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June 1984
A CWC/I Publication

RUN

The Commodore 64 & VIC-20 Magazine

Programs of the Month—
20/64 Joystick Artists at Work

DISK-O-64

Add New Disk Commands to Your C-64

0 74470 12069 06

Dear Susan,

I've discovered something very exciting that I want to share with you. I've always thought assembly language was too complicated for me to learn and I've been doing all my programming in Basic, or buying software that doesn't do quite what I want. You know, Basic is just too slow for a lot of tasks, and I can't find ready made software to do those specialized things I want to do.

Well, I just bought Panther's C64 Assembler and I found out that assembly language is easier than I thought, and it's also fun.

The C64 Assembler is very "friendly" and the documentation is clear and well written. One very nice feature of the manual is a section for the neophyte assembly language programmer that really helped me understand how to use the machine.

Now I'll be able to write those programs myself instead of waiting for some software manufacturer to guess what I'm looking for! My programs will do exactly what I want, and I'll have fun writing them.

The dealer even told me that Panther is looking for good programs in assembly language, and they're willing to publish and pay royalties for useful programs which meet their standards.

As you know, I don't have any experience yet, so I can't compare assemblers, but Jim's seen it and he's a professional assembly language programmer. He says it's the easiest-to-use and the fastest assembler he's seen for any microcomputer. In fact, he said he's going to buy a Commodore 64 just so he can use it.

Come on over to my place when you have time and I'll show off the assembler for you, or go to the dealer down the street to see it. The whole Commodore community is excited about the C64 Assembler.

I've got to sign off now. I'm anxious to get back to my assembler and finish the program I'm working on. This is fun!

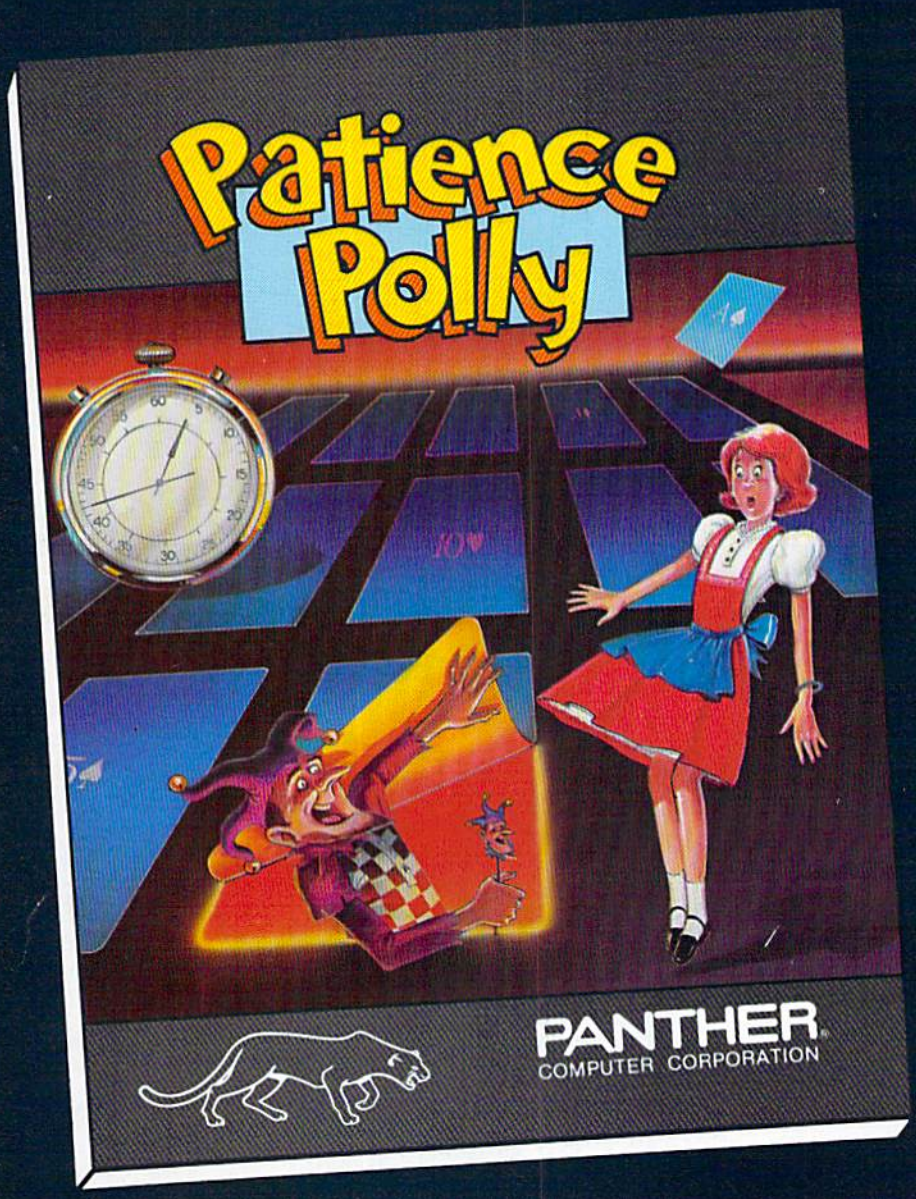
Let's get together soon,

Bob

WARNING:

Don't Play this Game.

(Habit Forming)



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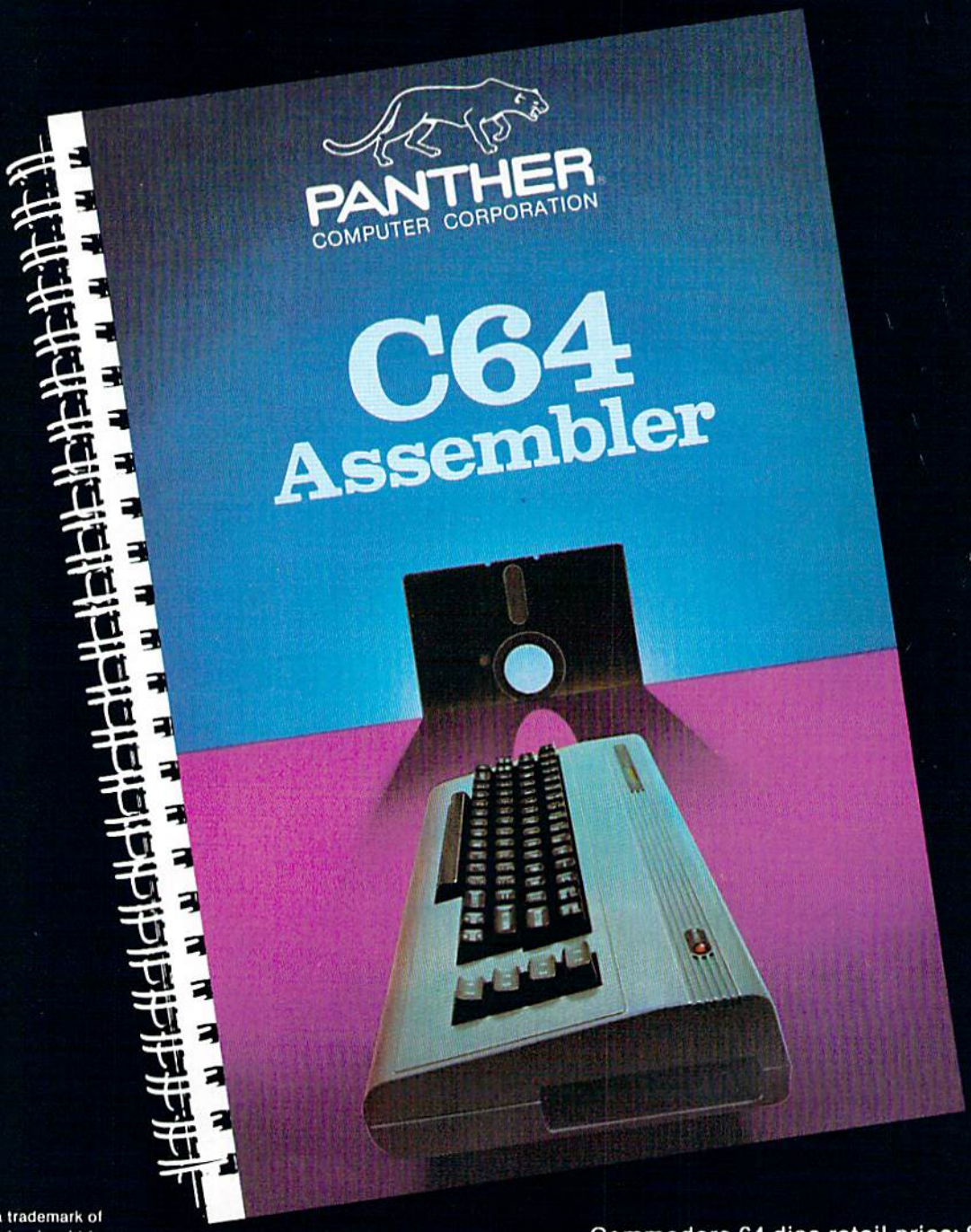

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RUN

June 1984
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FEATURES

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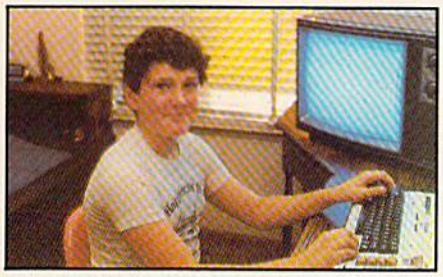

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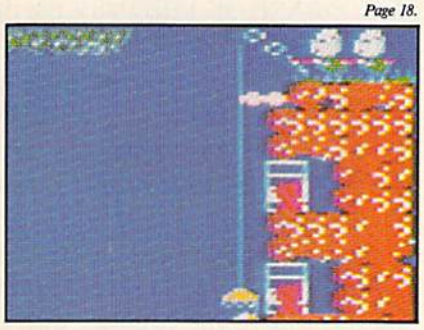

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Designed by Suzanne Torsheya.

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Introducing ReRUN:
Programs on Tape/Disk

For as long as *RUN* has been available, readers have been writing and calling us to ask when we're going to offer our programs on tape or disk. That time has arrived!

Now you'll be able to get every wonderful program ever published in *RUN* magazine on either tape or disk (well, perhaps not *every* program, but at least the best ones), all debugged and ready to load.

During 1984, we'll be coming out with two installments of ReRUN (that's what we have decided to call this project). Since we are only doing two installments this year, and there are so many programs printed in the magazine, we've had to pick and choose between articles. This first ReRUN will include some of the best programs from the January through June issues of *RUN*.

Something for Everyone

ReRUN will offer a mixture of games, utilities and educational programs for both the VIC-20 and the Commodore 64.

From our January issue, there will be DISK-O-VIC (a popular disk utility program that gives you 13 new disk commands), Canyons of Zelaz and The Riddle of the Symbol Code (two games for the 64).

From February, we have available Database Deluxe (a file-handler program that should help you get things in order), Fancy Fingering on the Function Keys (finally puts those function keys to work for you), Iron Hand or VIC-20? (a kingly simulation for both the VIC-20 and C-64 of survival economics in a time long past), Spriten Up! (sprite graphics made a bit easier) and Create a VICasso (generating custom characters on your VIC-20).

From the March issue we offer Mad Bomber (a C-64 program that will tune up those typing skills), Serpent of Death and Baja 1000 (add more action to your VIC-20 arcade game library).

April *RUN* brings Funky Monkey for the unexpanded VIC-20 (a word game for the very young to play with their parents).

May has Repeat the Sequence (Simon for the 64, only much more), Total Music for the 64 (a tune creator for all you Commodore composers) and Caves of Alpha-Ceti (tunnels of death-filled action for the VIC-20).

June closes out this first installment of ReRUN with Doodle on Your VIC (high-resolution drawing utility designed for designing) and an old favorite returning in a new form—DISK-O-64 (same dance as the DISK-O-VIC from our premier issue, only this time the tempo is for the C-64).

As you can see, there's something for everyone in this list of programs, and the price for a disk or tape is unusually low.

All the programs have been tested and refined, but you're going to have to refer back to your own copies of *RUN* to find out how the programs work. (For those who may be missing one or two back issues, we have included copies of the articles in booklet form. Read the articles to understand how to get the most out of each program.)

All programs have been tested and refined, but read the articles to get the most out of each program.

Born to Run

Many of the programs are self-explanatory, and if there were ambiguities, we tried to simplify things. For example, the VIC-20 versions of Database Deluxe, Doodle on Your VIC and Serpent of Death all require that you add a 3K memory expansion cartridge.

System requirements, as space allows, are included in the title; in which issue and on which page the program appeared are also specified. DBASE/3K FEB P48 is the title for Database Deluxe, VIC-20 version. The /3K means the program needs a 3K expander, the FEB P48 means the original article appeared in the February issue of *RUN*, starting on page 48.

On the tape version of ReRUN, all the VIC programs are recorded on one side of the cassette, with the C-64 programs on the flip side.

On the disk version, the C-64 programs are listed first in the directory, with the VIC-20 versions on the second half. We put a do-nothing program, called UP C64><DOWN

(continued on p. 131)

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Commodore Clinic

By Jim Strasma

Commodore Clinic is a monthly column designed to help you, the RUN *reader, through any troubles or questions you have as you use your new VIC-20 or C-64 computer. Send questions along with a self-addressed stamped business-size envelope to:*

Jim Strasma
Commodore Clinic
1238 Richland Ave.
Lincoln, IL 62656

So this column can help as many people as possible as RUN *continues to grow in popularity, please try to limit your questions to topics of general interest, and limit each letter to one question. This column is somewhat like a free medical clinic—the price is right, but the lines are long. Including a stamped self-addressed reply envelope will cut your wait, but I can only give full answers to questions that will appear in the Clinic.*

First off, for all who asked for a bulletin board system for the C-64 that uses Commodore's 1650 AUTO-MODEM, Steve Punter has now released a 64 version of the Punter Bulletin Board System used by nearly all of the U.S. bulletin boards that use Commodore equipment.

It reportedly costs $100 and requires an IEEE disk drive. (If your board will be active, use at least an 8050.) I have seen the new version, but not tested it. For more information, call 416/624-5431 (daytime for voice, evenings for modem).

Q: I would like to get the VIC-Modem, but it comes with a tape and I have a disk drive. Could you tell me how to get a program for the modem?

Mark Johnson
Simi Valley, CA

A: Just buy the VIC-Modem from a dealer willing to help you copy Term64 from the cassette packed with the VIC-Modem onto a disk. It only has to be done once, and can be done quickly and easily. From then on, use the disk copy.

Q: Does the 64 have a command similar to the TRS-80's Print Using statement? It's such a simple way to insert dollar signs and decimals and to line up columns. This is the only way our Commodore doesn't measure up to the Radio Shack version, but it certainly is irritating!

Patty Groff
College Station, TX

A: At least two utility programs add this command to the 64. One is the VIC TREE, from Skyles Electric Works; it isn't cheap, but comes on a convenient cartridge and works. Another, SuperBASIC, from Blue Sky Software in Cherry Hill, NJ, comes on disk; I've not tested it yet.

Q: Is there a 64 program similar to Apple's Locksmith that will copy protected programs?

Herb Gross
Elgin, IL

A: Yes, Canada AM, from Skylight Software, Belfast, ME, and The Clone Machine, from Microware distributors, Butler, NJ, are both fairly effective.

Both copy most DOS-protected software on the market, though neither copies itself (which seems morally inconsistent to me). Both companies emphasize their programs are not intended to be used for the indiscriminate mass copying typical of some who use Locksmith on the Apple. Only an archival backup for the use of the one who bought the program is either legal or moral. And on that note, we read...

Q: Do you know any police or sheriff officers using the 64 in law enforcement? I would like programs for suspect files, reports and the like.

Butch Bridges
PO Box 11
Ardmore, OK 73402

A: If there are any around, you should hear from them now. Meanwhile, you might write the inmate programmers at Lincoln College's Logan Prison campus, c/o Book Room, Vocational Center, Box 1000, Lincoln, IL 62656.

They've written a wide variety of programs for Commodore computers that are used daily by the prison. Do include a stamped reply envelope for their convenience.

Q: I am interested in using a low-cost computer for the design and detailing of small mechanical parts. Do you know of any computer-aided drafting packages built around the 64?

Tom Bulpitt
9763 Paso Robles Ave.
Northridge, CA 91325

A: The only such package I've heard about is called Draft Aid. It's available from Richvale Telecommunications, Toronto, Ontario, where it is used to design printed circuit boards. However, it may still only run on the 80-column Commodore models. I've included your full address, in case other companies with suitable products wish to contact you.

Hardware

Q: There seems to be a lot of talk about the "old" 64 versus the "new" one. How do I tell them apart?

Jeff Williamson
New Orleans, LA

A: Many readers asked this question. Since the C-64 was first released, its appearance has changed in several ways. The function keys have appeared in three colors, two visibly different power supplies have been used and early 64s lack the rainbow design in the upper left corner of newer units. One way to be sure a 64 is fairly current is to count the pins in the video monitor connector on the back of the keyboard unit. Those

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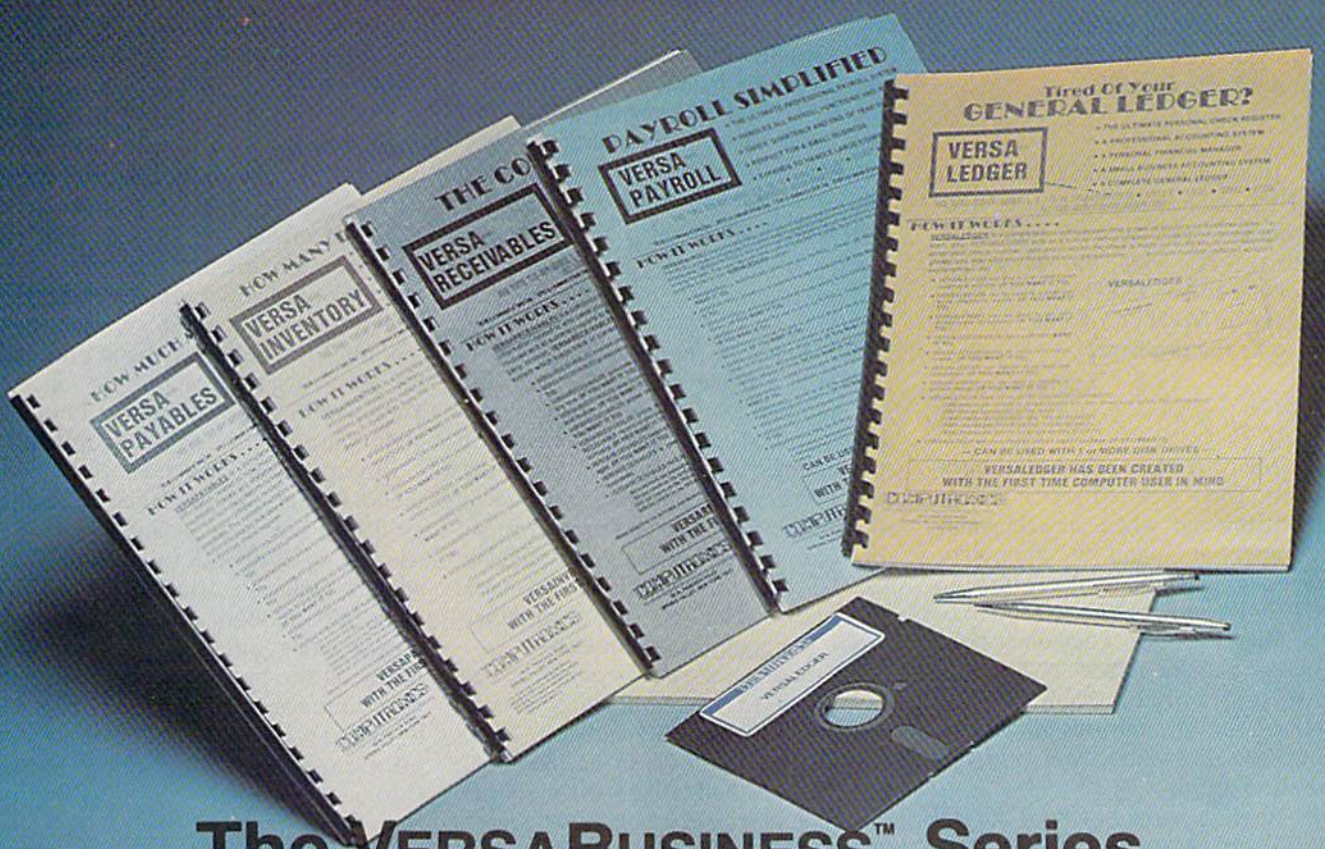

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with five pins are older than those with eight pins.

Newer isn't always better—the first power supplies were easier to repair than newer ones. Similarly, the latest keyboards are harder to type on than those that were shipped up until a few months ago. On the other hand, newer units provide a cleaner picture and have been improved internally.

Q: It seems to me that software for a 32K PET, such as the PETspeed compiler, should be able to work with a 32K expanded VIC with an 80-column board. I can add an IEEE-488 interface, such as the Interpod or V-Link. So what seems to be the problem?

Michael Colvin
Gary, IN

A: Many readers asked this question, too. There's an old joke, "Everytime I figure out where it's at, somebody moves it," and in computers, "somebody" is Commodore, famous since 1979 for unnecessary relocation of key routines in ROM. Four times now, the majority of the important locations used by programs in machine language have been moved, and the Model 264, announced last winter, will probably move them again.

Although the same functions are still included, and changes are not that difficult for a machine language programmer, the fact remains that very few machine language programs designed for one model of Commodore computer will run on any other model. If you buy PETspeed, it will jump to addresses it "knows" do certain things in a PET, only to find something else there. In all likelihood, it will then go off and sulk, and you'll be out of luck. Unless a PET program written in machine language claims to also work on your VIC, it probably won't.

Similarly, adding memory to a VIC won't make it a 64. Among other things, you'll still lack the famous SID and VIC-II chips behind the 64's spectacular sound and sprite graphics. Fortunately, many of the best games for the 64 are also available for the VIC, usually on cartridge, although some adventures and other games are sold on cassette for VICs with 8- or 16K of added memory.

Q: What is the correct order to turn on all your equipment? The outlet on my surge suppressor nearest the power cord will receive electricity first, because the power traveling down the wires will get to the first plug first. Will placing the power-supply plug in the last socket qualify for turning on the computer last?

The length of the cables to the peripherals needs to be taken into account, too, right? And the resistance? Does the time span need to be large (a few seconds) or very short (nanoseconds)? And what is the reason for a specific powering on protocol?

Kuri Kawakami
Anchorage, AK

A: I use a multi-plug extension cord with a single switch that turns on my entire system at once. Unless you have two 1541 disk drives, or an old (pre-summer '83 recall) 1526, this works fine. Forget about the time it takes electricity to go from one end of your surge protector to the other. We're talking 186,000 miles per second here—a mere foot or two takes less time than either you or the computer will notice.

The reason for special power-on sequences is to overcome bugs in the design of the early 1541 and early 1526. If you have two 1541s or an old 1526, Radio Shack and others sell a special multi-line plug with a built-in sequencer to switch on each socket in turn.

Q: I would like to add a monochrome monitor to my 64, but my primary misgiving is the compatibility of the 64's 40-column format versus the 80-column capacity of monochrome CRTs. What kind of a display will I see? Will it be half the screen?

Stephen Ballo
Plymouth, PA

A: Rest easy—the monitor will give the same display as a 40-column TV, except with less interference and added sharpness. Even though you *could* hook up an 80-column computer to most monochrome monitors, no rule says you have to. The format of the display lines is determined by the computer, not the monitor.

Do ask about a built-in speaker if that matters to you. Some monitors have one and others don't. The 64 uses that speaker for all its sound.

Q: I have a 64 and want a 40- to 80-column monitor. Is there any danger to the computer in having a video-only monitor? I remember a stereo rig should not be used without speakers, so I wonder whether there's comparable danger if I run a program that normally has sound. Also, are there any monochrome video *plus* audio monitors you recommend?

H.D. Germer
42 Brookmead Road
Wayne, PA 19087

A: If there is danger, I'm in trouble...for several months I've used a video-only Gorilla monitor. The difference between a stereo's speaker output and the computer's audio output is the level of amplification. As far as I know, you're safe leaving the low-level audio output of the 64 unconnected.

I'm not aware of a video plus audio monochrome monitor that is readily available, but have included your full address, so those with suitable units can contact you. Personally, I'd recommend Commodore's 1702 color monitor; it limits you to 40 columns, but nearly all the best programs for the 64 now take advantage of its color capability. The 1702 is an excellent monitor at a price close to that of many monochrome monitors.

Q: In the Sears catalog is a monitor that sounds like just what I've been looking for. The catalog says it gets TV reception, is RBG and has a switch for an all-green display. I especially need to know if this monitor will work with the Data/20 80-column board in the green display setting.

Dale Switalla
Corpus Christi, TX

A: I couldn't find the model you mentioned in the current catalog, but the 64 is not directly compatible with RBG monitors, and no one seems to be offering a suitable adapter yet. On the other hand, if there are also video-in and audio-in jacks, or chrominance, luminance and audio jacks, it should work just fine with a monitor cable from the 64.

I would expect the green setting just turns off the red and blue dots of the color display, without altering the fundamental resolution of the monitor. As with any TV or monitor you intend to

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use with a computer, wait on this purchase until you can test it in the store with your own 64 and the 80-column board you will use.

Q: I need to know the cheapest way to hook up six VICs and one 64 to a disk and maybe a printer.

Emmitt Moore
West Monroe, LA

A: I think you want a networking attachment for each machine. One such device that works well is called the VIC-SWITCH, available from A.B. Computer, Colmar, PA, for about $150. It allows up to eight VICs and/or 64s to share a single serial bus disk unit, and works with both Commodore and MSD drives. Competing units from Skyles Electric Works, Richvale Telecommunications and others may also be good, but have not been tested here yet.

Programming

Q: In *RUN*'s MAGIC column (January 1984) trick $02 explains how to adjust the VIC screen horizontally or vertically. Are there corresponding Pokes for the 64?

Ronald Berry
Virginia Beach, VA

A: Another popular question. No, sorry. The sometimes suggested Pokes to locations 53270 and 53265 only appear to work, and do not really center the screen. If your TV or monitor image is not centered properly, or does not properly fill the screen, this can usually be adjusted quickly and easily by any TV technician.

The optional repair kit for the original PET computers gave a full description of the needed steps. Someone in your user group probably knows how to do it. Just remember the inside of a CRT cabinet contains extremely high voltage, so be careful.

Q: I recently purchased a 64, a 1541 disk drive and a package of 10 Verbatim Datalife disks. I tried to use them and nothing happened. I made sure all my plugs were in. I'm getting no response from the disks. Could you please tell me what is wrong?

John Bryer
Port Vue, PA

A: Before a new disk can be used, it must be formatted. This is a process that puts electronic tracks on the disk, similar to the grooves on a record. The needed sequence of commands to do this is unusual, so be sure to enter the following carefully. Later, when you learn more about Basic, you will understand it.

```
OPEN 15,8,15
PRINT#5,"N0:NAME,ID"
CLOSE 15
```

If you are using the Wedge program from the disk packed with the 1541, just enter:

```
@N0:NAME,ID
```

The part shown as NAME may be any word of your choice, up to sixteen characters in all, but avoid punctuation marks, the asterisk (*) and the question mark (?).

Similarly, the part shown as ID may be any two characters of your own choice. It is important that this ID number be different for each disk you use, because the changing of that number is what tells the disk drive you have put in a different disk each time you do so.

After you enter the above command, the disk will go into operation for just under a minute. When it halts again, the disk is formatted, unless the red error light on the front of the disk drive is flashing on and off. If that happens, either something was wrong with your command, or something is wrong with your disk (you might have put it into the drive label-side down, which would be incorrect). Verbatim's Datalife disks normally work well with Commodore disk drives.

Once the disk is formatted, store programs on it with the Save command, and retrieve them with the Load command, as follows:

```
SAVE"0:PROGRAM NAME",8
LOAD"0:PROGRAM NAME",8
```

The words PROGRAM NAME can, of course, be replaced with your own choice of words, subject to the same limits as the disk name. Although you can often get away without the 0: on a 1541, it's best to get in the habit of using them, in case you ever use a dual disk drive.

Q: I recently purchased a 1541 disk, and as of yet it has seemed useful only as a paperweight. From the users manual: "Remember to always remove the diskette before the drive is turned off or on. Never remove the diskette when the green drive light is on." The green light is the power indicator, and is on whenever the 1541 is switched on. Could you explain this?

Also, after studying four manuals, I have not been able to save or load anything on the disk. Could you refer me to someone who sells an understandable manual on the subject? I have *Your Commodore 64* by Osborne/McGraw-Hill, among others.

Cal Rice
Hutchinson, MN

A: I expect your problem with loading and saving is that your disks have not been formatted yet. The previous question and answer includes the detailed instructions you requested, as do pages 68 and 69 of our Consumer's Guide book, *The User's Guide to Commodore 64 & VIC 20*, available on the bargain tables of most bookstores or from me ($6 postpaid).

As for the quote, the phrase "green drive light" should be "red drive activity light," and then it makes sense. If you turn the drive on or off with a disk in place and the door latched, you will probably damage the data on the disk. Similarly, if you remove a disk while a file is open to write data, indicated by the red light being on, that file will be lost.

Q: What is the proper procedure for cleaning the head on the 1541 disk using a head-cleaning kit? I can't figure out how to run the drive with the head engaged for more than a few seconds.

John Aloi
Ridgway, PA

A: The trick is to repeatedly give the disk command until the cleaning is done, and make the command one that won't halt on an error. Here's a sequence that should work:

```
10 OPEN 15,8,15
20 FOR I=1 TO 500
30 : PRINT#15,"I0"
40 NEXT
```

Contrary to the directions packed with many disk-cleaning kits, I have found no visible benefit from cleaning a disk drive weekly. For folks that use good disks and avoid obvious sources of dirt and pollution, once a year is enough. R

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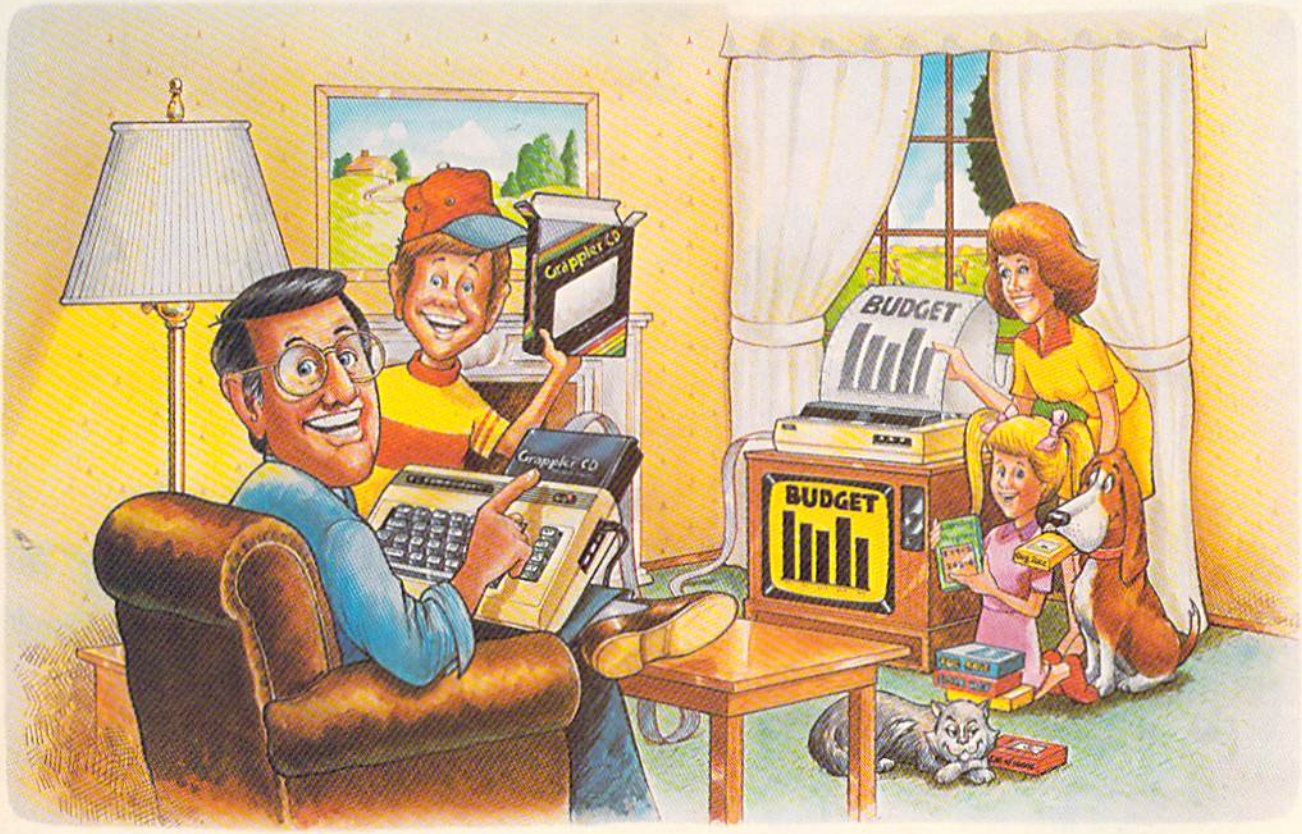

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Compiled by Louis F. Sander

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$67 Increasing execution speed—In a program that has a stack of If statements, place the decision with the highest probability at the top of the stack. Better yet, replace the Ifs with ON...GOTOs, if possible.

Also, place frequently used subroutines at the beginning of your program, and use a GOTO to jump around them when the program is first run. Since the search for subroutines starts with line number zero and continues in ascending order, the subroutines with low line numbers will be found faster.

Wayne Robotham
Kingston, Jamaica

$68 Simple tricks—[Certain valuable tricks, although presented in the user's guides, are not known and used by everyone. From time to time, we will print them here, for the benefit of those who haven't read their manuals closely enough. Ed.]

Pressing the shifted run/stop key will load and automatically run the next program on the tape.

During C-64 tape loads, the tape stops and the screen display returns every time a program is found. After a pause of several seconds, the screen clears and the tape starts turning again. During the pause, you can start the tape immediately by pressing the CTRL, Commodore or space keys.

During a List, or any time the computer is printing to the screen, you can slow the printing appreciably by holding down the CTRL key.

If you hit the stop key by mistake, you can usually use the CONT command to resume execution of your program.

When using an If statement to test for a non-zero value of a variable, the < > can be omitted. The expression IF X THEN...is equivalent to the expression IF X < > 0 THEN...

L.F.S.

$69 INT hint—Some Basic statements and functions automatically perform an INT as an early step in their processing, and in those cases an INT in your program may be unnecessary. Poke is one of these, and one where we often see the unnecessary use of INT. You can prove it to yourself by running this little program:

```
100 POKE 5000,INT(99.5)
110 PRINT PEEK(5000)
120 POKE 5001,99.5
130 PRINT PEEK(5001)
```

As you can see, both Peeks are 99. As you learn more about Basic, you'll see more and more places where you can eliminate INT.

A.W. Grym
London, England

$6A Overcoming Load Errors—It's not necessarily fatal when a Datassette load terminates with a ?LOAD ERROR message. There are two copies of the program on every tape, and the error message arises when the computer compares them and finds them different, even if the copy it loads into memory is perfectly good.

So when you get a Load error, try this: List the program in memory to see that it's a good copy (if it's bad, the problem is usually *very* obvious), then, in Direct mode, type:

```
POKE45,PEEK(831):POKE46,PEEK(832):CLR
```

Chances are excellent that your program will run perfectly.

Thomas Schuster
Staufenberg, West Germany

$6B Character set switch disable—To prevent the user from switching between the graphics and lowercase character sets, just enter POKE 657,128. This will disable the use of the shift/Commodore key combination. POKE 657,0 will enable it again.

Joe Paydarfar
Chapel Hill, NC

$6C Typing tip—When typing a number of spaces in a Print statement, looking at the line just above your cursor will help you count the spaces you are entering.

Darin Hieb
Lodi, CA

$6D Typing hint—When typing programs from magazines or books, you can save time and memory by *not* typing the REM statements. Be careful, because sometimes GOTO statements go to a REM line. [Bad programming practice. Ed.] In these cases, just change the number in the GOTO statement to the next highest non-REM line number.

Joseph Flynn
Pearl River, NY

$6E Typing tip—When typing in a program line with lots of parentheses, it's easy to leave one out. Try counting the number of parentheses—if a number is even, you've probably typed in the correct number. If it's odd, you've surely left something out.

Kris Jackowski
Wethersfield, CT

$6F TV Typewriter—On the VIC and C-64, a direct mode POKE 120,0 turns the computer into a mindless printing machine. Characters typed on the keyboard will be repeated on the screen, but not accepted as input to the computer. You can't run, load, save, undo the Poke, or *anything*, until the computer is reset. All keys work properly, including color and cursor controls, but the stop/restore key combination has no effect.

Quyen N. Truong
Address unknown

$70 TV Typewriter II—Here's another way to do the same thing on the VIC:

```
10 SYS 58959 : PRINT "{CRSR UP}"CHR$(13) : GOTO 10
```

Run the program and you're in TV typewriter mode. In this case, the stop/restore key combination will get you out of the program.

Matt Cisternino
Ontario, CA

$71 Error Message—There have been reported mysterious occurrences of the Out Of Data error when editing and fiddling about in general. This is not a bug, but is due to pressing Return while the cursor is over the Ready prompt. The machine interprets this as READ Y, and since there is usually no corresponding Data statement to the Read command, we get the error.

The Transactor

$72 VIC curiosity—On the VIC-20, if you Poke into location 36866, graphics symbols and colors appear on the screen. For starters, type in:

```
POKE 36866,10
```

After this, you can Poke numbers up to 100 or so, and get interesting patterns on the screen. To get out of this mode, use run/stop and restore keys.

Jason Issendorf
Brandon, SD

$73 VIC scrolling—The following line will make the entire VIC screen scroll downward, being replaced by the background color.

```
100 FORI=25TO130:POKE36881,I:NEXT
```

This line will scroll it back up again:

```
200 FORI=130TO25STEP-1:POKE36881,I:NEXT
```

While the screen is down (out of sight), you can clear it and/ or print onto it, and the resultant copy will be on the screen as it scrolls back up. Presto-change-o!

Rob Jacob
Jones, MI

$74 VIC one-liner—Run it, then press some keys.

```
100 POKE 36879,PEEK(197) OR 8 : GOTO 100
```

Walter Orange
Hollywood, CA

$75–$79 C-64 one-liners—The accompanying listing includes five different C-64 programs submitted by our readers. We have listed them all together, with numerous REMs, but you can easily separate them.

Computer Sounds meets the one-line criterion, but you must abbreviate *every* possible keyword in order to fit it in. The abbreviations are in Appendix D of your user's guide. When you run the program, be sure your monitor's volume control is turned up to maximum.

The Alphabet Pokers give some interesting screen displays. Clearing the screen before running them gives the best effect, but of course it takes a second line. Tch, tch!

Skyline and Squares also can run as one-liners, but the extra lines give a nicer presentation.

L.F.S.

C-64 one-liners.

```
9 REM
90 REM ** ALPHABET POKER #1 **
91 REM    CLEAR SCREEN, THEN RUN.
92 REM    LAMAR MCLOUTH, DAVISON, MI
93 REM
95 A=RND(0)*26+1:POKE1030+A+40*12,A:POKE55302+A+40*12,1
   4:FORI=1TO150:NEXT:GOTO95

99 REM
100 REM ** ALPHABET POKER #2 **
102 REM    CLEAR SCREEN, THEN RUN.
104 REM    LAMAR MCLOUTH, DAVISON, MI
106 REM
150 POKE53281,0:A=RND(0)*26+1:B=RND(0)*998+1024:POKEB,A
    :POKEB+54272,A:GOTO150

199 REM
200 REM ** SQUARES **
202 REM    LINE 240 IMPROVES THE COLOR.
204 REM    GLENN ZUCH, N. TONAWANDA, NY
206 REM
240 POKE53280,6:POKE53281,6:PRINT"{SHFT CLR}{CTRL 8}":F
    ORI=1TO19:PRINT:NEXT
250 PRINTMID$("{CRSR UP}{CRSR DN}{CRSR LF}{CRSR RT}",RN
    D(.9)*3+1,1)"{SPACE}{CRSR LF}";:FORI=1TO50:NEXT:PR
    INT"{CTRL 9}{CRSR RT}{CRSR LF}{CRSR RT}";:GOTO250

0 REM ** COMPUTER SOUNDS **
1 REM    KEYWORDS HAVE BEEN ABBREVIATED
2 REM    TURN VOLUME TO MAXIMUM!
3 REM    HO LAM, NEW YORK, NY
4 REM
5 S=54272:P{SHFT O}S+4,17:F{SHFT O}I=0TO1:J=INT(R{SHFT
  N}(1)*99):P{SHFT O}S+I,J:P{SHFT O}S+I+5,J:N{SHFT E
  }:P{SHFT O}S+24,15:G{SHFT O}5

299 REM
300 REM ** SKYLINE **
302 REM    LINE 340 IMPROVES THE COLOR.
304 REM    GLENN ZUCH, N. TONAWANDA, NY
306 REM
340 POKE53280,12:POKE53281,12:PRINT"{SHFT CLR}{CTRL 1}"
    :FORI=1TO19:PRINT:NEXT
350 PRINTMID$("{CRSR UP}{CRSR DN}{CRSR LF}{CRSR RT}",RN
    D(.5)*4+1,1)"{SPACE}{CRSR LF}";:FORI=1TO50:NEXT:PR
    INT"{CTRL 9}{2 SPACEs}{CRSR LF}";:GOTO350
```

$7A Character colors—On the VIC and C-64, memory location 646 holds the color code of the current character color, and you can change the character color by Poking 646. Under most conditions it is easier to change it by printing a color control character such as CTRL 3, but there are times when POKE 646 is better. For example, when you want to print in random colors, you can do this:

```
100 POKE 646,RND(0)*8
110 PRINT "MULTICOLOR",
120 FOR I=1 TO 200 : NEXT
130 GOTO 100
```

Line 100 randomly sets the character color, as running the program will prove. C-64 owners can change the 8 in that line to a 16 to take advantage of the C-64's eight additional colors. VIC owners making that change will see something quite unexpected.

L.F.S.

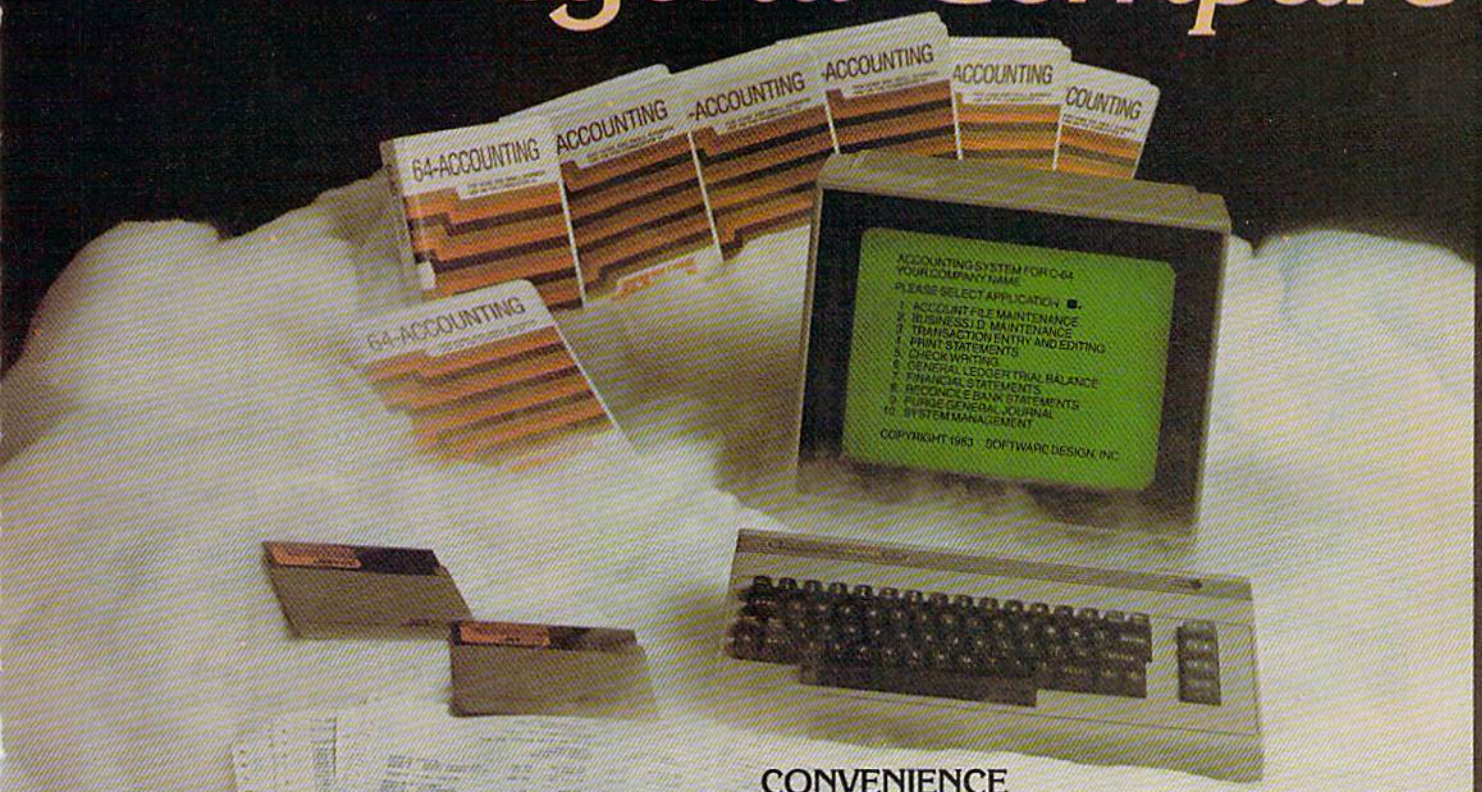
$7B RF modulator hint—Sometimes when the RF modulator is too close to the TV set, it causes interference. Moving it can improve the TV picture, and so can wrapping it with aluminum foil.

Reginald Reed
Orange Park, FL

$7C Indented listings—You can indent Basic program lines by using shifted characters. To indent a line, type the line number, then any shifted letter, then any number of spaces, then the material you want on the line. When the line is listed, the shifted letter will be ignored, but the

(continued on page 140)

64 Software Beyond Compare



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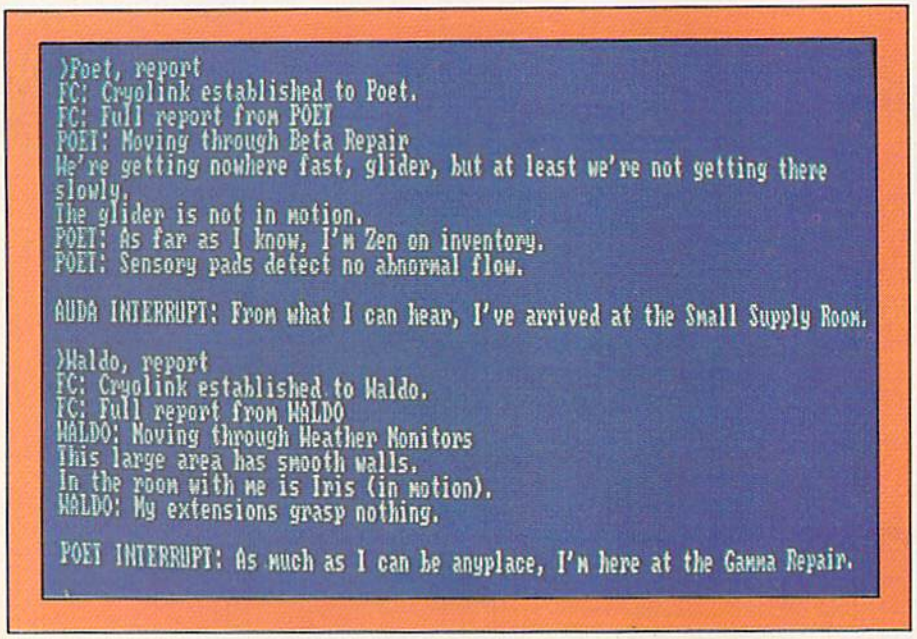
Software Gallery

Compiled by Shawn Laflamme



Report Card

A—Superb!
An exceptional program that outshines all others.

