPE is the editorial director of *Easy Home Computer* magazine.

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