B—Very Good.
One of the better programs available in its category. A worthy addition to your software library.

C—Good.
Lives up to its billing. No hassles, headaches or disappointments here.

D—Mediocre.
There are some problems with this program. There are better on the market.

E—Poor.
Substandard, with many problems. Should be deep-sixed!

Suspended

Six Robots Do Your Bidding in a World Of Impending Doom

A

You've seen the box. Everyone who has been in any store that sells software has seen the box. It's bigger than the typical software package, with a white mask and black, staring eyes.

It's hardly an IBM corporate-image-conscious, quietly-efficient spreadsheet package. It's more like a cybernetic nightmare, or a cross between a Halloween costume and the death mask of Voltaire.

Anyone can manufacture a startling package and fill it with the same old stuff. Shoot-the-asteroids, bounce-the-fat-boy-through-the-maze and swords-and-sorcery adventure games are the usual fare.

But in this case, behind the extraordinary packaging you'll find an extraordinary game—Suspended, from Infocom, Inc. (55 Wheeler St., Cambridge, MA 02183. $49.95). The Commodore 64 version of Suspended is now being distributed by Commodore Business Machines (1200 Wilson Drive, West Chester, PA 19380).

The object of the game is to solve problems that the program presents in the format of an adventure. It has no moving displays and requires no joysticks. It is based upon your own typed-in commands and requests.

Yes, it's an adventure game, and it's a good one. Some of the game's particularly strong points are the writing (including humor that does not grow stale on the second reading), a colorful fold-out map of the playing area and the ability to store up to eight partial games for future playing.

Some of the game's weaknesses are the size of the instruction booklet (so large that it is rather difficult to use as an easy reference, which you will need to do often during your first few playings) and the size of the map board (few people have two feet of free space next to their computers).

Suspended, like many adventure games, starts with a premise that is used to justify what happens during the game. It sets the stage and gets you started. It gives the whole thing some point and purpose.

Suspended's story is based on the idea that you are in charge of a maintenance complex that contains all the life-support systems for some unpleasant planet. Unfortunately, you are asked to accept the notion that you are suspended in a cryogenic state—unable to move, but able to think and

SOFTWARE ARTISTS?

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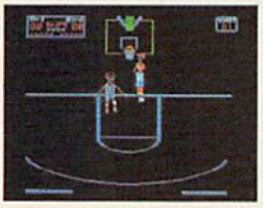
We talked to them, photographed them in action, studied their moves and their stats and their styles. Then we set out to create on computer disc an event which may never happen in real life. We put the two of them together on a dream court of light, for an electronic afternoon of one-on-one.

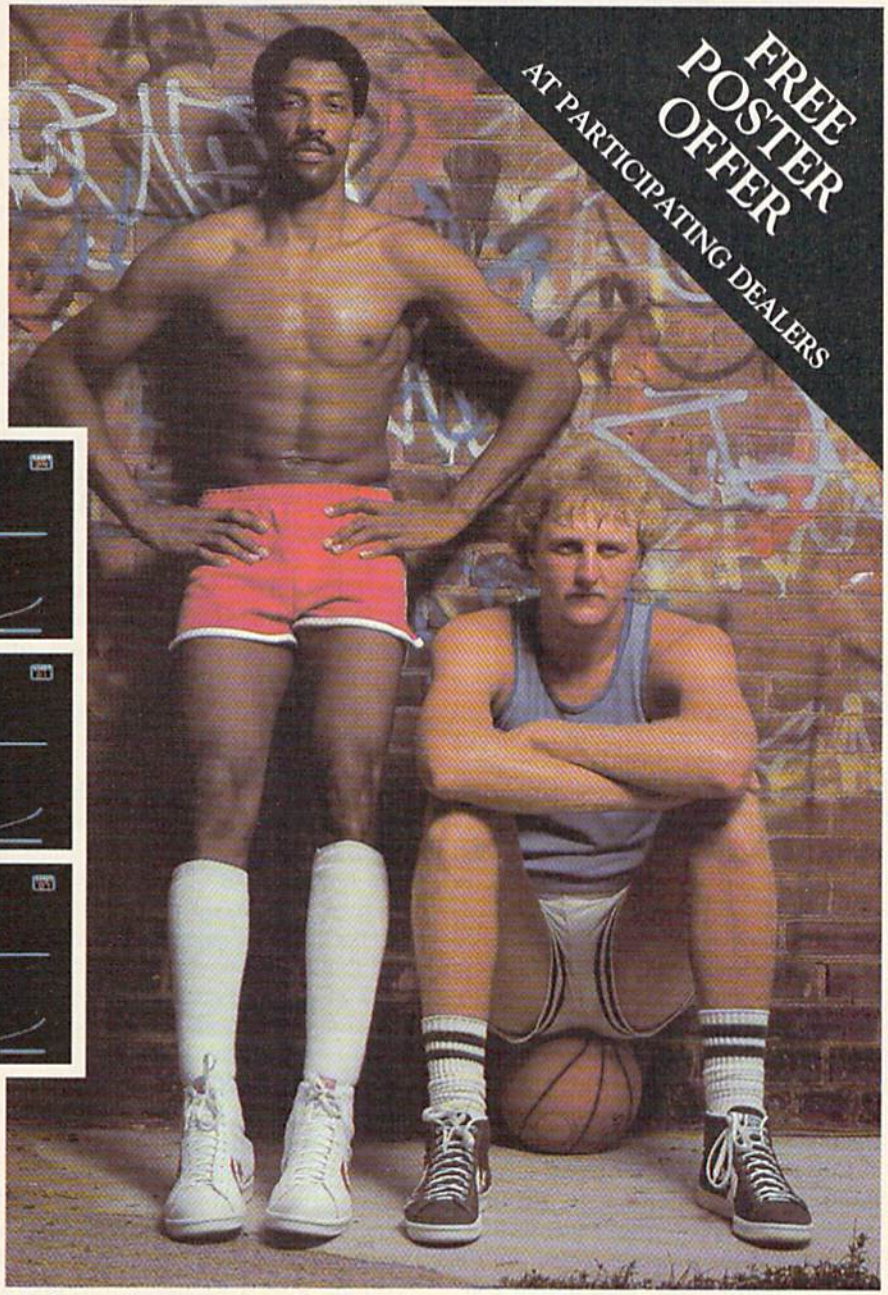


It wasn't easy. When they talked, we listened. When they criticized, we made big changes. When they gave suggestions, we took them.

And it shows. This thing is absolutely uncanny. You actually take on all the skills and characteristics of Bird or The Doctor – their own particular moves, shooting abilities, even strength and speed.

You'll meet with fatigue factors, hot and cold streaks, turnaround jump shots, and 360-degree slam dunks. But there's some whimsy in here, too – a funny referee, a shattering backboard, even instant replay.

It's called *Julius Erving and Larry Bird Go One-on-One.*™ You're Bird. Or you're The Doctor. And that's the last decision you'll have plenty of time to make.



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This adventure game integrates the computer, the adventure and you. It's a masterpiece!

communicate with robots (something like a Popsicle with brains and a microphone). This condition results in your having to use six robots to do everything that needs doing around the complex.

It's simple. Just type in the robot's name, tell it what to do, and it will do it. It will go wherever you send it, tell you what it "sees" there, and do what it can to fix anything that's wrong. And there is always something wrong. That's the whole point of the game—you must respond to various emergencies in order to keep the systems from breaking down completely and killing all the planet's inhabitants.

Now that seems to be a reasonable premise for a science fiction game. And, if this were nothing more than a standard science fiction game, I would have no complaint. But Suspended is something more than standard, and it is too bad that the writers decided to clutter the plot of the adventure with cryogenics.

The designers of Suspended have made a major move forward in adventure games. They have found a way to put you directly into the game. In no other adventure game that I have seen is there quite so powerful a sense of being there. In Suspended, you *are* the character in the story. You are the moving force behind the unfolding plot. The game's designers accomplished this by using the computer keyboard and robots.

Now, all computer adventure games use the keyboard. You use the keyboard to tell the computer where you want the main character to go. You type in instructions telling him what to do. The computer tells you when he does the right thing or the wrong thing, and he either wins or dies. The program calls the main character "you."

But there is one problem. "You" don't function according to keyboard commands. "You" don't go north or south because someone typed in the words "north" or "south." "You" don't swing a sword at a dragon by sitting down at a keyboard and typing in the words "Swing the sword at the dragon."

The problem with virtually all adventure games is the intrusion of the keyboard, which produces words on your screen. Many adventure games now use graphics in an attempt to make things more realistic. Unfortunately, the graphics don't look very realistic. We'll just have to wait a few more years for realistic screen displays. But, even then, we may still be typing in "Swing the sword at the dragon," which somehow doesn't quite capture the intensity of a St. George slaying dragons and rescuing fair maidens.

Suspended, in one brilliant stroke, overcame that keyboard intrusion. The designers overcame it by making the keyboard essential to the unfolding of the game's plot. In a very realistic way, you are completely dependent upon the computer for all information and communication with the "outside world."

Forget the player-frozen-on-a-stick for a moment. Picture yourself in a situation where you are responsible for maintaining and repairing all survival systems on a particular planet. You are inside an air bubble of some kind, and you must use robots to move around in airless places and work on unseen machines. You are sitting in front of a computer, typing in questions to the robots about what they have found, and reading their reports as they are sent back to you and spelled out on your monitor. They tell you where they are at any given moment, what condition they are in and what their surroundings are like. On the basis of these reports, you tell them what to do next.

That's the scenario of Suspended, and that's what makes it very close to a work of software genius. It uses the keyboard and the monitor as no other adventure game does—it uses them exactly as they would be used in reality under the same conditions. You are not talking to some godlike character—you're talking to your robots.

The effect is something very special. You type in a question and wait for your robot to send back the answer. You ask what it sees, and, if its eyes are working, it tells you. You then tell it to go somewhere, and, when it gets there, it sends you a message—often interrupting your conversation with another robot—telling you it's there, and waiting to be told what to do.

You are completely dependent upon the robots to function as your sensory system, and they are dependent upon you for instructions.

It is real enough that you will often find yourself talking to the robots out loud, muttering something like, "Come on, Waldo. Move it, baby," while knowing that good old Waldo is moving as fast as he can to wherever you have sent him. You wait for his report, and begin to picture him in some hallway working his way slowly towards a large steel door into the Beta FC area where there is a breakdown...and Iris breaks in and reports that she is now in the Central Chamber, but can't see.

And so it goes. It's a game that will take you through many long and difficult sessions as you strive to become master of six robots in a world of impending disaster.

I strongly suggest that, when you play Suspended (and I *do* recommend that you play it), forget the cryogenics and play as though you were perfectly healthy, sitting in front of a computer keyboard, working like a madman trying to solve the mechanical problems of the underground maintenance complex before the whole thing goes to pieces. The only tools you have to work with are your robots, your computer and your brains.

Played that way, Suspended is an adventure game that integrates the computer system, the adventure and you in a way not found in any other game. It is a masterpiece.

G. Scott Wright
Albany, NY

Speed Reader II

Let This C-64 Program Help You Double or Triple Your Reading Speed

Are you bogged down with too much information at work and home—reports, newspapers and magazines that you really should go through, but where's the time? Welcome to our "information society," recently described in a best-selling book entitled *Megatrends*.

Give wings to your imagination and voice to your adventure

Legendary adventurer, rider of the magic Pegasus, protector of the beautiful Andromeda—**you** are Perseus in the new Tymac Talkie computer game **Pegasus and the Trials of Perseus**. You must penetrate the temples of the fearsome Titans and defeat them in mortal combat. The sage advice of Zeus, spoken in riddle, holds the key to your survival. But the talons of a screaming harpy may seal your doom. Life hangs by a thread in the challenging world of the gods.

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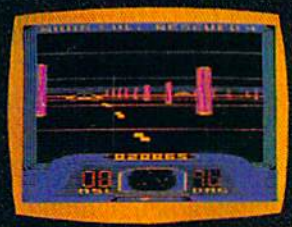
Gandalf the Sorcerer

Codename: DEADZONE



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Circle 124 on Reader Service card.

Is there any way to pull ahead of today's information flood? One suggestion: learn to read faster.

Computers and other high-tech innovations have created a communications revolution, and chances are you're being deluged with data. It's hard to escape the ever-growing tide of facts and figures, whether you're a busy executive with reams of material to wade through, a college student facing piles of books to be read, or the average American slogging through newspapers and circulars. Is there any way to pull ahead of this information flood? One suggestion: read faster.

Speed-reading has been used successfully by notables such as John F. Kennedy and TV personality Dick Cavett. You, too, can double or triple your current reading rate—with your Commodore 64 and Speed Reader II, from Davidson & Associates (6069 Groveoak Place #12, Rancho Palos Verdes, CA 90274. $69.95).

Designed and tested by Dr. Janice Davidson, a professional educator and consultant, Speed Reader II is a comprehensive self-help program. It can help fifteen-year-old Susie overcome her reading problems or help Johnny, a freshman in college, forge ahead through that required reading. Grampa will find it helpful and so will any of us who need some way to increase our intake of words. (Additional data disks are also available for children as young as ten.) After ten 30-minute sessions, using a series of six simple exercises, you'll be amazed at your progress.

Getting Started

Speed Reader II is simple to use and fun. (Don't expect any glamorous graphics, because the program's primarily composed of words.) The master menu contains seven choices beginning with warm-up exercises.

Having absolutely no idea of how fast I could read, I first decided to take the timed reading test and then go back to the exercises later. (The manual recommends this.) Removing the program disk and inserting the data disk, I was given 15 reading selections to choose from, and I chose "Wall Street Psychiatrist." (There's a total of 35 reading selections in the entire program.) The program told me to get ready to read, and the article began.

After reading the information on the screen, I simply pressed the space bar and the article continued. There was no rush; I took it at my own pace. I discovered I was reading 487 words per minute (wpm). But were the words really penetrating? Was I retaining any of the material? I took the little quiz to find out.

I scored 100%! According to the manual, the average college student reads and understands at the rate of 325 wpm. Could I beat my own score? It was worth a try.

Learning to Speed-Read

I went back to the exercises, choosing the warm-up exercises first. According to the manual, these exercises would improve my perception and peripheral vision. I started with the letter warm-up, and after a little box-like graphic (the "get ready" signal) flashed on the screen, the computer showed me two letters—for a long time. You start at a slow pace, working your way up quickly. When the letters finally disappeared, I typed them from memory. When you type the letters correctly, the program automatically increases your speed. And if you make a mistake, it'll push you back a speed.

I ordered the computer to produce my scores, and then I recorded them on the handy little sheets provided in the manual.

Next, I tried the warm-up exercises with words. I enjoyed these nonsensical little phrases, such as "local butchers react carefully" or "silly boys celebrate easily." Starting with two words, I quickly moved up to four, and got all the way up to speed seven, where I scored 73%. Several times I was absolutely certain I didn't know what I'd seen—it flashed by so fast. Why bother even trying? But I typed in something anyway, and about half the time it was right! Apparently my subconscious mind *did* see it. (I found that this subliminal perception actually increased after several lessons—an eerie and intriguing experience.)

Now on to the eye-movement lesson, where phrases are flashed back and forth from the left hand side of the screen to the right. You are supposed to use a sweeping motion of your eyes to read. (According to the manual, this exercise is to strengthen your eye muscles, *not* your neck muscles. "If you want to develop your neck muscles, go to a gym," it says.) You can choose from twenty articles to read, and then select any reading speed from 1 to 9.

Next, I decided to try the column-reading lesson. (The manual doesn't introduce this exercise until lesson 6, but I'm too curious and impatient to wait.) You read down more than across, and it looks similar to this:

When you skim milk,
you remove
the richest part,
the cream.
In reading,
skimming also
means taking the
richest part, the
important ideas
and significant
details, and
leaving the rest.

I had to choose my reading speed, from a range of 100 to 2000 wpm. (Can anyone read 2000 wpm? It seems physically impossible!) I chose 650 wpm.

After the column reading, I moved on to the reading-passage lesson. Here you're told to select the "window size," which refers to the number of lines on the screen at any one time. I could choose from 1 to 12 lines; I decided to go for a window size of 4 and a speed of 700 wpm. I took the quiz, and scored 75%—I guess I pushed too hard this time.

In the next few lessons, I tried everything again, limiting my sessions to about 30 minutes. (According to the manual, longer sessions slow your progress.) After the fourth session, I decided to test my speed again, and I scored 728 wpm and 87% on the quiz! Not perfect, but a whole lot faster!

After each session, I turned off the computer and read for about half an hour, trying hard to use what I'd learned. I gave the program a real test—I'm taking a boring correspondence course, and I usually become so distracted with this material that I find myself rereading it three or four times

before it makes even vague sense to me. But after a few speed-reading lessons, somehow the course material didn't seem so dull, and I understood it. My concentration improved; I didn't wander off to get a drink or look out the window.

Positive Reinforcement

I really liked the positive reinforcements in this program. When I answered correctly, the screen displayed, "Keep it Up!", "Congratulations Chris" and other verbal inducements. The program also gave me encouraging music, such as a few bars of "Seventy-Six Trombones" and other rousing, positive tunes. If I answered incorrectly, there were no awful noises and no messages telling me that I was stupid. I was wrong, that's all. No big deal. I simply had to try over again.

I also liked being able to increase my own speed, select the level of difficulty and so on. This was preferable to a videotape or a classroom situation, where I'd have to speed up or slow down to adjust myself to the group; the program gives you much more control.

Speed Reader II is an outstanding program, with readings that are not only educational and philosophical, but also humorous.

The price of this program is "friendly" too. You'd spend at least four or five times more than $69.95 for an Evelyn Woods course, and you'd have to drive there, find a place to park, maybe feed the meter, etc.

I had only one minor problem while using the program; I'm not a great typist, and I made a few typos in the warm-up exercises, even though I saw the right letters or words. I just learned to be more careful the next time.

You *will* have to exert some mental effort to increase your reading speed. (I don't think it'll strain you!) You won't learn to speed-read in one session. Concentration is a must.

I'm reading words in phrases now and cutting back on the internal voice that mentally intones every single word as I read. Sure, I know that I won't be able to read everything at 700 wpm; some difficult articles or books will take me longer.

I think Speed Reader II is an outstanding program. The readings provided are educational, philosophical and even humorous. And if you get tired of these articles, you can send the company $19.95 and receive a new data disk with 20 eye-movement/column-reading selections and 15 reading passages. Also, the exceptionally well-written manual provides simple, step-by-step instructions on how to add your own material.

I think Speed Reader II would be very helpful to college students, busy executives and the rest of us who need and want to increase the amount of material we're able to read by reading it faster. Whether you want to get your facts from *People* magazine or the *Wall Street Journal*, speed-reading can help you do it faster and better. And once

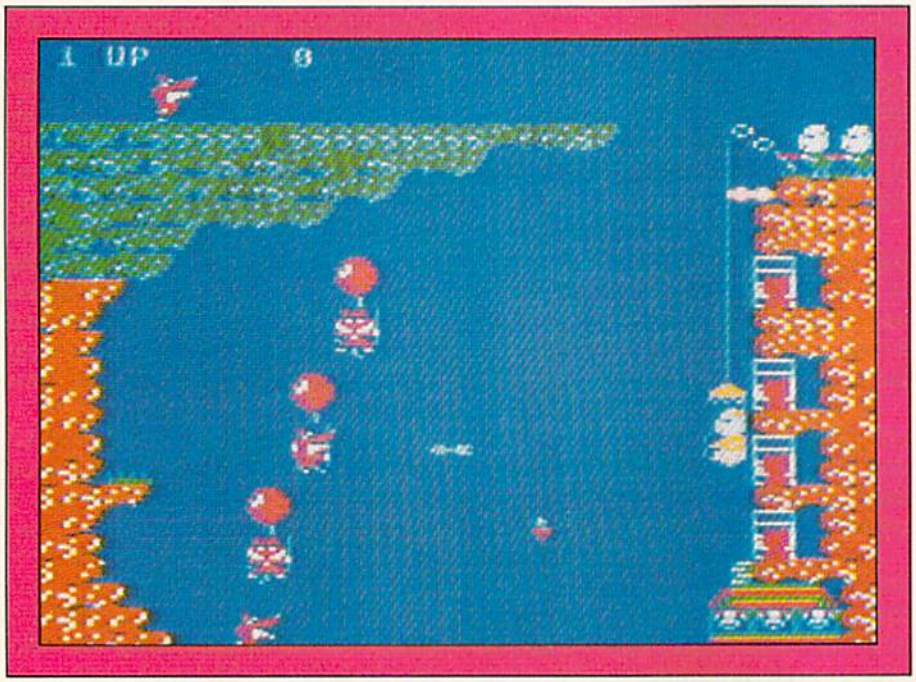
you've mastered the program and increased your rate, you need only return to it once every three or four weeks to keep up your speed.

If you are one of those people plagued by too much information (and you probably are if you've read this far), then step up to Speed Reader II. Full speed ahead!

Christine Adamec
Palm Bay, FL

Pooyan

Your task is to rescue defenseless piglets from the mouths of hungry wolves.



Your Precious Piglets Are In Peril! Can You Rescue Them From the Cunning Canines?

Datasoft has to be commended for their fine Commodore 64 version of Konami's Pooyan. The gameplay, music and graphics rival the arcade game itself. (Just to set the record straight, Pooyan is phonetic Japanese for pig or piglet.)

After loading Pooyan (from tape or disk), you're automatically treated to a Demo mode. This not only shows some good strategy tips, it also happens to be rather entertaining in its own right.

A joystick is a necessity, as there is no provision for total keyboard control. Also, the two-player variation requires two sticks. (Kraft System's joystick proved to be particularly good for the fine control needed for success in this vertically-oriented slide-and-shoot.)

Your task is to rescue defenseless piglets from the mouths of hungry wolves. In the first screen, you must glide up and down in your gondola—the vicious wolves, floating up and down from a tree with the aid of balloons, throw deadly acorns at your gondola. Pressing the fire button launches a feathered arrow at the descending wolves and their acorns. A knock on the noggin by one of the acorns sends you hurtling to your doom.

Bursting the wolves' balloons as they launch from the tree will send the furry ones to their deaths on the hard-packed earth below. Seeing them tumble end over end is a satisfying experience for any pig lover!

Periodically, a hunk of red meat appears at the top of your gondola. Hurl this tempting treat at the wolf pack, and they will foolishly let go of their floating perches and fall straight to their demise. Each fallen wolf is worth 400 points more than the one before, up to a maximum of 1600 points per wolf.

Numerous wolves are in this pack: 32 in the first round, 40 in the next, and 48 in each succeeding round. The number of wolves left in a round is depicted on an ensign in the upper-left corner, while the round is displayed on a matching flag on the right-hand side. The first four wolves to escape the William Tell treatment climb the ladder behind the gondola. From there they occassionally snap at you, sending you to video heaven upon contact. My, what big teeth they have!

The second scene is strictly hostile territory as the wolves have captured some piglets between screens. The little porkers are caged below the wolves' lair.

Here, the loco lobos ascend skyward toward a cliff top with their helium-filled balloons. If seven wolves reach the cliff top, they push a large boulder down on you.

Passengerless balloons are worth 50 points, others (with animal payload) are worth 200 points. Rapid fire and a good aim are essential, especially when the wolves use their deflective shields.

A boss wolf with a blue, armored balloon appears when there are five or fewer wolves left in this round. Failure to stop his ascent causes five more wolves to join in the fray. Once again, the meat is available to help you defend the piglets.

Two bonus scenes also aid in reaching that hefty 50,000 points needed for an additional game life. In the first one, you are armed only with the beef. Judicious timing is needed since another slab apears only after the hurtling piece reaches the ground. In the second one, the lupines toss non-fatal strawberries. Shooting them with arrows will give you 200 points each with a 5,000 point bonus for hitting them all.

An unlimited supply of arrows is at your disposal, but tactics and strategy are also vital ingredients for success. The launching patterns of the wolves and the way that they use their shields can be turned against them. Think of the consequences before acting on an impulse!

The visuals are of arcade quality; the musical score is first class. The gameplay is very fluid and infectious. Pooyan, though easy enough to learn quick-

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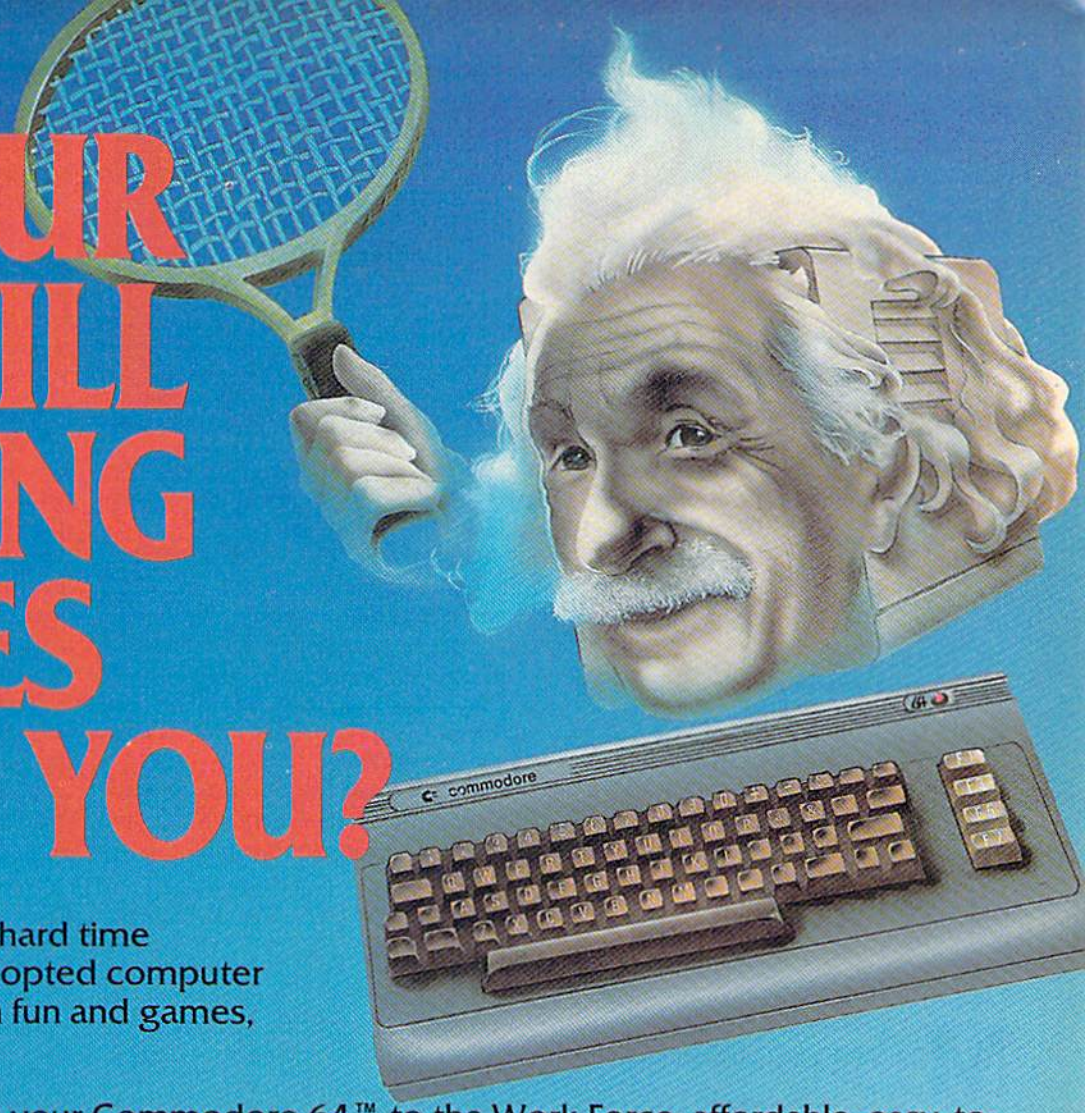

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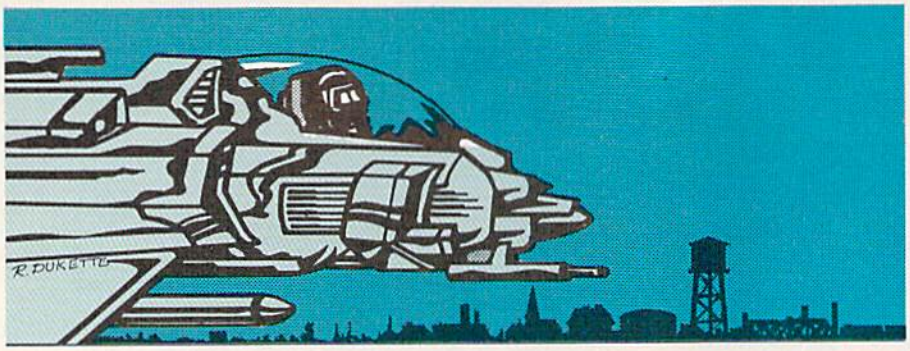


ly, packs the challenge needed to become an enduring favorite. *(Datasoft, Inc., 9421 Winnetka Ave., Chatsworth, CA 91311. $29.95.)*

Ted Salamone
Bridgeport, CT

Math Marauders

This VIC-20 Program Combines Shoot-'em-up Action With the Experience of Learning

B

Math problems are invading our planet!

This alarming announcement is your child's warning to brace himself for a learning adventure, with Math Marauders, from Micrograms, Inc. (PO Box 2146, Loves Park, IL 61130. $12.95).

Math Marauders (on cassette for the unexpanded VIC-20) weds shoot-'em-up action with the experience of learning. Your youngster's sole defense while playing this game consists of lining up each target and firing. Targets, in numerical form, consist of two numbers, placed one above the other, with a plus sign between them, atop a short line. The A and D keys guide your child's weapon left and right at the bottom of the screen. Each problem must be destroyed before it completes its descent and reaches the ground.

Typing in the correct answer to a problem fires a bomb upward from the defender. Direct hits obliterate a target, leaving a misty residue in the sky. Partial hits erase one side of the problem, but the missing half springs back into existence after a brief moment.

Problems are taken from the standard addition table, with examples such as: eight plus zero, four plus one, six plus three and so on. (I didn't experience double-digit solutions during my evaluation of the program.)

Math Marauders comes complete with color-changing skies, excellent sound effects, and a slick-moving weapon. The one complaint I had with the visual effects concerns the depiction of zeroes—they look like fuzzy blurs, resembling fives. But once you realize this, it's no problem.

The game may foster retention and enjoyment in math-haters. And, for those who already enjoy math, why can't the pleasure be enlivened?

Math Marauders offers a splendid format for practicing math at home, in the good old tradition of flash cards. If you're looking for a way to increase your child's interest in learning, this game will teach your budding scholar a fun approach to numbers.

John DiPrete
Cranston, RI

Sky Blazer

Only a Seasoned Pilot Can Win This Battle Against Tyranny

C

In Sky Blazer, from Broderbund Software, Inc. (17 Paul Drive, San Rafael, CA 94903. $34.95), your challenge is to destroy the defenses of the tyrannical Bungeling Empire. As you pilot your aircraft, you must destroy radar stations, tanks, ICBMs, and finally, the Empire's headquarters.

After you insert the cartridge and power up your VIC-20, a demo shows you how to play the first three stages of the game.

When you're ready to play, a screen appears with a line of trees, houses, billboards and other objects at the bottom. The sky is dotted with tiny, distant stars. The top of the screen shows your score, fuel supply and the number of bombs remaining. One of your ships pokes out its nosecone—seeing that all is clear, it turns over the controls to you. You can now use your joystick to maneuver your ship around the screen.

Part I of this fierce space war has begun. Flying at high altitudes allows you to shoot rays; at low altitudes, you can drop bombs. In part I, you must bomb targets on the ground below. Towers are worth 80 points, trees will reduce your score by 20 points (a good decision on the author's part), and everything else gives you 40 points.

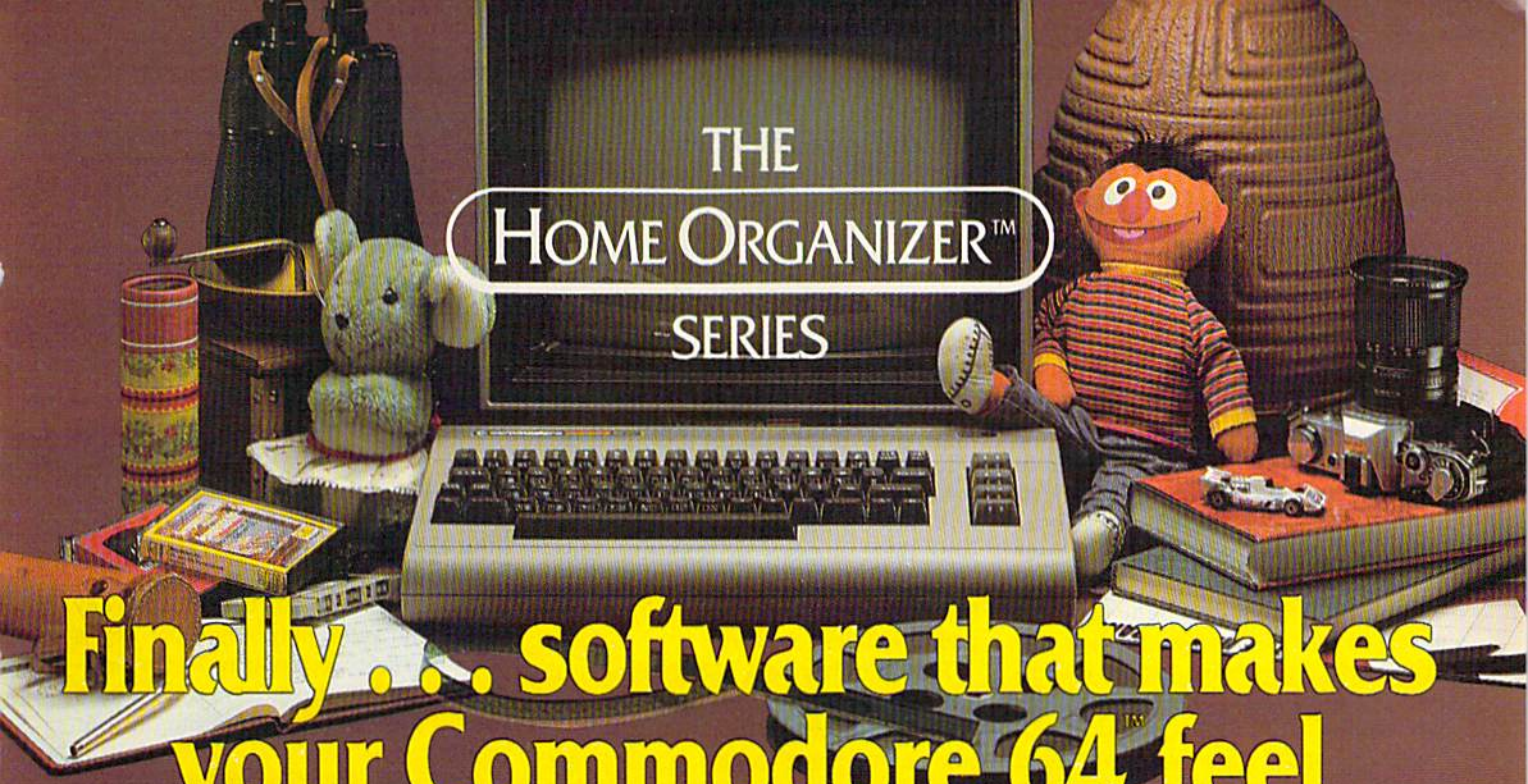
A glance at your fuel counter shows you that your fuel is rapidly diminishing. A yellow supply plane passes overhead, dropping a small package that opens into a parachute. The parachute is loaded with fuel and bombs—a welcome sight! When you catch the chute, your fuel is restored and you gain 100 points in the process. Now that you are refueled, you're free to continue your aerial offensive.

When you run out of bombs (your limit is 30), you must patiently wait for the next supply ship to drop its package. While you are waiting, you see a radar scope appear below you among the other objects. This is what you must eventually bomb to move on to part II.

The supply ship finally arrives and drops its package. As you go to intercept it, a fuel-guzzling bluebird comes from out of nowhere and snatches your cargo. You roam around aimlessly, without bombs and with your fuel running low. Another radar passes below you. Your fuel is almost exhausted. Finally, another ship arrives and you race to catch the falling supplies, only to find your aircraft drifting away, out of fuel!

You must try again with one of your remaining ships. You carefully drop bombs and patiently wait for the radar. Whenever supply ships come, you must make sure to grab the supplies before the bluebird of unhappiness takes them away. You finally spot the radar and descend to bomb it. As your hatch opens, you line up and drop your bomb. Success!

Your aircraft's controls are again taken over by the on-board computer as you soar off into part II. Your mission



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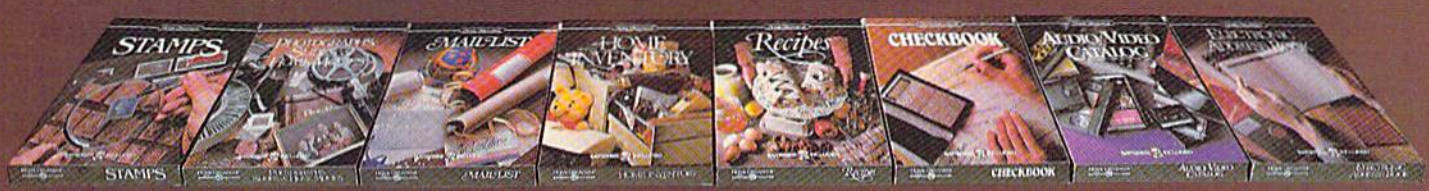

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Five fighter planes on a kamikaze mission try to destroy you and your fuel shipments.

here is to bomb a speedy tank. Every time you sneak up on the tank, it speeds up out of reach. Meanwhile, five fighter planes on a kamikaze mission try to destroy you and your fuel shipments. In your race with the tank, you notice that you can sometimes pass it for a brief time. This is when you must drop your bomb.

When you finally bomb the tank and go on to part III, you see familiar surroundings. The ground scenery is identical to that of part I, but now helicopters appear and flood the sky with "balloon bombs" that shoot out behind the copters and float up to the sky. With all of these air obstacles, it is easy to miss your supplies until it is too late; they drift off the screen while you chase after them in vain. Eventually you spot an ICBM—another enemy target.

If you have managed to survive the supply-snatching birds and the balloon-bearing copters, you will arrive at part IV. Again, you are in familiar territory. The tank and kamikazes are back for a rematch, but this time the tank fires heat-seeking missiles at you. You can stop these missiles by shooting them down, luring them off the screen or bringing them up to where the fighter planes will destroy them.

Part V brings back the challenge of part III with an additional menace. Aside from helicopters and balloons, silos launch heat-seeking missiles that will chase you all over the screen unless you can bomb the silos first. If you manage to escape this heavy bombardment, you must bomb the enemy's air traffic control tower to complete your mission.

Sky Blazer's graphics are terrific, but the gameplay falls a bit short. For one thing, there are really only two screens repeated over again with minor differences. Other problems stem from the lack of response from the joystick. While maneuvering around the screen, you will often seem to run into things that are quite a distance from your ship. Quite often, after pushing the fire button, you will notice that there is a delay before your shot or bomb is released. Also, the shot or bomb sometimes appears to emit from a place other than your aircraft.

The game has several special keyboard features: hitting the run/stop key pauses the game until any other key is hit; the restore key returns to the demonstration; the cursor keys can be used to shift the game screen around on your monitor.

It takes a lot of time and aggravation to master Sky Blazer, but if you like shoot-'em-up games, you should find this one to be an enjoyable challenge.

Robert Spahitz
Staten Island, NY

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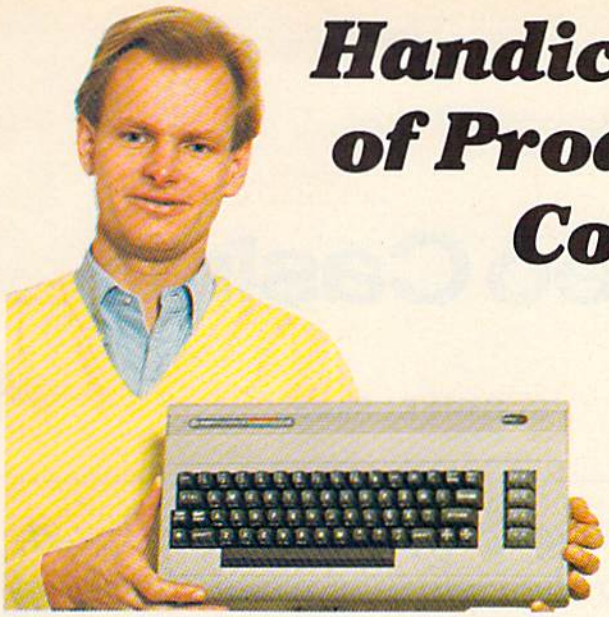

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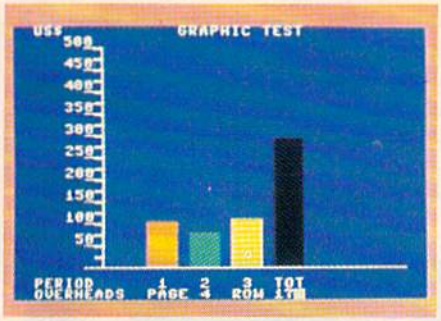
Calc Result Easy is a simple-to-use spreadsheet program for the Commodore 64. It includes 254 lines × 64 columns, built-in graphics, and flexible printout formats. Plug-in cartridge... just plug it in and its ready. Perfect for cash flow analysis, personal net worth, IRA analysis, travel expenses, credit card expenditures, gas and electricity bills, etc.



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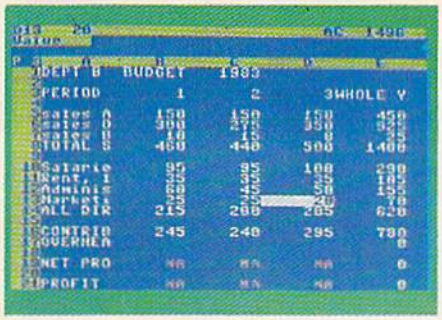

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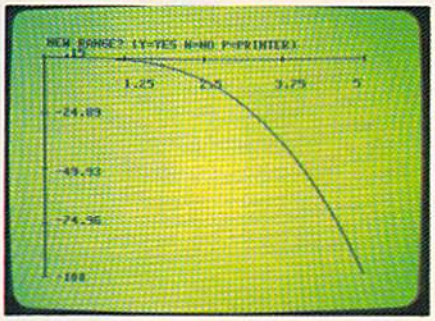

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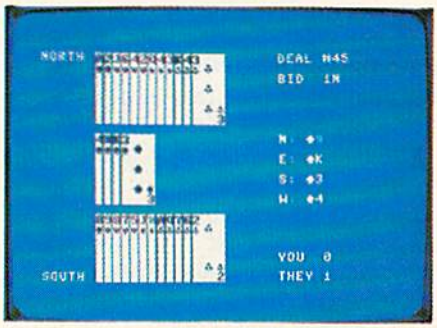

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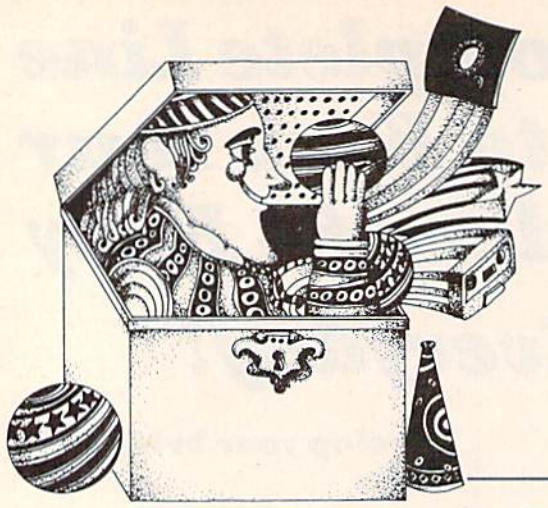


Video Casino

By David D. Busch

Reflex is a game that tests your reaction speed. Can you beat your opponent to the right key when the signal sounds? But beware—if you jump the gun, you lose points.

Are you ready to test your reflexes against the computer this month? Ha! That would hardly be fair. The VIC-20 and Commodore 64 can count from 1 to 50 faster than you can reach for a key. Computers are dumber and less mobile than humans, but, given simple tasks, even the slowest are faster than Bruce Lee, and nearly as ruthless.

How about testing your reflexes against another human being, with the computer as referee? That's a little more reasonable, as the computer's impartial and able to gauge your responses more quickly than yourself. You can take advantage of the computer's speed, without letting it take advantage of you.

Reflex requires you and your opponent to wait for a signal, at which time you each try to hit your designated key on the keyboard. If you're on the left-hand side, you must press only the left-arrow key. If you're on the right-hand side, you should press only the INST/DEL key. Whoever succeeds first gets a point.

Once the signal's been given, if you press any other key, you'll neither void your turn nor produce success. However, if you hit *any* key prior to the NOW!!! signal, you'll trigger a penalty routine that subtracts a point from your total. Whoever reaches ten points first wins the game.

You and your opponent are designated as player left and player right, and your scores are stored in variables PL and PR, respectively. Each round, the VIC-20 or C-64 selects a random delay.

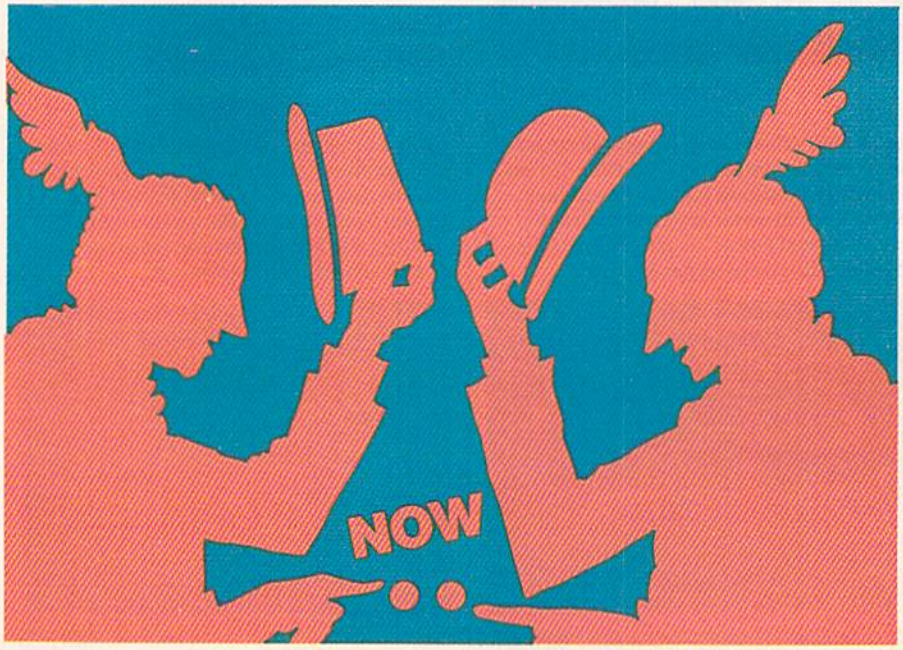
Instead of measuring "jiffies," Commodore's 1/60-second intervals, we'll simply have the computer count from one to some number, with that time span becoming our delay. In Reflex, the computer is asked to count off a random amount of numbers—more than 500, but less than 1500.

The For...Next loop that affects the delay then begins. Each time through the loop, the computer checks to see that no one jumps the gun and presses a key. Although there are several ways for Commodore computers to do this, one that is *not* used is to Peek an appropriate memory location. Instead, Reflex takes advantage of a popular programming trick that is a bit simpler for the novice to understand.

The technique is an unusual Get A$ line. Unlike most similar Get lines, this one does not repeat itself until you press a key. The most common incarnation is as follows:

```
10 GET A$:IF A$="" GOTO 10
```

When such a line is encountered, the computer will fetch a single character



RUN It Right

Unexpanded VIC-20
Commodore 64

Address all author correspondence to David D. Busch, 5217-C Cline Road, Kent, OH 44240.

from the keyboard, and assign its value to variable A$. If you don't press any of the keys, then A$ will equal nothing, or the null string. This is also expressed as two quotation marks with nothing between them ("").

Normally, the computer will go on to the next program statement. Since the Commodore 64 and VIC-20 poll, or strobe, the keyboard so quickly, you'd have very little chance of pressing a key at the exact moment the computer was looking for input. So, Get statements are normally placed inside loops, such as the one shown above. If, as is usually the case, A$ equals nothing (""), then line 10 will repeat. Only if you press a key will A$ equal something other than nothing, causing the program to drop down to the next line.

In Reflex, however, you do *not* want the computer to pause and wait for you to press a key. You want it to continue counting off the selected delay interval, while still keeping a watch out for any premature key depressions. Rather than allowing the computer to become stuck on one line, you can write a module like the following.

```
100 FOR N=1 TO DELAY
110 GET A$: IF A$<>"" GOTO 140
120 NEXT N
130 END
140 PRINT "AHA! YOU PRESSED A KEY !!!"
```

With the above module, the computer will cycle through the For...Next loop at its normal speed. If you press a key when line 110 is executed, the program will branch to line 140, where a message is displayed. Otherwise, since A$ does equal "", the program will drop down to line 120 to repeat the loop. Since each operation is carried out so quickly, the computer appears to be polling the keyboard constantly, even though it's counting off the delay loop at the same time.

This is the technique used in Reflex. The Get A$ line is included, and if A$="", then the program simply goes on to Next N.

However, if A$<>"", then the program goes to line 550, checks to see who the culprit was and subtracts a point from his or her score. You see, during the delay loop, you are *not* allowed to jump the gun and press a key!

If the loop does finish without incident, NOW!!! is printed to the screen. A beep tone begins inside a longer Get A$ loop. This one repeats, beeping, until you press a key. The ASCII code of that key is stored in variable A.

If you've pressed either the left-arrow

Listing 1. The Reflex program for the unexpanded VIC-20.

```
10 REM **********
20 REM *{8 SPACEs}*
30 REM * REFLEX *
40 REM *{8 SPACEs}*
50 REM **********
60 MA=22
70 POKE 36878,15
80 VOICE=36874
90 SOUND=255
100 PRINT"{SHFT CLR}{2 CRSR DNs}"
110 PRINTTAB(6)"{CTRL 9}{CTRL 3}REFLEX{CTRL 7}{2 CRSR D
    Ns}"
120 PRINT"WHEN {CTRL 9}NOW!!{CTRL 0} FLASHES,"
130 PRINT"{CRSR DN}PLAYER LEFT HITS {CTRL 9}{LEFT ARROW
    }{CTRL 0}"
140 PRINT"{CRSR DN}PLAYER RIGHT HITS {CTRL 9}INST{CTRL
    0}"
150 PRINT"{2 CRSR DNs}FIRST 10 PTS. WINS!"
160 PRINTTAB(6)"{2 CRSR DNs}{CTRL 9}{CTRL 4}HIT ANY KEY
    {CTRL 7}"
170 GET A$:IF A$="" GOTO 170
180 PRINT"{SHFT CLR}{2 CRSR DNs}";TAB(2)"HIT ENTER TO B
    EGIN"
190 PRINTTAB(2)"NEXT ROUND."
200 INPUT A$
210 PRINT"{SHFT CLR}"
220 IF PL>9 OR PR>9 GOTO 690
230 DELAY=RND(1)*1000+500
240 FOR N=1 TO DELAY
250 GET A$:IF A$<>"" GOTO 550
260 NEXT N
270 PRINT"{3 CRSR DNs}";TAB(MA/2-4);"{CTRL 9}{CTRL 7}NO
    W!!!{CTRL 7}"
280 GET A$
290 POKE VOICE,SOUND
300 POKE VOICE,0
310 IF A$="" GOTO 280
320 A=ASC(A$)
330 IF A=95 OR A=20 GOTO 350
340 GOTO 280
350 IF A=95 GOTO 450
360 IF A=95 GOTO 450
370 PRINT"{SHFT CLR}{2 CRSR DNs}"
380 PR=PR+1
390 PRINTTAB(4)"LEFT:";PL
400 PRINTTAB(4)"RIGHT:";PR
410 PRINTTAB(4)"{2 CRSR DNs}WINNER !! {CTRL 9}{CTRL 3}-
    -->{CTRL 0}{CTRL 7}"
420 A$=""
430 FOR N=1 TO 1000:NEXT N
440 GOTO 180
450 PRINT"{SHFT CLR}{2 CRSR DNs}"
460 PL=PL+1
470 PRINTTAB(4)"LEFT:"PL
480 PRINTTAB(4)"RIGHT:";PR
490 PRINT"{2 CRSR DNs}{CTRL 9}{CTRL 3}";TAB(4)"<---{CTR
    L 0}{CTRL 7} WINNER!!"
500 PRINT"{2 CRSR DNs}"
510 IF A$<>"" GOTO 420
520 IF A$<>"" GOTO 520
530 FOR N=1 TO 1000:NEXT N
540 GOTO 180
550 A=ASC(A$)
560 IF A=95 OR A=20 GOTO 580
570 GOTO 260
580 IF A=95 THEN PL=PL-1: GOTO 600
590 GOTO 630
600 PRINT"PLAYER {CTRL 9}{CTRL 3}<---{CTRL 0}{CTRL 7} J
    UMPED GUN"
610 PRINT"LOSE ONE POINT!"
620 GOTO 660
```

More

key, or the INST/DEL key, the program goes to the proper win routine. Otherwise, the key is ignored and Reflex waits for an acceptable entry.

As you and your opponent each win a round, your points are increased, and a helpful arrow points to the winner. Then you return for more action. At the end of the game, the winner is announced—to much praise or derision. R

Listing continued.

```
630 PR=PR-1
640 PRINT"PLAYER {CTRL 9}{CTRL 3}--->{CTRL 0}{CTRL 7} J
    UMPED GUN"
650 PRINT"LOSE ONE POINT!"
660 PRINTTAB(6)"{2 CRSR DNs}{CTRL 9}{CTRL 4}HIT ANY KEY
    {CTRL 7}"
670 GET A$:IF A$="" GOTO 670
680 GOTO 180
690 PRINT"{SHFT CLR}{2 CRSR DNs}"
700 IF PL>9 THEN PRINT"PLAYER {CTRL 9}{CTRL 3}<---{CTRL
    0}{CTRL 7} WINS!":GOTO 720
710 PRINT"PLAYER {CTRL 9}{CTRL 3}--->{CTRL 0}{CTRL 7} W
    INS!"
720 PRINT"{2 CRSR DNs}"
730 PRINT"PLAY AGAIN?"
740 INPUT B$
750 IF LEFT$(B$,1)="Y"THEN RUN
```

Listing 2. The Reflex program for the C-64.

```
10 REM **********
20 REM *{8 SPACEs}*
30 REM * REFLEX *
40 REM *{8 SPACEs}*
50 REM **********
60 POKE 53281,1
70 PRINT"{SHFT CLR}{2 CRSR DNs}"
80 PRINTTAB(14)"{CTRL 9}{CTRL 3}REFLEX{CTRL 7}{2 CRSR D
   Ns}"
90 PRINTTAB(8)"WHEN {CTRL 9}NOW!!{CTRL 0} FLASHES,"
100 PRINTTAB(8)"{CRSR DN}PLAYER LEFT HITS {CTRL 9}{LEFT
    ARROW}{CTRL 0}"
110 PRINTTAB(8)"{CRSR DN}PLAYER RIGHT HITS {CTRL 9}INST
    {CTRL 0}"
120 PRINTTAB(8)"{2 CRSR DNs}FIRST 10 PTS. WINS!"
130 PRINTTAB(12)"{2 CRSR DNs}{CTRL 9}{CTRL 3}HIT ANY KE
    Y{CTRL 7}"
140 GET A$:IF A$="" GOTO 140
150 PRINT"{SHFT CLR}{2 CRSR DNs}";TAB(12)"HIT ENTER TO
    BEGIN"
160 PRINTTAB(12)"NEXT ROUND."
170 INPUT A$
180 PRINT"{SHFT CLR}"
190 IF PL>9 OR PR>9 GOTO 670
200 DELAY=RND(1)*1000+500
210 FOR N=1 TO DELAY
220 GET A$:IF A$<>"" GOTO 530
230 NEXT N
240 PRINT"{3 CRSR DNs}";TAB(16);"{CTRL 9}{CTRL 7}NOW!!!
    {CTRL 7}"
250 POKE 54296,15
260 POKE 54273,34
270 GET A$
280 IF A$="" GOTO 270
290 POKE 54296,0
300 A=ASC(A$)
310 IF A=95 OR A=20 GOTO 330
320 GOTO 270
330 IF A=95 GOTO 430
340 IF A=95 GOTO 430
350 PRINT"{SHFT CLR}{2 CRSR DNs}"
```

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Listing continued.

```
360 PR=PR+1
370 PRINTTAB(8)"LEFT:";PL
380 PRINTTAB(8)"RIGHT:";PR
390 PRINTTAB(8)"{2 CRSR DNs}WINNER !! {CTRL 9}{CTRL 3}-
    -->{CTRL 0}{CTRL 7}"
400 A$=""
410 FOR N=1 TO 1000:NEXT N
420 GOTO 150
430 PRINT"{SHFT CLR}{2 CRSR DNs}"
440 PL=PL+1
450 PRINTTAB(8)"LEFT:"PL
460 PRINTTAB(8)"RIGHT:";PR
470 PRINT"{2 CRSR DNs}{CTRL 9}{CTRL 3}";TAB(8)"<---{CTR
    L 0}{CTRL 7} WINNER!!"
480 PRINT"{2 CRSR DNs}"
490 IF A$<>"" GOTO 400
500 IF A$<>"" GOTO 500
510 FOR N=1 TO 1000:NEXT N
520 GOTO 150
530 A=ASC(A$)
540 IF A=95 OR A=20 GOTO 560
550 GOTO 230
560 IF A=95 THEN PL=PL-1: GOTO 580
570 GOTO 610
580 PRINTTAB(8)"PLAYER {CTRL 9}{CTRL 3}<---{CTRL 0}{CTR
    L 7} JUMPED GUN{2 CRSR DNs}"
590 PRINTTAB(8)"LOSE ONE POINT!"
600 GOTO 640
610 PR=PR-1
620 PRINTTAB(8)"PLAYER {CTRL 9}{CTRL 3}--->{CTRL 0}{CTR
    L 7} JUMPED GUN{2 CRSR DNs}"
630 PRINTTAB(8)"LOSE ONE POINT!"
640 PRINTTAB(12)"{2 CRSR DNs}{CTRL 9}{CTRL 4}HIT ANY KE
    Y{CTRL 7}"
650 GET A$:IF A$="" GOTO 650
660 GOTO 150
670 PRINT"{SHFT CLR}{2 CRSR DNs}"
680 IF PL>9 THEN PRINTTAB(12)"PLAYER {CTRL 9}{CTRL 3}<-
    --{CTRL 0}{CTRL 7} WINS!":GOTO 700
690 PRINTTAB(12)"PLAYER {CTRL 9}{CTRL 3}--->{CTRL 0}{CT
    RL 7} WINS!"
700 PRINT"{2 CRSR DNs}"
710 PRINTTAB(12)"PLAY AGAIN?"
720 INPUT B$
730 IF LEFT$(B$,1)="Y"THEN RUN
```

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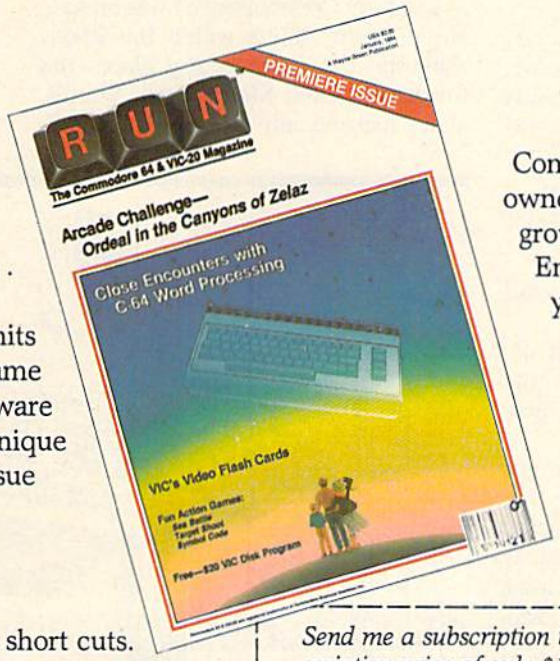

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The 91st Day

By G.S. Wright

Power on. Monitor—fancy name for a Panasonic 12-inch color TV set that costs $278.16, but works well—on. Disk-drive on. Commodore 64 on.

Dots on the screen. Four vertical lines of dots. Maybe ten dots in each line.

Flicker.

Eight vertical lines of dots. Can't count the number.

Flicker.

Horizontal lines of dots. Flicker. More lines. Flicker. Lines increasing. Flickers. More lines. Then—maybe thirty seconds after all the stuff was turned on—the screen clears and

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shows up—right where it's all supposed to be.

And I could work with it until it decided it had had enough, began the flickering again and crashed the program—and I was back to nothing.

As they say in kindergarten, it got broke.

All things tend to break eventually. Soap bubbles in seconds, volcanoes around every 50,000 years. Given enough time, it'll get broke. Even Commodore 64s.

I'd owned and used my Commodore 64 for approximately 5 months; then it broke. I could accept that.

Subsequent events were a little harder to swallow.

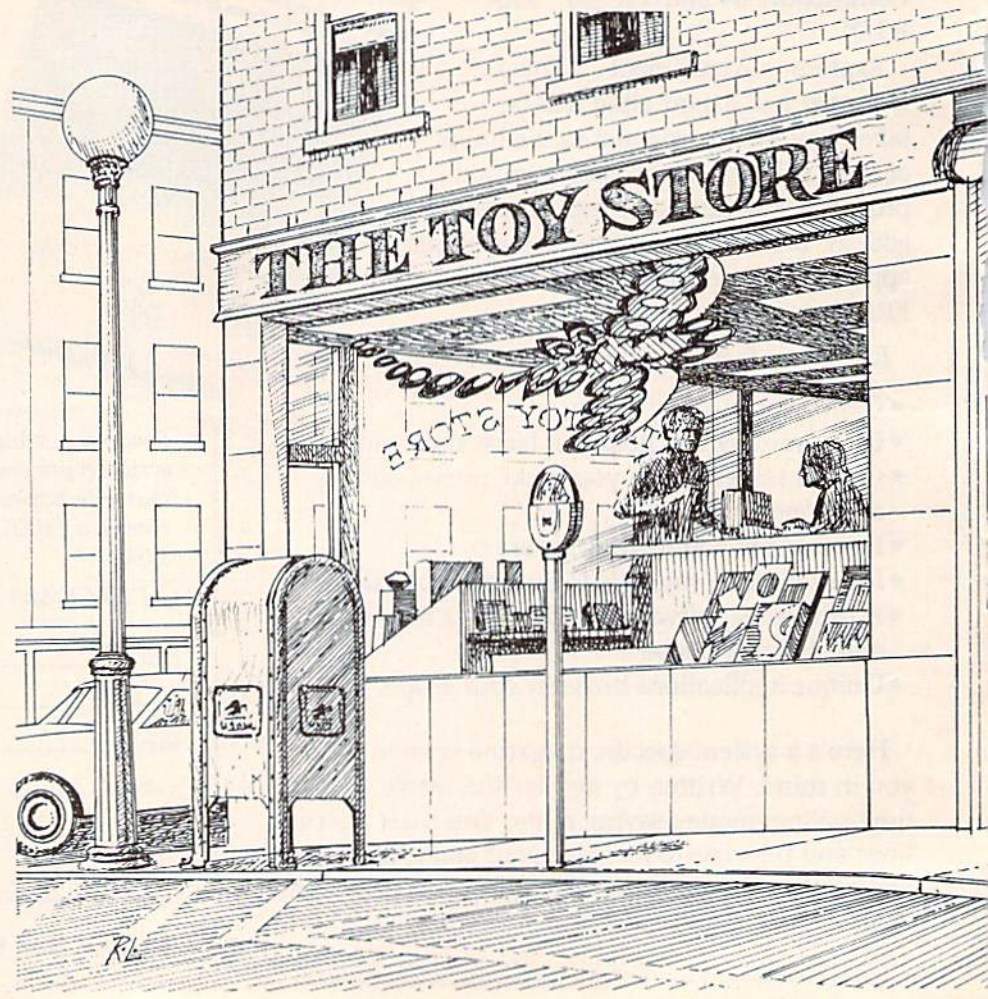
I went back to the store where I bought the computer. It's a big, local toy store—three stores in the area—and it's been around a long time. Best prices and nice people.

I said my Commodore 64 was broken. No problem. If it's within the 90-day warranty. No problem any place—this toy store, Sears, Montgomery Ward's, and, I imagine, any other store that sells Commodores. They simply take back the old and broken computer, and give you a new one. No problem. *If* it's within the 90-day warranty period.

My computer waited till the 150th day, and things are different when you reach that age.

Nice Guys—but No Fix

The nice people at my local toy store don't service Commodore 64s. They *sell* Commodore 64s, and VIC 20s, and Adams, and even Apples, but they don't fix them if they break. And they don't



Address all author correspondence to G. Scott Wright, 54 Vly Road, Albany, NY 12205.

Learn from this story of the travails one frustrated C-64 owner experiences when he tries to get his inexpensive computer repaired—after the 90-day warranty has expired.

give you a new one if it's after 90 days.

The 91st day seems to be the moment of truth. And the truth is, in my town, if your Commodore 64 breaks after the 90th day, you're in real trouble. And my "town," if you consider the entire metropolitan area, is a "town" of close to a million people—hardly out in the sticks.

The nice guys at the toy store sent me to another outfit—a serious, no-messing-around, no-Cabbage-Patch-dolls-here, real-live computer sales and service store that, I was told, services Commodores that break after the 90th day.

I drove over there. Nice, clean, efficient place.

I understand you guys fix Commodore 64s.

No, they didn't. No way. Wouldn't touch my Commodore. Only service Commodores *they* sell. Did I want to buy one from them, which they would guarantee to service when it broke?

Back to the nice guys at the toy store. Now what? Gee, fella, those other folks always worked on ours before. But here's another place that does that kind of work. And they gave me the name of another outfit that repaired Commodore 64s.

I'd just driven a total of ten miles to be told the first outfit wouldn't fix my computer, but I was smarter now...I called this new outfit right from the store.

They wouldn't touch a Commodore 64.

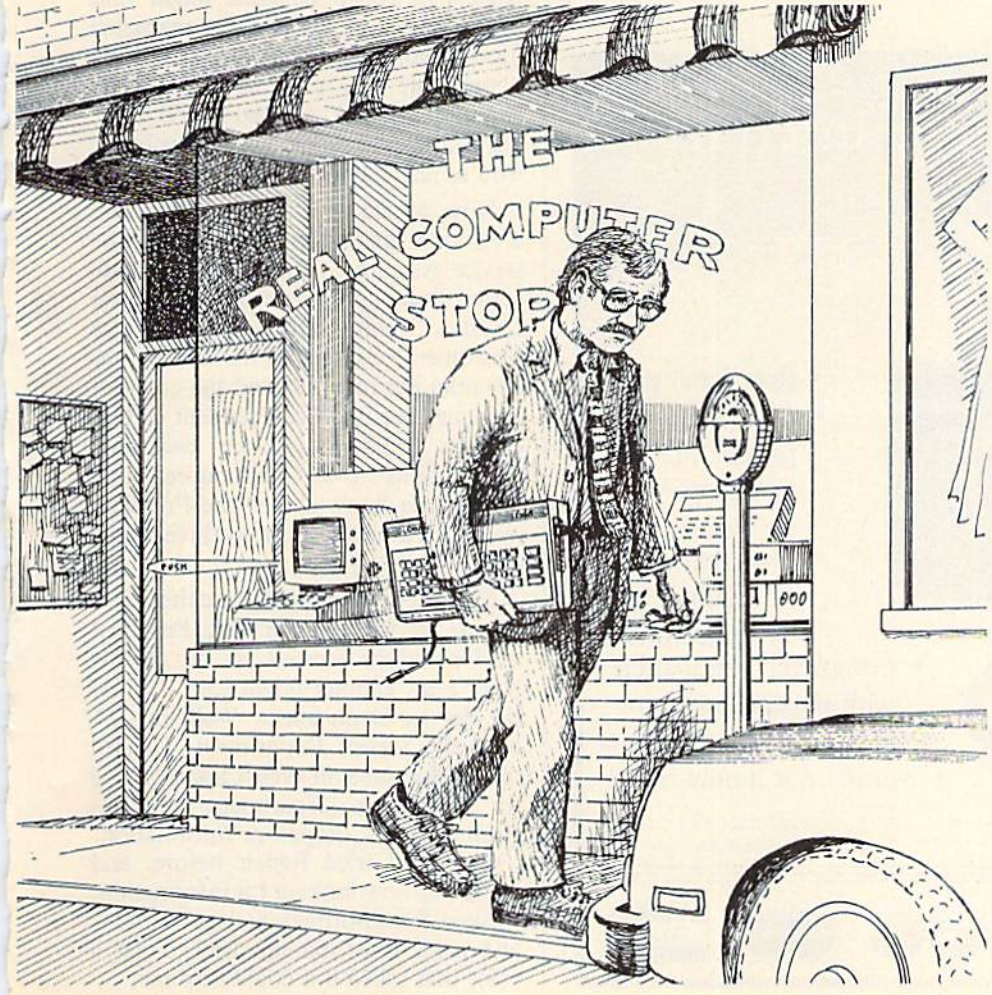
Gee! Well, maybe there's somebody else. More calls. Calls to a big electronics repair place which advertises that it fixes computers. Willing to work on Ataris, but no Commodores. Another electronics fixer—General Electric, believe it or not. Atari, yes; Commodore, no. And a third, and the same answer.

Now I figured I either ought to get an Atari, or Atari computers break a lot, making it worthwhile for these shops to learn how to fix them. Of course, maybe Ataris are just easier to fix than Commodore 64s. I didn't ask. I had my trusty Commodore 64 to worry about.

The nice guys in the toy store were beginning to have to work very hard at their job of being nice. Not to me—by this time we were old war buddies, sharing the same foxhole—but they were having a little trouble being nice when they spoke about Commodore's repair service.

They conferred, and finally decided to go right to the top. They made a long distance call to Commodore in West Chester, Pennsylvania.

I didn't listen in, but they came away from the phone with two approaches to



my problem. Either go to the local Commodore service center, or send the computer directly to Commodore in West Chester. Obviously, the first was the better solution, as I wanted to use the computer before next Christmas.

The local service center was 45 miles away. If my computer had been working, it would have shown that I'd be making a 90-mile round trip to take the computer to the shop, and another 90-mile round trip to get it back. According to the latest Hertz figures, it costs 43+ cents a mile to drive a car. According to my adding machine, it would cost me $77.40+ to carry my computer from here to the local service center and get it back whenever it was fixed.

Now, I am often naive—I tend to assume that large companies such as Commodore have figured out the problems of servicing their machines—but I ain't stupid. I called their local service center before driving all that way.

Their local service center doesn't fix Commodore 64s.

Don't ask for any deeper explanation—I don't have one. The voice on the phone said they don't fix Commodore 64s. That's all I know.

OK. OK, I'd had it. Driving around to places that don't fix Commodores. Calling repair outfits that don't fix Commodores. The whole mess.

Go to the Top

I gave up, and called Commodore in West Chester, Pennsylvania.

They eventually answered the phone, and transferred me to Service, where I was told that all I had to do was send in my computer with a check for $55 and a note saying what was wrong, and they'd fix it. That's all there is to it. I pay the shipping, of course, which ups the cost somewhat.

I asked what the charge would be if it were only a $10 or $15 repair. (I have a TRS-80 Color Computer, and have had it serviced—locally, I must admit—and the bill was $16.05 the first time and $35 the second—both significantly less than $55, to say nothing of no shipping charge, and I got the computer back in a day.) The Commodore man said the price was $55 *regardless* of what was wrong.

Now that sounded a little strange to me. I told the gentleman it was my understanding that a *new* 64 cost Commodore about $30 to manufacture, so what was the $55 for? He said he was simply telling me what the policy was. Send back the computer and $55, and they'd fix it.

After I hung up, I thought about that deal. If my computer needed a $5 repair, I would have to spend about $60 getting it fixed, wait whatever length of time it took for the thing to get to West Chester, Pennsylvania, be repaired and then returned—and I would still have my old computer back, complete with potential age problems and future breakdowns.

On the other hand, if I dropped a rock on the computer before sending it to West Chester, Commodore would have to send me a new machine for my $55 (plus shipping).

Now, children, I am *not* advocating dropping rocks on Commodore 64s before sending them to West Chester, Pennsylvania. Bear with me. You will see that Commodore may have a rotten service system, but they ain't stupid either.

I decided that the story of my trying to get my Commodore 64 repaired had grown to such proportions that the readers of *RUN* magazine might find some value in it. I called the magazine (does anyone want to contribute to my phone bill? Any small amount will be appreciated), and they said they'd be interested in an article on the subject. You're reading it.

Now, armed with a commission from a national magazine to investigate the service system of Commodore, I made some more phone calls. To West Chester, Pennsylvania, and the nice Customer Relations (I think that was her title) person, who said she couldn't help me, but the Vice President of Operations could. I have no idea what "Operations" is at Commodore, but I will let you know if the Vice President ever finds time to return my three phone calls.

So, given the fact that neither Customer Service nor the Vice President of Operations seemed to be of any help, I got another bright idea. I called the Service Department. Well, not exactly the Service Department. I called the main number in West Chester, asked for the Service Department, and was given a choice—Repair or Information.

As I had tried Repair before, and really was now looking for information, I asked for Information. I got Hold—and held. Four minutes later, I got a voice that asked if it could help me.

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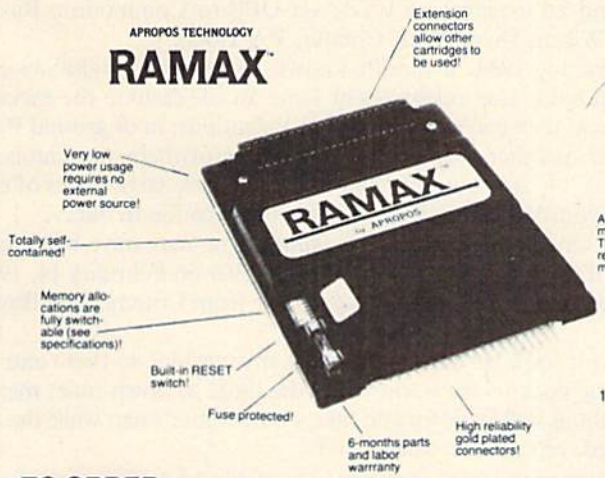

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APROPOS TECHNOLOGY

A *New* One?

I said I had a broken Commodore 64 and wanted to get it fixed.

"Is it still in warranty?"

"No."

"Then send it to Commodore in West Chester, Pennsylvania, with a check for $55, and Commodore will send back a new one. Oh. Include a note explaining what's wrong with the old one."

That sounded familiar. But wait a second! "What's this about a *new* one? I mean, suppose the repairs are minor?"

"We send you a new one, regardless of the problem with the old one."

Son of a gun!

Apparently they'd figured out the dropping-a-rock-on-the-old-computer-before-sending-it-to-West-Chester-Pennsylvania routine. I told you they weren't stupid. (And, if you'll remember, I also told you not to drop rocks on your computer.)

I went through the whole thing again just to make sure. If something is wrong with your Commodore 64, and it's the 91st (or more) day after you bought it, and there's no one in your town who can or will fix it, send it to Commodore in West Chester, Pennsylvania, with your check for $55, and they'll send you a brand-new, fresh-in-the-box, never-been-touched-by-a-repairman's-hands Commodore 64 computer.

If I read that right, they can't fix them either. But they'll sell you a replacement for $55 (plus the cost of shipping them the old one).

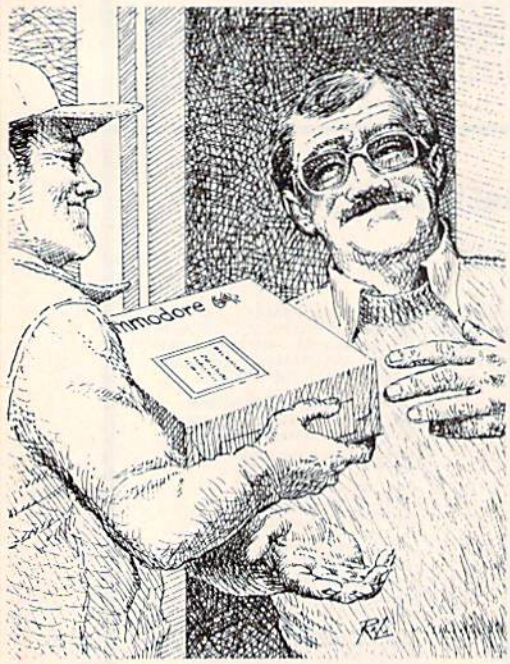
That's Commodore's idea of service. You're free to draw whatever conclusions you want. Commodore 64s do a lot of computing. More and more software companies are including Commodore 64s in their small-print lists of computers that can run their programs. It would seem that Commodore may well be the only major low-end (inexpensive) home computer in the market in a year or so (if you don't count Radio Shack, and the software people don't count Radio Shack, which makes Radio Shack computers less than desirable).

Commodore 64s are good, inexpensive computers, with a growing inventory of good, relatively inexpensive software.

If you are about to buy a Commodore, ask about service. Every store will tell you the wonders of their exchange policy within the 90-day warranty; but, unless you intend to keep your computer for less than 90 days, ask about service *after* the warranty runs out. And don't accept the clerk's assurance that there are all kinds of places where you can get it fixed. You may live in a town like mine.

But, consider this: while most of the world may not be ready to repair Commodore computers when they break, Commodore itself *will* sell you a replacement for $55 (plus shipping the old one to West Chester, Pennsylvania).

And that, dear friends, is what is called "Commodore's Service Program." It's not exactly what I expected when I bought my computer, but, on the other hand, maybe it works. I'll send my Commodore 64 to West Chester, Pennsylvania (along with my check for $55 and a note about what's wrong with the old computer), and see what happens. Wish me luck. R



The 91st Day—Addendum

To those of you who sympathized with my plight and were concerned as to whether or not I would get my computer fixed, replaced, or whatever, I dedicate this brief but happy addendum.

On January 31, 1984, I sent my Commodore 64 computer, along with my check for $55 and an explanatory letter, via UPS to Commodore Business Machines, 1200 Wilson Drive, West Chester, PA 19380.

On February 14, 1984, a month known to ancient Anglo-Saxons as Sprout-Kale, and a day that celebrates in some arcane fashion the execution of at least two good men called Valentine, or Valentinus, in or around Rome, by some emperor or other—we do know that one of them was clubbed to death on February 14, 269, but how that relates to those large boxes of chocolates on sale at your local drug store, I can't begin to figure out...

Where was I? Oh, yes, St. Valentine, whoever he may have been, is not really the point of all this. The point of all this is that on February 14, 1984, I received a replacement for my broken computer from Commodore Business Machines.

The two weeks it took between my sending my machine to them and their sending a new one back to me is known in the trade as down-time, meaning that the user might as well lie down and take a long winter's nap while the computer's being fixed, replaced or whatevered.

Further, no letter or note was enclosed. There was no explanation of Commodore's repair policy, or even if the replacement machine was under a new warranty. But it *did* come with a warranty/questionnaire card in the box, and I mailed that in immediately.

So, despite all of the trials and tribulations (which really are insignificant compared with poor old Valentinus getting clubbed to death on the road to Rome), I now have a Commodore 64 computer on my desk. And it works.

How's that for a happy ending, gang?

-G.S.W.

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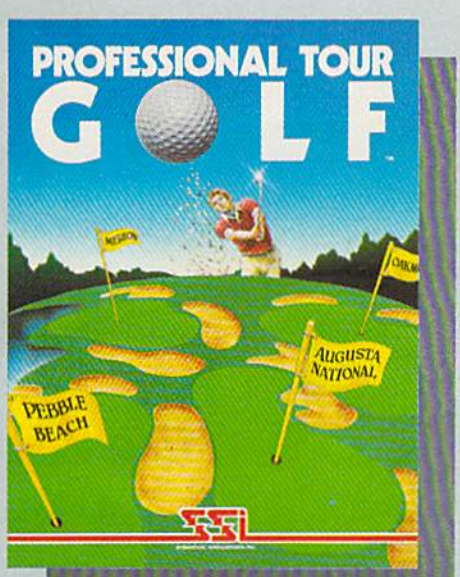

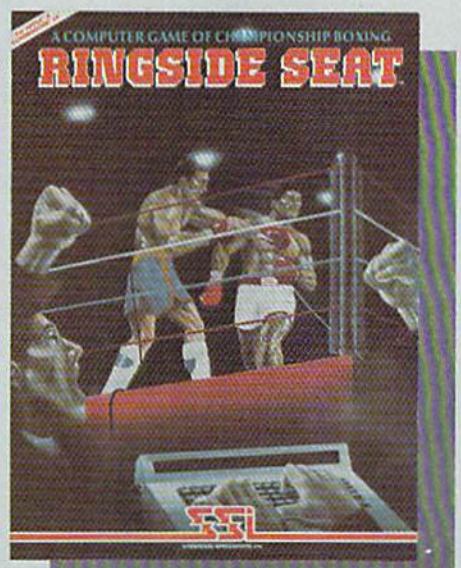

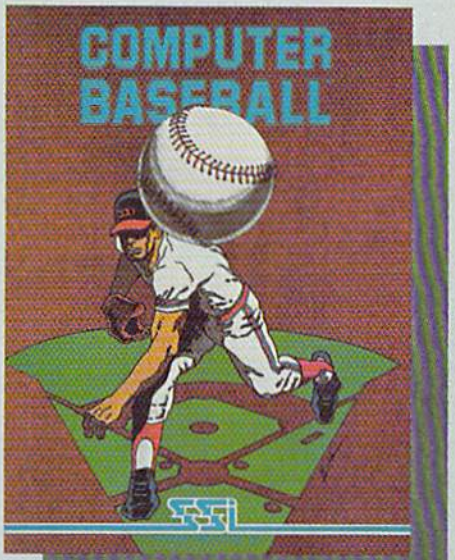

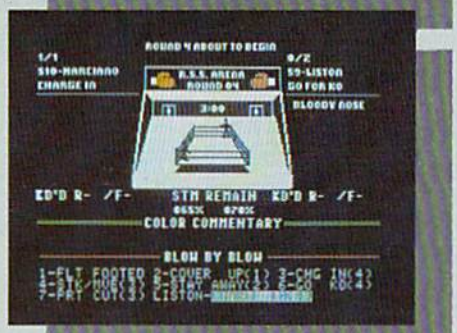

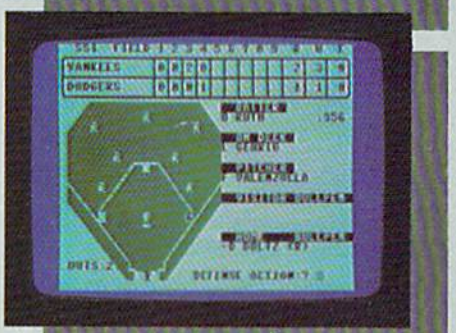

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By Annette Hinshaw

The Joy of Modems

Computer bulletin boards are springing up everywhere, making computer-to-computer communications easily accessible and changing the way we lead our daily lives. To join the fun of instant information exchange, all you need are a modem, computer and telephone. It's as easy as making a phone call.

Science fiction often portrays life in the future with a family communication terminal that processes many everyday tasks. We see people send and receive mail, receive daily news, shop, pay bills and even attend school or work for an office—and it's all happening through a machine that looks a lot like a home computer. The resemblance is not coincidental.

These functions are technically and economically feasible with today's computers. Until recently, modems were expensive and rare, but now the VIC-Modem costs as little as $59.95. Telecommunications may soon be within the reach of every household, and the way we conduct our daily lives may be changed forever.

In the Meantime

The modem is the door to one of the greatest delights of home computing: the computer bulletin board. A bulletin board system (BBS) is a program that allows the computer on which it runs to receive messages from another computer and download (transmit) text from its memory to the memory of the calling computer. Communication is done through a modem on each computer and an ordinary telephone line in between.

The bulletin board acts as a forum for general information, answers to questions, notices of hardware or software for sale and other kinds of personal communication. Messages may be public, and read by anyone, or private (electronic mail, E-mail), and read only by the person to whom they are addressed. You may sign on to the BBS with your real name or an assumed one. Users upload (transmit from caller to host) or download (from BBS computer to caller) software.

Using bulletin boards takes a little practice and a bit of know-how. The rewards for trying are worthwhile and the cost is usually the price of a phone call, and then only if the call is long distance. Most bulletin boards are a service provided by their owner. Some system operators (SYSOPs) ask for donations to help defray the costs of running the board, but few ask for regular fees.

Accessing a BBS

Before you call a computer bulletin board, you must attach the modem to the computer. The VIC-Modem plugs into the user port—only plug and unplug it when the computer's power is off, or you may ruin the computer.

The program that comes with the VIC-Modem, VICTERM I, sets up your computer as a terminal so it can talk to the other computer. You begin by loading and running this program. If you're using some other terminal software, follow the instructions that go with the program.

Calling another computer is almost as easy as making any other phone call. When you dial the number, the phone either responds with a busy signal or rings into the line.

Popular bulletin boards are often so hard to get into that BBS fans use autodialers (either hardware or software) to reduce the frustration. When the call rings in, you listen for a high squeal, called a carrier, which indicates the host computer is on the line. Then you remove the cord from the telephone handset and plug it into the VIC-Modem. Within seconds, a welcome message from the BBS computer will print across your screen.

If the message is garbled, the connection is bad. The terminal program might have loaded wrong or the modem or calling computer might have a hardware problem. A bad connection can also be caused by a bad telephone connection, a bad telephone line or something wrong with the host computer.

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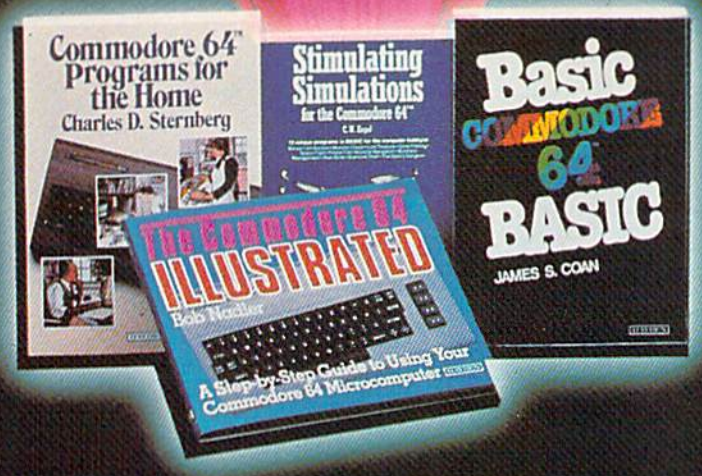

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If you get an unreadable connection, hang up the phone, which disconnects the two computers, and try again. If the problem persists, try again at a later time. If the problem occurs on more than one BBS, your hardware equipment should be checked.

Once you successfully connect with the bulletin board, you'll be asked to identify yourself. Many systems will ask for a password, but advise a new caller to respond with a carriage return (CR means hit the return key). Then type in your own name or a pseudonym. You may be asked to type in the name of your city.

Systems that use passwords usually will permit new users to read any of the public bulletin boards, but not to leave messages or to access certain sub bulletin boards within the system. You can apply for a password. Some bulletin boards will generate a random password. Other boards give you a chance to choose your own password.

When you choose one, remember that the computer does not consider a word in lowercase letters to be the same as the same word in uppercase letters. The password must be recorded exactly as it is entered.

In subsequent calls to the BBS, the password is your identification. With a four- to eight-character password, the host computer identifies you and whatever privileges you have on the bulletin board. It will tell you if messages are waiting for you, and will automatically put your name as the sender of any messages you leave.

Passwords protect the BBS and its users (some of whom are elementary school children) from irresponsible individuals who may leave abusive or obscene messages on a public part of the board. Some BBSs have separate parts of the system for "adult" humor or sexually explicit language. Before you gain access to an X-rated section of these boards, the SYSOP makes sure you're an adult. Where assumed names like Joystick, Donald Duck or James Bond are permitted, the SYSOP may require your real name and phone number before clearing the password that goes with the assumed name.

Whether or not the system uses passwords, most BBS programs will check the entered identity and may refuse to let certain individuals on the board. If you use a particular name or password that is blacklisted, you'll probably be disconnected by the computer.

Using a Computer Bulletin Board

Bulletin board programs usually limit the amount of time for any one call. Twenty or 30 minutes may sound like a long time, but many bulletin boards have more material available than can be read in that amount of time, even if you only look at messages that have been added since your last call. If you also want to leave messages, you may find that you have "timed out" and been disconnected before you're ready to leave the bulletin board.

As a novice BBS user, you may want to have an experienced user help you the first few times you try to find your way around a board. Instructions on using the board may be confusingly brief. If the explanations are clear, you may use up precious time scrolling across the screen. Some bulletin boards let you set the rate at which text is transmitted to your computer screen, or change your level of expertise so only symbols for the various options are printed. Many bulletin boards have "help" signals that you can enter when you need more information.

As the novelty of adult conversation wore off, the X-rated board became so inactive it was hardly worth checking.

Bulletin boards have several sections that may themselves be multi-part, and accessing individual sections is a matter of selecting options from a menu. The top or main menu is likely to show sections for E-mail, which is for private messages; sections for particular kinds of computers; or sections for special-interest groups (SIGs). If the board has messages for you, the BBS tells you at sign-on where they are on the bulletin board.

Take a Byte

Trying a new bulletin board is like going to a tasting party. You should dip into as many sections of a new board as possible to find out which appeal to you the most. You don't have to go through a whole section if you don't like it. You may type S for stop, E for escape or some other signal that takes you back to a menu.

Bulletin boards have a lot of variety. On the Tulsa Information Exchange (T.I.E.) in Oklahoma, there are boards for several lines of computers besides Commodore, although the Commodore people are the most active users of this system. The Commodore section is divided into messages, bulletins and tips and software to be downloaded. The messages range from serious questions and answers to notices of user group meetings to an exchange of smart remarks about the relative values of Commodore and TRS-80 computers.

More specialized boards on T.I.E. include titles like X-rated, Dr. Who, Video Games, Adventure Games and Penthouse. The last one, by the way, is especially for kids under 14, although adults occasionally wander into it. The assistant SYSOP, who keeps this section's message board cleaned up, is in junior high.

Just to give a flavor of what goes on, consider a "killer" game (pretend assassination of the players) on the Dr. Who board. It featured peanut butter bombs and nonsense messages with encrypted words like boom and bomb. The person addressed would be "blown up" and out of the game when he read his message.

The X-rated board had a lonely-hearts-type column by a persona named Miss Thing. When someone complained that the X-rated board was pretty tame, someone else wrote one paragraph of a porn story and invited others to add to it. It took five episodes for it to get so out of hand that no one was interested in trying to top it.

One interesting sidelight is that when people found they could engage in adult (as opposed to obscene) conversation on the Commodore board, the X-rated board became so inactive it was hardly worth checking. The Commodore board is still where the action is, thanks to the hard work (15 to 20 hours a week) of the assistant SYSOP, Jerry Morgan.

Uploading and Downloading

One of the attractions of computer bulletin boards is the availability of free software. Until recently, most bulletin boards did not have much Commodore software available, for two reasons: lack of terminal software programs and Commodore's non-standard ASCII.

VICTERM I, the program that accompanies the VIC-Modem, is a terminal emulator. That is, it sets up the calling computer so it can read messages from

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the host computer, and can transmit limited inputs to the host computer. The host computer can receive what you type in when the BBS program permits it, but text can be sent only at your typing speed. This text cannot be edited if it is sent incorrectly. It can only be deleted and re-sent. Text on the BBS—whether messages, bulletins or programs—cannot be saved and printed out later by the caller.

Tulsa has a lot of Commodore software on its local BBSs partly because a member of the local user's group, Jerry Morgan, wrote a series of programs to perform all the functions needed to upload and download software to a bulletin board. This set of programs, known locally as "Morganload," was widely distributed both in Oklahoma and elsewhere because Morgan generously offered it free to anyone who asked. As the Commodore SYSOP on five bulletin boards around the country, he no longer sends out copies because he is just too busy. Besides, good commercial programs are now available.

Morgan's series of programs illustrates how uploading and downloading of programs works. The first program is entirely text and explains how to use the rest of the programs. The first step is to prepare a program for uploading.

Commodore programs use many handy special symbols, such as the cursor down, which prints in the program listing as a reversed Q. Unfortunately, BBS programs are prepared to accept standard ASCII, and these special symbols either do not transmit or they transmit as garbage.

Any program that uses these symbols must be changed. An empty Print statement takes the place of cursor down. SPC and TAB statements are used for cursor right. CHR$ statements that will perform the Commodore functions when someone downloads the program are substituted for those handy special symbols. CHR$(147), for example, is the equivalent of the heart that signals clear screen.

Once a program has been edited so it can be transmitted, it must be changed from a program to an ASCII file. That is, the computer has to look at it as a string of characters rather than as a series of instructions. Using the Open command, you save your program on tape as an ASCII file.

The second program in the Morganload series is the ASCII Reader. You load it, then put the tape with the ASCII-converted program into the Datassette. When the ASCII Reader is run, it reads this prepared tape and puts the ASCII file into high memory. Uploading and downloading usually require more than the VIC's standard memory.

The next step is to load the third program, the VIC Upload, on top of the ASCII Reader. This program acts as a terminal emulator. You call up the BBS you plan to upload, and proceed as usual. When you get to the section of the BBS designated to receive uploads, hit the British pound sign key to begin and end the upload. Later, the SYSOP will move the program to the download section of the bulletin board.

Uploading programs is a lot of trouble, but anyone who hopes to get free software by downloading should reciprocate the favor by adding public domain software to the available supply. These same procedures can be used to upload regular text for long messages or for general-interest bulletins to the bulletin board users.

Downloading is relatively simple. The Morganload set has a second terminal-emulator program for downloading. Again, you load and run the VIC Download. You access the bulletin board as usual. When you get to the download section or a portion of the message board that you want to download, hit the British pound sign key to begin. With this particular program, downloading continues until the two computers are disconnected or the calling computer runs out of memory, whichever comes first.

When the download is software, it comes to the calling computer as an ASCII file. It has to be changed into a program before it can be executed.

The final program in Morganload is called VIC Creator. It is loaded in after the calling computer disconnects. When it is executed, it automatically reads the ASCII file that was downloaded and rewrites it as a program into the Basic program area of the computer. When the whole program is created, you delete the few lines of the creator program and save your new software as usual.

Modem—Modulator-demodulator. A device for modulating (changing) an electronic signal so it can be transmitted over telephone lines or demodulating (decoding) such a signal so it is intelligible to its receiver.

BBS—Bulletin board system. A program run on a computer that lets the host computer receive and save messages from other computers and transmit text from its memory to a calling computer.

Host computer—Computer on which a bulletin board program is run.

Calling computer—Computer that accesses a BBS through a phone line.

Upload—Transmit text from a calling computer to a host computer.

Download—Transmit text from a host computer to a calling computer.

E-Mail—Electronic mail. Messages on a computer bulletin board for particular persons.

SYSOP—System operator. The person in charge of a bulletin board system or a section of such a system. Deletes outdated messages, answers users' questions, keeps track of software and bulletins, etc.

ASCII—An 8-bit code for transmitting characters, especially on phone lines. Stands for American Standard Code for Information Interchange.

ASCII file—Text that the computer thinks of as characters, rather than a program, which the computer sees as a set of instructions.

SIG—Special-interest group.

Password—Usually a four- to eight-character identification that a BBS stores as the key to a file giving name, address and privileges of a bulletin-board user.

Table. Glossary of terms.

You can also download programs that were not written for Commodore computers and change them so they'll work on your machine. The programmer's reference manuals for the Commodore machines give hints on how to make such modifications. For more specific help, Radio Shack publishes a small book on "translating" between Commodore Basic, Applesoft and TRS-80 Basic. Modifying programs written for other computers not only opens up large banks of software to the Commodore user, but also provides excellent practice in programming.

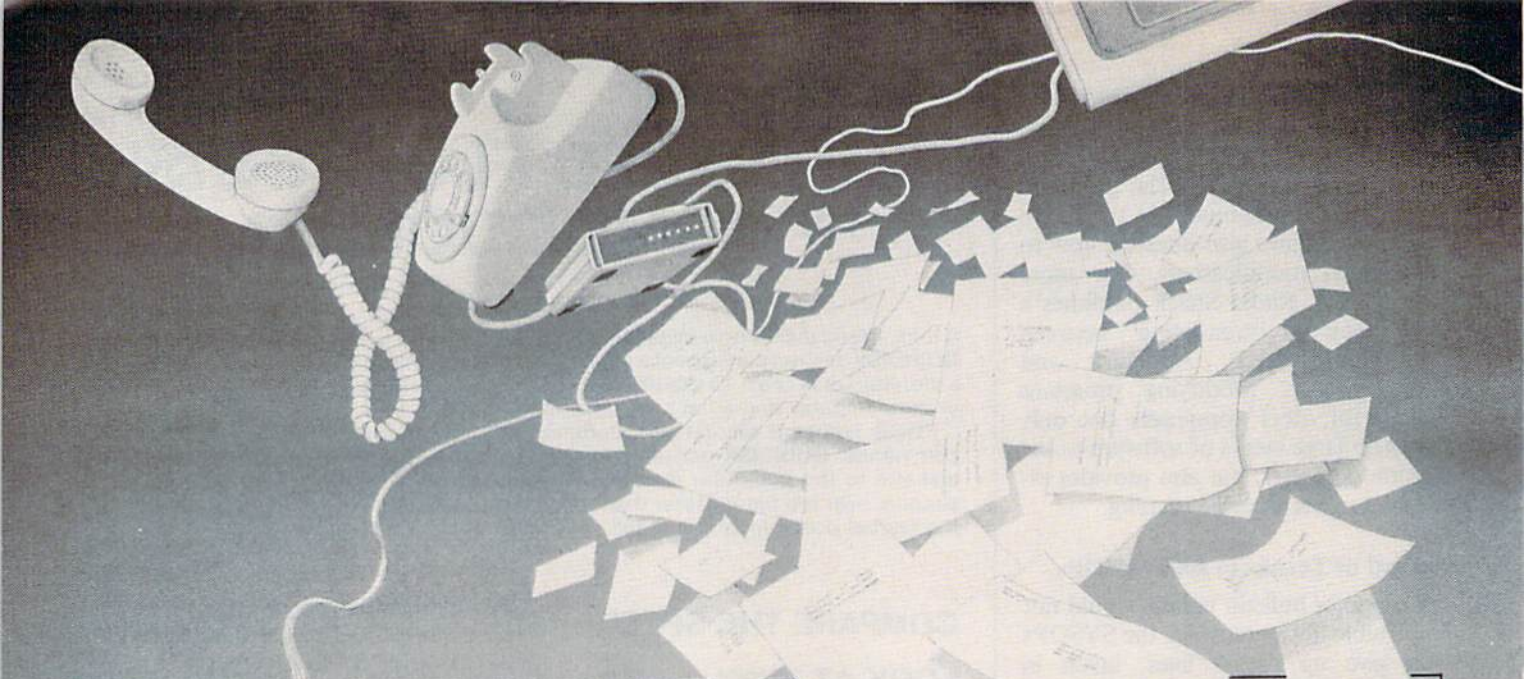
A word of Thanks to BBS SYSOPs

Computer bulletin boards would not be possible if it weren't for the SYSOPs who give up phone lines, invest in heavy-duty hardware and keep these systems going. In Tulsa, there are three bulletin board systems that run 24 hours a day. Steve Lerman, Steve Epps and Floyd Grant all run the same program (TBBS) on TRS-80 computers. Each pays for a business phone line, which is not used for anything but the bulletin board. Each gives up free access to the computer that runs the program. Each contributes substantial amounts of money for hardware, repair and long-distance calls to download software for users.

Even though each one has recruited assistant SYSOPs to maintain many of the individual bulletin boards in the system, each spends hours of time keeping the system going, backing up disks, deleting outdated messages and adding new users and new software to the system.

Most bulletin board operators don't offer 24-hour operation. Their motivations differ. A computer business might offer a bulletin board after business hours to keep in touch with the market. Someone else might look for a free software supply, or just a glimpse of the myriad quirks and quibbles that come up on a service as personal as a hobby computer bulletin board. However, a desire to offer a service to the community of computer users must underlie the decision to maintain a BBS, because the material rewards do not cover the time and expense involved.

Bulletin board users who have a forum for personal expression, a source of free software, a means of answering questions, a marketplace for unneeded hardware or newly-created software or just a place to have fun should keep in mind their debt to the SYSOPs. May their numbers increase. R



By Scott Converse

Working the Nets

With the advent of the affordable home microcomputer, more and more people are becoming involved in a new underground revolution—home computer networking. The proliferation of the networking phenomenon is being caused by several factors, the primary ones being the rise of private bulletin board services (BBS) and the availability of low-cost modems as well as microcomputers.

For several years the military services and several larger companies have been using their computers for networking. Usually, the only persons who had access to the systems were specific, authorized employees.

Now, bulletin boards are used widely in both home- and business-based systems, and they serve four main functions.

Network Uses

First, the networks are used as message centers, where users can leave electronic mail (E-mail) for each other. E-mail is much like regular mail, except for one main advantage—all mail is stored in a host computer, and users simply call up the host to send and receive their mail. It's similar to having a PO box, but you never need to leave your terminal.

Second, many of these networks have bulletin boards on which users can post public items of interest, such as classified ads, political opinions, hardware and software reviews—almost any subject you can think of.

The third use is the fun stuff—games. Unlike home computer games, where you pit your skills against the computer, bulletin boards allow you to compete against other users.

The fourth advantage is free software. There is a huge library of public domain (donated by the programmer for public use) software available on these networks.

RCPS, a network in my area, has over 73 Mbytes of free CP/M software available for downloading (copying over the phone lines via your computer and modem). The software and the phone call are free, and so is the software program that allows you to do this on CP/M-based machines. The latter is called MODEM7 and is available from any CP/M club for the price of a blank disk.

When networks first began on the larger business/host systems, they were uninspired, at times almost sterile.

However, this wasn't and isn't true with the private boards. Many of these boards are run by individuals who've had little or no experience with computers outside of their networking activities, so each board tends to have a casual, conversational tone, quite unlike the rigidly formatted commercial networks.

The character of any BBS is shaped and reshaped by each of its 300–500 users. These users usually discover networks through books, newspaper and magazine articles, or, more likely, a friend who already has a system and is active in the BBS networks.

There are as many different types of bulletin boards as there are people using them. Aside from the general interest—classified ad boards—there are soapbox boards for rambling debates or discussions about politics, hobbies, personalities, movies, computers, profanity and other subjects. These topics are discussed, debated and dissected on the BBS networks in one of the truest forms of free expression in America today.

Other popular types of boards are the sex networks, where you can read or contribute to the X-rated stories started and added to by other system users.

One system operator (SYSOP) who runs such a network is planning to publish the collected works (in novel form) of the material written by his 60-plus users.

There are also many networks that cater to the (at times) bizarre sexual appetites of its users. There is a network in Ohio called Love Line that claims over 400 active users who "connect" with each other over the network. Often it's innocent enough, but sometimes it isn't.

Game Boards

But wait, we're still skimming the surface—where would these networks be without games? I'm not referring only to video games, but to adventures and role-playing games, in which groups of people from all over the country are participating on these BBSs. These fantasy games allow you to create new personalities and interact with other networkers without having to reveal your true identity.

Here's a very brief sampling of what's out there. The boards I will describe are local to Denver, but there are probably similar operations near you.

NORAD-Cheyenne Mountain: This is an Apple-based BBS that, at the initial log-on, appears to be the NORAD computer system from the movie "War Games." It's run by a 16-year-old from his parents' house.

The Unknown BBS: This is run by a CBS affiliate news editor in his spare time. This board's sole purpose is the propagation of jokes, preferably ones in poor taste.

UFONET: This fantasy-type BBS has a main board and several subboards run by up to ten remote system operators. This makes for pretty interesting and, at times, weird goings-on. I bled to death in Iceworld one day, and spent an hour in middle earth the next.

Of course, the list goes on and is limited only by the imaginations of the SYSOPs and their users. Most SYSOPs are open to suggestions by their users, and will comply with reasonable requests. They will even try something that sounds unreasonable if it looks like it may be fun.

How to Begin

Getting started is easier than you'd suspect. Some people use low-cost computers and inexpensive modems. I have a friend who uses a VIC-20, a VIC-Modem and a software cartridge as a remote terminal—total cost: $186.

Others simply purchase a modem and communications software for their existing systems and proceed from there. Modems for home use can range in price from under $50 to $695.

More than likely, your area has at least one network up. If you're based in a larger metropolitan region, you have access to at least dozens, and sometimes hundreds, of networks. (Denver has approximately ninety.) All it takes to get connected is one BBS number.

If you have a computer and modem, try the following suggestion from Alfred Glossbrenner in his book *The Complete Handbook for Personal Computer Communications*.

"Dial: (213) 881-6880. Be sure to hit your return key twice to tell the system that you're there. When the message LOG ON PLEASE appears on your screen, type CAT. This is a system maintained by Novation, Inc., of Tarzana, California, manufacturers of Cat Modems. It is available 24 hours a day and offers an extensive list of features, including games, free programs, and (of course) on-line descriptions of the firm's products."

Most BBSs have an area called Others or Phones or Other BBS numbers. These contain numbers of other networks. I started with an Apple user's group in Golden, Colorado. From that board, I got 20 or so numbers to other boards. From each of those boards, I collected 15–20 numbers to yet more boards.

Before I knew it, I had well over 50 pages of BBSs for the nation. I have since found that this is only a small sample of what's out there. If you don't watch them, the numbers tend to breed in your desk drawer.

I know of only one network in my area that asks for a membership fee, and it's a sex-based board that connects "swingers." Networking could become a very expensive hobby if all networks charged membership fees.

Most networks require that you give your correct name, city, state and phone number. After the SYSOP verifies the information as correct, you're granted free access to the system. You're usually assigned a private log-on code when you first call, and once you're verified (usually within 24 hours), you're on. From here, the possibilities are unlimited.

The Dark Side

On occasion, you may read about a group of "hackers" breaking into computer systems around the country. This reveals the dark side of the BBS phenomenon.

There are dozens of "phreak" boards across the country that post illicit information such as Sprint and MCI codes, Telenet access codes and passwords, SATELCO numbers and Bell calling card and loop numbers. These phreak boards appeal to the bit of larceny that most of us human beings have. In many cases, those who gain access to the information usually don't use it. This group just enjoys having something they're really not supposed to have.

However, more often than not, people do use these numbers in a negative way. Networking, in its current state, is totally underground and unregulated, and several of these phreak boards exist, though hidden, on regular BBSs.

Here's how it works. The only way to find out about the phreak boards is from a fellow user who already has access (networking at its finest). Names of prospective members are posted on the invisible sub-boards, and those not deemed acceptable by the phreakers aren't allowed access to the board. Also, you must have a cleared user vouch for you.

Ma Bell is often aware of these boards and will let them stay up and running as long as they don't cause any trouble.

However, one board in the Denver area had an extensive phreak section that was far from hidden. It listed almost nothing but MCI and Sprint numbers. The phone company didn't interfere until someone posted the number to an AT&T mainframe computer.

The SYSOP's phone lines were disconnected for over a week and Bell threatened legal action. The SYSOP promised not to run any more phreak sections if the phone company would restore his lines and not prosecute. They complied, and he kept his board clean.

It's interesting to note that the SYSOP had a disclaimer in the preface of the phreak board, but Ma Bell claimed he was responsible for anything that happened on his phone lines. It would have made a very interesting case had it gone to trial.

BBSs are not only informative, they're interesting, fun, and for the most part, free. The phenomenon is similar to the CB radio explosion you saw in years past, and it promises to spread more widely in the near future.

The SYSOPs tend to be information junkies, and many feel they're the forerunners of a new form of human communication, pioneers in the computer age. They may well be right. R

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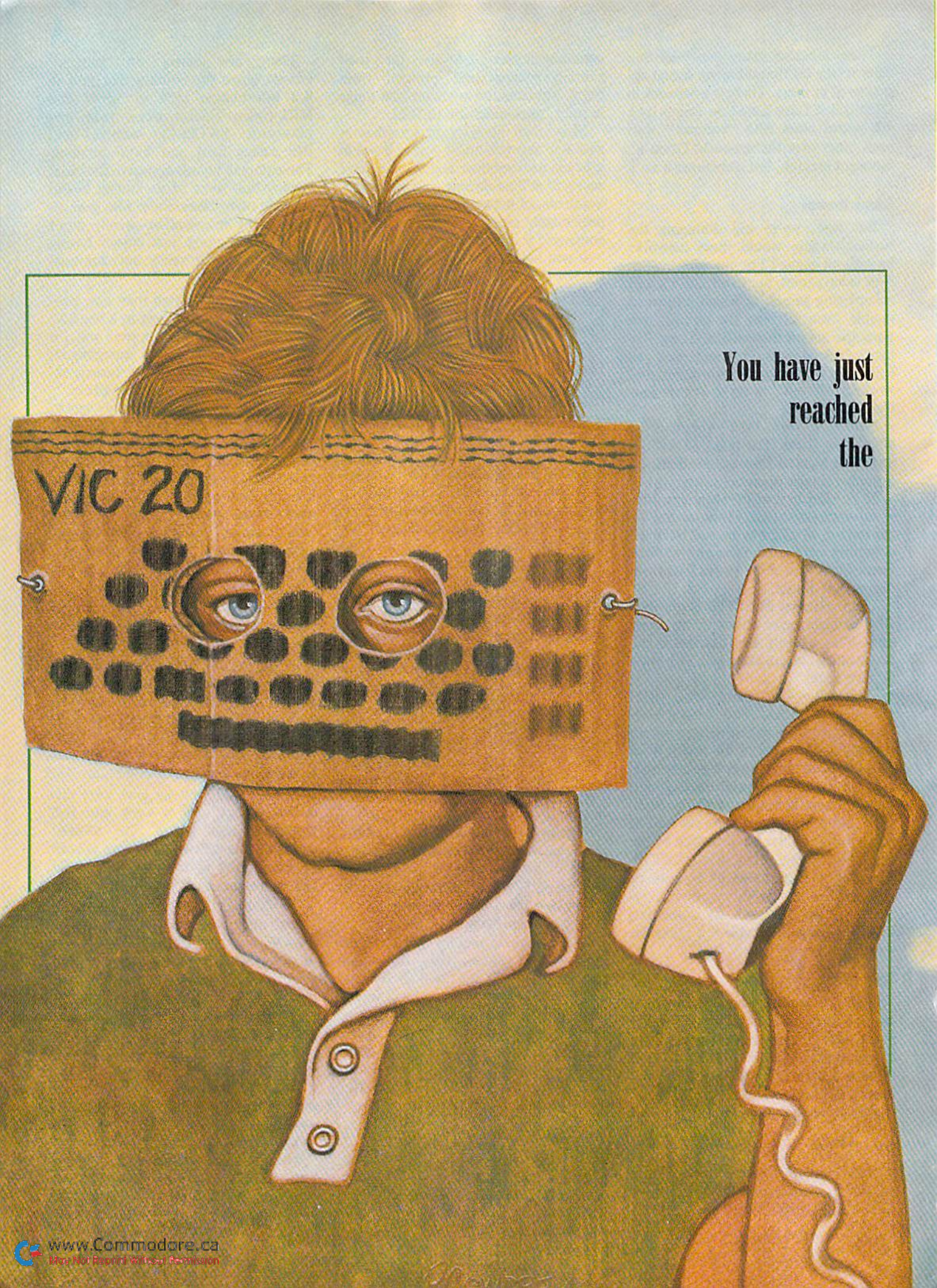


By Dale F. Brown

Incredible Jeremy Landers

Meet the boy SYSOP of Sacramento, who uses his VIC-20 to run a bulletin board that is not only businesslike, but also perhaps the friendliest in the country.

Some kids play army. Others play doctor. Others play house, secret agent, firemen or superheroes.

Jeremy Landers, age 12, of Sacramento, California, plays Computer Bulletin Board System!

Jeremy Landers owns a VIC-20, a VIC-Modem and a Datassette recorder. He has VIC-Term II, the terminal software packaged with the VIC-Modem, but little else. He has no fancy telecommunications software or sophisticated auto-answer modem.

Jeremy, however, wanted to operate his own local bulletin board system. There are several bulletin boards operating in the Sacramento area, most with uploading and downloading capabilities, and most operate 24 hours a day. He knew he'd be in direct competition with these established, well-run, expensive systems.

That didn't stop Jeremy. He went on-line with CHAT-20, his own bulletin board system. He announced his number and operating hours on all the local nets, and within a few short days, Jeremy's house was swamped with calls. So many, in fact, that now Jeremy has his own phone number!

Jeremy's humorous invitations on the local nets were so irresistible that I called his number one afternoon. Instead of the familiar carrier tone, however, a human voice answered the phone.

"I'm sorry," I said. "I was looking for CHAT-20."

"Okay," replied the young but confident voice on the other end, "I'll put it on." It took only a few minutes for Jeremy to log me in, turn on his VIC-20 and boot up his terminal program. I plugged the phone into my VIC-Modem and switched my terminal program to VIC-to-VIC ASCII format.

The introductory message appeared on my screen, welcoming me to CHAT-20. I noticed I wasn't receiving an "echo" on my screen, and Jeremy reminded me to switch from full- to half-duplex in my terminal program. The introductory messages were unusually slow, but I thought nothing of it at first.

The Human Touch

Once the introduction page was finished, I was asked for my computer type and screen width. This time, there were a few misspelled words, which were corrected by backspacing. I began to wonder about this. A terminal program making gross misspelling errors?

A menu appeared on the screen, asking me if I just wanted to chat, leave a message or play some games. Again, there were a few misspellings. Curious, I typed, "Jeremy, are you typing all this in by hand?"

His response: "Non-numeric reply," and the menu was displayed again.

I responded, "C'mon, Jeremy, are you typing this in by hand?" There was a brief pause, then: "Yes, I'm typing this in by hand."

I was stunned! All that text, the entire introduction, *all done by hand*! For someone not accustomed to other bulletin board systems, it could've passed for the real thing!

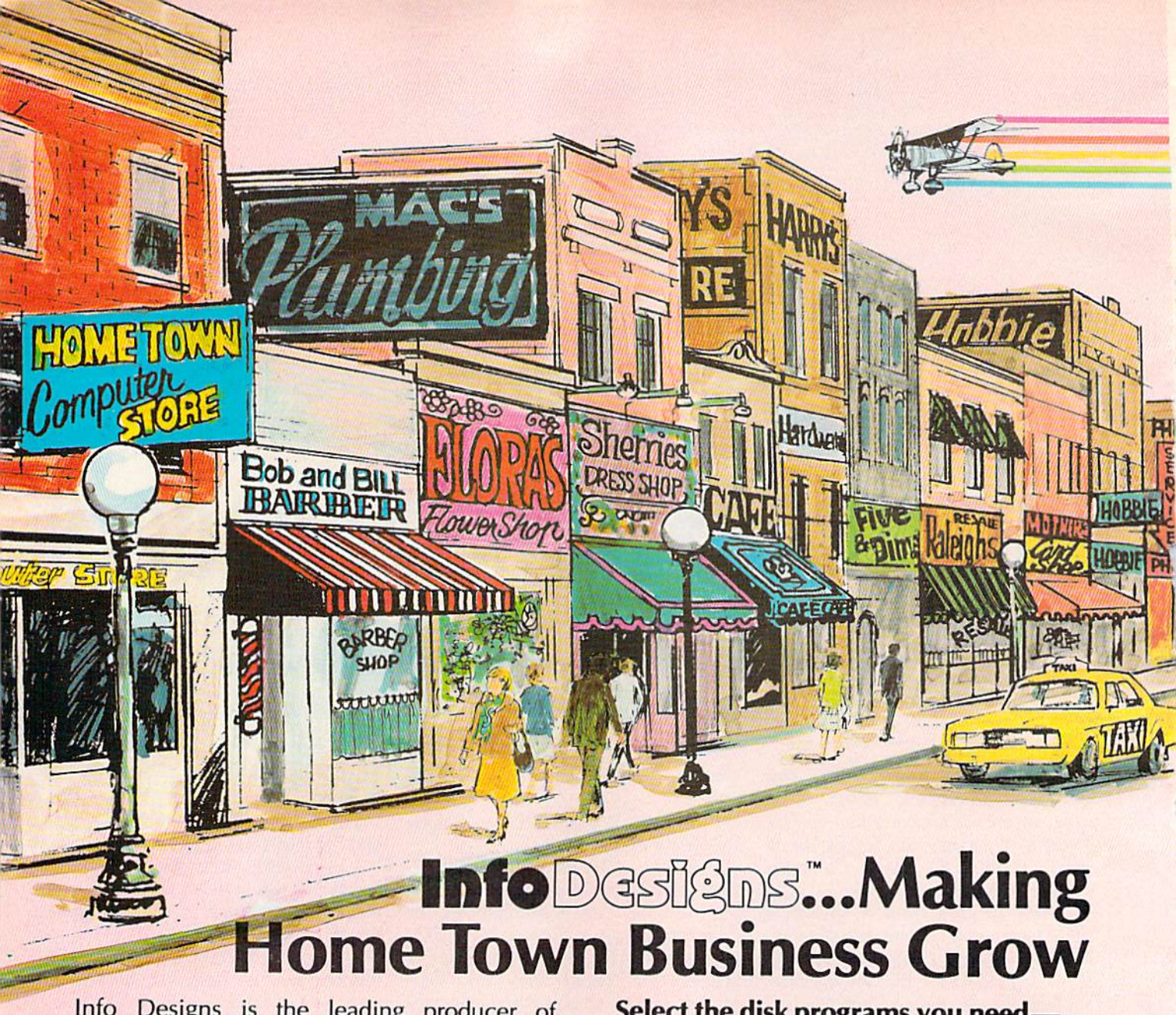
I typed, "Aren't your fingers getting tired?"

He replied, "No," then the menu came up again.

Obviously, Jeremy was dead serious about all this. I was fascinated!

I didn't want to spoil Jeremy's system this time around, so I typed 3 for Games. He typed an elaborate introductory page for me, complete with graphics and welcoming flourishes. I had a choice of two games (it has since expanded to six). I asked which one he preferred, and, after admonishing me again for typing a non-numeric response, he recommended his own construction, called Adventure My Way.

He then asked if I wanted instructions, and, by reflex, I typed in "yes." I instantly felt like a heel. It was as if Jeremy had opened the instruction



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At the end of the game, Jeremy assured me that my character and position would be saved, and he whisked me back to the main menu "on a magic carpet!"

book to some complicated strategy board game and had begun to type the entire manual onto the screen! Had I not interrupted him, I'm sure this dedicated young SYSOP would have typed in each word of the game's instructions for me!

I told him that I'd have to log off. We chatted for a few more minutes, mainly so I could verify for myself that Jeremy really wasn't fooling around. He presented the options menu again, this time with a log-off procedure line added. I chose this option, and Jeremy asked me to wait while he updated his user log (making a note of who called, I imagine, in a notebook). He then assured me that he enjoyed our chat, asked if I wanted to leave a private message with the SYSOP and cleared me to hang up anytime.

This was too much! As a parting gesture, I typed "Bye, J.L.!" after the hang-up-now message, and I received a friendly "Bye, D.B." message in reply. Talk about user-friendly!

Charming CHAT-20

I found Jeremy's CHAT-20 to be so charming that I wanted to call back and find out more about him. I've learned that Jeremy has since updated his system a bit, leaving his phone hooked up to his VIC-20 all during his published on-line hours. (Jeremy is not on-line during lunchtime or dinnertime, and the computer gets shut off promptly at 8 PM for bedtime. I can guess that his hours will be modified even more when school starts!)

Jeremy added a question-and-answer section to his main menu, which I immediately selected. Jeremy informed me that he is the eldest of two children, and that he's in the seventh grade. He uses his VIC-20 almost exclusively for CHAT-20. On Monday evenings, he teaches Basic programming to children just starting out in computing, and he's been asked many times to demonstrate his system in school.

Jeremy mentioned that he would like to become a coin-op video game operator in the future, designing state-of-the-art games and simulations. He says computers are the wave of the future and that it's inevitable they'll be a great part of everyone's life because of their intelligence and versatility.

I suggested that perhaps he could teach programming when he grew up, since he does quite a bit of teaching now (and he taught me a few things I didn't know!). He seemed to mull this suggestion over, then replied, "Why teach something for money that you do so well as a hobby?" I wish I'd been that smart at twelve years of age!

When I suggested logging off so someone else could talk for a while, the SYSOP of CHAT-20 invited me to play a game of Adventure, and I could not refuse. We played for a few minutes—Jeremy was the dungeonmaster, and he refused to let me get killed by all the dumb moves I was making. (Does your sophisticated bulletin board help you out like that?)

At the end of the game, Jeremy assured me that my character and position would be saved, and he whisked me back to the Main Menu "on a magic carpet!"

I asked Jeremy how long he would keep CHAT-20 on-line, and he replied, "until I get a better system."

Jeremy Landers, let me assure you—you've *got* a better system! R

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DISK-O-64

Add 13 Disk-Related Commands to Your System.

It's easy to keep your disk drive operations neat and tidy with this C-64 conversion of the DISK-O-VIC utility program that ran in *RUN*'s first issue.

By Cal Overhulser

In the premiere issue of *RUN* appeared a dynamite disk utility package for the VIC-20 called DISK-O-VIC by Thomas Henry. It is one of the most useful 1541 disk utilities I've seen, and it made disk drive housekeeping operations very easy on my VIC-20. I wanted the same capabilities on my C-64, so I decided to try converting DISK-O-VIC to DISK-O-64.

The main problem was that of converting the addresses for the system calls in DISK-O-VIC to those addresses appropriate for the C-64. The Kernal calls were easy, since they are the same for both machines and are published in several reference manuals. The real problem involved other system calls such as Warmstart, Reset and Printstring.

After some searching of the C-64 ROMs, I found the routines I needed. Table 1 lists the variable names from the original DISK-O-VIC assembly listing that require changes, along with their new system addresses for the C-64. Once I had the correct system addresses, the actual conversion became relatively easy.

First, I found the affected system calls every place they appeared in the original assembly listing and located their equivalents in the original hex dump. Next, I determined the changes necessary to fix the startup screen. I then loaded in DISK-O-VIC, made the necessary changes with a monitor and saved a copy of DISK-O-64 with the same length and same capabilities as DISK-O-VIC.

Entering the Program

You'll need a machine-language monitor to enter the DISK-O-64 program from the hex-dump listing. After loading and entering your monitor, you begin entering the program at address $0801 and continue through $0D2F. Then use the method appropriate for your monitor to save DISK-O-64. Using the C-64 monitor from Commodore, you'd type:

```
S "DISKO64",08,0801,0D2F
```

Make sure you use $0801 as the start address so you can later load it like a Basic program. You now have a copy of DISK-O-64 that can be loaded and saved like any Basic program. Then you exit the monitor and reset the C-64, either by typing SYS64738 in the Direct

Label	VIC	C-64
WARMST	C474	E386
WAIT	C48C	A48C
INFIN	C49F	A49F
CHAIN	C533	A533
CLR	C659	A659
INTEGR	C96B	A96B
PSTRNG	CB1E	AB1E
ERROR	CF08	AF08
PRLINE	DDCD	BDCD
CHROUT	E742	E716
RESET	FD22	FCE2

Table 1. DISK-O-64 label equate changes from DISK-O-VIC assembly listing.

RUN It Right

Commodore 64
1541 disk drive
Machine-language monitor

Address all author correspondence to Cal Overhulser, 15 Nutting Road, Westford, MA 01886.

mode or by turning the power off and on.

Now load and run DISK-O-64 like any Basic program. Just type LOAD "DISKO64",8 to load it into your C-64, and then type RUN. If all goes well, the startup screen appears, and DISK-O-64 is now in place, protected in upper memory.

Table 3 lists the new commands now in place. If you read the original article on DISK-O-VIC, you'll see that all commands remain the same for DISK-O-64. Use a scratch disk and experiment with each command to become familiar with them (also to make sure everything is working OK, with no typos).

DLoad/DSave Restriction Changes

I found one minor irritant in the original DISK-O-VIC. I couldn't use DLoad/DSave on a hybrid program (one containing both Basic and machine language). It would appear to load and save all right, but I noticed that the saved program had fewer blocks than the original.

The real problem was that I didn't realize what was happening until one day a favorite hybrid program (DISK-O-VIC) wouldn't run, and I had to type the whole thing in again. In all fairness to Mr. Henry, I must say he mentioned this restriction in his article, but in my haste I failed to note it.

I traced the problem to the DLoad routine in DISK-O-VIC. DISK-O-64 has this modified so DLoad/DSave can be used with hybrid programs as long as they are loaded like a normal Basic program, i.e., LOAD"NAME",8.

The only exception is with the Append command, which can be used to append only pure Basic programs, not hybrids. Practically speaking, the need to append the Basic portions of hybrid programs is extremely rare (I've never done it).

The changes to edit the original DISK-O-VIC are shown in Table 2 for the convenience of DISK-O-VIC users who may want to modify their copies.

I'll be glad to make you a copy of DISK-O-64. Just send me a tape or floppy disk and a self-addressed, stamped return mailer, plus $3. R

VIC Hex Address	New Hex Value
126E	86
126F	2D
1270	84
1271	2E
1272–127B	EA
127C	20
127D	33
127E	C5

Table 2. DISK-O-VIC changes for DLoad/DSave with hybrid programs.

Append—This command allows a Basic program to be appended from the disk to a program in memory that has lower line numbers. The proper syntax is: APPEND"NAME".

Catalog—Typing CATALOG will read the directory from the disk and display it on the screen without destroying the program in memory.

Collect—This performs a validate, which means it tidies up the disk and makes all unused blocks available.

DLoad—Acts like the normal Load command, but you don't have to type ,8. It also initializes before, and checks for errors after, it loads. Both Basic and hybrid programs can be loaded as long as the hybrid programs are normally loaded like all-Basic programs.

DSave—Just like DLoad, but saves programs to the disk.

Header—This command will format a disk. Since all data will be destroyed, it asks "ARE YOU SURE? Y or N." The correct syntax is: HEADER"NEWNAME",Ixx. You must use the ,I. The xx is any ID you want to assign (different for every disk you own).

INIT—This is the same as OPEN15,8,15,"I":CLOSE15 in Basic.

Kill—This does a reset of the C-64 much like turning the power off and on or typing SYS64738.

Off—This one will disable DISK-O-64, but leave it and any other program in memory intact. DISK-O-64 slows down Basic a little, so you can turn it off when you're interested in maximum speed. To turn it back on, type: SYS256*PEEK(56)+PEEK(55).

Rename—Allows you to rename a program that already exists on the disk. The syntax is: RENAME"OLDNAME"TO"NEWNAME".

Scratch—This will scratch a program on the disk; it is equivalent to OPEN15,8,15,"S0:NAME":CLOSE15 in Basic. It also asks "ARE YOU SURE? Y or N." The correct syntax is: SCRATCH"NAME".

Send—With this one, you can send any command to the disk that you can send in Basic; it is the same as OPEN15,8,15,"xxxx":CLOSE15 in Basic, where xxxx is the command string. The proper syntax is: SEND"xxxx".

Status—Displays the disk status without executing a program. When you get a disk error, just type STATUS.

Table 3. Explanation of DISK-O-64 commands.

Hex-dump listing.

```
:0800  00 40 08 01 00 99 22 93
:0808  11 12 22 A3 31 35 29 22
:0810  44 49 53 4B 2D 4F 2D 36
:0818  34 11 22 A6 32 33 29 22
:0820  43 36 34 20 44 49 53 4B
:0828  20 43 4F 4D 4D 41 4E 44
:0830  20 50 41 43 4B 41 47 45
:0838  11 22 A6 32 30 29 3B 00
:0840  7A 08 02 00 99 22 42 59
:0848  20 43 41 4C 20 4F 56 45
:0850  52 48 55 4C 53 45 52 11
:0858  22 A6 31 38 29 22 46 52
:0860  4F 4D 20 44 49 53 4B 4F
:0868  56 49 43 20 42 59 20 54
:0870  2E 20 20 48 45 4E 52 59
:0878  22 00 93 08 06 00 9E 32
:0880  35 36 AC C2 28 34 34 29
:0888  AA C2 28 34 33 29 AA 31
:0890  34 38 00 00 00 A5 2D 85
:0898  22 A5 2E 85 23 A5 37 85
:08A0  24 A5 38 85 25 A0 00 A5
:08A8  22 D0 02 C6 23 C6 22 B1
:08B0  22 D0 3C A5 22 D0 02 C6
:08B8  23 C6 22 B1 22 F0 21 85
:08C0  26 A5 22 D0 02 C6 23 C6
:08C8  22 B1 22 18 65 24 AA A5
:08D0  26 65 25 48 A5 37 D0 02
:08D8  C6 38 C6 37 68 91 37 BA
:08E0  48 A5 37 D0 02 C6 38 C6
:08E8  37 68 91 37 18 90 B6 C9
:08F0  BF D0 ED A5 37 85 33 A5
:08F8  38 85 34 6C 37 00 BF A2
:0900  00 00 A0 00 00 BD 93 FF
:0908  00 F0 07 99 7E 00 00 C8
:0910  E8 D0 F4 4C B6 E3 B0 0A
:0918  C9 20 F0 32 38 E9 30 38
:0920  E9 D0 BD FD FF 00 08 68
:0928  BD FC FF 00 8E FE FF 00
:0930  BC FF FF 00 BA BD 01 01
:0938  C9 8C D0 07 BD 02 01 C9
:0940  A4 F0 12 AC FF FF 00 AE
:0948  FE FF 00 AD FC FF 00 48
:0950  AD FD FF 00 28 60 4C 73
:0958  00 00 AD FC FF 00 4A 90
:0960  3A A2 00 00 B6 0B A4 7A
:0968  B9 00 00 02 38 FD 9B FF
:0970  00 F0 13 C9 80 F0 13 E6
:0978  0B E8 BD 9A FF 00 10 FA
:0980  BD 9B FF 00 D0 E4 F0 C6
:0988  E8 C8 D0 E0 84 7A A5 0B
:0990  0A AA BD E3 FF 00 48 BD
:0998  E2 FF 00 48 20 7B FC 00
:09A0  4C 73 00 00 68 68 20 7B
```

More

Listing continued.

```
:09A8  FC 00 20 6B A9 4C 9F A4
:09B0  A0 02 A5 2D D0 02 C6 2E
:09B8  C6 2D 88 D0 F5 A5 2D 85
:09C0  FB A5 2E 85 FC 4C 7B FD
:09C8  00 20 29 FF 00 A9 24 8D
:09D0  3C 03 A2 3C A0 03 A9 01
:09D8  20 BD FF A9 0E A0 60 A2
:09E0  08 20 BA FF 20 C0 FF A9
:09E8  08 20 B4 FF A9 60 20 96
:09F0  FF A9 00 00 85 90 A0 03
:09F8  8C 3C 03 20 A5 FF 85 FD
:0A00  A4 90 D0 39 20 A5 FF 85
:0A08  FE A4 90 D0 30 AC 3C 03
:0A10  88 D0 E5 A6 FD A5 FE 20
:0A18  CD BD 20 78 FF 00 20 A5
:0A20  FF A6 90 D0 19 C9 00 00
:0A28  F0 0E 20 D2 FF 20 E1 FF
:0A30  F0 0D 20 66 FF 00 4C 42
:0A38  FD 00 20 75 FF 00 A0 02
:0A40  D0 BB A9 0E 20 C3 FF 20
:0A48  CC FF 4C 86 E3 20 2C FF
:0A50  00 4C 86 E3 A5 2B 85 FB
:0A58  A5 2C 85 FC 20 ED FE 00
:0A60  20 D8 FE 00 A9 00 00 A6
:0A68  FB A4 FC 20 D5 FF 86 2D
:0A70  84 2E EA EA EA EA EA EA
:0A78  EA EA EA EA 20 33 A5 20
:0A80  59 A6 4C B8 FD 00 20 ED
:0A88  FE 00 20 D8 FE 00 A5 2B
:0A90  85 FB A5 2C 85 FC A9 FB
:0A98  A6 2D A4 2E 20 D8 FF 20
:0AA0  24 FF 00 20 92 FE 00 4C
:0AA8  86 E3 20 39 FF 00 20 EF
:0AB0  FE 00 20 73 00 00 C9 2C
:0AB8  D0 2D 9D 3C 03 E8 20 73
:0AC0  00 00 C9 49 D0 22 20 73
:0AC8  00 00 F0 1D 9D 3C 03 E8
:0AD0  20 73 00 00 F0 14 9D 3C
:0AD8  03 E8 20 73 00 00 D0 0B
:0AE0  9D 3C 03 20 4E FF 00 D0
:0AE8  09 4C 71 FE 00 4C 08 AF
:0AF0  20 29 FF 00 4C 86 E3 20
:0AF8  E2 FC A2 04 4C 41 FC 00
:0B00  20 3C FF 00 20 79 00 00
:0B08  F0 E7 C9 22 D0 E3 A5 7A
:0B10  85 FB A5 7B 85 FC 20 73
:0B18  00 00 F0 D6 C9 22 D0 F7
:0B20  20 73 00 00 C9 54 D0 CB
:0B28  20 73 00 00 C9 4F D0 C4
:0B30  20 73 00 00 20 EF FE 00
:0B38  A9 3D 9D 3C 03 E8 A5 FB
:0B40  85 7A A5 FC 85 7B 20 EF
:0B48  FE 00 A9 00 00 9D 3C 03
:0B50  4C 71 FE 00 20 3F FF 00
:0B58  20 EF FE 00 A9 00 00 9D
:0B60  3C 03 20 4E FF 00 D0 29
:0B68  4C 71 FE 00 20 ED FE 00
:0B70  A9 00 00 9D 3C 03 20 29
:0B78  FF 00 20 1A FF 00 A0 00
:0B80  00 B9 3C 03 F0 06 20 A8
:0B88  FF C8 90 F5 20 AE FF 20
:0B90  92 FE 00 F0 03 20 92 FE
:0B98  00 4C 86 E3 A9 08 85 BA
:0BA0  20 B4 FF A9 6F 20 96 FF
:0BA8  A0 00 00 20 A5 FF 99 3C
:0BB0  03 C8 C9 0D D0 F5 A9 00
:0BB8  00 99 3C 03 20 AB FF A0
:0BC0  00 00 A9 30 D9 3C 03 D0
:0BC8  06 C8 D9 3C 03 F0 15 20
:0BD0  24 FF 00 20 CC FF 20 75
:0BD8  FF 00 A9 3C A0 03 20 1E
:0BE0  AB 68 68 4C 86 E3 60 20
:0BE8  29 FF 00 8A A2 3C A0 03
:0BF0  20 BD FF A9 0B AA A0 00
:0BF8  00 84 90 4C BA FF A2 00
:0C00  00 86 B7 20 79 00 00 F0
:0C08  1F C9 22 D0 1B E6 7A D0
:0C10  02 E6 7B A0 00 00 B1 7A
:0C18  F0 0A C9 22 F0 06 9D 3C
:0C20  03 E8 D0 EA E4 B7 F0 01
:0C28  60 68 68 4C 0B AF A9 0B
:0C30  20 B1 FF A9 6F 4C 93 FF
:0C38  A9 0B 4C C3 FF A9 49 2C
:0C40  A9 56 48 20 1A FF 00 68
:0C48  20 A8 FF 4C AE FF A9 4E
:0C50  2C A9 52 2C A9 53 A2 00
:0C58  00 9D 3C 03 E8 A9 3A 9D
:0C60  3C 03 E8 60 A2 00 00 BD
:0C68  7D FF 00 F0 06 20 16 E7
:0C70  E8 D0 F5 20 CF FF C9 59
:0C78  0B 20 75 FF 00 2B 60 20
:0C80  E4 FF F0 09 C9 20 D0 05
:0C88  20 E4 FF F0 FB 60 A9 0D
:0C90  2C A9 20 4C D2 FF 0D 41
:0C98  52 45 20 59 4F 55 20 53
:0CA0  55 52 45 3F 20 28 59 2F
:0CA8  4E 29 20 00 00 4C 52 FC
:0CB0  00 00 00 B0 0A C9 00 00
:0CB8  41 50 50 45 4E C4 43 41
:0CC0  54 41 4C 4F C7 43 4F 4C
:0CC8  4C 45 43 D4 44 4C 4F 41
:0CD0  C4 44 53 41 56 C5 48 45
:0CD8  41 44 45 D2 49 4E 49 D4
:0CE0  4B 49 4C CC 4F 46 C6 52
:0CE8  45 4E 41 4D C5 53 43 52
:0CF0  41 54 43 C8 53 45 4E C4
:0CF8  53 54 41 54 55 D3 00 00
:0D00  D7 FC 00 EF FC 00 6C FD
:0D08  00 72 FD 00 A0 FD 00 C0
:0D10  FD 00 FD FD 00 03 FE 00
:0D18  06 FE 00 0B FE 00 55 FE
:0D20  00 6B FE 00 BB FE 00 00
:0D28  00 00 00 00 00 00 00 00
```

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Munchin' Mushrooms

By John Stilwell

Skill in maneuvering delectable mushrooms is the key to victory in this game of one-jumpsmanship, whether you play against yourself or the Little Wizard.

RUN It Right

Unexpanded VIC-20

Address author correspondence to John Stilwell, 5018 Marathon Drive, Madison, WI 53705.

It's that time of the year again! The mushroom patch is overflowing with the Little Wizard's magic carnivorous mushrooms. Mushrooms is two board games in one! If you play by yourself, the object is to get rid of as many of the pesky varmints as possible. If you play against the Little Wizard, the object is to be the last one to make a move.

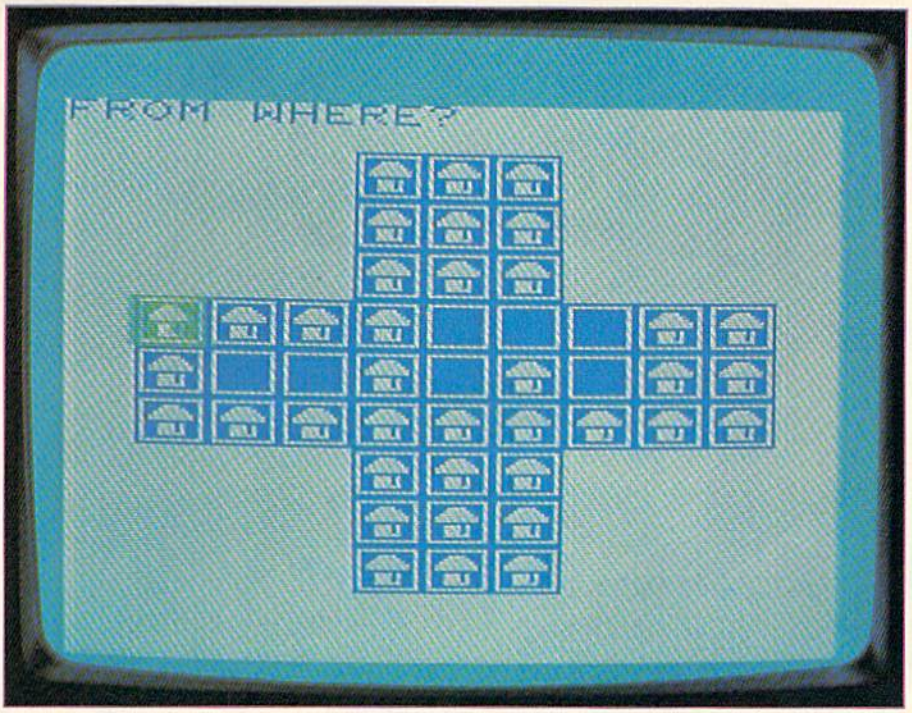
The program is designed for the unexpanded VIC-20. It features high-res graphics with redefined characters. You must run the character-set program first. It sets up a data table that's necessary to do the graphics. The second program, Mushrooms, is the game.

Once the game is loaded and run, what first appears is "Play Against Me?" You push the Y key to play against the Little Wizard. Any other key will give you a game by yourself.

Once the board is set up, the computer will ask you "From Where?" It wants to know which mushroom will do the eating. You move the colored cursor with the cursor keys, and when it's on top of the mushroom you want, you push the F1 key.

A mushroom may only eat its neighbor. As in checkers, the mushroom jumps the piece next to it and finishes in an empty square. Unlike checkers, you can only move up, down, left or right—not diagonally. Also, there's only one jump per turn.

After you've selected the mushroom that'll do the eating and pushed F1, the computer will ask "To Where?" It wants to know which mushroom you're going to eat. In response, move the cursor into the empty square where the eater will end up, and push F1 once



again. Invalid moves will cause your turn to start over and the cursor to appear on the left side of the board.

Trial Run

Let's try a turn. Run the game and pick either option. The board is shaped like a cross, with the only empty square in the center. Move the cursor down one square and two to the right. Push F1 to say that *this* mushroom will do the eating.

Now move the cursor to the right two more squares. It should be on the empty space. Push F1 again to say that this is where the mushroom is to go. This ends a turn.

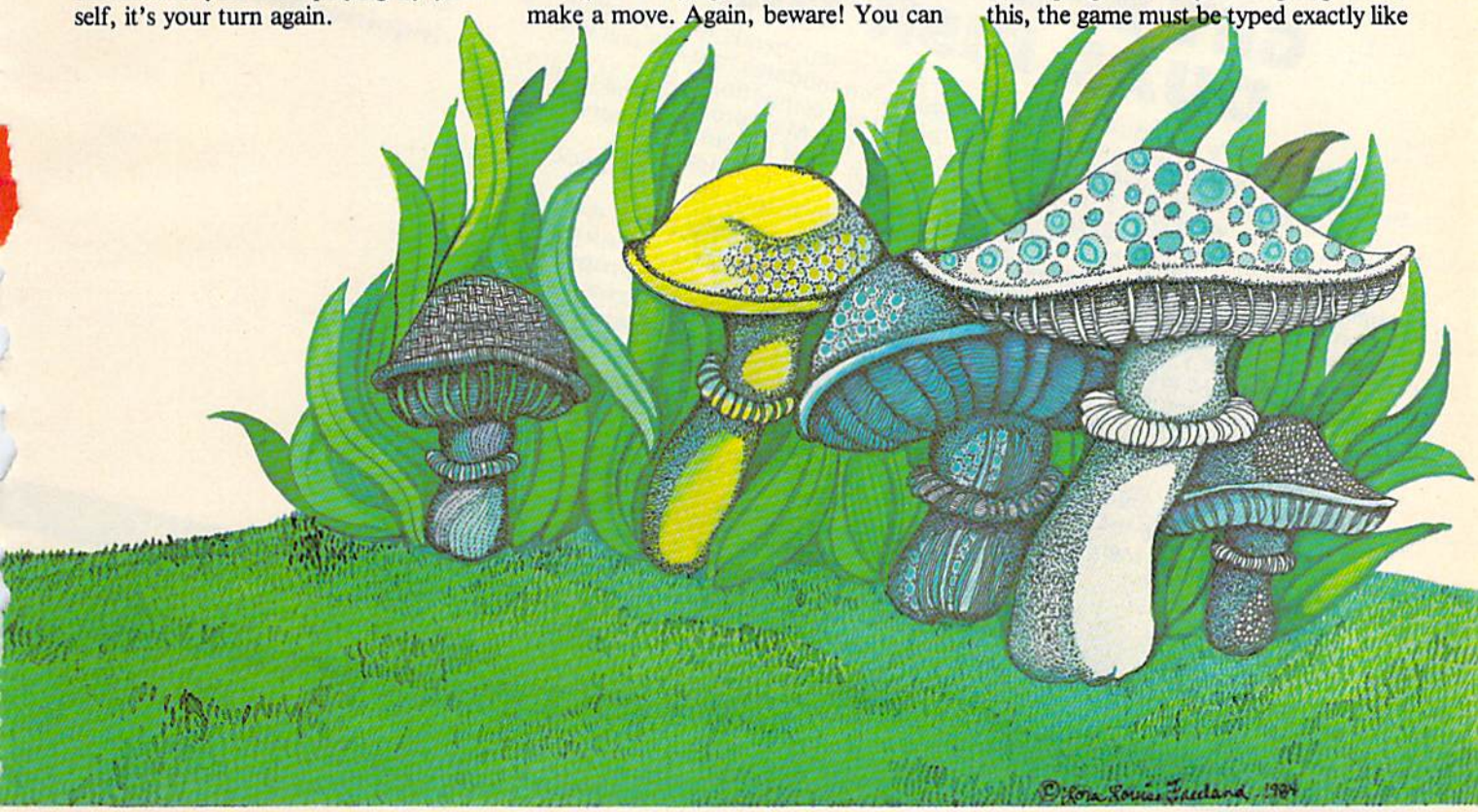
If you were playing the Wizard, he would appear in a puff of smoke to take his turn. If you were playing by yourself, it's your turn again.

The game is over when there are no moves left. It's possible to clear the board of all but one mushroom, though few have ever succeeded. In the game you play by yourself, this is your task. But I warn you, mushrooms are easily isolated from their companions, and are thus safe from being eaten.

When playing against the Little Wizard, the object of the game changes. Now you're trying to be the last one to make a move. Again, beware! You can never tell when the Wizard will get sneaky.

Program Quirks

For convenience, it would be nice to combine the two programs into one. There is a way. You can store the character set at the top of memory. This is accomplished by tricking the VIC into treating the graphics table as part of the Basic program. If you're going to do this, the game must be typed exactly like



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If you were playing the Wizard, he would appear in a puff of smoke to take his turn.

the listing. If you add one extra space or character, the method won't work. We're going to move the pointers for the end of Basic, the beginning of variables and the end of available memory.

First, load in the character-set program and run it. Next, load in the game and do not run it. Instead, add the following line. (Its line number is zero and since it's over eighty characters long, it must be typed in with abbreviations. For example, POKE is typed P shifted O. Your user's guide contains a list of abbreviations for all of the Basic commands.)

```
0 POKE54,173:POKE46,26:POKE47,173:POKE
48,26:POKE49,173:POKE50,26:POKE51,0:
POKE52,28:POKE55,0:POKE56,28
```

Do the next set of Pokes by hand. Do not add them to the program. In other words, there shouldn't be any line numbers in front of them. They move the pointers from the end of the program to the end of the character set. When the program is saved, the graphics go with it.

```
POKE45,64
POKE46,29
POKE47,64
POKE48,29
POKE49,64
POKE50,29
POKE51,0
POKE52,30
POKE55,0
POKE56,30
```

Saving It

At this point, you must save the program. Since the computer has treated all of the RAM as part of the program, you'll have to save it without a name. If you try to give it a name, you'll get an Out Of Memory error. Later, if you want to add a name, put a memory expansion into the VIC. Load the game and resave it before running it. If you run the program before saving it, you'll lose the graphics. If, however, you save the program, you won't have to enter these Pokes again.

If you don't want to type in this program, send me $3 and a stamped, self-addressed mailer, and I'll be very happy to send you a tape. R

```
40 READX%:IFX%<0THEN60
45 FORI=X%TOX%+7:READJ%:POKEI,J%:NEXT:GOTO40
60 END
500 REM GRAPHICS
600 DATA7168,255,128,191,191,191,191,191,191
601 DATA7176,255,1,253,253,253,253,253,253
602 DATA7184,191,191,191,191,191,191,128,255
603 DATA7192,253,253,253,253,253,253,1,255
604 DATA7200,255,128,191,188,184,176,160,160
605 DATA7208,255,1,253,61,29,13,5,5
606 DATA7216,191,184,184,184,184,191,128,255
607 DATA7224,253,93,93,93,29,253,1,255
608 DATA7232,255,128,191,188,184,182,166,160
609 DATA7240,175,181,184,184,184,191,128,255
610 DATA7248,255,1,253,61,29,109,101,5
611 DATA7256,245,173,29,93,29,253,1,255
612 DATA7264,190,173,162,188,184,191,128,255
613 DATA7272,125,181,69,125,29,253,1,255
614 DATA7280,255,128,191,161,192,176,48,0
615 DATA7288,255,1,253,253,253,125,61,61
616 DATA7296,251,246,234,82,32,255,128,255
617 DATA7304,191,130,130,130,128,191,128,255
618 DATA7312,255,128,191,191,191,190,188,188
619 DATA7320,255,1,253,133,3,13,12,0,7328,223,47,23,10,
     4,255,1,255
621 DATA7336,127,11,11,11,3,253,1,255
622 DATA7344,255,1,255,255,192,176,48,0
623 DATA7352,255,128,191,191,191,127,63,63
624 DATA7360,255,1,253,253,253,254,252,252
625 DATA7368,255,128,255,135,3,13,12,0
626 DATA7376,191,191,188,184,176,166,166,224
627 DATA7384,253,253,61,29,13,101,101,7
628 DATA7392,255,136,184,184,184,184,184,191
629 DATA7400,255,17,93,93,93,93,29,253,7408,184,182,160
     ,160,160,160,160,224
631 DATA7416,29,109,5,5,5,5,5,7
640 DATA7472,0,1,3,7,7,5,4,3
642 DATA7432,128,192,224,240,240,80,16,224
644 DATA7480,255,120,40,42,44,28,4,15
646 DATA7448,255,14,20,84,52,56,32,240
648 DATA7456,7,8,8,11,11,14,6,15
650 DATA7464,224,16,16,208,240,112,96,240
652 DATA7424,0,0,0,0,0,0,0,0,-1
```

Listing 1. Character set program.

Listing 2. Main program of Mushrooms game.

Note: the command "POKE" in line 0 has been abbreviated as "P{SHFT O}". This is done so that you can enter the entire line into your VIC-20. When you list the program, each P{SHFT O} will be replaced with the word POKE. If you make a mistake while entering the line into your computer, retype the entire line rather than trying to edit it.

For more information about abbreviating commands, see your owner's manual, p. 133.

```
0 P{SHFT O}45,173:P{SHFT O}46,26:P{SHFT O}47,173:P{SHFT
     O}48,26:P{SHFT O}49,173:P{SHFT O}50,26:P{SHFT O}5
    1,0:P{SHFT O}52,28:P{SHFT O}55,0:P{SHFT O}56,28
1 PRINT"{SHFT CLR}"TAB(51)"MUSHROOMS"SPC(204)"COPYRIGHT
     1983"SPC(14)"BY JOHN STILWELL"
2 E=7726:X=36874:POKEX+4,15:POKE36879,27:FORI=1TO2000:N
    EXT:POKE36869,255
3 PRINT"{SHFT CLR}{CTRL 9}PLAY AGAINST ME?":GOSUB71:P$=
    A$
4 PRINT"{SHFT CLR}":FORI=0TO8:FORJ=0TO8:IF(J<3ORJ>5)AND
    (I<3ORI>5)THEN6
5 GOSUB54
6 NEXTJ,I:I=4:J=4:GOSUB55
7 GOSUB17:A=3:B=0:IFK=0THENGOTO51
```

More

Listing 2 continued.

```
 8 PRINT"{HOME}{CTRL 9}FROM WHERE? ":GOSUB25:IFPEEK(E+44
     *A+2*B)=0THEN7
 9 J=A:I=B:GOSUB56
 10 A=J:B=I:PRINT"{HOME}{CTRL 9}TO WHERE?{6 SPACEs}":GOS
     UB25:IFPEEK(E+44*A+2*B)<>0THENGOSUB54:GOTO7
 11 G=(A-J)/2:Y=(B-I)/2:IFABS(G)=1ANDABS(Y)=0ORABS(Y)=1A
     NDABS(G)=0THEN13
 12 GOSUB54:GOTO7
 13 IFY=1THENGOSUB62:GOTO35
 14 IFY=-1THENGOSUB58:GOTO35
 15 IFG=1THENGOSUB68:GOTO35
 16 GOSUB65:GOTO35
 17 Y=1:G=0:GOSUB21:IFK=1THENRETURN
 18 Y=-1:GOSUB21:IFK=1THENRETURN
 19 Y=0:G=-1:GOSUB21:IFK=1THENRETURN
 20 G=1:GOSUB21:RETURN
 21 K=0:FORI=0TO8:FORJ=0TO8:Z=PEEK(E+44*J+2*I):IFZ<>4THE
     N24
 22 IFPEEK(E+44*(J+G)+2*(I+Y))<>4THEN24
 23 IFPEEK(E+44*(J+2*G)+2*(I+2*Y))=0THENK=1:J=8:I=8
 24 NEXTJ,I:RETURN
 25 GOSUB73:POKEK,5:POKEK+1,5:POKEK+22,5:POKEK+23,5
 26 Y=0:G=0:GOSUB71:IFA$="{CRSR LF}"THENY=-1:GOTO32
 27 IFA$="{CRSR RT}"THENY=1:GOTO32
 28 IFA$="{CRSR UP}"THENG=-1:GOTO32
 29 IFA$="{CRSR DN}"THENG=1:GOTO32
 30 IFA$="{FUNCT 1}"THENGOSUB77:RETURN
 31 GOTO26
 32 D=PEEK(E+22+44*(A+G)+2*(B+Y)):IFD=2ORD=6THEN34
 33 GOTO26
 34 GOSUB77:A=A+G:B=B+Y:GOTO25
 35 IFP$<>"Y"THEN7
 36 PRINT"{HOME}{CTRL 9}{10 SPACEs}":A=INT(RND(VAL(TI$))
     *4)+1:ONAGOTO38,40,42,44
 37 GOSUB81:IFA=1THEN50
 38 C=1:U=1:GOSUB78:Y=1:G=0:GOSUB46:IFK=1THENGOSUB80:GOS
     UB62:GOSUB81:GOTO7
 39 GOSUB81:IFA=2THEN50
 40 C=1:U=7:GOSUB78:Y=-1:G=0:GOSUB46:IFK=1THENGOSUB80:GO
     SUB58:GOSUB81:GOTO7
 41 GOSUB81:IFA=3THEN50
 42 C=7:U=7:GOSUB78:Y=0:G=1:GOSUB46:IFK=1THENGOSUB80:GOS
     UB68:GOSUB81:GOTO7
 43 GOSUB81:IFA=4THEN50
 44 C=7:U=1:GOSUB78:Y=0:G=-1:GOSUB46:IFK=1THENGOSUB80:GO
     SUB65:GOSUB81:GOTO7
 45 GOTO37
 46 K=0:FORI=0TO8:FORJ=0TO8:Z=PEEK(E+44*J+2*I):IFZ<>4THE
     N49
 47 IFPEEK(E+44*(J+G)+2*(I+Y))<>4THEN49
 48 IFPEEK(E+44*(J+2*G)+2*(I+2*Y))=0THENK=1:A=J:B=I:J=8:
     I=8
 49 NEXTJ,I:J=A:I=B:RETURN
 50 GOSUB78:PRINT"{HOME}{CTRL 9}YOU ARE WISER THAN I":GO
     SUB71:GOTO3
 51 IFP$="Y"THENGOSUB78:PRINT"{CTRL 9}{HOME}YOU HAVE MUC
     H TO LEARN,YOUNG ONE":GOSUB71:GOTO3
 52 PRINT"{HOME}{CTRL 9}{CRSR DN}PUSH ANY KEY":GOSUB71:G
     OTO3
 53 PRINT"{HOME}{CRSR RT}{CRSR DN}";:FORD=0TOI*2:PRINT"{
     CRSR RT}";:NEXTD:FORJJ=0TOJ*2:PRINT"{CRSR DN}";:NE
     XTJJ:RETURN
 54 GOSUB53:PRINT"DE{CRSR DN}{2 CRSR LFs}FG";:RETURN
 55 GOSUB53:PRINT"@A{CRSR DN}{2 CRSR LFs}BC":RETURN
 56 GOSUB53:PRINT"HJ{CRSR DN}{2 CRSR LFs}FG{CRSR UP}";:G
     OSUB74
 57 PRINT"{2 CRSR LFs}HJ{CRSR DN}{2 CRSR LFs}IK";:GOSUB7
     5:PRINT"{2 CRSR LFs}FG";:GOSUB74:GOSUB74:RETURN
 58 GOSUB59:GOSUB59:GOSUB56:GOTO54
 59 GOSUB56:PRINT"{CRSR UP}{CRSR LF}E{CRSR DN}{2 CRSR LF
     s}";:GOSUB74:PRINT"L";:GOSUB74:PRINT"{CRSR LF}F";:
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      GOSUB74:PRINT"{CRSR LF}L";
60 GOSUB74:PRINT"{CRSR LF}{CRSR UP}NO{CRSR DN}{2 CRSR L
     Fs}PC";:GOSUB74:PRINT"{3 CRSR LFs}{CRSR UP}VWA{CRS
     R DN}{3 CRSR LFs}PB";:GOSUB74
61 PRINT"{3 CRSR LFs}{CRSR UP}HE@{CRSR DN}{3 CRSR LFs}L
     G";:GOSUB74:PRINT"{2 CRSR LFs}F";:GOSUB74:I=I-1:RE
     TURN
62 GOSUB63:GOSUB63:GOSUB56:GOTO54
63 GOSUB56:PRINT"{CRSR UP}{2 CRSR LFs}D";:GOSUB74:PRINT
     "{CRSR DN}M";:GOSUB74:PRINT"{CRSR UP}{2 CRSR LFs}R
     S{CRSR DN}{2 CRSR LFs}BT";:GOSUB74
64 PRINT"{CRSR UP}{2 CRSR LFs}@XY{CRSR DN}{2 CRSR LFs}C
     T";:GOSUB74:I=I+1:PRINT"{CRSR UP}{3 CRSR LFs}@ADJ{
     CRSR DN}{3 CRSR LFs}CFM";:GOSUB74:RETURN
65 GOSUB66:GOSUB66:GOSUB56:GOTO54
66 GOSUB56:PRINT"{CRSR UP}{CRSR LF}E";:GOSUB74:GOSUB54:
     GOSUB74:PRINT"{2 CRSR LFs}{2 CRSR UPs}{UP ARROW}{L
     EFT ARROW}{CRSR DN}{2 CRSR LFs}{LB.}]{CRSR DN}{2 C
     RSR LFs}BC";:GOSUB74
67 PRINT"{CRSR UP}{2 CRSR LFs}@A":J=J-1:GOSUB54:GOSUB74
     :PRINT"{CRSR LF}{CRSR UP}J";:GOSUB74:RETURN
68 GOSUB70:GOSUB74:PRINT"{2 CRSR LFs}BC{CRSR DN}{2 CRSR
      LFs}HJ";:GOSUB74:GOSUB70
69 PRINT"{CRSR DN}{2 CRSR LFs}{LB.}]";:GOSUB74:PRINT"{C
     RSR UP}{2 CRSR LFs}BC":GOSUB56:GOTO54
70 GOSUB56:PRINT"{CRSR UP}{2 CRSR LFs}@A{CRSR DN}{2 CRS
     R LFs}Z[";:J=J+1:RETURN
71 GETA$:IFA$=""THEN71
72 RETURN
73 K=38446+44*A+2*B:RETURN
74 FORD=1TO60:NEXTD:RETURN
75 POKEX,163:FORD=1TO50:NEXTD:POKEX,167:POKEX,175:POKEX
     ,179:POKEX,183
76 FORD=1TO200:NEXTD:POKEX,0:RETURN
77 POKEK,6:POKEK+1,6:POKEK+22,6:POKEK+23,6:RETURN
78 I=C:J=U:GOSUB53:PRINT"{CTRL 9}{SHFT J}{SHFT K}{CRSR
     DN}{2 CRSR LFs}{SHFT U}{SHFT I}";:GOSUB74:GOSUB74:
     PRINT"{CRSR UP}{2 CRSR LFs}{SHFT I}{CRSR DN}{SHFT
     J}";:GOSUB74
79 PRINT"{CTRL 0}{CRSR UP}{CRSR LF}!{CRSR DN}{2 CRSR LF
     s}$";:GOSUB74:GOSUB74:PRINT"{CRSR UP}{CRSR LF}&{CR
     SR DN}%":RETURN
80 Q=I:W=J:I=C:J=U:GOSUB53:PRINT"{CRSR DN}'#":GOSUB74:G
     OSUB74:I=Q:J=W:RETURN
81 I=C:J=U:GOSUB53:PRINT"{CRSR DN}$%";:GOSUB74:GOSUB74:
     GOSUB74:PRINT"{CTRL 9}{CRSR UP}{2 CRSR LFs}{SHFT K
     }{SHFT J}{CRSR DN}{2 CRSR LFs}{SHFT I}{SHFT U}";:G
     OSUB74
82 GOSUB74:PRINT"{CRSR UP}{2 CRSR LFs}{SHFT I} {CRSR DN
     }{2 CRSR LFs} {SHFT J}";:GOSUB74:PRINT"{CRSR UP}{2
      CRSR LFs}{CTRL 9} {CRSR DN} ":RETURN
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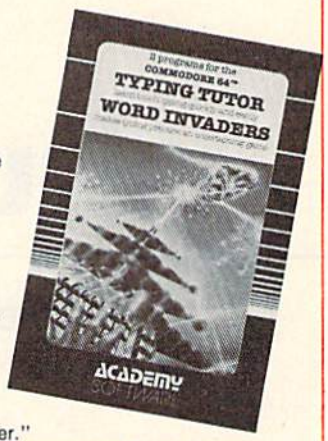

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By Karl T. Thurber

In late 1982, I obtained my VIC-20, followed several months later by the Commodore 64, a color monitor, two VIC-1541 disk drives and a 1525 printer. The serial I/O bus made connection of the disk drives and printer to either computer (but not both in a single system) an easy matter, since the devices are simply daisy-chained together.

However, I still wanted to be able to conveniently use the VIC-20 with all the peripherals, having acquired a substantial software collection (particularly games) for the VIC. Keeping the VIC would certainly make the children happy and would also provide a trainer for them. What I needed was a simple interface box that would do two things: switch to either computer the six-wire serial I/O bus carrying the peripherals, and switch the audio and video outputs to the color monitor.

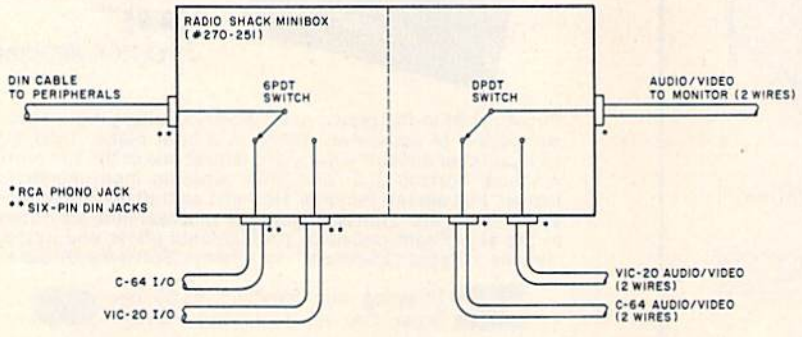

Fig. 1. Block diagram of the custom-built interface.

I couldn't locate such a ready-made device, so I had to build one myself. The interface required a six-pole, double-throw (6PDT) wafer-switch for the serial I/O bus, and a double-pole, double-throw (DPDT) wafer or toggle switch for the audio and video lines. (A single eight-pole switch could have been used instead.)

The switches were mounted in a small 3¼-×2⅛-×4-inch minibox (Radio Shack #270-251). Six-pin female DIN jacks were installed on the rear apron for the serial bus connections, while RCA-type phono jacks, also installed on the rear panel, were used for the switched audio and video connections.

I used unshielded, six-conductor cables having six-pin male DIN plugs on each end to connect the serial I/O bus on each computer to the interface box. Standard, audio-type, five-pin DIN cable assemblies served to connect the computers' audio/video ports to the interface box (these assemblies have RCA phono plugs on the other end). I used a set of audio cables to connect the interface box to the monitor, and another six-conductor cable to link the interface box to the first 1541 drive in the daisy-chain.

Though simple and straightforward, and costing less than $25 to make, the little interface box allows instant switchover from one computer to the other, using a shared set of peripherals and monitor, without the need for any plugging and unplugging of cables.

The only care you need to take in operation is to turn off all equipment when switching between computers to avoid the possibility of transient voltages damaging either computer or peripherals. Of course, the color monitor's controls require minor readjustment when switching between the two computers. Fig. 1 shows a block diagram of the interface connections described. R

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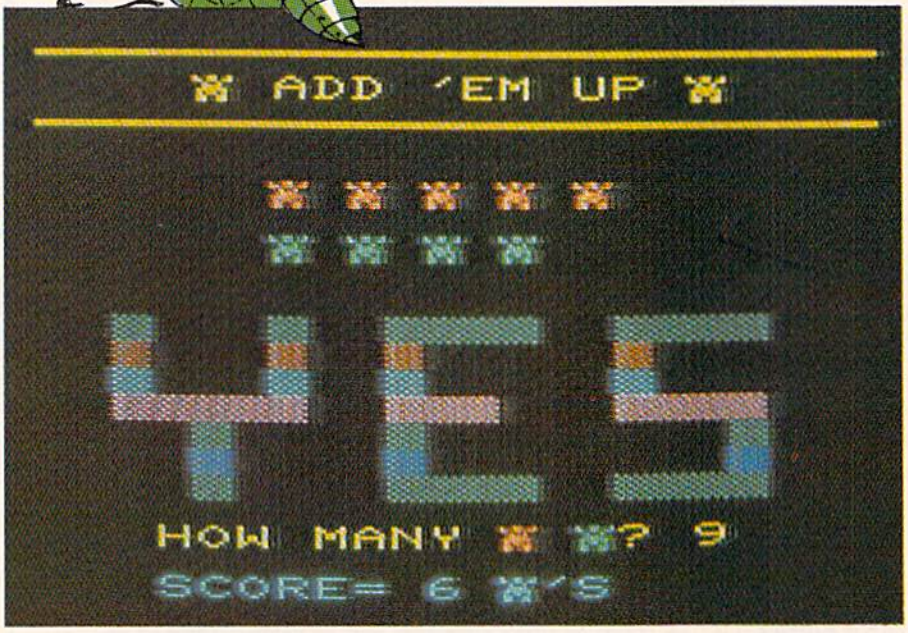
BUGS
For the Counting

By James R. Miller

Here's a fun program that can help your young children learn to count and add.



Bunch-O-Bugs combines sound and color with special characters to create a simple but entertaining counting game for preschoolers who are just becoming familiar with numbers. The program, divided into two main routines, allows a child to count red and green bugs in order, then add them up to solve simple addition problems.

Instructions are easy to understand, and the use of language and numbers on the screen is kept to a minimum. Even so, parents are urged to assist their children with the program until the youngsters become familiar with its operation.

The instructions (lines 50–70) simply ask a child to count the red and green bugs and to touch a key to begin. The program will pause while the computer sets up the special character set. The @ character in the brackets will change into a bug when the program is ready to begin.

Once the screen clears, "Count the Bugs" appears, along with a Touch Return command. Now the action begins. Red and green bugs pop up across the screen. The random number generators in lines 200–202 limit the number of colored bugs to no more than ten of each color.

When all the bugs have appeared, the screen displays a new message asking the child how many red bugs there are. The easiest way to count them is to touch the screen with a finger, counting the red bugs out loud. If there are five red bugs, the child types 5 on the screen and then presses the return key.

A giant YES appears in the center of the screen each time a right answer is given, and a score appears on the last line of the screen. Touching the return key again clears the screen, and the child then is asked how many green bugs there are. The multicolored YES appears again for a right answer.

Incorrect responses return the program for another try and this continues until the correct answer is found. The score will decrease, however, for each wrong response.

Correctly counting the red and green bugs advances the program to the next section, and the screen color changes to black. In this routine, the child adds up all red and green bugs on the screen and types in the answer. Right answers earn the child a higher score and another YES printed on the screen in many colors against the black background.

Bunch-O-Bugs continues through each section of the program until the

RUN It Right

VIC-20 unexpanded

Address author correspondence to James R. Miller, 2142 Odema Drive, Lima, OH 45806.

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Listing of Bunch-O-Bugs program for the unexpanded VIC-20.

```
50 PRINT"{SHFT CLR}{HOME}{CRSR DN}{3 CRSR RTs}{CTRL 1}*
    {CTRL 3}*BUNCH-O-BUGS*{CTRL 1}*{CTRL 7}"
51 SK=0
55 PRINT"{CRSR DN}{2 SPACEs}{CRSR RT}{CTRL 1}1.COUNT TH
    E {CTRL 3}RED{CTRL 7}":PRINT"{2 SPACEs}{CRSR RT}{C
    TRL 1}AND {CTRL 6}GREEN{CTRL 1} BUGS!{CTRL 7}"
60 PRINT"{2 CRSR DNs}{3 CRSR RTs}2.PRESS {CTRL 1}RETURN
    .{CTRL 7}"
65 GETA$:IFA$<>CHR$(13)THEN65
70 PRINT"{6 CRSR DNs}{CTRL 5}{3 SPACEs}{CTRL 9}PLEASE W
    AIT{CTRL 0}{CTRL 1} [@]{CTRL 7}"
100 X=PEEK(56)-2:POKE52,X:POKE56,X:POKE51,PEEK(55):CLR
110 CS=256*PEEK(52)+PEEK(51)
120 FORI=CSTOCS+511:POKEI,PEEK(I+32768-CS):NEXT
130 FORI=0TO7:READJ:POKECS+I,J:NEXT
140 DATA 153,219,36,60,126,90,102,102
150 POKE36869,255
155 FORDE=1TO1500:NEXT
156 PRINT"{SHFT CLR}":POKE36879,25
160 GOSUB500
170 GETA$:IFA$<>CHR$(13)THEN170
180 V=36878:S1=36875:S2=36874
200 RV=INT(10*RND(1))+1
202 RW=INT(10*RND(1))+1
205 PRINT"{HOME}{5 CRSR DNs}"
210 FORTX=1TORV
215 GOSUB400
220 PRINTTAB(2);"{CTRL 3}@ {CTRL 7}";
230 FORDE=1TO250:NEXT
240 NEXTTX
241 PRINT"{CRSR DN}"
242 FORTY=1TORW:GOSUB400
243 PRINTTAB(2);"{CTRL 6}@ {CTRL 7}";
244 FORDE=1TO250:NEXT
245 NEXTTY
248 POKEV,15:POKES1,250:FORDE=1TO30:NEXT
249 POKEV,0:POKES1,0
250 PRINT"{HOME}{19 CRSR DNs}{3 CRSR RTs}{CTRL 1}HOW MA
    NY {CTRL 3}@{CTRL 1}?";:INPUTN
255 IFN=RVTHENGOSUB1000
256 IFN<>RVTHENGOSUB2000:GOTO250
265 POKEV,15:POKES1,225:FORDE=1TO30:NEXT:POKEV,0:POKES1
    ,0
267 PRINT"{HOME}{19 CRSR DNs}{3 CRSR RTs}{CTRL 1}HOW MA
    NY {CTRL 6}@{CTRL 1}?";:INPUTM
269 IFM=RWTHENGOSUB1000
270 IFM<>RWTHENGOSUB2000:GOTO267
280 PRINT"{SHFT CLR}":POKE36879,8
300 PRINT"{HOME}{CRSR DN}{CTRL 9}{CTRL 8}{22 COMD Ys}{C
    TRL 0}";
305 PRINT"{4 SPACEs}@ ADD 'EM UP @"
310 PRINT"{CTRL 9}{22 COMD Ps}{CTRL 0}";
312 FORDE=1TO1000:NEXT
315 AX=INT(6*RND(1))+1
316 AY=INT(6*RND(1))+1
325 PRINT"{CRSR DN}"
330 FORI=1TOAX:GOSUB400
335 PRINTTAB(6);"{CTRL 3}@ ";
340 NEXTI
342 PRINT"{CRSR DN}"
345 FORJ=1TOAY:GOSUB400
350 PRINTTAB(6);"{CTRL 6}@ ";
352 NEXTJ
353 FORDE=1TO700:NEXT
355 PRINT"{HOME}{19 CRSR DNs}{3 CRSR RTs}{CTRL 8}HOW MA
    NY {CTRL 3}@{CTRL 1}+{CTRL 6}@{CTRL 8}";:INPUTQ
360 IFQ=AX+AYTHENGOSUB1000
365 IFQ<>AX+AYTHENGOSUB2000:GOTO355
367 IFSK=>250 THENGOTO3000
370 GOTO156
400 POKEV,15:POKES1,225+RV
```

More

child has scored 250 or more points (bugs), whereupon the game ends.

How the Program Works

The VIC-20 has many keyboard graphics characters that could be used to help a child with counting and summing, but the creation of special characters like bugs is a simple technique; it requires the use of only five or six lines near the start of the program to set up the VIC for your own characters.

To put it simply, lines 100–150 move the VIC's own character set out of its normal location (ROM) into RAM. The memory is lowered a bit to protect Basic programming from the special character set, and one Data statement is read by the program to change @ to our new bug once the program is running.

Line 140 is the Data statement for our new character. The eight numbers in the statement change the @ character into a bug. If you have a utility program that helps you design your own characters, you may change the bug to look like anything you wish. At the end of the article, I offer a few new data lines that produce different bugs.

Lowering memory for special characters can cause a few problems when rerunning the program. Lines 100–150 will continue to lower the memory each time the program is rerun if you've halted the program's operation by touching the run/stop and restore keys. Doing this two or three times (to list the program or edit a line) will cause an Out-of-Memory message.

During an actual run, GOTO commands keep the program from doing this, but when you're typing in a program, it's often tempting to run and rerun it to see how it operates. Be careful.

You can avoid the repeated lowering of memory and the consequent risk of the Out-of-Memory message by starting reruns from line 150. When the black screen displays your score at the end of the game, type RUN 150, and the game will run from that point without loss of memory.

The number of bugs that appear in each section of the program is controlled by random number generators. In the counting routine, there are no more than ten red or green bugs, and in the Add-'Em-Up section, no more than six of each.

Lines 205–280 print the bugs on the screen for the counting routine, and lines 300–370 print those for the adding routine. Lines 1000–1090 create the giant YES in multicolor. Other routines

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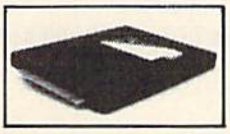

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RUN

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produce the sounds used to signal right or wrong answers.

Different Bugs

If you wish to create other bugs, you may try your own (with the help of a character building program) or try some of those suggested below. (Note: change the data in line 140 *before* the program has been run, or the bug will remain the same as the original.) Simply load the program from tape, list line 140 and change the eight numbers to your own. Try:

```
140 DATA 24,60,90,219,255,66,36,24
```

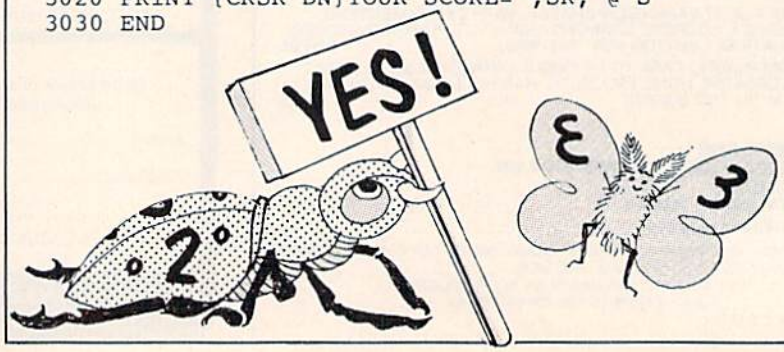
or:

```
140 DATA 129,255,189,60,153,255,189,24
```

Have fun! R

Listing continued.

```
405 FORDE=1TO30:NEXT
410 POKEV,0:POKES1,0
420 RETURN
500 PRINT"{SHFT CLR}{HOME}{CRSR DN}"
501 PRINT"{CTRL 9}{CTRL 1}{22 COMD Ys}{CTRL 0}";
505 PRINT"{CTRL 3}{2 SPACEs}**{CTRL 6}COUNT THE BUGS{CT
    RL 3}**"
510 PRINT"{CTRL 9}{CTRL 1}{22 COMD Ps}";
515 FORDE=1TO1000:NEXT
516 PRINT"{HOME}{4 SPACEs}{CTRL 9}{CTRL 7}{SHFT Z}PRESS
     RETURN{SHFT Z}{CTRL 0}"
517 POKEV,15:POKES1,245:FORDE=1TO20:NEXT
518 POKEV,0:POKES1,0
520 RETURN
1000 PRINT"{HOME}{10 CRSR DNs}"
1001 POKEV,15:FORMM=215TO250STEP.5:POKES2,MM:NEXTMM
1002 POKEV,0:POKES2,0
1010 PRINT"{CTRL 9}{CTRL 6}{2 SPACEs}{COMD +}{3 SPACEs}
     {COMD +}{2 SPACEs}{4 COMD +s}{2 SPACEs}{4 COMD +s}
     "
1020 PRINT"{CTRL 9}{CTRL 3}{2 SPACEs}{COMD +}{3 SPACEs}
     {COMD +}{2 SPACEs}{COMD +}{5 SPACEs}{COMD +}"
1030 PRINT"{CTRL 9}{CTRL 4}{2 SPACEs}{COMD +}{3 SPACEs}
     {COMD +}{2 SPACEs}{COMD +}{5 SPACEs}{COMD +}"
1040 PRINT"{CTRL 9}{CTRL 5}{2 SPACEs}{5 COMD +s}{2 SPAC
     Es}{3 COMD +s}{3 SPACEs}{4 COMD +s}"
1050 PRINT"{CTRL 9}{CTRL 6}{4 SPACEs}{COMD +}{4 SPACEs}
     {COMD +}{8 SPACEs}{COMD +}"
1060 PRINT"{CTRL 9}{CTRL 7}{4 SPACEs}{COMD +}{4 SPACEs}
     {COMD +}{8 SPACEs}{COMD +}"
1070 PRINT"{CTRL 9}{CTRL 6}{4 SPACEs}{COMD +}{4 SPACEs}
     {4 COMD +s}{2 SPACEs}{4 COMD +s}{CTRL 0}{CTRL 7}"
1075 SK=SK+N
1076 PRINT"{HOME}{21 CRSR DNs}{3 CRSR RTs}{CTRL 4}SCORE
     =";SK;"@'S"
1080 GETA$:IFA$<>CHR$(13)THEN1080
1085 FORCL=7900TO8185
1086 POKECL,32:NEXT
1090 RETURN
2000 POKEV,15:FORMM=245TO200STEP-.5:POKES1,MM:NEXTMM
2005 FORRO=8021TO8185:POKERO,32:NEXT
2006 POKEV,0:POKES1,0
2007 SK=SK-N
2010 RETURN
3000 PRINT"{SHFT CLR}"
3010 PRINT"{HOME}{3 CRSR DNs}{CTRL 8}GAME OVER!"
3020 PRINT"{CRSR DN}YOUR SCORE=";SK;"@'S"
3030 END
```



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The highlight of the show was, for this reviewer, when *BLITZ!* compiled a string of BASIC programs such that one loaded the next. An impressed audience looked on as Skyles effortlessly passed information from one program to another.

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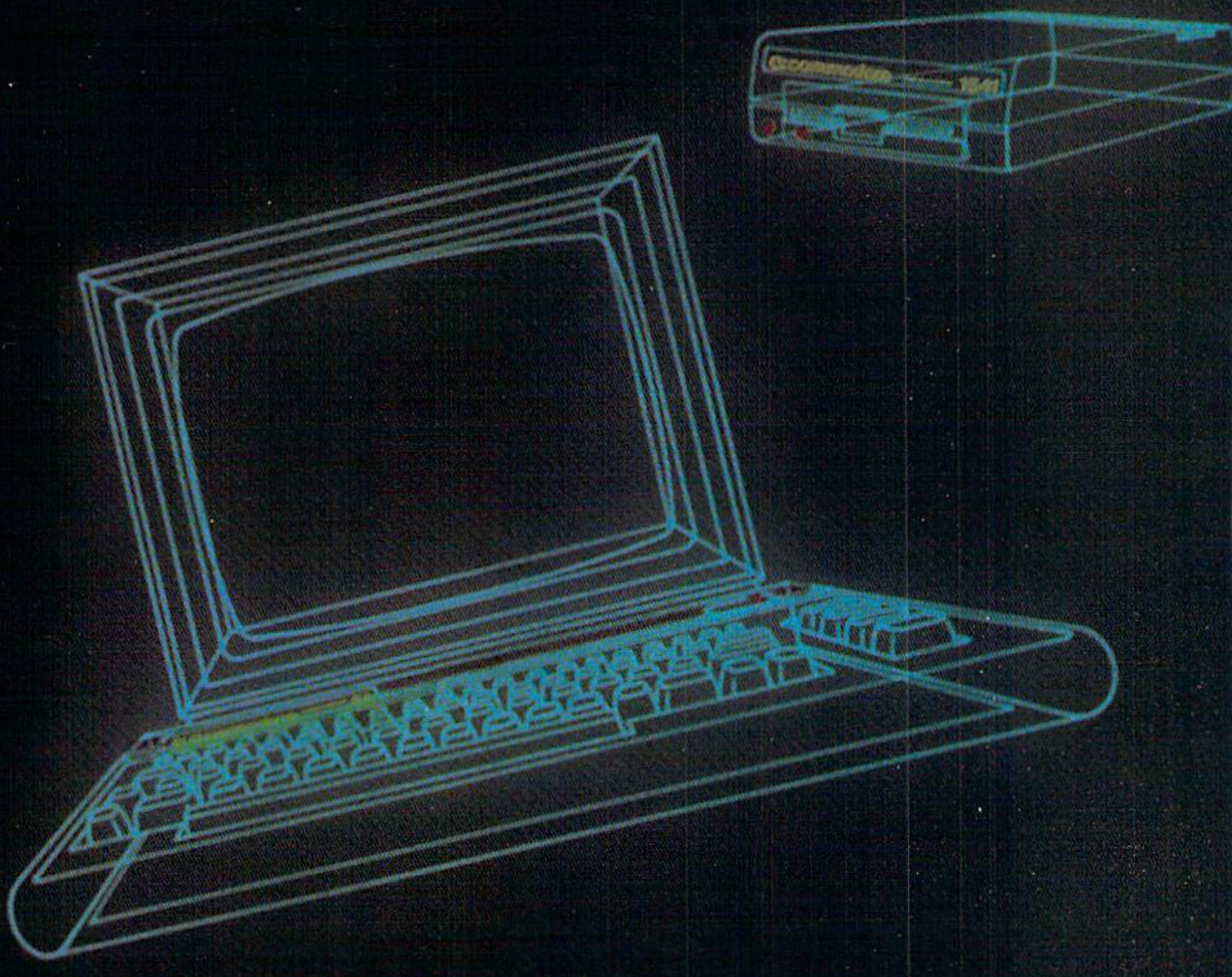

Artwork by Jim Laurier. *Design by Suzanne Torsheya.* *Photo composite and special effects by Mike Kressley.*

By Philip I. Nelson

Continue snooping through your computer's memory in the conclusion of this adventurous voyage.

As you tour through your Commodore in the second part of this article, you'll see the operating system ROM, the zones for color, sound and the handling of external devices, and finally, a look at Pokes, Peeks and the arithmetic of addressing.

Traveling below page zero, we'll flip over into the highest 8K (8000-byte) block of memory (57344-65535). Here is the computer's operating system, a giant machine language program that Commodore calls the Kernal ROM.

ROM (Read Only Memory) is a program that's always inside the silicon chip, even when you turn off the power. RAM, however, is volatile memory, meaning its contents are totally disorganized when you turn off the power.

Unless you're ready to learn machine language, this zone is pretty much beyond your ken. There's no real secret here—we can snoop around all we like, and Abacus Software (PO Box 7211, Grand Rapids, MI 49510) has even published complete listings of this program and 64 Basic (see *The Anatomy of the Commodore 64*), but that still doesn't make this easy for beginners to understand.

Even we snoopers, though, can recognize a few things in this region. Scoot down around 61624, for example, and you'll see the text of various messages the computer sends you during Save/Load/Verify operations. Literal text, again, is stored letter-for-letter the way it will be shown to the user. Further down, around 58464, is the familiar message that appears when you turn on the power. Further down, at the lower edge of this zone, is just a lot more Kernal ROM.

Passing below the Kernal ROM brings us to an extremely busy neighborhood (53248–57343), peopled with sprites, noisemakers and other active critters. You can think of this 4K block as the input/output area, which handles much more than we have space here to explain.

Located from 56320 to 56831 are two CIA (complex interface adapter) chips that control joysticks, paddles, timers and external devices like the disk drive. A little further down (55296–56295) is the 1000-byte block set aside for color memory. Just as we control what shape goes into screen memory by Poking values in that zone, we can control the color of any on-screen character by Poking values into color memory.

Both blocks are exactly the same size, 1000 bytes, and the computer automatically matches them up for us, location for location. As you can see by scrolling down through this area, color memory is a frantically busy place right now.

Below color memory, we'll enter the land of noisemakers—locations 54272–55295, which contain the C-64's sound synthesizer (SID chip). At the bottom of the I/O zone is the VIC-II chip, which handles sprites and high-resolution graphics (53248–54271). Some of these areas (like the sound chip) are quiet now, since Snooper doesn't use them. But no matter what you or your program are doing, there's always plenty of motion somewhere in this neighborhood.

Sealed-off RAM Zone

If you want a rest after that, the next 4K block will provide you with an op-

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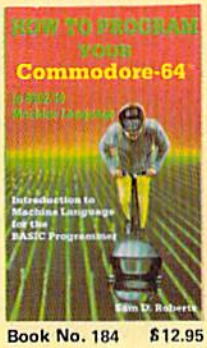

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portunity for one. Move below 53248, and you'll find an area that looks suspiciously similar to the free RAM we traveled through at the beginning of our trek. The truth is, that's exactly what we've found—4000 bytes of vacant, programmable RAM, available for your use.

But curiously enough, this big hunk of memory is sealed off from the rest of user RAM. If you're industrious enough to write a program that burns up all 38K+ of the C-64's regular Basic text space, and then add another line of code, the computer will send you an Out Of Memory Error, leaving this area as empty as it now looks.

Why build a sealed-off RAM zone into a computer? One reason will suggest itself if you scroll down to the very lowest address in this block, location 49152. Sound familiar? You typed it in when you entered Snooper. This is where our ML subroutine starts.

Of course there's still plenty of vacant RAM in our Basic text space, so we could have stuck the ML program there (as we did with our instruction display), but what would happen if we carelessly plopped our ML program into the middle of Basic text, or right next to it in the spaces it needs for variables or arrays? The result would be a glorious crash. To make life simple, we're keeping our ML routine safe up here, where Basic will never intrude.

To read the ML program in front of you, use the screen-display-code table. When setting up, the first data value we Poked in here was 160, which shows up as a white square (reversed space) on the screen.

While we're here, note how compact the ML program is, compared to our Basic text. It's only 69 bytes long, but does in a flash what would take long, boring seconds in Basic. ML programs are so short because they're written in the computer's mother tongue: pure numbers. Many of the characters you see here represent full instructions, similar to a Basic keyword, which the computer can instantly execute. No line numbers to worry about, no pointers to twiddle with—just clean, unencumbered values.

Another Basic Program

Move down into the next 8K zone, and you'll learn more of the reasons behind this big difference in speed. This zone (8K blocks are popular up here in high memory) stretches from 40960 to 49151. As you slog on down, you may be thinking this stuff looks a lot like the big operating-system program we saw at the top of memory. If so, you're right again. We're looking at another jumbo ML program, the one most of us call Basic.

If you do not have, or cannot get, the May issue of RUN, *which carried Part 1 of this article and its program listing, we will gladly mail you photocopies thereof if you'll send us a self-addressed stamped envelope. Address your request to* RUN *Editorial Office, 80 Pine St., Peterborough, NH 03458.*

Maybe you haven't thought of it this way, but the Basic language is just another program, permanently recorded in ROM. The purpose of the Basic program is simply to help *you* write programs. If you still don't believe us, move down to where Basic begins, around 40960. Just like Snooper, this program has a title: CBM Basic. Further downscreen are the many Basic keywords and error messages stored as literal text. Let's pause here and reflect—there's a lot to learn.

By doing lots of hard jobs for you and catching many of your mistakes, this Basic program, often called an interpreter, is what makes your computer such a friendly device. Each time you turn on the computer, its operating-system program sends it through a host of set-up routines (one of these, we learned, is to set the start-of-Basic pointer). As soon as that internal housekeeping is done, the computer automatically goes to the Basic program and starts to execute it.

Let's say you just turned on the computer. Basic is already running quietly in the background. Even though the computer only "understands" raw numbers, the Basic program will let you order it around using familiar, English-like words. If you type in the first line of Snooper and hit the return key, the computer will store its condensed version of line 1 at the bottom of Basic text space. Type in the second line, and your text will grow upward in memory. In addition to compressing, numbering and storing your program lines and managing its pointers, the computer is checking your syntax against the stylebook that's part of Basic.

For example, if, rather than a numbered Basic line, you foolishly enter MONKEYBIZ, the computer will send you an error message. Your entry has no line number, so it can't be stored as part of Basic text, and the computer has checked your word against its built-in dictionary and found that MONKEYBIZ doesn't exist in the CBM Basic lexicon. This means the computer also can't perform your word as a direct command in Immediate mode. It can only alert you to a syntax error, and you'll have to try again.

The same kind of error-checking is performed while the computer runs your Basic text. As it reads along, the computer recognizes each Basic keyword by trying to match it against something in its word list. If it finds a match, it's ready to rush forward. What happens next depends on several things, so let's take them one at a time.

Let's say your Basic text contains the statement POKE A,B, and the computer has just verified that Poke is a meaningful Basic word. Next it has to find out what value A represents, which requires a quick trip to the A pigeonhole in variable storage space. Now the computer knows what *address* we want to Poke into, but not what *value* to put there. So it's off to the B-variable pigeonhole, to collect B's value and then try to carry out our command—as soon as it's done some more checking, that is.

What would happen if we told the computer to Poke into a place that doesn't exist, like a location with a negative address, or one that's higher than 65535? Or, what if we're using a legal address, but we've told the computer to plop in a value that's too big for any memory cell to hold? The computer will recognize the mistake, find the Illegal Quantity Error message in Basic ROM, abort our Basic program and display the message on the screen. As an extra bonus, it will even tell us which program line contains the blunder!

But don't jump to conclusions. Just because the computer quit executing our Basic text doesn't mean it's no longer running Basic. It's only dropped out of Running mode into Editing mode so we can fix our text. This part of the Basic program lets us list the offending line, change it and replace the old line of text with the new. After it stores the new line, the computer will adjust all its pointers as needed, then sit back patiently, waiting for its human user to give it some sensible commands.

While we're computing, then, the computer is executing the Basic program *simultaneously*, scurrying around like a frantic mother hen to smooth our

way. It's this complex process of translating our commands and catching mistakes that slows down Basic programs so much. When we ask our computer to do all this at the speed of light, we're asking a lot; it has other work to do, too, like sending a video image that your TV can redraw on its screen 60 times every second.

We're Almost Home

If you're still with us, take heart. We're just about to reenter home territory—the free RAM used for Basic text. On the C-64, this stretches from 2048 to 40959. That's a lot of little pigeonholes, as you'll see in a minute. But before we take the last, long trek back to our instruction display, let's look at that fourth "extra" zone your computer sets aside when you run a program.

This zone is string storage space. Unlike variable and array storage, which start low and build upward, string storage starts at the *top* of user RAM and grows *downward*. In fact, this space has been growing in size throughout our entire journey. I can't tell you just where the leading edge of string storage is located, since I don't know how many times you pressed a key while we've snooped around. It's somewhere below 40959, and moves lower every time you press a key.

Move the cursor steadily downward and you'll spot it as a line of q characters moving leftwards across the screen. If you're not sure whether you have it, hold down the space bar—a solid dark bar will move across from right to left, from higher addresses to lower ones.

What we're doing is cycling endlessly through the GET A$ statement in line four. If you've pressed a new key when the computer hits that statement, it redefines the variable we call A$, and also stores the new string separately up here. For reasons we won't go into here, this lets you do powerful things with Basic strings. In Snooper, each new string is just one character long, but CBM Basic lets you make strings as long as 255 characters by concatenating (adding) little strings together.

Using hundreds of Get statements for keyboard input makes this zone easy to find, but the technique is not without hazards. As I write this, the leading edge of my string space is in memory somewhere around 38000, which is a long way from the end of our Basic text, though our instruction screen is a lot higher (12288–12387). If string storage grows down that far, it'll plow right through the instruction-display locations, filling them with mindless q shapes. Keep in mind that there are other ways to fetch input from the keyboard (Peeking at location 197, for example) that won't burn up memory this way.

We're nearly home now, so let's start the long haul back to our instruction display. I didn't have a true sense of how much user RAM the C-64 contains until I made this last trip down from the top. Don't worry if your instructions are all jumbled—the same pattern is still there, stored in exactly the same locations. In our loop-the-loop of the Commodore 64, we've been traveling in 40-byte steps to keep our screen image coherent. The number 40 doesn't divide evenly into 65536, which is the number of memory cells we just trudged through, so we ended up off base. And you're probably still in lowercase Graphics mode. To set everything back to normal, just press Q to quit, and type RUN again.

How Snooper Works

Now that you've seen your computer's insides, you may wonder how Snooper puts them on the screen. I originally wrote the ML part of this program for a game that lets the player scroll up or down inside a long, many-screen-sized playfield, which I'd drawn in memory just like the instruction display in Snooper. Once I learned how to move in the playfield, I realized there was no point stopping there—with the same technique, I could go anywhere in the computer, break in and *look* at all those mysterious, invisible things I'd been reading so much about.

Your computer comes with two built-in memory windows. One is the Peek statement, which will fetch you the numerical value stored inside any single memory location. Peek can take us anywhere from zero to 65535, but it's just a peephole. Screen memory is another sort of window, a thousand times bigger. Whatever happens to be Poked into that zone gets displayed on the screen, but how do we make that big window move?

Well, screen memory has a limited portability. By Poking (carefully!) into a control location, 53272, we can shift screen memory to any of sixteen locations in the C-64. But these are all fixed locations, and this technique creates other complications. Scrolling up or down a few bytes at a whack still looks impossible. What's the solution?

If we can't bring the screen to the data, we'll have to bring the data to the screen. In Basic it's simple (but slow) to copy any thousand-byte block of memory onto the screen. We just Peek at each source location consecutively, Poking the values we find into screen memory. Let's try a little speed test. If you're still running Snooper, press Q to quit. Now clear the screen, enter the following as one line and hit the return key.

```
FOR J=0 TO 999: POKE 1024+J,
PEEK(12288+J): NEXT J
```

Voila! The source block we copied is the one holding our instructions. To scroll up or down one line in memory, we can add or subtract 40 from 12288, and do it over again. This works, all right, but snooping in Basic through 65536 locations will take a *very* long time. Our ML program is still in memory, so let's see whether it can speed things up. Clear the screen and enter this as one line:

```
POKE 251, 0: POKE 252, 48: SYS 49152
```

I guess you see who won the race. In addition to copying 1000 bytes, the ML routine just filled all 1000 cells in color memory with white values for the "new" C-64 ROMs. You could call Snooper a hybrid, since the program works in two parts, each doing what it's best suited for. The ML routine performs a simple, repetitive task with blistering efficiency, and Basic handles more complex calculations where speed's not critical.

I realized I could go anywhere in the computer and look at all those mysterious things.

This kind of ML program is known as a mass-move utility, and, given the C-64's large memory, its possible uses are legion. You could set up different display screens at various points in RAM, then flip through them at the speed of light, to switch playfields in a game, write successive pages of instructions, and so on. Before it can do its work, the ML routine needs just one piece of information: the starting address of the 1000-byte source block of memory we want to copy.

Moving the Address

Getting that address where it must go is the job of our Basic program, and this kind of information-passing is fundamental to all computing, so let's give it a closer look. You already saw how your computer stores variable values in special pigeonholes, which it sets aside and labels specifically for that purpose. Whenever the variable changes, or it's needed for use elsewhere, the computer pops back to the pigeonhole to store a new value or retrieve the current one. We're doing exactly the same thing in Snooper. Every time you press the up/down cursor key, the program calculates a new source address and stores it in the pigeonhole where it knows the ML routine will look.

If that's hard to visualize, picture our ML routine as a messenger boy. Our boss, the Basic program, writes the address on a slip of paper and stuffs it into the pigeonhole while his ML messenger boy's asleep. Then the boss wakes up the messenger with a loud SYS com-

mand. The messenger boy obediently runs to his assigned pigeonhole, reads the address and then rushes where he's been told, to fetch the 1000 bytes of data and deliver it where it's needed (screen memory).

That much is simple, but the story gets complicated because your computer needs *two* memory cells to store most addresses. So our pigeonhole really consists of two cells, right next door to each other. Remember, each cell can only hold a (decimal) number from zero to 255, while the computer has addresses ranging up to 65535. To better understand this, let's learn a little about binary numbering.

We all know the decimal numbering system, which is called base 10 because it has ten digits: 0 through 9. But there are lots of other ways to count. A silicon chip is simpler than your brain, so it's more convenient for computers to use binary, or base-2 numbers, which use only two numerals: 0 and 1. In this extremely simple system, we can write any number from 0 through 255 using eight digits. The decimal number 1 looks like this: 00000001. Decimal 254 looks like this: 11111110.

Think of each memory cell as a collection of eight little switches we can turn on or off to represent a binary 1 or 0 to the computer. That's fine if we stay in page zero, where every address is under 256. But the highest address in the computer, 65535, takes a full sixteen bits to write, and looks like this: 1111111111111111. That's twice the size of any memory cell!

The solution for this is to double-up. The 6502-based microprocessors used in Commodore, Apple and Atari computers all read addresses by looking at *pairs* of numbers in adjacent memory cells, adding the two eight-bit halves together to form a full sixteen-bit address. So in Snooper, our Basic boss actually has to stuff half our source address into one pigeonhole (location 251) and the other half in the cell next door (location 252).

If you've followed thus far, don't give up. The final wrinkle to be mastered arises because our messenger boy is strangely crosseyed—he can't put the two halves of the address together unless the boss *reverses* them! Thinking in binary again, this means the eight highest (most significant) digits go in the second pigeonhole, and the eight lowest (least significant) digits go in the first one. Look back at line four of Snooper, and you'll see that LO gets Poked into 251, and HI goes into 252. This is often called low byte/high byte format.

At first glance this system may strike you as maddening and illogical, but it's worth learning if you want to go beyond the simplest programming. Most home computers use the 6502 microprocessor, so low byte/high byte format is going to be around for a long time. Like anything else that looks baffling at first, it becomes simple if you keep your cool and digest it one bit at a time.

In any case, once you understand what LO and HI represent, the rest of Snooper is simple. The screen never moves at all. We just change the address of the source block we want to copy, send that low byte/high byte address to the right pigeonholes and the speed of machine language does the rest.

You still haven't seen inside your computer, of course; it's dark in those little chips, and you can't see electrons, anyway. But it's fun to see a big picture for a change, and the more you look, the more you'll want to learn.

After you've snooped a while, you may want to try changing what you see. To do that, call the Poke routine by pressing P, then enter two values, the first for the address and the second for the value you want to Poke.

If you've never done much Poking, try something easy first, like putting a graphic shape in the blank area of the instruction screen. Be careful—you're risking a crash if you just started Poking blindly into sensitive areas like the zero page.

For a copy of this program (specify C-64 or VIC-20), send me a blank cassette or disk along with a self-addressed stamped mailer and $3. R

Snooping Into the VIC-20

The VIC-20 and C-64 are distinctly different machines, but in this case they can both use almost exactly the same program. There's much less user RAM in the VIC, so I left out the instruction display, but otherwise tried to highlight the CBM family resemblance by keeping the two listings similar.

VIC Snooper is for the unexpanded VIC only, so remove any plug-in RAM cartridges before you run it. Adding RAM moves screen memory, color memory and Basic text to different locations, depending on how much you add, so consult the *VIC-20 Programmer's Reference Guide* if you want to modify the program to work on an expanded machine. You'll have to change the ML routine to send data to the relocated screen.

Running VIC Snooper starts you right at the bottom of Basic text storage, looking at locations 4096-4601. Screen memory is much smaller (506 bytes compared to 1000 on the C-64), which means you'll travel in 22-byte steps, the length of one VIC screen line. Since we're copying smaller blocks of memory, the ML routine is substantially shorter, too. The VIC-20 has no "extra" RAM like the C-64, so we placed the ML routine in the cassette buffer, starting at location 828.

You'll find the same essential gear as you snoop around the VIC-20: CBM Basic and an 8K Kernal in ROM, plus a nearly identical zero page. But these are in different places (see the memory maps in your manual), and there are other major differences between the machines.

The VIC-20 has no sprites, of course, and its soundmaker is less versatile than the C-64's flashy SID chip. And though the VIC's 6502 microprocessor, like the C-64's 6510, can address any memory location from zero to 65535, you'll find that big parts of an unexpanded VIC aren't used for anything. They're just holes in memory, waiting to be filled with plug-in cartridges to expand RAM, add new ROMs or whatever.

But don't underestimate your VIC-20. Its chunky programmable characters are twice as big as the C-64's, and it can do things its bigger brother can't, like change the centering of its screen on your TV monitor. Though small in memory, it has a powerful, industry-standard microprocessor inside, and if you can truly master this machine, you'll have no trouble moving to other computers.

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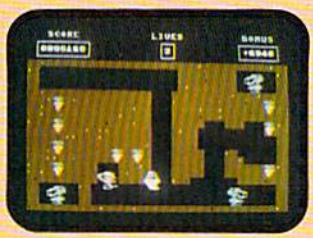

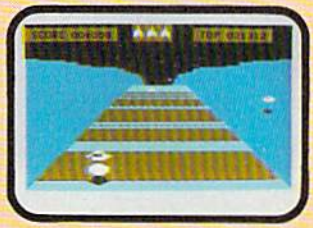

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You must first learn your Do-Re-Mi's if you want to play a musical instrument. This program will help you to recognize notes on the staff at a glance.

By Frank Colosimo

One of the first things that the fledgling piano students in my family had to learn was the identification of musical notes. I decided to write a program that would be interesting to play and at the same time help them remember their notes.

Music Teacher is the result. It's an educational game in which you score points depending on how quickly you can identify the letters of musical notes.

The program is a good demonstration of the capabilities of the VIC-20 and C-64. It uses sound generation, color graphics and custom characters to add interest to the game.

How to Play

Music Teacher consists of a series of 30 randomly selected notes, played one at a time and displayed on the staffs. The object of the game is to press the letter corresponding to the displayed note as quickly as possible. A correct answer is worth over 30 points with a quick response, or as little as minus two points if too much time elapses. A wrong answer results in five points subtracted from the score.

Memory-prompting phrases are visible on the screen at all times to help new players. The first letter of each word in these phrases is the same as the letter of the corresponding space or line of the staff, starting from the bottom and moving upward. You should know that you'll get few points if you have to look up the correct letter for each note. To prevent excessive discouragement for newcomers, the total score doesn't fall below zero.

Entering the Program

The C-64 version is a single program that may be typed and run normally. After saving a copy of the program, enter RUN 300 to check the Data statements.

For the VIC-20 you need two programs to play the game. The first (see Listing 1) is the main program and uses a data file produced by the program in Listing 2. This second program is interactive and somewhat automatic. When you run it, it sums all the values in the Data statements and compares them to checksum figures. If it finds an error, it reports the line number of the Data statement that has the problem. If everything is correct, it asks you to put in a new tape, and the data file is produced.

After making the tape, the VIC-20 program asks you to rewind the tape so it can read the file back and check it. If it finds an error, it prints the number of

Know Those Notes!

the Data statement, the value read from tape and the correct value. This should aid you in debugging if you encounter a problem.

After the data file is prepared, you can run the main program. The VIC-20 program will ask you to place the data file cassette into the recorder and press the play button. After the data is read, the game starts.

If you choose to stop the VIC-20 program at some point, you restart it with the command GOTO 200. If you edit the program or use the Run command, the program variables will be lost, and garbage will appear on the screen. If this occurs, you'll have to rerun the program from the start, including rereading the data tape.

I'll gladly supply a tape containing the program and data file for those who do not want to do all the typing. Just send me a stamped, self-addressed envelope and $3, and specify which version you want. R

RUN It Right

VIC-20 (5K) or C-64

Address author correspondence to Frank Colosimo, 112 Shoreway Drive, Rochester, NY 14612.

Listing 1. Music Teacher program for the VIC-20.

Note: The command "POKE" in line 254 has been abbreviated as "P{SHFT O}" so that you can enter the entire line into your VIC-20. When you list the program, the word POKE will appear instead of P{SHFT O}.

Also note that the command "RETURN" in line 1015 has been abbreviated as "RE{SHFT T}" for the same reason. For more about abbreviating commands, see p. 133 in your owner's manual.

```
1 PRINT"{SHFT CLR}{CTRL 5}***VIC MUSIC TEACHER**":PRINT
    "{CRSR DN}{CTRL 3} RESPOND QUICKLY FOR{2 SPACEs}HI
    GHEST SCORE":GOTO3800
200 PRINT"{SHFT CLR}{CTRL 3}":FORN=38422TO38840:POKEN,0
    :NEXT:PRINTSPC(34)"{CTRL 6}SCORE"
210 POKE36869,255:DI=7770:FORN=0TO4
220 FORM=DI+44+N*22TODI+49+N*22
230 POKEM,38:POKEM+7*22,38
240 NEXT:NEXT
252 POKE7790,27:POKE7791,28:POKE7812,29:POKE7813,30:POK
    E7834,31:POKE7835,41:POKE7856,42
254 POKE7857,43: POKE7878,44:POKE7879,45:POKE7966,46:PO
    KE7967,47:POKE7988,58:P{SHFT O}7989,59

256 POKE8011,60:POKE8032,61:POKE8033,62
258 IFQ=0THENGOSUB4000:Q=1
260 PRINT"{HOME}"SPC(141)"{CTRL 5}SPACES{2 SPACEs}{CTRL
     7} FACE":PRINTSPC(9)"{CTRL 5}LINES{2 SPACEs}{CTRL
     7}EVERY":PRINTSPC(12)"GOOD BOY
262 PRINTSPC(11)"DOES FINE":PRINTSPC(53)"{CTRL 5}SPACES
    {2 SPACEs}{CTRL 7}ALL
263 PRINTSPC(8)"COWS EAT GRASS":PRINTSPC(9)"{CTRL 5}LIN
    ES{2 SPACEs}{CTRL 7}GOOD"
264 PRINTSPC(10)"BOYS DESERVE"SPC(10)"FUDGE ALWAYS
300 NO=RND(0)*26+1
315 X=X+1:IFX=30THEN3000
318 PRINT"{HOME}{CTRL 7}WHAT NOTE{6 SPACEs}{3 CRSR LFs}
    ";
320 GOSUB500
350 TI$="000000"
400 INPUTG$
430 IFG$=A$(NO)THEN1000
440 PRINT"{HOME}{CTRL 3}TRY AGAIN";:Y=-5:GOSUB2000:FORN
    =1TO800:NEXT:GOTO400
500 POKEDI+B(NO),A(NO,1):POKEDI+B(NO)+22,A(NO,2)
```

More

Listing 1 continued.

```
600 IFNO>20THENS=36874
602 IFNO<21THENS=36876
604 POKES,M(NO):FORN=1TO14:FORM=1TO35:NEXT:POKEVO,14-N:
    NEXT:POKES,0:RETURN
1000 T=TI:PRINT"{CTRL 5}{HOME}YOU GOT IT!"
1010 POKEDI+B(NO),38:POKEDI+B(NO)+22,38
1015 POKEDI,32:POKEDI+22*7,32:POKEDI+22,32:POKEDI+22*8,
    32:POKEDI+22*14,32:IFQ=0THENRE{SHFT T}
1030 IFT<180THENY=32-6/60*T:GOTO1100
1040 IFT<540THENY=20-2/60*T:GOTO1100
1050 IFT<900THENY=2:GOTO1100
1060 IFT>900THENY=-2
1100 GOSUB2000:GOTO300
2000 POKEVO,15:SC=SC+Y:IFSC<0THENSC=0
2010 PRINT"{HOME}{CTRL 6}";SPC(100)"{3 SPACEs}{3 CRSR L
    Fs}";INT(SC)"{HOME}"SPC(12);
2100 POKEVO-1+(Y>-4),240+100*(Y<-4):FORN=1TO600:NEXT
2102 POKEVO-1,0:POKEVO-2,0:FORN=1TO400:NEXT:RETURN
3000 PRINT"{SHFT CLR}{2 CRSR DNs}YOU SCORED"INT(SC)"POI
    NTS!{2 CRSR DNs}"
3040 PRINT"{2 CRSR DNs}AGAIN? Y/N "
3050 GETX$:IFX$=""THEN3050
3060 IFX$="Y"THENSC=0:X=0:GOTO200
3800 POKE52,28:POKE56,28
3802 DI=7726:DIMA$(26),B(26),A(26,2),M(26)
3804 B(1)=0:C=1:D=1:VOL=36878
3806 C=C+1:B(C)=22*D:IFC=14THEND=D+1:GOTO3806
3812 B(C+1)=22*D:C=C+1:D=D+1:IFC<25THEN3806
3825 FORN=7168TO7679:POKEN,PEEK(N+25600):NEXT
3850 PRINT"{CRSR DN}{CTRL 7}POSITION DATA TAPE AND PRES
    S RETURN{CTRL 6}"
3852 GETA$:IFA$=""THEN3852
3860 OPEN1,1,0
3865 PRINT"{CRSR DN} {CTRL 5}PLEASE WAIT{CTRL 7}"
3870 FORN=1TO26:INPUT#1,A:M(N)=A:NEXT
3872 FORN=1TO26:INPUT#1,A:A$(N)=CHR$(A):NEXT
3874 FORN=1TO26:INPUT#1,A,B:A(N,1)=A:A(N,2)=B:NEXT
3880 FORN=7448TO7495:INPUT#1,A:POKEN,A:NEXT
3882 FORN=7384TO7423:INPUT#1,A:POKEN,A:NEXT
3884 FORN=7496TO7551:INPUT#1,A:POKEN,A:NEXT
3886 FORN=7632TO7671:INPUT#1,A:POKEN,A:NEXT
3900 CLOSE1:GOTO200
4000 FORNO=1TO26:GOSUB500:GOSUB1010:NEXT:RETURN
```

Listing 2. Data file program for the VIC-20.

```
1 REM DATA CHECK
2 DIMA(19):FORN=1TO19:READA(N):NEXT
3 FORM=1TO19
4 FORN=1TO16:READA:B=B+A:NEXT
5 IFB<>A(M)THENPRINT"ERROR IN DATA STATEMENTS #";6000+M
    :GOTO18
6 B=0:NEXT:PRINT"GOOD TYPING!"
16 GOTO20
18 PRINT"PLEASE CHECK DATA STMNTS AND RERUN":END
20 REM PREPARE DATA TAPE
22 PRINT"INSERT DATA TAPE AND PRESS RETURN"
24 GETA$:IFA$=""THEN24
30 RESTORE:OPEN1,1,1,"DATA"
32 FORN=1TO19:READA:NEXT
35 PRINT"MAKING DATA TAPE- PLEASE WAIT"
40 FORN=1TO304:READA:PRINT#1,A:NEXT
50 CLOSE1:PRINT"DATA TAPE DONE"
200 REM CHECK TAPE
209 PRINT"{CRSR DN}THIS IS A DATA TAPE CHECK"
210 RESTORE:PRINT"{2 CRSR DNs}REWIND DATA TAPE AND PRES
    S RETURN"
215 GETA$:IFA$=""THEN215
218 FORN=1TO19:READA:NEXT
220 OPEN1,1,0,"":FORN=1TO304:INPUT#1,A:READB
221 IFA<>BTHENPRINT"BAD TAPE-VAL#"N"DATA="B"TAPE="A:END
```

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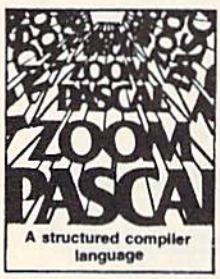

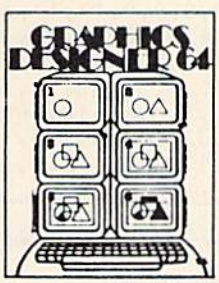

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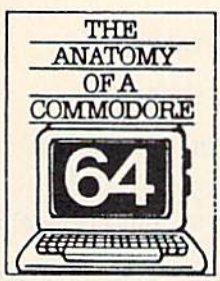

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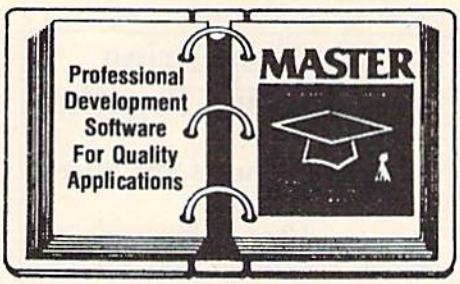

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Listing 2 continued.

```
222 NEXT
225 CLOSE1:PRINT"GOOD TAPE"
230 END
5000 DATA3426,2352,1085,729,594,600,612,762,828,147,324
     ,343,586,679,455,424,192,456,411
6001 DATA237,235,232,231,228,225,223,219,215,209,207,20
     1,195,195,191,183
6002 DATA175,163,159,147,225,223,219,215,209,207,65,71,
     70,69,68,67
6003 DATA66,65,71,70,69,68,67,67,66,65,71,70,69,68,67,6
     6
6004 DATA65,71,70,69,40,37,35,38,40,37,39,38,36,37,39,3
     8
6005 DATA36,37,39,38,36,37,39,38,36,37,39,32,36,37,40,3
     7
6006 DATA35,38,40,37,39,38,36,37,39,38,36,37,39,38,36,3
     7
6007 DATA39,38,36,37,39,32,36,37,0,24,36,66,66,66,36,24

6008 DATA255,0,0,0,0,24,36,66,255,66,36,24,0,0,0,0
6009 DATA255,0,0,0,0,0,0,0,255,24,36,66,66,66,36,24
6010 DATA0,0,0,0,0,24,36,66,0,1,2,2,4,4,4,4
6011 DATA0,192,32,16,16,16,16,16,4,4,2,2,2,2,2,2
6012 DATA16,16,32,32,32,64,64,64,2,2,2,3,2,2,5,5
6013 DATA128,128,128,0,0,0,0,0,9,9,17,17,35,37,37,41
6014 DATA0,0,224,224,16,16,16,8,32,32,32,32,16,16,8,7
6015 DATA8,8,8,16,16,32,32,192,0,3,12,16,16,32,32,32
6016 DATA0,128,64,32,16,16,16,8,32,32,56,24,0,0,0,0
6017 DATA8,8,8,8,8,8,8,10,10,8,8,18,18,16,16,32
6018 DATA0,0,0,0,0,1,1,6,32,32,64,64,128,128,0,0
6019 DATA8,48,0,0,0,0,0,0,1,13,71,111,50,48,48,13
```

Listing 3. Music Teacher program for the C-64.

```
0 REM MT64-9 *          * F COLOSIMO
2 :
4 REM ** INITIALIZE
6 :
8 POKE53281,1:GOSUB116
10 :
12 REM ** MAIN PROGRAM
14 :
16 NO=RND(0)*26+1
18 FORN=1TO400+2000/(SC+2):NEXT
20 X=X+1:IFX=30THEN100
22 PRINT"{HOME}{COMD 4}WHAT NOTE{7 SPACEs}{3 CRSR LFs}"
   ;
24 AN=-1:GOSUB76
26 TI$="000000"
28 PRINTH$SPC(13);:INPUTG$:AN=(G$=A$(NO))
30 IFNOTANTHEN68
32 :
34 REM{2 SPACEs}** CORRECT ANSWER
36 :
38 T=TI:PRINT"{CTRL 1} {HOME}YOU GOT IT!"
40 POKEDI+B(NO),38:POKEDI+B(NO)+40,38
42 POKEDI+2,32:POKEDI+40*7+2,32:POKEDI+42,32:POKEDI+40*
   8+2,32
44 POKEDI+40*14+2,32:IFQ=0THENRETURN
46 :
48 REM{2 SPACEs}** CALC SCORE
50 :
52 IFT<180THENY=32-6/60*T:GOTO60
54 IFT<540THENY=20-2/60*T:GOTO60
56 IFT<900THENY=2:GOTO60
58 IFT>900THENY=-2
60 GOSUB88:GOTO16
62 :
64 REM{2 SPACEs}** WRONG ANSWER
66 :
68 GOSUB76:PRINT"{HOME}{CTRL 1}{2 SPACEs}TRY AGAIN";:Y=
   -5:GOSUB88:GOTO28
```

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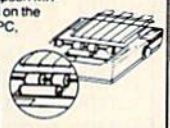

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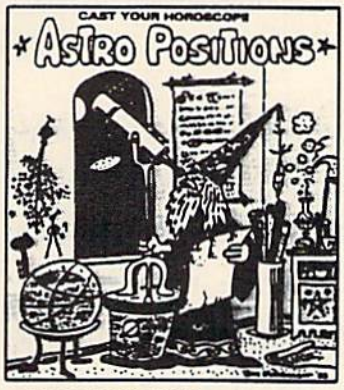

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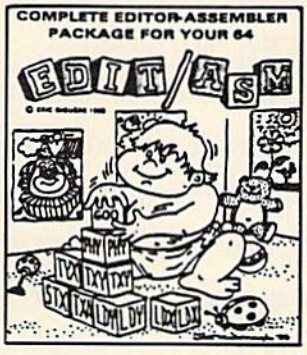

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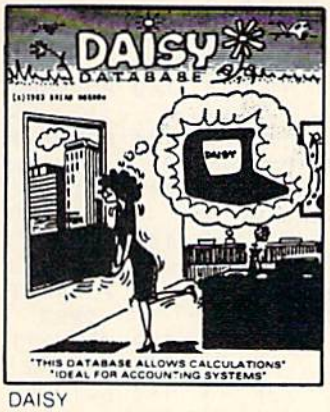

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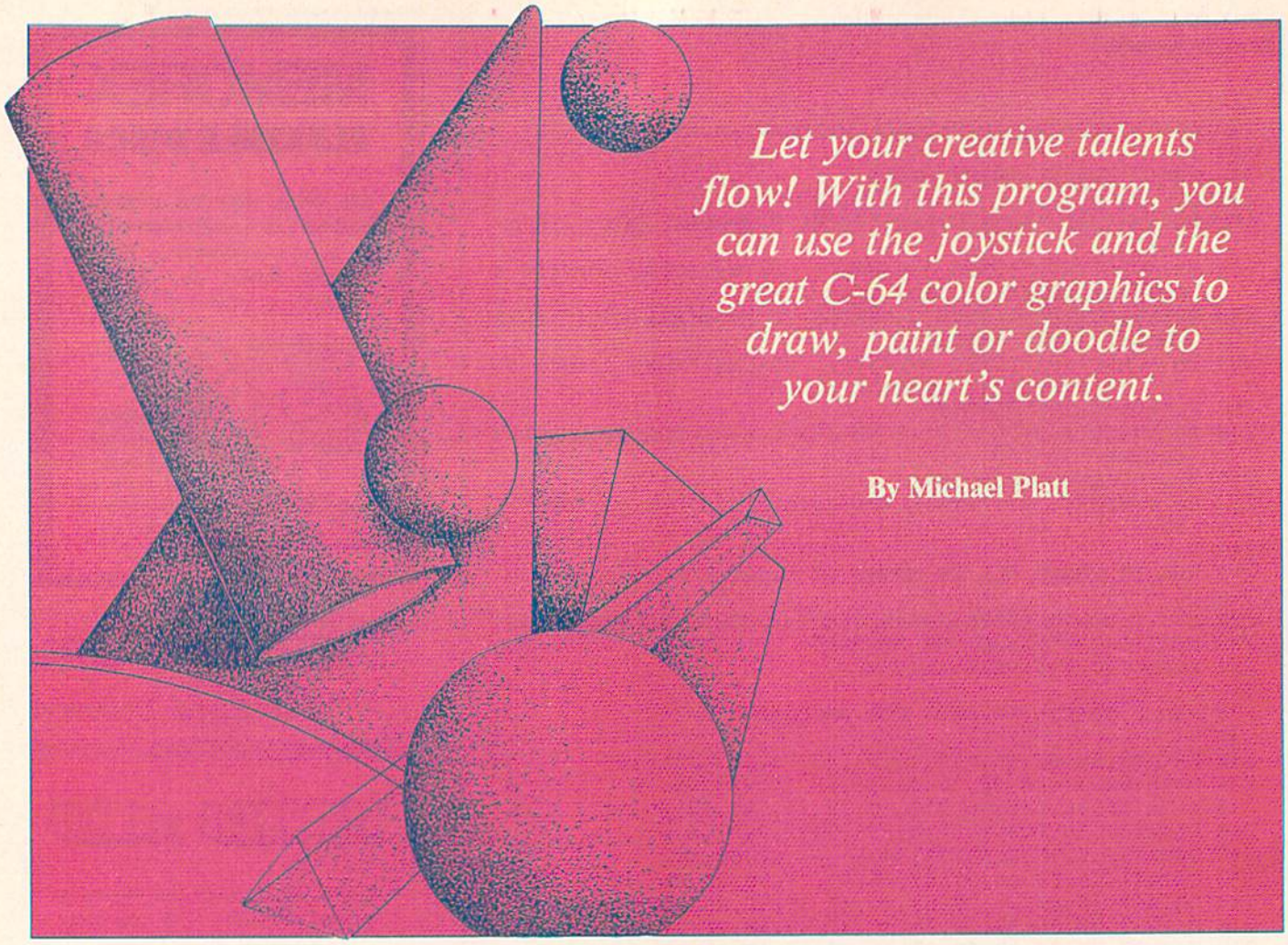
Listing 3. continued.

```
 70 :
 72 REM{2 SPACEs}** MAKE MUSIC; ERASE NOTES
 74 :
 76 POKES+4,SR:SR=129+64*AN:POKES+4,SR:POKES,M(NO,1):POK
    ES+1,M(NO,2)
 78 POKEDI+B(NO),A(NO,1):POKEDI+B(NO)+40,A(NO,2)
 80 SR=128+62*AN:RETURN
 82 :
 84 REM{2 SPACEs}** UPDATE SCORE
 86 :
 88 SC=SC+Y:IFSC<0THENSC=0
 90 PRINT"{HOME}"SPC(141)"{20 SPACEs}"
 92 PRINT"{HOME}{CTRL 1}";SPC(141)INT(Y)"{3 SPACEs}"INT(
    SC):RETURN
 94 :
 96 REM{2 SPACEs}**{2 SPACEs}END OF GAME
 98 :
100 PRINT"{SHFT CLR}{2 CRSR DNs}{CTRL 1}YOU SCORED"INT(
    SC)"POINTS!{2 CRSR DNs}"
102 PRINT"{2 CRSR DNs}AGAIN? Y/N "
104 GETX$:IFX$=""THEN104
106 IFX$="Y"THENX=0:RESTORE:GOSUB148:SC=0:GOTO16
108 POKE53272,23:PRINT"{SHFT CLR}":END
110 :
112 REM ** INITIALIZATION
114 :
116 PRINT"?{SHFT CLR}{CTRL 7} *** WELCOME TO C-64 MUSIC
    TEACHER ***":PRINTSPC(92)"PLEASE WAIT"
118 POKE52,48:POKE56,48:PRINTCHR$(142)
120 DIMA$(26),B(26),A(26,2),M(26,2)
122 SK=56334:B(1)=2:C=1:D=1:S=54272:H$=CHR$(19)
124 C=C+1:B(C)=40*D+2:IFC=14THEND=D+1:GOTO124
126 B(C+1)=40*D+2:C=C+1:D=D+1:IFC<25THEN124
128 :
130 REM ** SET UP SOUND REG.
132 :
134 FORN=STOS+24:POKEN,0:NEXT:POKES+5,10:POKES+3,8:POKE
    S+24,15
136 :
138 REM ** SET UP PROG CHAR.
140 :
142 POKESK,PEEK(SK)AND254:POKE1,PEEK(1)AND251:FORI=0TO5
    12
144 POKEI+12288,PEEK(I+53248):NEXT:POKE1,PEEK(1)OR4:POK
    ESK,PEEK(SK)OR1
146 PRINT"{CRSR DN}{CTRL 3} RESPOND QUICKLY TO GET HIGH
    EST SCORE"
148 FORN=1TO26:READM(N,1):READM(N,2):NEXT: REM ** MUSIC
    NOTES
150 FORN=1TO26:READA:A$(N)=CHR$(A):NEXT:REM ** NOTE LET
    TERS
152 FORN=1TO26:READA(N,1):READA(N,2):NEXT:REM ** NOTE S
    CREEN POKE POS.
154 L=12288: REM ** PROG. CHAR. DATA
156 FORN=L+272TOL+327:READA:POKEN,A:NEXT
158 FORN=L+216TOL+255:READA:POKEN,A:NEXT
160 FORN=L+328TOL+359:READA:POKEN,A:NEXT
162 FORN=L+368TOL+383:READA:POKEN,A:NEXT
164 FORN=L+464TOL+503:READA:POKEN,A:NEXT
166 POKE53281,0:PRINT"{SHFT CLR}":POKE53280,5:POKE53281
    ,15
168 POKE53272,(PEEK(53272)AND240)+12
170 :
172 REM{2 SPACEs}** PRINT LINES
174 :
176 DI=1234:FORN=0TO4
178 FORM=DI+80+N*40TODI+85+N*40
180 POKEM,38:POKEM+7*40,38
182 NEXT:NEXT
184 :
186 REM **{2 SPACEs}DRAW CLEFFS
```

More

Listing 3. continued.

```
188 :
190 CL=1271:FORN=1TO17:READA,B:POKECL+A,B:NEXT
192 :
194 REM{2 SPACEs}PRINT HELPS
196 :
198 PRINTH$SPC(150)SPC(150)"{CTRL 3}SPACES {COMD 4}F A
    C E"
200 PRINTSPC(60)"{CTRL 3}LINES{2 SPACEs}{COMD 4}EVERY G
    OOD":PRINTSPC(27)"BOY DOES FINE"
202 PRINTSPC(100)"{CTRL 3}SPACES {COMD 4}ALL COWS":PRIN
    TSPC(27)"EAT GRASS"
204 PRINTSPC(20)"{CTRL 3}LINES{2 SPACEs}{COMD 4}GOOD BO
    YS":PRINTSPC(27)"DESERVE FUDGE";
206 PRINTSPC(27)"ALWAYS"
208 PRINTSPC(163)"''''''{2 SPACEs}C-64{2 SPACEs}MUSIC T
    EACHER ''''''"
210 IFQ=0THENGOSUB220:Q=1
212 PRINTH$SPC(101)"PTS{3 SPACEs}SCORE":POKES+4,66:RETU
    RN
214 :
216 REM ** SOUND ALL 26 NOTES AT START
218 :
220 AN=-1:FORNO=1TO26:GOSUB76:FORN=1TO200:NEXT:GOSUB40
222 NEXT:PRINT"{HOME}GET READY!"
224 FORN=1TO2000:NEXT:RETURN
226 :
228 REM{2 SPACEs}** DATA FOR PROGRAM
230 :
232 DATA99,56,60,50,193,44,62,42,162,37,135,33
234 DATA165,31,49,28,30,25,96,22,31,21,209,18
236 DATA195,16,195,16,210,15,24,14,143,12,48,11
238 DATA143,10,104,9,97,8,233,7,12,7,71,6
240 DATA152,5,71,5,65,71,70,69,68,67,66,65
242 DATA71,70,69,68,67,67,66,65,71,70,69,68
244 DATA67,66,65,71,70,69,40,37,35,38,40,37
246 DATA39,38,36,37,39,38,36,37,39,38,36,37
248 DATA39,38,36,37,39,32,36,37,40,37,35,38
250 DATA40,37,39,38,36,37,39,38,36,37,39,38
252 DATA36,37,39,38,36,37,39,32,36,37,8,8
254 DATA8,16,16,32,32,192,0,24,36,66,66,66
256 DATA36,24,255,0,0,0,0,24,36,66,255,66
258 DATA36,24,0,0,0,0,255,0,0,0,0,0
260 DATA0,0,255,24,36,66,66,66,36,24,0,0
262 DATA0,0,0,24,36,66,0,1,2,2,4,4
264 DATA4,4,0,192,32,16,16,16,16,16,4,4
266 DATA2,2,2,2,2,2,16,16,32,32,32,64
268 DATA64,64,2,2,2,3,2,2,5,5,128,128
270 DATA128,0,0,0,0,0,9,9,17,17,35,37
272 DATA37,41,0,0,224,224,16,16,16,8,32,32
274 DATA32,32,16,16,8,7,0,3,12,16,16,32
276 DATA32,32,0,128,64,32,16,16,16,8,32,32
278 DATA56,24,0,0,0,0,8,8,8,8,8,8
280 DATA8,9,9,8,8,17,17,16,16,32,0,0
282 DATA0,0,0,1,1,6,32,32,64,64,128,128
284 DATA0,0,0,27,1,28,40,29,41,30,80,31
286 DATA81,41,120,42,121,43,160,44,161,34,320,46
288 DATA321,47,360,58,361,59,401,60,440,61,441,62
290 :
292 REM ** 'RUN300' TO CHECK DATA
294 :
296 DATA 973,725,899,707,774,821,635,450,444,454,383,55
    4,762,315,573
298 DATA 139,320,204,407,252,646,190,408,128,140,456,30
    7,1213,2671
300 DIMA(29):FORN=1TO348:READA:NEXT
302 FORM=1TO29:READA(M):NEXT:RESTORE
304 FORM=1TO29:FORN=1TO12:READA:B=B+A:NEXT
306 IFB<>A(M)THENPRINT"ERROR IN DATA STATEMENT #";230+2
    *M:GOTO310
308 B=0:NEXT:PRINT"GOOD TYPING!":END
310 PRINT"PLEASE CHECK IT AND TRY AGAIN"
```



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By Michael Platt

64 Joystick Artist

The Commodore 64 computer has amazing color graphics capabilities. In the multi-color mode, you can have up to four different colors in an 8×8 pixel matrix. Unfortunately, due to the lack of built-in commands, you must use numerous Peeks and Pokes, and this makes your task cumbersome.

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After you run the program, the border will be blue, the background black. You can change these colors with the F5 and F7 keys.

Your joystick should be plugged into Port 2. Your cursor, which you can move in any direction with the joystick, will be in the center of the screen. To draw, press the fire button.

In the upper left-hand corner is the status area. The left box displays a 1, 2 or 3 to indicate the current Drawing mode or an E to indicate the Erase mode. The box on the right displays the color the cursor will draw. Between these two boxes will be displayed either one or two dots to indicate a single or double drawing cursor.

In an 8 × 8 matrix of pixels, you may have only one color for each Drawing mode. To have four different colors, including the background color, you'll have to use all three Drawing modes. You select the Draw or Erase modes with the F3 key.

The cursor can draw in 16 colors: black, white, red, cyan, purple, green, blue, yellow, orange, brown, light red, dark gray, medium gray, light gray, light green and light blue. You can select the cursor color with the F1 key.

Keys to Color

The cursor can also draw in single or double thickness. In the Single mode, the cursor draws with a 1 × 2 pixel area, in the Double mode, a 2 × 2 area. The asterisk key (*) toggles the cursor from a single to double thickness.

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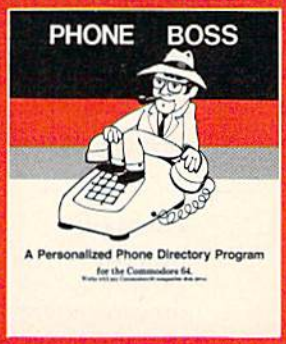

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Your favorite background and border colors can be saved in memory with the shifted pound key and recalled with just the pound key (£).

To obtain an unobstructed view of your picture, press the minus-sign key. This will remove the cursor and the status box from the screen. To bring them back, use the plus-sign key.

When you are finished drawing, you can save your pictures to disk with the F2 key and load them with the F4 key. If you're using a tape drive, save them with the F6 key and load them with the F8 key.

Whatever your medium, you'll be prompted for the name of your file. After you enter it, hit the return key. To get out of the Save or Load mode, hit the return key, then the run/stop key; you'll be returned to the normal Draw mode.

When saving a file that's intended to replace an existing file of the same name, type "@0:" before the file name.

See Table 1 for a summary of the command keys.

Sample display (above) of the 64 Joystick Artist program (below).

```
15 PRINT:PRINT "{SHFT CLR}POKING MACHINE CODE -- PLEASE
     WAIT"
19 REM CHECKSUM
20 Z=0:S=206122:FORT=0TO1809:READA:Z=Z+A:NEXT
30 IFZ=STHENPRINT"DATA STATEMENTS CORRECT":GOTO50
40 IFZ<>STHENPRINT"ERROR IN DATA STATEMENTS":END
50 RESTORE
99 REM MAIN ROUTINE
100 FORT=49152TO49456:READD:POKET,D:NEXT
110 DATA128,64,32,16,8,4,2,1,192,192,48,48,12,12,3
120 DATA3,128,128,32,32,8,8,2,2,64,64,16,16,4,4,1
130 DATA1,63,63,207,207,243,243,252,252,169,8,133,34,56
     ,176,29
140 DATA169,16,133,34,56,176,22,169,24,133,34,56,176,15
     ,169,32
```

More

KEY	COMMAND
F1	CHANGE COLOR CURSOR DRAWS IN
F3	CHANGE DRAW MODE (1,2,3, OR E)
F5	CHANGE BORDER COLOR
F7	CHANGE BACKGROUND COLOR
F2	SAVE PICTURE TO DISK
F4	LOAD PICTURE FROM DISK
F6	SAVE PICTURE TO TAPE
F8	LOAD PICTURE FROM TAPE
ONE THROUGH NINE	SELECT SPEED OF CURSOR
MINUS	TURN SPRITES OFF (CURSOR AND STATUS BOX)
PLUS	TURN SPRITES ON
CLR HOME	CLEAR SCREEN
SHIFTED POUND	SAVE BORDER AND BACKGROUND COLORS
POUND	RECALL BORDER AND BACKGROUND COLORS
ASTERISK	SET SINGLE OR DOUBLE DRAWING CURSOR

Table 1. A summary of the command keys.

The Basic Loader

Once you've typed in the program, be sure to first save it to tape or disk, because it will erase itself after it's run. And verify it to make sure your copy is a good one. To enter the graphics program, type RUN and hit the return key. This will Poke the machine language program into high RAM locations $C000-CFFF. Once this program is in memory, it need not be re-loaded.

If you want to get out of the program, hit the run/stop key and the restore key. As long as you don't Poke those high RAM locations, you may now run a Basic program without destroying the machine language code. However, a Basic program may be overwritten by the graphics program, so save it first. To re-enter the graphics program, type SYS52992 and hit the return key.

Before exiting, save any picture you may have in memory, or it will be erased.

The Checksum

Lines 20 to 50 contain the checksum. This will tell you whether or not you've entered a Data statement incorrectly. After you've entered and checked the entire program, you may delete these lines.

Multicolor Bit-Mapping

Multicolor bit-mapping creates detailed multicolor pictures. With this method, an 8K section of memory is visually displayed on the screen. In this case, the section of memory occupies lo-

cations $2000–3F3F. Each two bits (bit pair) in this 8K section controls a dot, and there are 32,000 (160 × 200) dots on the screen.

The combination of a pair of bits determines where the color information of each dot comes from. With two bits, there are four possible combinations: both bits off (00), both bits on (11) or one bit on and one bit off (01 and 10). See Table 2 for the sources of color information.

The Pixel Subroutine

The heart of this graphics program is a short routine at locations $C000–C130. It can be transported to other programs that require high-resolution plotting, such as graphics.

Your artist's palette is the C-64 Keyboard, where you can change screen colors, line thickness and cursor speed with a simple keystroke.

Before you use it, the initialization routine starting at $C0E7 must first be called. It will turn on a pixel or a pair of pixels with X and Y screen coordinates.

The range of X is 0 to 319 (horizontal) and the range of Y is 0 to 199 (vertical), with the 0,0 position in the upper left-hand corner of the screen. Before you enter the routine, the X coordinate must be stored in locations $0340–0341, the Y coordinate in location $0342.

Two bytes are required to hold the X coordinate because the range of X exceeds 255, the maximum number one byte can hold.

How the Program Works

To turn on a pixel, you must find the correct byte of the 8K section. Then you must determine which of the 8 bits of that byte to set.

The formulas that determine the byte and bit are given in the *Commodore 64 Programmer's Reference Guide*:

```
Byte = Base+(INT(Y/8)*320)+(INT(X/8)*8)+
       (Y AND 7)
Bit = 7-(X AND 7)
```

Base in this case is equal to 8192, because that's where our bit map starts. I simplified the byte formula to:

```
Byte = Base+((Y AND 248)*40)+(X AND
       248)+(Y AND 7)
```

I then translated this formula to machine language, which is located at $C065–C0C0. But instead of turning on the appropriate bit in that byte from the above formula, I used an index to a table of predetermined mask values. (A mask is a bit pattern that isolates one or more bits from a group of bits.) In the event that you want to vary the mask values and turn on individual bits or bit pairs for the multicolor screen, you should offset this index to the correct place in the table.

The Kernal Save and Load Routines

The picture data is saved in one continuous block of memory at $2000–47FF. Before saving, the color data for bit pair 11 (normally color memory) is transferred to locations $4000–43FF. The color data for bit pairs 01 and 10 (normally screen memory) is transferred to locations $4400–47FF. When you load a picture, the data is transferred back into its proper locations.

To save and load, I used the Kernal subroutines SETLFS, SETNAM, Save and Load. R

BIT PAIR	COLOR INFORMATION COMES FROM
00	BACKGROUND COLOR $D021
01	UPPER NYBBLE (4 BITS) OF SCREEN MEMORY $0400–07FF
10	LOWER NYBBLE (4 BITS) OF SCREEN MEMORY $0400–07FF
11	COLOR NYBBLE $D800–DBFF

Table 2. Sources of color information.

$00FD–00FE	BYTE IN BIT MAP IN WHICH BIT IS SET
$0022–0023	TEMPORARY STORAGE
$0024	SPEED OF CURSOR
$0025	TAPE OR DISK
$0026	SINGLE OR DOUBLE CURSOR
$0027	TEMPORARY STORAGE
$003F–0041	TEMPORARY STORAGE
$00A5	DRAWING MODE
$00A6–00A7	COLOR BYTE
$00A8	CURSOR COLOR
$033C–033F	TEMPORARY STORAGE
$0340–0341	X COORDINATE
$0342	Y COORDINATE
$CFFD–CFFF	TEMPORARY STORAGE
$2000–3F3F	BIT MAP AREA
$3F45–3F46	SAVE AREA FOR BORDER AND BACKGROUND COLORS
$4000–43FF	COLOR MAP SAVE AREA
$4400–47FF	SCREEN MAP SAVE AREA
$C000–C0E6	MAIN ROUTINE
$C0E7–C130	INITIALIZE BIT MAP
$C150–C1D3	MOVE CURSOR
$C300–C34C	DRAW
$C400–C4FC	READ KEYS—CHANGE CURSOR COLOR/ CHANGE DRAW MODE/ CHANGE BORDER AND BACKGROUND COLORS/ CLEAR SCREEN/ CHANGE CURSOR SPEED
$C500–C584	POKE BYTE IN COLOR MAP
$C600–C676	DISPLAY DRAW MODE
$C700–C742	READ KEYS—TOGGLE BETWEEN SINGLE AND DOUBLE CURSOR
$C900–C96F	LOAD
$CA00–CA7A	SAVE
$CB00–CB6E	INITIALIZATION
$CC00–CC4F	DATA FOR SAVE/LOAD PROMPT
$CC50–CCCF	SPRITE DATA
$CD00–CD8B	NAME INPUT FOR SAVE/LOAD
$CE00–CE37	TRANSFER MEMORY TO SAVE AREA
$CE50–CE87	TRANSFER MEMORY FROM SAVE AREA
$CF00–CF17	LOOP CALLING SUBROUTINES
$CFA0–CFAB	TRANSFER SPRITE DATA TO CASSETTE BUFFER

Table 3. Memory locations used.

Listing continued.

```
150 DATA133,34,56,176,8,169,0,133,34,56,176,1,96,173,65
    ,3
160 DATA201,2,176,248,201,1,208,7,173,64,3,201,64,176,2
    37,173
170 DATA66,3,201,200,176,230,169,0,141,63,3,133,254,173
    ,64,3
180 DATA41,248,141,60,3,173,66,3,41,7,24,109,60,3,141,6
    0
190 DATA3,173,65,3,105,0,141,61,3,173,66,3,41,248,133,2
    53
200 DATA160,5,10,46,63,3,136,208,249,141,62,3,165,253,1
    60,3
210 DATA10,38,254,136,208,250,24,109,62,3,133,253,165,2
    54,109,63
220 DATA3,133,254,24,165,253,109,60,3,133,253,165,254,1
    09,61,3
230 DATA24,105,32,56,133,254,173,64,3,41,7,24,101,34,17
    0,189
240 DATA0,192,133,35,160,0,177,253,166,34,224,32,240,5,
    5,35
250 DATA145,253,96,37,35,145,253,96,162,0,169,38,157,0,
    4,157
260 DATA0,5,157,0,6,157,0,7,169,1,157,0,216,157,0,217
270 DATA157,0,218,157,233,218,232,208,225,169,63,133,16
    7,169,0,133
280 DATA166,168,145,166,136,192,0,208,249,198,167,166,1
    67,224,31,208
290 DATA241,173,17,208,9,32,141,17,208,173,24,208,9,8,1
    41,24
300 DATA208,96
309 REM MOVE CURSOR ROUTINE
310 FORT=49488TO49619:READD:POKET,D:NEXT
320 DATA230,63,165,63,197,36,208,123,169,0,133,63,173,0
    ,220
330 DATA41,1,208,10,173,1,208,201,40,240,3,206,1,208,17
    3,0
340 DATA220,41,2,208,10,173,1,208,201,239,240,3,238,1,2
    08,173
350 DATA0,220,41,8,208,32,173,16,208,201,1,208,7,173,0,
    208
360 DATA201,62,240,18,238,0,208,238,0,208,173,0,208,201
    ,0,208
370 DATA5,169,1,141,16,208,173,0,220,41,4,208,20,173,16
    ,208
380 DATA201,0,208,7,173,0,208,201,0,240,6,206,0,208,206
    ,0
390 DATA208,173,16,208,201,1,208,12,173,0,208,201,254,2
    08,5,169
400 DATA0,141,16,208,96
409 REM DRAW ROUTINE
410 FORT=49920TO49996:READD:POKET,D:NEXT
420 DATA173,16,208,141,65,3,173,0,208,141,64,3,173,1,20
    8
430 DATA56,233,40,141,66,3,173,0,220,41,16,208,48,165,1
    65,201
440 DATA0,208,9,32,61,192,206,66,3,32,61,192,165,165,20
    1,1
450 DATA208,3,32,40,192,165,165,201,2,208,6,32,61,192,3
    2,47
460 DATA192,165,165,201,3,208,6,32,61,192,32,54,192,96
469 REM READ COMMAND KEYS/ POKE COLOR MAP ROUTINES
470 FORT=50176TO50564:READD:POKET,D:NEXT
480 DATA169,8,133,37,32,159,255,32,228,255,201,133,208,
    12,230
490 DATA168,166,168,224,16,208,4,162,0,134,168,166,168,
    142,37,208
500 DATA201,134,208,12,198,165,166,165,224,255,208,4,16
    2,3,134,165
510 DATA201,135,208,15,238,32,208,174,32,208,224,16,208
    ,5,162,0
520 DATA142,32,208,201,136,208,15,238,33,208,174,33,208
    ,224,16,208
530 DATA5,162,0,142,33,208,201,49,208,4,162,5,134,36,20
    1,50
540 DATA208,4,162,10,134,36,201,51,208,4,162,16,134,36,
    201,52
550 DATA208,4,162,21,134,36,201,53,208,4,162,32,134,36,
    201,54
560 DATA208,4,162,48,134,36,201,55,208,4,162,64,134,36,
    201,56
570 DATA208,4,162,112,134,36,201,57,208,4,162,255,134,3
    6,201,147
580 DATA208,3,32,8,193,201,137,208,3,32,0,202,201,138,2
    08,3
590 DATA32,0,201,201,45,208,5,162,0,142,21,208,201,43,2
    08,5
600 DATA162,3,142,21,208,201,139,208,7,162,1,134,37,32,
    0,202
610 DATA201,140,208,7,162,1,134,37,32,0,201,201,169,208
    ,12,174
620 DATA33,208,142,254,207,174,32,208,142,255,207,201,9
    2,208,12,174
630 DATA254,207,142,33,208,174,255,207,142,32,208,133,3
    9,96,2,0
640 DATA0,173,0,220,41,16,208,125,32,21,195,165,254,41,
    7,170
650 DATA165,254,74,74,74,133,167,165,253,74,74,74,133,1
    66,224,0
660 DATA240,15,202,24,165,166,105,32,133,166,144,242,23
    0,167,56,176
```

More →

Listing continued.

```
670 DATA237,160,0,165,165,201,3,208,16,177,166,41,15,10
    6,106,106
680 DATA106,5,168,42,42,42,42,145,166,165,165,201,2,208
    ,8,177
690 DATA166,41,240,5,168,145,166,165,165,201,1,208,40,2
    4,165,167
700 DATA105,212,133,167,165,253,41,1,176,11,177,166,41,
    240,5,168
710 DATA145,166,56,176,16,177,166,41,15,106,106,106,106
    ,5,168,42
720 DATA42,42,42,145,166,96
729 REM DISPLAY DRAW MODE ROUTINE
730 FORT=50688TO50806:READD:POKET,D:NEXT
740 DATA165,165,201,3,208,25,169,171,141,201,3,141,204,
    3,141
750 DATA210,3,141,213,3,169,191,141,216,3,141,198,3,141
    ,207,3
760 DATA201,2,208,27,169,191,141,198,3,141,207,3,141,21
    6,3,169
770 DATA171,141,201,3,141,204,3,169,186,141,210,3,141,2
    13,3,201
780 DATA1,208,23,169,171,141,198,3,141,201,3,141,204,3,
    141,207
790 DATA3,141,210,3,141,213,3,141,216,3,201,0,208,25,16
    9,191
800 DATA141,198,3,141,207,3,141,216,3,169,186,141,201,3
    ,141,210
810 DATA3,141,204,3,141,213,3,96
819 REM SINGLE/ DOUBLE CURSOR ROUTINE
820 FORT=50944TO51010:READD:POKET,D:NEXT
830 DATA165,39,201,42,208,15,166,38,240,7,162,0,134,38,
    56
840 DATA176,4,162,1,134,38,166,38,224,1,208,25,206,66,3
    ,32
850 DATA0,197,162,140,142,211,3,142,214,3,162,136,142,2
    17,3,142
860 DATA220,3,56,176,14,162,128,142,211,3,142,214,3,142
    ,217,3
870 DATA142,220,3,96
879 REM LOAD ROUTINE
880 FORT=51456TO51567:READD:POKET,D:NEXT
890 DATA32,0,206,165,165,141,253,207,169,27,141,17,208,
    169,21
900 DATA141,24,208,173,33,208,141,69,63,173,32,208,141,
    70,63,169
910 DATA0,141,21,208,169,6,141,33,208,160,0,185,0,204,3
    2,210
920 DATA255,200,192,40,208,245,165,37,201,1,208,13,160,
    0,185,40
930 DATA204,32,210,255,200,192,20,208,245,32,0,205,169,
    0,32,213
940 DATA255,173,69,63,141,33,208,173,70,63,141,32,208,1
    69,3,141
950 DATA21,208,32,32,193,32,80,206,32,160,207,173,253,2
    07,133,165
960 DATA96
969 REM SAVE ROUTINE
970 FORT=51712TO51834:READD:POKET,D:NEXT
980 DATA32,0,206,165,165,141,253,207,169,27,141,17,208,
    169,21
990 DATA141,24,208,173,33,208,141,69,63,173,32,208,141,
    70,63,169
1000 DATA0,141,21,208,169,6,141,33,208,160,0,185,0,204,
    32,210
1010 DATA255,200,192,20,208,245,165,37,201,1,208,13,160
    ,0,185,40
1020 DATA204,32,210,255,200,192,20,208,245,32,0,205,169
    ,17,32,210
1030 DATA255,169,0,133,61,169,32,133,62,162,0,160,72,16
    9,61,32
1040 DATA216,255,173,69,63,141,33,208,169,3,141,21,208,
    32,32,193
1050 DATA32,80,206,32,160,207,173,253,207,133,165,96
1059 REM INITIALIZATION
1060 FORT=51968TO52078:READD:POKET,D:NEXT
1070 DATA32,231,192,169,3,141,21,208,169,1,141,39,208,1
    69,160
1080 DATA141,0,208,141,1,208,169,0,141,33,208,169,1,141
    ,29,208
1090 DATA173,22,208,9,16,141,22,208,169,3,133,165,169,3
    ,141,28
1100 DATA208,169,32,133,36,141,2,208,169,58,141,3,208,1
    69,6,133
1110 DATA167,169,108,133,166,169,38,133,170,169,1,133,1
    71,169,1,133
1120 DATA168,169,1,141,40,208,169,0,133,38,141,37,208,1
    69,6,141
1130 DATA32,208,32,160,207,169,14,141,248,7,169,15,141,
    249,7,96
1149 REM DATA FOR SAVE/LOAD PROMPT
1150 FORT=52224TO52431:POKET,0:NEXT
1160 FORT=52224TO52283:READA:POKET,A:NEXT
1170 DATA147,5,17,17,18,29,29,68,73,83,75,32,83,65,86
1180 DATA69,32,32,146,58,32,13,145,29,29,29,29,29,29,29
    ,18
1190 DATA76,79,65,68,29,29,29,29,146,19,17,17,18,29,29,
    84
1200 DATA65,80,69,29,29,29,29,29,29,29,29,29,29,146
1210 POKE52329,12:POKE52332,8:POKE52338,8:POKE52341,12
```

More

Listing continued.

```
1219 REM SPRITE DATA
1220 FORT=52371TO52397:READA:POKET,A:NEXT
1230 DATA170,140,85,191,140,85,171,136,85,171,136,85
1240 DATA191,128,85,171,128,85,171,128,85,191,128,85,17
     0,128,85
1249 REM NAME INPUT ROUTINE FOR SAVE/LOAD
1250 FORT=52480TO52619:READA:POKET,A:NEXT
1260 DATA162,0,160,0,232,224,255,208,251,200,192,16,208
     ,246,32
1270 DATA159,255,32,228,255,201,32,144,7,201,96,176,3,3
     2,210,255
1280 DATA201,20,208,3,32,210,255,166,211,224,31,208,4,1
     60,30,132
1290 DATA211,224,14,208,4,160,15,132,211,201,13,208,3,5
     6,176,3
1300 DATA56,176,190,169,1,166,37,160,1,32,186,255,162,1
     12,160,254
1310 DATA202,200,189,0,4,201,32,240,247,132,65,169,16,5
     6,229,65
1320 DATA168,162,0,24,189,94,4,201,47,176,10,201,32,176
     ,6,24
1330 DATA105,64,157,94,4,232,224,17,208,233,152,162,95,
     160,4,32
1340 DATA189,255,169,13,32,210,255,169,192,32,144,255,9
     6
1349 REM TRANSFER MEMORY TO SAVE AREA ROUTINE
1350 FORT=52736TO52791:READA:POKET,A:NEXT
1360 DATA162,0,189,0,216,157,0,64,189,0,217,157,0,65,18
     9
1370 DATA0,218,157,0,66,189,0,219,157,0,67,189,0,4,157,
     0
1380 DATA68,189,0,5,157,0,69,189,0,6,157,0,70,189,0,7
1390 DATA157,0,71,232,224,0,208,203,96
1399 REM TRANSFER MEMORY FROM SAVE AREA ROUTINE
1400 FORT=52816TO52871:READA:POKET,A:NEXT
1410 DATA162,0,189,0,64,157,0,216,189,0,65,157,0,217,18
     9
1420 DATA0,66,157,0,218,189,0,67,157,0,219,189,0,68,157
     ,0
1430 DATA4,189,0,69,157,0,5,189,0,70,157,0,6,189,0,71
1440 DATA157,0,7,232,224,0,208,203,96
1449 REM LOOP CALLING SUBROUTINES
1450 FORT=52992TO53015:READA:POKET,A:NEXT
1460 DATA32,0,203,32,80,193,32,0,195,32,0,196,32,0,197
1470 DATA32,0,198,32,0,199,76,3,207
1479 REM TRANSFER SPRITE DATA TO CASSETTE BUFFER ROUTIN
     E
1480 FORT=53152TO53163:READA:POKET,A:NEXT
1490 DATA160,128,185,79,204,153,127,3,136,208,247,96
1500 POKE2049,0:POKE2050,0:SYS52992
```

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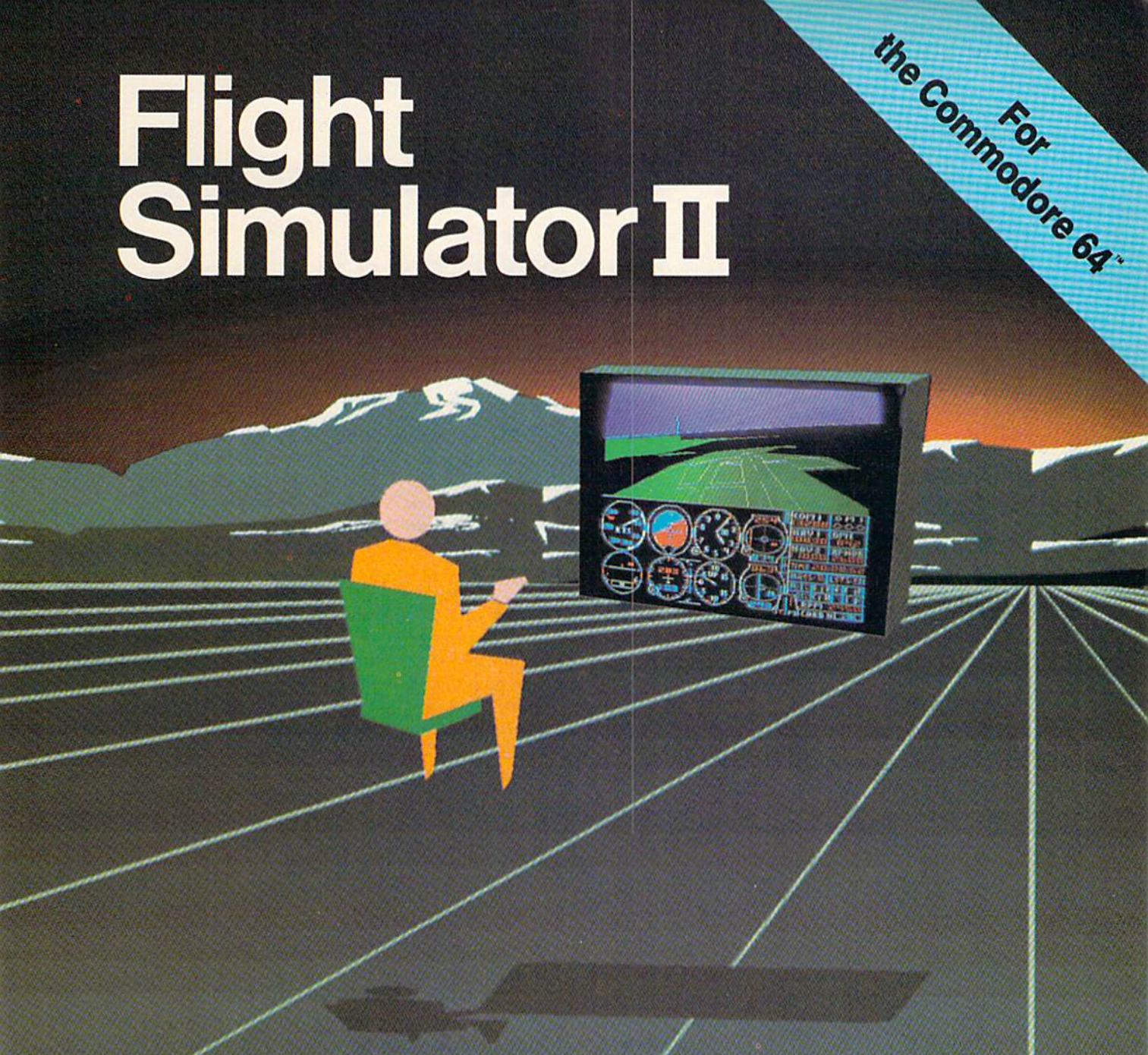

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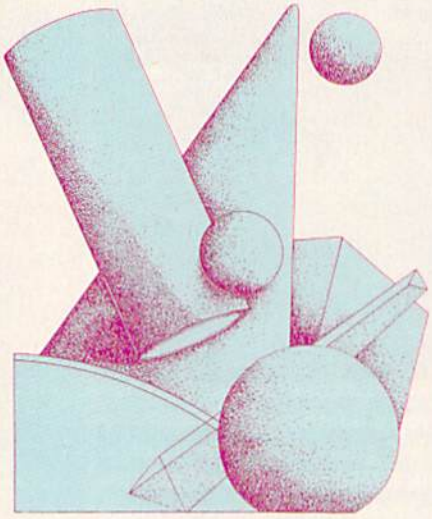
By Terence Bryner



RUN It Right

VIC-20
3K, 8K or 16K expansion
printer desirable
joystick optional

Address author correspondence to Terence Bryner, 15 Crane Road, Groton, CT 06340.

How would you like to see your flights of fancy in high-resolution, color graphics on your VIC, without a lot of planning or bother? If you have 3, 8 or 16K memory expansion, you can doodle to your heart's content with this program, which runs with keyboard or joystick; use a printer, too, to preserve your finest efforts for posterity.

To use the program, type in Listing 1 and save it. Table 1 is a summary of directions. If your VIC has only the 3K memory expansion, simply load and run the program; the operating system will start it at 1024, and the program protects the high-resolution graphics screen.

If you have more memory, type in the command line at the top of Table 1 *before* loading the program. This causes the operating system to load it beginning at 8192, above high-resolution screen memory.

The program first asks whether you prefer keyboard or joystick control. After you hit J or K, the display goes mushy while the screen is reconfigured to 20 characters by 22 lines, and a flashing black dot appears in a white screen with a black border.

The border color is a key to the doodling mode—black is Draw. If you manipulate the joystick, or press a movement key (see Table 1), a dot will appear on the screen. If you hold the joystick in one direction or repeatedly press the movement keys, you'll leave a trail of black dots.

The left-arrow key, or the joystick's fire button, shifts you to the Erase mode, where the border is white and the trail of dots, becoming one with the background color, are invisible; use this mode to correct mistakes. If you hit the left-arrow key or the fire button again, you'll return to Draw mode. And that's how you doodle.

Several enhancements are provided. Press the f1 key and your flashing dot disappears. Press it again and it reappears, red. You can change it to five other colors and back to black (you'll see that the first color was really white).

The background color can be changed to any one of sixteen by hitting the f3 key. The f6 key stops the program and returns the screen to normal.

The f5 key causes the program to enter or leave Text mode. In this mode, the border is yellow and a 20-character banner (initially blank) moves across the top of the screen. If you strike a key while you're in this mode, the letter appears in the upper right-hand corner, pushing everything else to the left; you can use this to title your masterpieces. The f6 key still stops the program, and f5 returns you to the Draw/Erase mode.

If you have a 1515 or 1525 printer, you can save your creations by hitting f2 for a large (8-inches high) picture, or f4 for a smaller one.

A Compact Program

The program is short, in order to fit any memory expansion. Screen memory starts at 7680 for any memory configuration. The high-resolution graphics characters start at 4096 and continue to 7615 (this is why an expansion is necessary—there's no room left for the program).

Table 2 is a listing, by lines, of what each part of the program does. A few comments on specific techniques and variables may assist your understanding.

The screen is set up in 11 rows of 20 double-height characters. Screen memory contains numbers 0 thru 219, and character memory is set to start at 4096. This, along with clearing the screen and initializing variables, is done in lines 65–68.

Now a change to the bits in high-resolution character memory is reflected on the screen. X and Y contain the present

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Before loading with 8K or larger memory expansion, type in:

POKE 44,32: POKE 642,32: POKE 8192,0: NEW{RETURN}

Joystick	Keyboard	Result
↖ ↑ ↗	U I O	
←push→	J L	movement
↙ ↓ ↘	M , .	
firebutton	←	shift from Erase to Draw mode and back
	£	clear screen
	f1	cycle character color
	f2	print screen (large)
	f3	cycle background color
	f4	print screen (small)
	f5	shift graphics to Text mode and back
	f6	stop program

Table 1. Instructions for use.

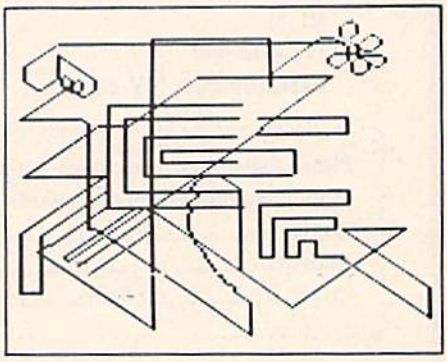
Table 2. Program description of VIC Artist.

Line #	Function
1–2	Lower top of memory for 3K expansion; skip to main routine
5–14	Get keyboard or joystick input; decode into KI
5–7	Get and decode function keys; if no input, check joystick
8	Skips to keyboard section if not using joystick
9–10	Read joystick and fire button, decode, return
11–12	Loop back to read joystick, if in use
13–14	Decode movement key
20–21	Dimension array to read joystick, initialize
25–30	Basic loop; get input, execute it
25	Gets next instruction, brings back in KI
26	Cycles next entry in array B—causes flashing
30	Decision on how to handle input—0 indicates no input, so return to 25
31–43	Handle movement instructions
31–38	Change X,Y to point to next location on screen; ensure it *is* in range 0–159, 0–175
39	Stores B(0) in old location, calculates new character CO, stores present character color there
40	Calculates address BY of new location and determines which BI bit
41	Starts setup of array B—element 1 has word with bit BI off, 2 has word with bit on
42	B(0) will hold final value—bit BI on for Draw mode, off for Erase mode
44	Cycles character color, changes in present location
45–49	Print screen section
45	Sets print flag to large and skips to it
46	Sets print flag to small
47	Realigns data direction register if using joystick
48	Prints to the screen; realigns DDR if using joystick
50–51	Cycle from Draw to Erase or vice-versa
50	Flips border color, Erase-Draw flag and true setting of present bit
51	Changes border color, indicating new mode
52	Cycles to next background color
53	Goes and clears screen (using part of initialization)
54–56	Text mode section
54	Saves border, sets border yellow and fixes DDR if using joystick

Table 2 continued.

position of the pen (flashing dot). BY is the address of the word in memory that contains that point, and BI is a pointer to the individual bit. CO is the character position used to set pen color on the screen. The array B contains the true value of the word at BY, a copy of the word with bit BI turned off and another copy with bit BI turned on. The point of interest flashes as the program, while waiting for input, cycles through the different values in B.

ED% is the variable that determines the Draw or Erase mode; C8 is the border-color variable, and contains the opposite of ED% (except in Text mode). C5 is the screen (background) color. C0 is the pen color—be aware



that the color control on the VIC is done in blocks of 8 × 16 dots, and the whole block changes color at once. The program spends most of its time in the loop from 25–30, waiting for input and flashing the dot.

One technique I've used extensively is multiplying by logical expressions. An expression, such as Y>0, has the mathematical value −1 if it's true, 0 if false. So line 31 places the value "one less than the present value of Y" into Y, if the present value of Y is greater than 0 (the preceding minus sign cancels the −1 of a true expression). If Y is zero, then the expression is false and its value 0; this effectively places a lower limit of zero on Y.

The following line:

```
Y=Y-1:IFY<0THENY=0:GOTO39
```

does *not* do the same thing. The GOTO at the end is only executed if the value of Y is initially less than one. Much more compact code can be written using this method.

Screen Printing

In printing the screen, I used an unusual technique, too. It is fairly direct for small copies obtained with the f4 key.

Lines 95–97 open a print file, set the

Graphics mode and step through each line. Variable I1 contains the value of the first dot in each line, from the top of a 0–175 screen. A3 is a variable that gives the height of the character minus one. Characters are seven dots high except for the bottom line, and for small pictures, LS% is zero, so line 96 is not yet significant.

Lines 93–94 step across each line and print the variable Y$. The last character in the line is again only partial, so line 94 uses A5 to limit the subroutine to the screen and pad out the character with two blanks (CHR$(128)).

Lines 86–88 build the array H for one column of the character— it contains 0 if the bit is off, 1 if it's on. The 6 × 7 characters that the graphics printer produces cross character boundaries in the 8 × 16 screen, so you must go through the computations in lines 87 and 88 each time you build the array, which slows down the program.

In line 89, the dots are summed, the mandatory 128 is added and a graphics character is added to Y$, which represents one column of the total 6 × 7 character. That is a workable, if not optimal, solution to drawing the high-resolution screen.

Table 2 continued.

55	Transfers to Text mode subroutine
56	Resets screen border; continues only if last character (BO) was not f6, else falls through
57–58	Restore screen, character set, DDR, clear, quit
60–64	Text mode—get character, put on screen
60	Gets character
61	Converts to ASCII value; quits if f5 or f6
62	Converts ASCII letters (lowercase) to screen codes (uppercase)
63	Slides 19 characters in top line one left
64	Copies desired character from ROM, adds color
65–68	Initialize variables, move screen, clear
79–84	Initialize program
79	Data for reading joystick
80–83	Select joystick or keyboard; align DDR if required
84	Reads joystick array; sets up keyboard array; goes to use section at 65 to initialize screen
86–97	Screen printing section
86–92	Subroutine loop to build Y$ representing one column of dots for character, starting at I2,I1
93–94	Subroutine loop to build row of characters, print
95–97	Basic loop to build whole screen, line at a time

This program is so easy to use that my six-year-old can also enjoy it.

However, a picture 176 dots high (on a printer that prints about 63 dots to the inch) is small. So I added the variable LS%, which causes each line of characters to be processed twice (accomplished in line 96) with LS% values of one and two.

Now, instead of line 89 building Y$, lines 90 and 91 do it. Line 90 builds the top half of a stretched character. For instance, if the top dot is on, then H(0) is 1, but instead of adding 2↑0 (or 1) to C, 3 is added (2↑0+2↑1). In other words, the first dot is stretched vertically over two dots.

Similarly, in the second half of the line, the created character is added twice to Y$, stretching it also horizontally. The second time the line is done, line 91 takes care of the bottom half. The result is a much larger copy, although the grain is not so fine.

This program is not only powerful, but it's easy to use. My six-year-old had no trouble enjoying the drawing part, and my eight-year-old likes the colors as well as the text at the top. They use the joystick, which is a bit faster, but I prefer the keyboard.

I did not add Multicolor mode, because I like the precision I can get now, but I could easily do it. Feel free to write me about that, or any other questions you might have concerning this program. I will provide you with a copy of the program if you'll send me a self-addressed stamped mailer, a cassette and $3. R

Listing of VIC Artist.

```
1 IFPEEK(44)=4THENPOKE56,16:POKE52,16:CLR
2 GOTO20
5 KI=0:GETIK$:IFIK$=""THEN11
6 FORI=10TO16:IFIK$=MID$(KK$,I,1)THENKI=I
7 NEXT:IFKI<>0THENRETURN
8 IFKJ=0THEN13
9 IK=188-((PEEK(37137)AND60)OR(PEEK(37152)AND128)):FORI
    =1TO9:IFIK(I)=IKTHENKI=I
10 NEXT:RETURN
11 IFKJ=1THEN9
12 RETURN
13 FORI=1TO9:IFIK$=MID$(KK$,I,1)THENKI=I
14 NEXT:RETURN
20 DIMIK(9)
21 GOSUB80
25 GOSUB5
26 IB=-(IB<2)*(IB+1):POKEBY,B(IB)
30 ONKI+1GOTO25,31,32,33,34,35,36,37,38,50,44,45,52,46,
    54,57,53
31 Y=-(Y-1)*(Y>0):GOTO39
32 Y=Y+1+(Y>174):GOTO39
33 X=-(X-1)*(X>0):GOTO39
34 X=X+1+(X>158):GOTO39
35 Y=-(Y-1)*(Y>0):X=-(X-1)*(X>0):GOTO39
36 Y=-(Y-1)*(Y>0):X=X+1+(X>158):GOTO39
37 Y=Y+1+(Y>174):X=-(X-1)*(X>0):GOTO39
38 Y=Y+1+(Y>174):X=X+1+(X>158)
39 POKEBY,B(0):CO=20*INT(Y/16)+INT(X/8):POKE38400+CO,C0
40 BY=4096+16*CO+Y-16*INT(Y/16):BI=7-(X-8*INT(X/8))
41 B(0)=PEEK(BY):B(2)=B(0)OR(2{UP ARROW}BI):B(1)=B(0)AN
    D(255-(2{UP ARROW}BI)):IB=1
42 B(0)=B(2):IFED%=0THENB(0)=B(1)
43 GOTO25
44 C0=-(C0+1)*(C0<7):POKE38400+CO,C0:GOTO25
45 LS%=1:GOTO47
46 LS%=0
47 IFKJ=1THENPOKE37139,128:POKE37154,255
48 GOSUB95:IFKJ=1THENPOKE37139,0:POKE37154,127
49 GOTO25
50 C8=ED%:ED%=1-ED%:B(0)=B(1):IFED%=1THENB(0)=B(2)
51 POKE36879,((PEEK(36879)AND248)ORC8):GOTO25
52 C5=-(C5+1)*(C5<15):POKE36879,((PEEK(36879)AND15)OR(1
    6*C5)):GOTO25
53 GOSUB65:GOTO25
54 C8=PEEK(36879):POKE36879,((C8AND248)OR7):IFKJ=1THENP
    OKE37154,255
55 GOSUB60:IFKJ=1THENPOKE37154,127
56 POKE36879,C8:C8=1-ED%:IFBO<>139THEN25
57 POKE36864,5:POKE36866,150:POKE36867,46:POKE36869,240
    :POKE36879,27
58 POKE37154,255:POKE37139,128:PRINT"{SHFT CLR}":END
60 GETX$:IFX$=""THEN60
61 BO=ASC(X$):IFBO=135ORBO=139THENRETURN
62 IFBO>64ANDBO<91THENBO=BO-64
63 FORI=0TO18:POKE38400+I,PEEK(38401+I):K=4096+16*I:FOR
    J=0TO7:POKE(K+J),PEEK(K+J+16)
64 NEXT:NEXT:K=32768+8*BO:FORI=0TO7:POKE4400+I,PEEK(K+I
    ):NEXT:POKE38419,C0:GOTO60
65 C8=0:C5=1:C0=0:POKE36864,7:POKE36866,148:POKE36867,2
    3:POKE36869,252
66 POKE36879,(8ORC8OR(16*C5)):B(0)=128:B(1)=0:B(2)=128:
    IB=0:ED%=1
67 FORI=0TO219:POKE7680+I,I:POKE38400+I,0:NEXT:FORI=409
    6TO7615:POKEI,0:NEXT
68 CO=110:BY=5856:BI=7:X=80:Y=80:POKE648,30:RETURN
79 DATA4,8,16,128,20,132,24,136,32
80 PRINT"{SHFT CLR}JOYSTICK(J) OR{8 SPACEs}KEYBOARD(K)?
    "
81 GETIK$:IFIK$=""THEN81
82 IFIK$<>"J"ANDIK$<>"K"THEN81
83 KJ=0:IFIK$="J"THENKJ=1:POKE37139,0:POKE37154,127
84 FORI=1TO9:READIK(I):NEXT:KK$="I,JLUOM.{LEFT ARROW}{F
    UNCT 1}{FUNCT 2}{FUNCT 3}{FUNCT 4}{FUNCT 5}{FUNCT
    6}{LB.}":GOSUB65:RETURN
86 FORI3=I2TOI2+A5:FORI5=0TO6:H(I5)=0:NEXT:FORI5=0TOA3:
    I4=I1+I5
87 B=16*(20*INT(I4/16)+INT(I3/8))+I4-16*INT(I4/16)
88 I=2{UP ARROW}(7-I3+8*INT(I3/8)):IF(PEEK(4096+B)ANDI)
    <>0THENH(I5)=1
89 NEXT:IFLS%=0THENC=0:FORI5=0TO6:C=C+H(I5)*(2{UP ARROW
    }I5):NEXT:Y$=Y$+CHR$(128+C)
90 IFLS%=1THENC=128+3*H(0)+12*H(1)+48*H(2)+64*H(3):Y$=Y
    $+CHR$(C)+CHR$(C)
91 IFLS%=2THENC=128+H(3)+6*H(4)+24*H(5)+96*H(6):Y$=Y$+C
    HR$(C)+CHR$(C)
92 NEXT:RETURN
93 A5=5:FORI2=0TO151STEP6:Y$="":GOSUB86:PRINT#1,Y$;:NEX
    T
94 A5=3:I2=156:Y$="":GOSUB86:Y$=Y$+CHR$(128)+CHR$(128):
    PRINT#1,Y$:RETURN
95 OPEN1,4:PRINT#1,CHR$(8):A3=6:FORI1=0TO169STEP7:GOSUB
    93
96 IFLS%=1THENLS%=2:GOSUB93:LS%=1
97 NEXT:A3=0:I1=175:GOSUB93:PRINT#1,CHR$(15):CLOSE1:RET
    URN
```

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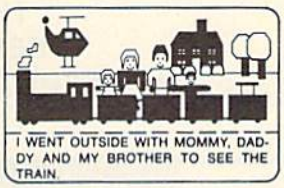

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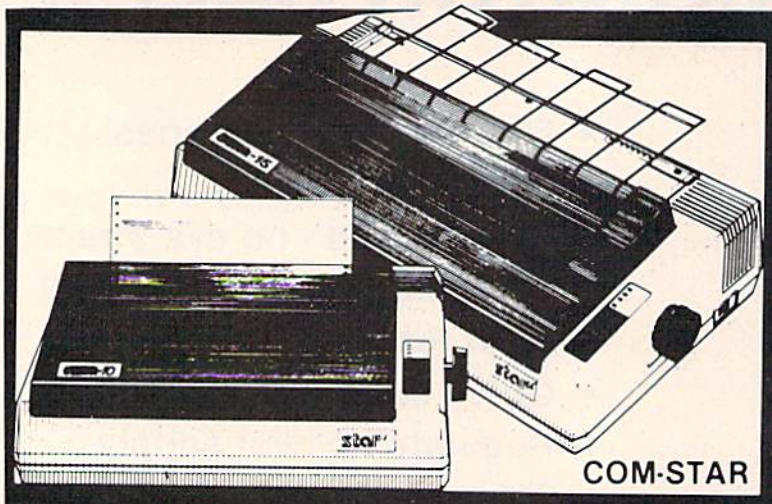

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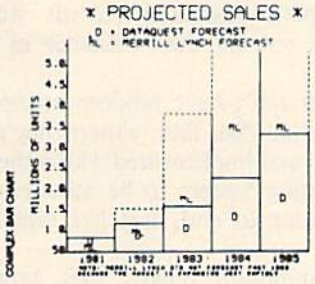

ACTUAL PRINT SAMPLES

UPPER CASE - ABCDEFGHIJKLMNOPQRSTUUWXYZ

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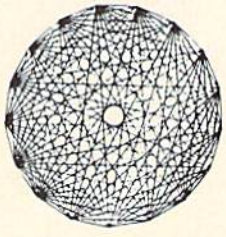

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Relatively Speaking

Part 3 of this continuing article on relative files takes a look at their use in situations where you really need the speed and convenience of random access to records.

By David R. Brooks

RUN It Right

Commodore 64
VIC-20 with 8K expansion
1541 disk drive

Address author correspondence to David R. Brooks, 805 Cockletown Road, Yorktown, VA 23692.

In Parts 1 and 2 of this article (which appeared in *RUN*'s April 1984 and May 1984 issues), I described a simple record-keeping program and tried to give you enough information about relative files so you could write your own programs.

In the last part of this series, I'm assuming that you understand how to read and write relative files, and that you may have used them in a program or two on your own.

Once you've become familiar with the structure and syntax of relative files, there's a lot to be said about their efficient use. It's not really worthwhile to use them in any application where a simpler sequential file structure will suffice, so let's examine their use in a situation that exploits the benefits of random access to records.

Consider the following two problems. First, you want to write a program to manage your bank account records. You have more than one account, and every month you get a bank statement for one or more of the accounts. You'd like to enter current information from the statements, and then you'd like to be able to look at past monthly records for one or more accounts, or get the current balance for all your accounts.

In the second instance, you'd like to write a program to store recipes. Then, if you want to cook chicken, you'd like to be able to pull out just the chicken recipes from your computerized file.

What do these two problems have in common? They both involve records stored under different categories. In the bank account example, the account number is a category, or keyword. In the recipe file, chicken is a keyword.

The question is: How can you locate all the records having the same keyword? Are they all together on the file? Not usually. Today you entered a chicken recipe, yesterday you entered a bread recipe and tomorrow you may enter a recipe for a pie. These three records will be adjacent on the file.

Can't you put them in order, alphabetically or otherwise? Yes, but alphabetizing large disk files (or sorting them in any other way) may be too slow for a practical solution. Can't you just search through the file for all the chicken recipes? Yes, and that is certainly the most obvious solution, but it, too, can be very slow, as you'll soon learn if you try it on your 1541 disk drive.

The whole point of random access is to have equally fast access to any record on the file, regardless of where it's physically located within the file. That won't work with taped-based files; they have to be read one record at a time, from where you are to where you want to be, and only in the forward direction. (Skipping unwanted records still involves reading their existence in some sense.)

You can't have random access with sequential disk files, either; they're designed and implemented within the Disk Operating System to be accessed from beginning to end, just like tape-based files.

Commodore relative files, however, provide you with a reasonable approximation to true random access: The time required to find any record on a file is very nearly independent of the location of that record.

You now only need a "trail" through the data file that would allow you to find the records you want by jumping from one location to another in the file, ignoring the records you don't want. By using the recipe-file problem, I'll illustrate how this can be achieved.

First, let's look at the data file. Each record will contain the keyword, all the corresponding information and an ad-

ditional value, the link, which tells where to look for the previous entry under that keyword.

Record #	Data (keyword, data..., location of previous entry)
1	...
2	chicken ...0
3	bread 0
4	...
5	chicken ...2
6	...
7	...
8	bread 3
9	...
10	chicken ...5
11	...
12	chicken ...10
13	...
14	bread 8
...	...

In this example, the last chicken entry is in record 12. This record includes the information that there is also a chicken recipe in record 10. Subsequently, you're led back to records 5 and 2. In record 2, the 0 for the location of the next entry indicates that there are no more chicken recipes. For bread, accessing record number 14 will lead to additional recipes in records 8 and 3.

How do you get started on this process; that is, how do you know where to look in the table for the last entry for a particular keyword? The solution to this problem is to create a second file, called the pointer file, which will contain the location of the most recent entry of every keyword in the data file. The pointer file might look like this:

Keyword	Last entry
...	
chicken	12
bread	14
...	

The pointer file tells you that the last chicken recipe is in record 12 of the data file and the last bread recipe is in record 14. Unlike the data file itself, the pointer file doesn't need to be a relative file. It will always be much smaller than the data file, so it can be stored on disk as a simple sequential file and read into memory when you run the program. While it's in memory, you can access it quickly to locate any keyword, change it when you add new keywords or new entries for old keywords and rewrite it to disk when you're done.

To summarize this concept, a linked list is defined as a data file that includes in each record a link to the location of a previous record with the same keyword, plus a separate pointer file that provides the initial link to every keyword represented on the data file. Such a file struc-

Listing of the Account Manager program.

```
100 REM PROGRAM NAME ACCOUNT MANAGER, DAVID R. BROOKS,
     DECEMBER, 1983
105 M$="{SHFT P}RESS ANY KEY TO CONTINUE, 'M' FOR MENU"

110 T0$="{4 SPACEs}*** {SHFT A}CCOUNT {SHFT M}ANAGER **
    *{4 SPACEs}"
115 R0=2:R3=1:TS=0:CH=0:C1=10
120 POKE53280,0:POKE53281,0:PRINTCHR$(14):AP$="ACCTPOIN
    TER":AF$="ACCTDATA"
125 DIM X2$(25),A1$(25),A2$(25),A3$(25)
130 OPEN1,8,15
135 SN=135:OPEN3,8,3,AP$+",S,R":GOSUB850
140 SN=140:INPUT#3,N2:GOSUB850
145 SN=145:FORI=1TON2:INPUT#3,X2$(I):GOSUB850:NEXT:CLOS
    E3
150 SN=150:OPEN2,8,2,AF$:GOSUB850
155 PRINTCHR$(147);CHR$(18);T0$;CHR$(146):PRINT:PRINT"{
    SHFT P}ROGRAM OPTIONS:":PRINT
160 PRINT"1 - {SHFT L}IST ALL RECORDS"
165 PRINT"2 - {SHFT A}DD NEW ACCOUNT"
170 PRINT"3 - {SHFT C}HANGE A RECORD"
175 PRINT"4 - {SHFT C}URRENT BALANCE, ALL ACCOUNTS"
180 PRINT"5 - {SHFT L}IST ALL RECORDS FOR GIVEN ACCOUNT
    "
185 PRINT"6 - {SHFT A}DD NEW RECORDS TO EXISTING ACCOUN
    T"
190 PRINT"7 - {SHFT S}PARE FOR FUTURE USE"
195 PRINT"8 - {SHFT E}ND PROGRAM"
200 PRINT:INPUT"{SHFT W}HICH OPTION (1-8)";J$
205 J=VAL(J$)
210 IFJ<1 OR J>8 THENPRINT"{SHFT O}PTION ERROR. {SHFT T
    }RY AGAIN.":GOTO200
215 IFJ=8THEN835
220 GOSUB890:PRINTM$:REM LIST POINTER FILE
225 GETZ$:IFZ$=""THEN225
230 IFZ$="M"THEN155
235 ONJGOTO245,285,415,515,620,625,815
240 STOP
245 PRINTCHR$(147);"{SHFT P}RINT ALL RECORDS":REM******
    ****************************
250 GOSUB930:REM READ DATA FILE COUNTER N
255 FORI=2TON+1
260 R1=I:GOSUB1305:REM READ AND DECODE RECORD AT R1
265 II=I-1:GOSUB945:REM DISPLAY RECORD, RETURN VALUE OF
     Z$
270 IFZ$="M"THEN155
275 NEXT
280 GOTO155
285 PRINTCHR$(147);"{SHFT A}DD A NEW ACCOUNT":PRINT:REM
    ****************************
290 GOSUB930:REM READ DATA FILE COUNTER
295 GOSUB1060:REM INPUT NEW DATA RECORD, RETURN TS
300 REM CHECK FOR MATCH WITH EXISTING ACCT #
305 IFTS<>1THEN320
310 TS=0
315 PRINT"{SHFT N}EW ACCT. # ALREADY EXISTS. {SHFT R}ET
    URN TO MENU":FORI=1TO1500:NEXT:GOTO155
320 E$="{2 SPACEs}0":TE$="{2 SPACEs}1"
325 II=N+1:GOSUB945:REM DISPLAY NEW RECORD, ENTRY POINT
     FROM OPTION 6, LINE 780
330 PRINT"{SHFT S}AVE ON DISK (Y/N)?"
335 GETZ$:IFZ$=""THEN335
340 IFZ$="Y"THEN370
345 PRINT"{SHFT T}RY AGAIN (Y) OR MENU(M)"
350 GETZ$:IFZ$=""THEN350
355 IFZ$<>"Y"THEN155
360 IFJ=6THEN625
365 GOTO295
370 R1=N+2:N=N+1:GOSUB1215:REM ENCODE AND WRITE DATA RE
    CORD
```

More

Listing continued.

```
375 SN=375:R1=1:GOSUB870:PRINT#2,N:GOSUB850:REM UPDATE
     RECORD COUNTER
380 IFJ=6GOTO785
385 N2=N2+1:X2$(N2)=LEFT$(A$+"{10 SPACEs}",C1)+RIGHT$("
     {3 SPACEs}"+STR$(N+1),3)+TE$
390 PRINT"{SHFT M}ORE NEW ACCOUNTS (Y/N)?"
395 GETZ$:IFZ$=""THEN395
400 IFZ$="Y"THEN295
405 CH=1:REM SET FLAG TO WRITE NEW POINTER FILE
410 GOTO155
415 PRINTCHR$(147);"{SHFT C}HANGE A RECORD":PRINT:REM**
     ****************************
420 GOSUB930:REM READ CURRENT COUNTER
425 INPUT"{SHFT W}HICH RECORD TO CHANGE";WH$:WH=VAL(WH$
     )
430 IFWH>NORWH<1THENPRINT"{SHFT R}ECORD DOESN'T EXIST.
     {SHFT T}RY AGAIN.":GOTO425
435 R1=WH+1:GOSUB1305:REM READ AND DECODE
440 II=WH:GOSUB945:REM DISPLAY CURRENT RECORD
445 IFZ$="M"THEN155
450 GOSUB1060:REM INPUT NEW RECORD
455 GOSUB945:REM DISPLAY NEW RECORD
460 PRINT"{SHFT S}AVE THIS RECORD ON DISK (Y/N)?"
465 GETZ$:IFZ$=""THEN465
470 IFZ$="Y"THEN490
475 PRINT"{SHFT T}RY AGAIN (Y) OR MENU(M)"
480 IFZ$<>"Y"THEN155
485 GOTO450
490 GOSUB1215:REM ENCODE AND WRITE NEW RECORD AT R1
495 PRINT"{SHFT M}ORE RECORDS TO CHANGE (Y/N)?"
500 GETZ$:IFZ$=""THEN500
505 IFZ$="Y"THEN425
510 GOTO155
515 PRINTCHR$(147);"{SHFT L}IST OF CURRENT ACCOUNT BALA
     NCES":PRINT:REM***************
520 PRINT"{SHFT A}CCOUNT #{7 SPACEs}{SHFT B}ALANCE{2 SP
     ACEs}{SHFT D}ATE":TT=0
525 PRINT"--------------------------------"
530 FORI=1TON2:REM STEP THROUGH POINTER FILE
535 R1=VAL(MID$(X2$(I),C1+1,3)):REM LOCATE CURRENT ENTR
     Y
540 GOSUB1305:REM READ AND DECODE RECORD AT R1
545 A1$(I)=A$:A2$(I)=B$:A3$(I)=D1$
550 PRINTA$;TAB(15);B$;TAB(25);D1$
555 TT=TT+VAL(B$):NEXT
560 PRINT"--------------------------------"
565 PRINTTAB(9);"{SHFT T}OTAL";RIGHT$("{9 SPACEs}"+STR$
     (TT),9)
570 PRINT"{SHFT P}RESS P TO SEND TO PRINTER FIRST, ANY
     OTHER KEY TO RETURN TO MENU."
575 GETZ$:IFZ$=""THEN575
580 IFZ$<>"P"THEN155
585 OPEN4,4:PRINT#4,"ACCOUNT #{11 SPACEs}BALANCE{2 SPAC
     Es}DATE"
590 PRINT#4,"-------------------------------------"
595 FORI=1TON2:PRINT#4,A1$(I);CHR$(9);A2$(I);CHR$(9);A3
     $(I):NEXT
600 PRINT#4,"-------------------------------------"
605 PRINT#4,CHR$(9);"TOTAL";CHR$(9);RIGHT$("{9 SPACEs}"
     +STR$(TT),9)
610 PRINT#4:CLOSE4
615 GOTO155
620 PRINT"{SHFT L}IST ALL RECORDS FOR A GIVEN ACCOUNT":
     PRINT:REM*********************
625 INPUT"{SHFT W}HICH ACCOUNT";A$:REM ENTRY POINT FOR
     OPTION 6, SEE LINE 730
630 A$=LEFT$(A$+"{10 SPACEs}",C1)
635 FORI=1TON2:REM LOCATE CURRENT ENTRY
640 IFA$=LEFT$(X2$(I),C1)ANDJ=6THEN740
645 IFA$=LEFT$(X2$(I),C1)THEN675
650 NEXT
```

More

ture is perfect for account-managing programs.

For the bank account problem, the account numbers are the keywords on the pointer file. If you enter records in the natural way, from monthly statements, you'll create a file in chronological order. The pointer file will always tell you the location of the most recent record for each account, and the order in which you follow a particular account through the file will be backwards in time.

Writing the Program

Although the linked-list concept is easy to grasp (I hope!), it can be tricky to implement. There are several programming details that must be taken care of in the proper sequence and two disk files to manage. The resulting Basic programs will be slower than corresponding machine language programs.

Is it worth it? I find the speed acceptable for my needs. The disk operations themselves take up a substantial portion of the waiting time in the program, and the time required for these operations is basically what governs the overall program performance. Also, I like the ease with which such programs can be changed to suit my own needs.

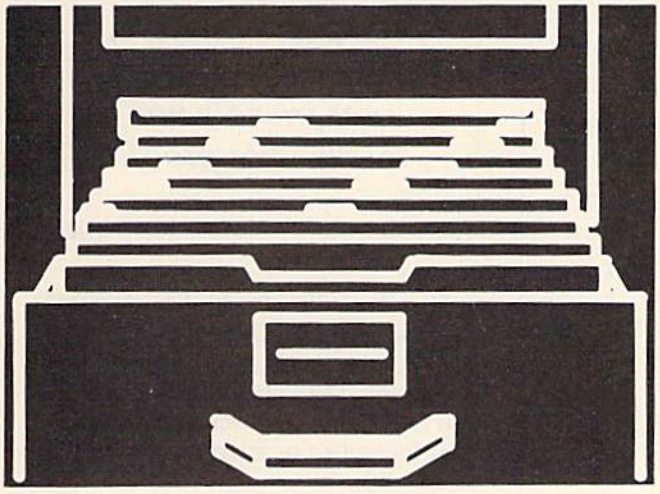
So, if you appreciate some independence from commercial software, you want a customized and flexible program, or you just enjoy programming, then, yes, it's worth it.

A note of caution: If you've done a lot of programming in Basic, you probably write simple programs at the keyboard without planning or writing them down ahead of time because it's easy to fix things as you go along. This approach doesn't work as well with disk files since successful disk operations and recovery from errors take quite a bit of time during program development.

Considering this and the relative logical complexity of record-managing programs, I strongly recommend that you outline everything ahead of time on paper. I've tried to modularize the program in this article, using subroutines as much as possible, to make it easier for you to adapt it to your own needs. There are four major sections:

- Initialization—define variables, dimension arrays, open files, read pointer file into memory
- Menu—define and select program options
- Options—provide a separate area of the program for each menu option
- Subroutines—perform the operations needed for more than one option

Software that has the Edge.



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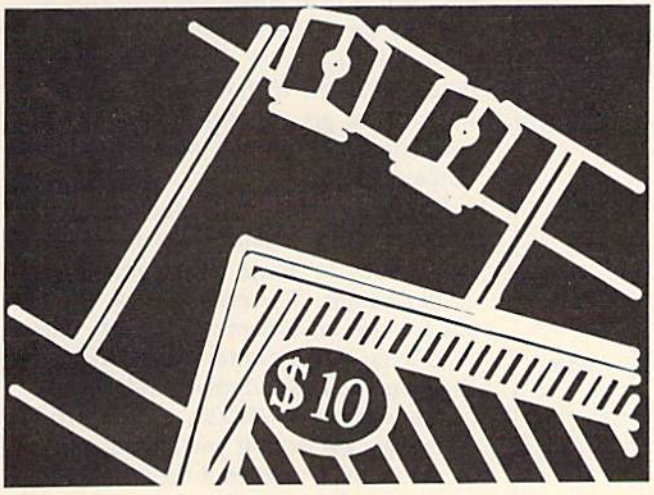

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Listing continued.

```
655 PRINT"{SHFT A}CCOUNT DOESN'T EXIST. {SHFT T}RY AGAI
    N (Y) OR MENU (M)."
660 GETZ$:IFZ$=""THEN660
665 IFZ$="Y"THEN625
670 GOTO155
675 R1=VAL(MID$(X2$(I),C1+1,3))
680 GOSUB1305:REM READ AND DECODE RECORD AT R1
685 II=R1-1:GOSUB945:REM DISPLAY RECORD
690 IFZ$="M"THEN155
695 R1=VAL(E$)
700 IFR1<>0THEN680
705 PRINT"{SHFT L}AST ENTRY FOR ACCT # ";A$:PRINT"{SHFT
    D}O ANOTHER ACCOUNT (Y) OR MENU (M)"
710 GETZ$:IFZ$=""THEN710
715 IFZ$="Y"THENFORI=1TON2:PRINTLEFT$(X2$(I),C1):NEXT:G
    OTO625
720 GOTO155
725 REM ADD NEW RECORDS TO AN EXISTING ACCOUNT ********
    ************************
730 REM ENTER AT 625 TO USE EXISTING CODE TO LOCATE CUR
    RENT ENTRY
735 REM RETURN HERE IF REQUESTED ACCOUNT EXISTS
740 R1=VAL(MID$(X2$(I),C1+1,3)):TE$=RIGHT$(X2$(I),3)
745 GOSUB1305:REM READ AND DECODE CURRENT ENTRY
750 II=R1-1:GOSUB945:REM DISPLAY CURRENT ENTRY
755 IFZ$="M" THEN155
756 E$=RIGHT$("{3 SPACEs}"+STR$(R1),3)
757 TE$=RIGHT$("{3 SPACEs}"+STR$(VAL(TE$)+1),3)
760 E$=RIGHT$("{3 SPACEs}"+STR$(R1),3)
765 TE$=RIGHT$("{3 SPACEs}"+STR$(VAL(TE$)+1),3)
770 GOSUB930:REM READ DATA FILE COUNTER
775 GOSUB1060:REM INPUT NEW RECORD
780 GOTO325:REM USE EXISTING CODE FOR WRITING RECORD
785 X2$(I)=LEFT$(A$+"{10 SPACEs}",C1)+RIGHT$("{3 SPACEs
    }"+STR$(N+1),3)+TE$
790 PRINT"{SHFT M}ORE ACCOUNT UPDATES (Y/N)?"
795 GETZ$:IFZ$=""THEN795
800 IFZ$="Y"THEN625
805 CH=1:REM SET FLAG TO UPDATE POINTER FILE
810 GOTO155
815 PRINTCHR$(147);"{SHFT N}OT IMPLEMENTED - AVAILABLE
    FOR FUTURE USE.":REM**********
820 PRINT"{SHFT P}RESS ANY KEY TO RETURN TO MENU"
825 GETZ$:IFZ$=""THEN825
830 GOTO155
835 REM END PROGRAM ***********************************
    ************************
840 IFCH=1THENGOSUB1030
845 CLOSE2:CLOSE1:END
850 REM DISK ERROR CHECKING ***********
855 INPUT#1,ER,ER$,E1,E2:IFER<20ORER=50THENRETURN
860 PRINT"DISK ERROR FROM STATEMENT ";SN:PRINTER;ER$:CL
    OSE2:CLOSE1:STOP
865 RETURN
870 REM POSITION POINTER **************
871 REM CHANNEL=R0, RECORD=R1, BYTE=R3
875 RH=0:RL=R1:IFR1>255THENRH=INT(R1/256):RL=R1-256*RH
880 PRINT#1,"P"CHR$(R0)CHR$(RL)CHR$(RH)CHR$(R3):GOSUB85
    0
885 RETURN
890 REM LIST POINTER FILE **************
895 PRINT:PRINT"{SHFT P}OINTER FILE HAS ";N2;" ENTRIES.
    "
900 PRINT"{11 SPACEs}{SHFT D}ATA"
905 PRINT"{11 SPACEs}REC. {SHFT T}OTAL"
910 PRINT"{SHFT A}CCT #{7 SPACEs}#{2 SPACEs}ENTRIES"
915 FORI=1TON2:PRINTLEFT$(X2$(I),C1);"{2 SPACEs}";
920 PRINTSTR$(VAL(MID$(X2$(I),C1+1,3))-1);"{2 SPACEs}";
    RIGHT$(X2$(I),3):NEXT
925 RETURN
930 REM READ DATA FILE COUNTER *********
935 R1=1:SN=935:GOSUB870:INPUT#2,N:GOSUB850
```

More

The program expects you to respond intelligently and accurately to its prompts. Therefore, it's neither totally user-friendly nor totally idiot-proof.

The data file should be initialized with my program, Open Rel File, from Part 1 of this article, with records of 181 characters. The details of what will go into the records are given in the subroutines for writing or interpreting a record on the disk.

For this program, I wrote the menu first, so as to formalize the list of things I wanted to do. Next I wrote the sections for adding new records and reading them. I used subroutines for things like disk error checking and screen displays, which I knew were going to be needed later on. With this much done, I was able to get the disk files working and check the layout of the screen displays.

Finally, I added the other options one at a time, making use of existing subroutines or Basic statements from other sections. The program was written for use on a Commodore 64, but there's no fundamental problem with changing the screen displays and using it on an expanded VIC-20; all the program logic will work if you have enough memory. (As I've given it here, the program occupies 8588 bytes.)

Before describing the Basic code, I'd like to make it clear that my goal has been to write a tutorial program that would demonstrate the logical and file manipulations necessary to use relative files successfully in this type of application.

I find it useful as is, though it's intended not so much as a finished product as a learning tool to be altered for your own needs. There are some elementary protections against unexpected keyboard inputs, and I've tried always to provide a clear path back to the menu, but basically this program expects you to respond intelligently and accurately to its Input prompts. Therefore, it's neither totally user-friendly nor totally idiot-proof.

A final note: Published programs may look like they were written all at once in a neat package (a line-renumbering utility adds to the illusion), but that's not true in my case. Even if you want to make what may seem like only minor changes to this program, take your time, do a piece at a time and expect to do it several times before you're satisfied with the results. (If you can do it right the first time, I don't want to hear about it.)

Initialization

Lines 100–125: Set some string variables and flags for use later in the program. Two of the disk file-positioning parameters are set now because they won't change during the program: R0 is the channel number for the data file and R3 is the record byte number. (Each record is always read from the beginning in this application.) The Pokes set the screen background and border to black. (This might not be the best choice for a color monitor.) The number of characters in the account number is stored in C1. PRINT CHR$(14) selects the lowercase/uppercase Display mode. The pointer file is stored in X2$. Information is sent to the printer through A1$, A2$ and A3$.

Lines 130–150: Open the disk files. The error channel must always be number 15. The pointer file is opened on channel 3 as a sequential file in the Read mode. The first value on this file is the number of keyword records, which is used to read the pointer file into memory.

In some circumstances, it's not possible to operate with the command file on channel 15 plus more than one disk file open at once, so the pointer file should be closed when you're done reading it. The data file is opened as a relative file on channel 2. Calls to the subroutine at 850 are for disk error checking. The statement number stored in SN is used to pinpoint the source of disk errors.

The Menu

Lines 155–240: Print the menu and select an option. PRINT CHR$(147) clears the screen. It's a good idea to read in the option as a string variable and convert it to a number with the VAL command. Otherwise, the accidental striking of a non-numeric character will cause the program to crash. Line 210 checks the numerical value of the option selection to make sure it has an allowed value.

The subroutine at 890 lists the current pointer file. The Get command (line

Listing continued.

```
940 RETURN
945 REM DISPLAY ************************
950 PRINTCHR$(147);"{SHFT A}CCOUNT STATUS, REC. # ";II:
    PRINT
955 PRINT"{4 SPACEs}{SHFT A}CCT. #:";A$
960 PRINT"{3 SPACEs}{SHFT O}WNER(S):";O$
965 PRINT"{7 SPACEs}{SHFT T}YPE:";T$
970 PRINT"{4 SPACEs}{SHFT P}URPOSE:";P$
975 PRINT"{4 SPACEs}{SHFT B}ALANCE:";B$;" {SHFT A}S OF
    ";D1$
980 PRINT"{3 SPACEs}{SHFT D}IVIDEND: ";DV$;" {SHFT A}S
    OF ";D2$
985 PRINT"{2 SPACEs}{SHFT D}IV. RATE:";R$
990 PRINT"{2 SPACEs}{SHFT A}UTO DEP.:";DP$
995 PRINT" {SHFT A}UTO WITH.:";W$
1000 PRINT"{6 SPACEs}{SHFT N}OTES: ";NO$
1005 PRINT:PRINT"{SHFT N}EXT ENTRY AT RECORD";VAL(E$)+(
     VAL(E$)<>0)
1010 PRINT"{SHFT T}OTAL NUMBER ENTRIES";TE$
1015 PRINT:PRINTM$:PRINT"{SHFT M}ENU COMMAND IGNORED IF
     YOU'RE WRITING RECORDS."
1020 GETZ$:IFZ$=""THEN1020
1025 RETURN
1030 REM WRITE NEW POINTER FILE ********
1035 CLOSE2
1040 SN=1040:OPEN3,8,3,"@:"+AP$+",S,W":GOSUB850
1045 SN=1045:PRINT#3,N2:GOSUB850
1050 SN=1050:FORI=1TON2:PRINT#3,X2$(I):GOSUB850:NEXT:CL
     OSE3
1055 RETURN
1060 REM INPUT NEW RECORD **************
1065 PRINTCHR$(147);"{SHFT T}O INPUT A RECORD, RESPOND
     TO THE {SHFT I}{SHFT N}{SHFT P}{SHFT U}{SHFT T} PR
     OMPTS."
1070 PRINT"{SHFT I}F YOU'RE CHANGING AN EXISTING RECORD
     ,"
1075 PRINT"OR ADDING A NEW RECORD TO AN EXISTING ACCOUN
     T,"
1080 PRINT"PRESSING ";CHR$(18);"{SHFT R}{SHFT E}{SHFT T
     }{SHFT U}{SHFT R}{SHFT N}";CHR$(146);" WILL LEAVE
     THE OLD"
1085 PRINT"VALUE UNCHANGED."
1090 PRINTCHR$(18);"{SHFT D}ON'T USE ANY COMMAS OR COLO
     NS!";CHR$(146)
1095 IFJ=3ORJ=6THENPRINT"{SHFT A}CCT # MAY NOT BE CHANG
     ED WITH THIS OPTION":GOTO1120
1100 PRINT"{SHFT A}CCT. #, NO MORE THAN"C1" CHARACTERS:
     ":INPUTA$:IFJ<>2THEN1120
1105 FORI=1TON2:IFLEFT$(A$+"{10 SPACEs}",C1)=LEFT$(X2$(
     I),C1)THENTS=1:RETURN
1110 NEXT
1120 PRINT"{SHFT N}EXT INPUT TO HERE......."
1125 INPUT"{SHFT O}WNER(S)";O$
1130 PRINT"{SHFT N}EXT 2 INPUTS TO HERE........."
1135 INPUT"{4 SPACEs}{SHFT T}YPE";T$
1140 INPUT" {SHFT P}URPOSE";P$
1145 PRINT" {SHFT D}OLLAR VALUES <=99999.99, NO $ SIGN.
     "
1150 PRINT"{SHFT D}ATES DD/MM/YR"
1155 INPUT" {SHFT B}ALANCE";B$
1160 INPUT"{3 SPACEs}{SHFT A}S OF";D1$
1165 INPUT"{SHFT D}IVIDEND";DV$
1170 INPUT"{3 SPACEs}{SHFT A}S OF";D2$
1175 INPUT"{SHFT D}IVIDEND RATE";R$
1180 INPUT"{SHFT A}UTOMATIC DEPOSIT";DP$
1185 INPUT"{SHFT A}UTOMATIC WITHDRAWAL";W$
1190 PRINT"{SHFT N}OTES, NO FARTHER THAN.............
     ..................HERE"
1195 INPUTNO$
1200 PRINT"{SHFT P}RESS ANY KEY TO CONTINUE"
1205 GETZ$:IFZ$=""THEN1205
1210 RETURN
```

More

225) is used here (and in several other places) to allow you to view a display for as long as you want, and then continue by striking an appropriate key. The ON...GOTO command selects the proper part of the program for the option selected.

The Options

Lines 245–280: The first step toward listing all the records on the data file is to read the data file counter, N. This is done in the subroutine at 930. Then, loop from I=2 to I=N+1 to read all the data records. For each value of I, set the disk record-positioning parameter R1 to I. The record is read and decoded in the subroutine at 1305.

The screen display is generated in a subroutine at 945. The display includes the current data record number I1, which is record I-1 on the data file. (Remember that the record counter is the first record on the data file.) A keyboard prompt is included in the display subroutine (line 1020), and the response is evaluated in line 270 after returning from the subroutine.

By responding with an M, you can return to the menu at any time. You might not want to list all the records very often, as your data file gets longer, but this option is very useful during program development when you want to see everything that's been put on the data file.

Lines 285–410: To add a new account, first read the current data file counter in the subroutine at 930, then provide information for the new account through the subroutine at 1060, which includes a check on the proposed new account number. If that number already exists, the flag, TS, is set to 1 (line 1105). A check on the value of TS in line 305 prevents duplication of account numbers on the pointer file.

The direct path back to the menu in line 315 forces you to start over to protect yourself from this error. Line 320 is essential for initializing the linked list for the new account. Recall that a 0 in the variable that points to the location of the next entry (E$) will be interpreted as the last entry for a given keyword. In the future, this new record will be the end of the trail for this particular account number. (You'll see what happens with subsequent entries in option six.) Setting TE$ = " 1" indicates that there is a total of one entry for this account.

The data record number for this new account will be N+1, so this is the value assigned to I1 in line 325, where the proposed new record is displayed. You are given the option of redoing the record, returning to the menu or storing the new record on the disk. When you're ready to put the new record on disk, line 370 performs this operation.

The record positioning parameter is set to N+2. (For example, if there are currently 10 data records (N=10), there are 11 records already on the data file, including the data record counter in record 1. So, a new account will go at R1=12.) Then the record counter is updated from N to N+1. The record is encoded and written to disk in the subroutine at 1215. Next, in line 375, the new record counter is written to disk after it's positioned to the first record by setting R1=1.

Line 385 updates the pointer file in memory with information about the new account, and then you're given the opportunity to add more accounts in line 390. When you're done with this option, the flag, CH, is set to 1. This will indicate that the pointer file has been altered, and will cause a new version to be written to disk before the program ends.

Lines 415–510: The option to change information on an existing record is for correcting mistakes or making other changes. First, read the current data record counter, then, in line 425, specify the record number you want to change. You have to try again if the record you ask for doesn't exist.

In line 435, the disk is positioned to

Listing continued.

```
1215 REM ENCODE AND WRITE AT R1 ********
1220 A$=LEFT$(A$+"{10 SPACEs}",C1)
1225 O$=LEFT$(O$+"{15 SPACEs}",15)
1230 T$=LEFT$(T$+"{20 SPACEs}",20)
1235 P$=LEFT$(P$+"{20 SPACEs}",20)
1240 B$=RIGHT$("{8 SPACEs}"+B$,8)
1245 D1$=RIGHT$("{8 SPACEs}"+D1$,8)
1250 DV$=RIGHT$("{7 SPACEs}"+DV$,7)
1255 D2$=RIGHT$("{8 SPACEs}"+D2$,8)
1260 R$=LEFT$(R$+"{5 SPACEs}",5)
1265 DP$=RIGHT$("{7 SPACEs}"+DP$,7)
1270 W$=RIGHT$("{7 SPACEs}"+W$,7)
1275 N1$="{59 SPACEs}":REM59SP.
1280 NO$=LEFT$(NO$+N1$,59)
1285 X$=A$+O$+T$+P$+B$+D1$+DV$+D2$+R$+DP$+W$+NO$+E$+TE$

1290 PRINTX$
1295 SN=1295:GOSUB870:PRINT#2,X$:GOSUB850
1300 RETURN
1305 REM READ AND DECODE FROM R1 *******
1310 SN=1310:GOSUB870:GOSUB850
1315 SN=1315:X$="":FORK=1TO12
1320 GET#2,Q0$,Q1$,Q2$,Q3$,Q4$,Q5$,Q6$,Q7$,Q8$,Q9$,R0$,
     R1$,R2$,R3$,R4$:GOSUB850
1325 X$=X$+Q0$+Q1$+Q2$+Q3$+Q4$+Q5$+Q6$+Q7$+Q8$+Q9$+R0$+
     R1$+R2$+R3$+R4$
1330 NEXT:R3=1
1335 A$=LEFT$(X$,C1):O$=MID$(X$,C1+1,15)
1340 T$=MID$(X$,26,20)
1345 P$=MID$(X$,46,20)
1350 B$=MID$(X$,66,8)
1355 D1$=MID$(X$,74,8)
1360 DV$=MID$(X$,82,7)
1365 D2$=MID$(X$,89,8)
1370 R$=MID$(X$,97,5)
1375 DP$=MID$(X$,102,7)
1380 W$=MID$(X$,109,7)
1385 NO$=MID$(X$,116,59)
1390 E$=MID$(X$,175,3)
1395 TE$=RIGHT$(X$,3)
1400 RETURN
1405 REM FOR FILE INITIALIZATION *******
1410 OPEN1,8,15:OPEN3,8,3,"@:ACCTPOINTER,S,W":GOSUB850
1415 PRINT#3,0:GOSUB850:CLOSE3
1420 OPEN2,8,2,"ACCTDATA":GOSUB850
1425 R1=1:R0=2:R3=1:GOSUB870
1430 PRINT#2,0:GOSUB850:CLOSE2:CLOSE1:STOP
```

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the proper record on the data file and read into memory. This not only displays the record as it currently exists; it also means that if you respond to Input prompts for new information by hitting the return key instead of typing in new values, the old values will be retained. This is convenient if only some of the values need to be changed.

After looking at the new record (in line 455), you have the option of saving the new record on disk, responding to all the Input prompts again or returning to the menu. In this option, the pointer file and data record counter are not changed. To protect against accidentally changing the account number and thereby losing track of it on the pointer file, the input subroutine at 1095 skips over the Input prompt for the account number when you're using this option.

Lines 515–615: Generating a list of balances for the most recent entries of each account involves looping through the pointer file and accessing the most recent record for each account. Line 535 decodes this location from X2$ and assigns it to R1. After the record is decoded, the account number, balance and date are stored in arrays for output to a printer.

Lines 550 and 555 display the current balances and update a total for each account. Line 570 allows you to output this information to the printer before returning to the menu.

The CHR$(9)s in line 595 are tabulation controls for my printer; yours will probably respond differently, so don't duplicate this line without understanding its effect. Be sure to close the printer output file when you're done.

Lines 620–720: Listing all entries for a given account utilizes the pointer file and subsequent links on each record to follow the account through the data file. The account is specified in line 625 and put in the proper format in line 630 (A$ must be C1 characters long). Lines 635–650 search through the pointer file for the account. If it's not there, you may try again.

Line 675 sets the disk record-positioning parameter to the desired location, which is also decoded from the pointer file. The record is read, decoded and displayed in lines 680 and 685. The record number I1 is the position in the data file minus 1. If you want to look at another account, the pointer file is printed again in line 715, to remind you of which accounts are available.

Lines 725–810: To add new records to existing accounts, I've first used some statements from a previous option to locate the current entry of the requested account. Line 740 assigns R1 and reads the total-entries parameter TE$ from the pointer file. The current record for this account is read and displayed.

> *I encourage you to develop this program into something that fits your specific needs.*

The next-entry pointer, E$, is set to the record number of the current data record in line 760. This is the critical step in providing a link to previous records; E$ will be written on the new record and used to locate this record when the new record is read in the future.

The total-entries parameter, TE$, is increased by 1 in preparation for adding a new record. Line 770 reads the current file counter. Line 775 calls for new record information. Because the current record has been read into memory, a Return in response to prompts for new information will retain the current values.

With this option, the Input subroutine prevents you from changing the account number. This is necessary to retain proper links to all the records on the file. Finally, the new record is written using some statements from option 2.

The ith record in the pointer file (which corresponds to the account being updated) is changed in line 785 to correspond to the new account information. This step is critical for future access to the new record for this account.

You have a chance to update more accounts. Before returning to the menu, the variable CH is set to 1 to indicate that the pointer file has been altered in memory.

Lines 815–830: Reserved for some future expansion of the options.

Lines 835–845: To end the program, first update the pointer file on disk, if CH = 1. Then close the disk files—the data file first, then the command file. If the files aren't closed properly, all the data may be lost in subsequent uses of the program.

The Subroutines

Lines 850–865: Check command file for disk errors. Error message values less than 20 aren't disk errors. An error number of 50 is an allowed operation for writing on previously uninitialized records, so don't respond to it. The variable SN should contain the line number from which this subroutine was called (directly, or indirectly in the case of disk positioning). The values of E1 and E2 aren't needed in this application.

Lines 870–885: Calculate the values needed to position the disk at the appropriate record and byte. The high-low (RH-RL) calculation for the record number is required because it's possible to store more than 255 records on a disk, but 255 is the largest number that will fit into one byte.

Lines 890–925: Read and decode the pointer file stored in memory. The array X2$ contains the account number in the first C1 characters, the record pointer in the next three and the total number of entries in the last three characters.

Lines 930–940: Position the disk to the first record and read the data record counter.

Lines 945–1025: Display account information. Note that in line 1005, (VAL(E$)<>0) is −1 if VAL(E$) ≠ 0, and 0 if VAL(E$) = 0. Thus, the value printed is the position of the previous data record relative to the start of the data records, whereas VAL(E$), by itself, locates the previous data record relative to the start of the data file.

Lines 1030–1055: Write a new pointer file on disk. I closed the data file first, then opened the pointer file as a sequential file in the Write mode. The "@:" preceding the file name allows the file to be replaced on disk. Write the record counter N2 first, then the X2$ array.

Lines 1060–1210: Request information for a new record. Don't use commas or colons when inputting text because Commodore Basic interprets these as field separators or end-of-record marks (see Part 2 of this article), and it will respond only to the text to the left of the first such character.

Lines 1215–1300: Encode all the values for a new record into a single variable, X$. By encoding the data in this way (see also the following subroutine), I've eliminated field separators and kept exact control over what goes where on the disk. Position the disk drive to the appropriate record, depending on the value of R1 at the time the subroutine is called.

Finally, write the record to disk. (Note that in line 1220 I've used the variable C1 for the length of the ac-

count number. Since this value is used in several other places in the program, I've assigned a variable name to it to make program changes easier. However, it should be clear that if you change the value assigned to C1 in line 115, you must make corresponding changes in this subroutine as well as the decoding subroutine at 1305.)

Lines 1305–1400: Read a record from the disk and decode it for display. First position the disk drive to the appropriate record as specified by R1, then set a variable, X$, to a null value. The data record is 180 bytes long (as you can see from lines 1390 and 1395), plus one more byte for a Return character put there by the system.

A limitation in Commodore Basic prevents use of an Input# command for the entire record (see Part 2 of this article). I've used the Get# command to read the 180 bytes in 12 sets of 15 bytes. It's necessary to reset the byte counter, R3, to 1 before reading from or writing to the disk again, as the Get# command doesn't do this for you.

Starting in line 1335, X$ is broken down into its component parts. The series of statements from 1335 to 1395 show clearly the location and length of each variable in the record. Along with the screen display information given in the subroutine at 945, the meaning of each quantity should be self-explanatory.

Lines 1405–1430: Use this section of the program to initialize the pointer file and to put a 0 on the first record of the data file. You can access lines 1410–1430 only by entering RUN1410; don't do it after you've stored data on the files! After you've initialized the files, you might want to delete these statements or turn them into remarks, just to make sure you don't erase information you wanted to keep.

In Conclusion

Before you run this program for the first time, don't forget to create the relative file with the Open Rel File program from April's installment. Then, when you have Account Manager loaded, enter RUN1410 to establish a blank pointer file and write a 0 for the data-record counter on the data file. (You could also use this section of the program if you wanted to write specific records for test purposes.) Note that in its present form, the program allows a maximum of 25 different account numbers (see line 125).

Once you've started to store records on a file, *always* terminate each use of the program by selecting option 8, which properly closes the data file and updates the pointer file if required. If you don't do this, you may destroy information on the data file, and the pointer file may no longer give proper access to all accounts the next time you use the program.

How would you go about modifying this program? First, decide what you want to display and how. Change the display subroutine at 945 and the data input routine at 1060. Change the subroutines at 1215 and 1305 to conform to your proposed record layout.

If you're generating current account balances, as in option 4, make sure that the account number, balance and date are properly identified as A$, B$ and D1$.

Finally, use the Open Rel File program to create a blank file with the appropriate record length. That's really all there is to it, and I encourage you to develop this program into something that fits your specific needs. R

Scroll, Scroll, Scroll Your Rows

Gently 'Cross the Screen

Scroll left! Scroll right! Put your screen displays through close-order drill with these programs that employ those machine language routines the user's manual doesn't explain.

By Bob Urso

One of the more interesting yet frustrating features of the Commodore 64 is its capacity to scroll the screen smoothly in any direction. If you've read the section of the *C-64 Programmer's Reference Guide* that explains smooth scrolling (p. 128), you know what I mean by frustrating.

The method for scrolling the screen one pixel at a time is explained clearly; then you're left up in the air by step five, which reads, "At this point, use your machine language routine to shift the entire screen one entire character in the direction of the scroll."

That's fine if you write machine language, but useless if you don't. So you're at a dead end...right? Wrong! I'd like to show you several ways to access the scroll capacity of your 64 by using machine language routines that plug into your Basic programs.

Basic to Machine Language

For those of you unfamiliar with machine language, the program in Listing 1, ZOG, is a simple space action game that utilizes a short machine language routine to scroll the entire screen left or right. I won't explain the routine just

	COL. 1	COL. 2	COL. 3	COL. 4
ROW 1	$C800	$C806	$C80C	$C812
ROW 2	$C801	$C807	$C80D	$C813
ROW 3	$C802	$C808	$C80E	
ROW 4	$C803	$C809	$C80F	ETC.
ROW 5	$C804	$C80A	$C810	
ROW 6	$C805	$C80B	$C811	

Fig. 1. Addresses for screen-data storage.

Listing 1. ZOG program.

```
10 REM QUICK SCROLL - B.URSO
20 P=1484:SH=3:UP=36:MET=35:DOWN=38:RT=37:LFT=39:ZOG=40
   :BLANK=32:S=54272
30 SLEFT=49226:SRIGHT=49152:DS=SRIGHT
40 POKE53281,0:POKE53280,0:GOSUB660
50 PRINTCHR$(147)TAB(250)"{CTRL 2}WAIT FOR DATA TO LOAD
   "
60 FORZ=0TO147:READ A:POKE49152+Z,A:NEXTZ
70 FORZ=280TO327:READB:POKE12288+Z,B:NEXT:RESTORE
80 FORZ=256TO263:POKE12288+Z,0:NEXT
90 PRINTCHR$(147)
100 POKE53272,(PEEK(53272)AND240)+12
```

More

RUN It Right

Commodore 64

Address all author correspondence to Bob Urso, 104 Viewcrest, Bellingham, WA 98225.

yet. Instead, I'll show you how to use it from your Basic program. The parts of ZOG that would be necessary in *any* program using the routine include:

- Lines 830–920, which contain the data for the machine language program.
- Line 60, which Pokes the data into high memory (49152 to 49300) so it will not interfere with your Basic program.
- The variables DS (direction of scroll), SRIGHT (scroll right) and SLEFT (scroll left). SRIGHT and SLEFT are defined in line 30 so that they will point to the machine language routines in high memory when you execute the SYS command.

How ZOG Works

Lines 20–30 initialize the variables: P is the starting screen position, SH is the number of ships you start with and S is the start of the sound chip. The rest of the variables equate to ASCII values for characters that have been redefined to create the meteor, ZOG, and the four positions of your spaceship.

Line 40 sets the screen colors, then sends you to the instructions subroutine.

Line 60 Pokes in the machine language data.

Line 70 Pokes in the data for the custom characters.

Line 80 Pokes in the data for a space in the custom character set.

Line 100 tells Basic to look for those redefined characters starting at 12288, rather than in the normal character ROM.

Lines 110–120 randomly Poke 25 meteors and the start position of your spaceship onto the screen.

Lines 130–180 get your keyboard input and then send the program off to the proper line, depending on which direction you move.

Lines 190–220 move your ship left. NP (new position) is the screen location you are about to move to. Your position (P) is blanked. The program sets DS (direction of scroll) to SRIGHT and then issues the SYS command, transferring control to the machine language program. This moves the screen one column right, then blanks out the left column. You then GOSUB to check for hits and whether you're off the screen.

If none of the above has happened, the correct character that defines the spaceship moving left (LFT) is Poked into the new position. The new position then becomes your present position. You then GOSUB to Poke new data into the left column, and finally go back to line 130 to check whether you've pressed any keys to change direction.

Listing 1 continued.

```
110 FORZ=1TO25:Q=1024+INT(RND(1)*990):POKE Q,MET:NEXTZ
120 POKEP,LFT
130 GET A$:IFA$<>G$ANDA$<>""THENG$=A$
140 IFG$="J"THEN190
150 IFG$="K"THEN230
160 IFG$="I"THEN260
170 IFG$="M"THEN310
180 GOTO130
190 NP=P-1:POKEP,BLANK:DS=SRIGHT:SYSDS
200 GOSUB490
210 POKENP,LFT:P=NP
220 GOSUB360:GOTO130
230 NP=P+1:POKEP,BLANK:DS=SLEFT:SYSDS
240 GOSUB490
250 POKENP,RT:P=NP:GOSUB410:GOTO130
260 NP=P-40:POKEP,BLANK:SYSDS
270 GOSUB490:POKENP,UP:P=NP
280 IFDS=SRIGHTTHENGOSUB360
290 IFDS=SLEFTTHENGOSUB410
300 GOTO130
310 NP=P+40:POKEP,BLANK:SYSDS
320 GOSUB490:POKENP,DOWN:P=NP
330 IFDS=SRIGHTTHENGOSUB360
340 IFDS=SLEFTTHENGOSUB410
350 GOTO130
360 Z=INT(RND(1)*70):IFZ>23THEN400
370 ND=Z*40+1024
380 GOSUB450
390 POKEND,Q
400 RETURN
410 Z=INT(RND(1)*40):IFZ>23THEN440
420 ND=Z*40+1063
430 GOSUB450:POKEND,Q
440 RETURN
450 Q=INT(RND(1)*10)+1:IFQ>1THEN470
460 Q=ZOG:GOTO390
470 Q=MET
480 RETURN
490 IFPEEK(NP)=MET ORPEEK(P)=MET THENGOSUB540:POKEP,BLA
    NK
500 IFPEEK(NP)=ZOG ORPEEK(P)=ZOG THEN GOSUB570:POKEP,BL
    ANK
510 IFNP<1024THENNP=P
520 IFNP>2023THENNP=P
530 RETURN
540 GOSUB815:FORZ=15TO0STEP-1:POKE53281,Z:FORTM=0TO10:N
    EXTTM:NEXTZ
550 SH=SH-1:IFSH=0THEN590
560 RETURN
570 FORZ=5TO0STEP-1:POKE53281,Z:POKE53280,Z:FORTM=0TO5:
    NEXTTM:NEXTZ
580 GOSUB811:SC=SC+10:RETURN
590 POKE53272,21
600 PRINTCHR$(147):PRINTTAB(240)"YOUR STAR FLEET HAS BE
    EN DESTROYED. "
610 PRINT"{CRSR DN}YOU SMASHED ";:PRINT(SC/10)"OF ZOG'S
     SHIPS"
620 PRINT"YOUR SCORE IS "SC
630 PRINT"{CRSR DN}TO PLAY AGAIN PRESS Y"
640 GETR$:IFR$<>"Y"THEN640
650 SC=0:SH=3:PRINTCHR$(147):GOTO100
660 PRINTCHR$(147)TAB(124)"{COMD 1}{31 COMD +s}"
670 PRINT"{CRSR DN}{14 SPACEs}{COMD 6}WELCOME TO ZOG"
680 PRINT"{CTRL 2}{CRSR DN} YOUR OBJECT IS TO PATROL TH
    E SKYS AND"
690 PRINT" SMASH INTO AS MANY ZOGGIAN SPACE SHIPS"
700 PRINT"{3 SPACEs}AS POSSIBLE WITHOUT GETTING HIT BY
    "
710 PRINT"{4 SPACEs}METEORS.{2 SPACEs}YOU HAVE THREE SH
    IPS."
720 PRINT"{4 SPACEs}LOSE THEM AND THE GAME IS OVER."
```

More

Listing 1 continued.

```
730 PRINT"{CRSR DN}{CTRL 4}{6 SPACEs}TO MOVE PRESS{2 SP
    ACEs}I{2 SPACEs}FOR UP
740 PRINT"{21 SPACEs}M{2 SPACEs}FOR DOWN
750 PRINT"{21 SPACEs}J{2 SPACEs}FOR LEFT
760 PRINT"{21 SPACEs}K{2 SPACEs}FOR RIGHT
770 PRINT"{CTRL 8}{CRSR DN}{7 SPACEs}GOOD LUCK EARTHLIN
    G."
780 PRINT"{CRSR DN}{COMD 1}{3 SPACEs}{31 COMD +s}"
790 PRINT"{CRSR DN}{3 SPACEs}{CTRL 2}PRESS THE SPACE BA
    R TO CONTINUE"
800 GETR$:IFR$<>" "THEN800
810 RETURN
811 POKES+24,15:POKES+6,240:POKES+4,17:FORA=1TO10:FORK=
    1TO255STEP25:POKES+1,K
812 NEXTK:NEXTA:POKES+4,32:FORK=1TO24:POKES+K,0:NEXT
813 RETURN
815 POKES+24,15:POKES+5,9:POKES+1,20:POKES+4,128:FORD=1
    TO10:NEXTD
816 POKES+4,129:FORK=1TO24:POKES+K,0:NEXT
817 RETURN
820 REM******SCROLL RT M/L*************
830 DATA 169,0,133,251,169,4,133,252
840 DATA 160,38,177,251,200,145,251,192,1,240,5,136,136
    ,76,10,192,165,251
850 DATA 24,105,40,133,251,144,2,230,252,165,251,201,23
    2,208,223,169,0,133,251
860 DATA169,4,133,252,160,0,162,25,169,32,145,251,24,16
    5,251,105,40,133,251,144
870 DATA2,230,252,202,224,0,208,236,96
875 REM******SCROLL LFT M/L*************
880 DATA 169,0,133,251,169,4,133,252
890 DATA160,1,177,251,136,145,251,192,38,240,5,200,200,
    76,84,192,165,251,24,105
900 DATA 40,133,251,144,2,230,252,165,251,201,232,208,2
    23,169,39,133,251,169,4
910 DATA133,252,160,0,162,25,169,32,145,251,24,165,251,
    105,40,133,251,144,2,230
920 DATA 252,202,224,0,208,236,96
925 REM***DATA FOR REDEFINED CHARACTERS
930 DATA 0,0,166,93,116,156,0,0,24,60,102,60,126,231,23
    1,24
940 DATA 96,116,126,155,155,126,116,96,24,231,231,126,6
    0,102,60,24
950 DATA 6,46,126,217,217,126,46,6,153,42,129,153,153,1
    29,42,153
```

Listing 2. Color Scroll program.

```
10 REM COLOR SCROLL - B.URSO
20 POKE53281,15
30 B$="{3 CRSR UPs}{3 SPACEs}{CRSR DN}{3 CRSR LFs}{SHFT
    *}{SHFT +}{SHFT *}{CRSR DN}{3 CRSR LFs}{3 SPACEs}
    "
40 C$="{3 CRSR UPs}{SHFT M}{2 SPACEs}{CRSR DN}{3 CRSR L
    Fs} {SHFT V} {CRSR DN}{3 CRSR LFs}{2 SPACEs}{SHFT
    M}"
50 D$="{3 CRSR UPs}{2 SPACEs}{SHFT N}{CRSR DN}{3 CRSR L
    Fs} {SHFT V} {CRSR DN}{3 CRSR LFs}{SHFT N}{2 SPACE
    s}"
60 GOSUB290
80 CL=56056
90 PRINTCHR$(147)
95{2 SPACEs}PRINT"{12 CRSR DNs}"
100 FORZ=0TO39:POKECL+Z,6:NEXT
110 FORZ=40TO89:POKECL+Z,4:NEXT
120 FORZ=80TO119:POKECL+Z,8:NEXT
130 FORZ=120TO159:POKECL+Z,2:NEXT
140 FORZ=160TO199:POKECL+Z,9:NEXT
150 FORZ=200TO239:POKECL+Z,1:NEXT
160 POKE53281,15:POKE53280,12
```

More

Lines 230–250 go through the same steps, but move the spaceship right and scroll the screen left.

Lines 260–300 are similar steps that move the spaceship up. The only difference is that lines 280 and 290 check to see what direction you are presently scrolling, and continue the scrolling in the same direction.

Lines 310–350 do the same to move the spaceship down.

Lines 360–400 Poke into the left column either a blank, a meteor or ZOG.

Lines 400–440 Poke a character into the right column.

Lines 450–480 randomly select whether ZOG or a meteor will be Poked in. Notice that the odds are nine to one that a meteor will be selected.

Lines 490–530 check to see if your new position or your present position (which has by now been blanked and scrolled into) contains either ZOG or a meteor. They also check to see if you're about to go off either the top or bottom of the screen.

Lines 540–560 GOSUB to a raygun sound routine, then flash the screen for a crash effect and finally update your score.

Lines 570–580 do the same when you crash into a meteor. They reduce the number of your ships and check to see if you are out of ships.

Lines 590–650 are the end-of-game subroutine. Notice that you first have to tell Basic to look for its character data in the character ROM, and not where you have your redefined characters. Since you only redefined six characters, the rest of that area of memory contains garbage.

Lines 660–810 are your instructions subroutine.

Lines 811–817 are two different sound subroutines that are used in the crash subroutines.

Lines 820–950 contain our data for the machine language routines, as well as character definitions.

I've tried to keep things simple so you could see how the scroll routines work without typing them all in. I didn't include a smooth scrolling routine before transferring control to the machine language routines. Since that can be accomplished in Basic, I thought I'd leave that part up to you. Just follow the steps on pages 128 and 129 in the *C-64 Programmer's Reference Manual.*

The best way to save these routines for use in other programs is to use a machine language monitor such as Supermon or HesMon. After you've typed in one of the programs, run it to Poke the data into memory; then exit the pro-

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Listing 2 continued.

```
170 SYS 49152
180 GETG$:IFG$<>A$ANDG$<>""THENA$=G$
190 IFA$="K"THEN220
200 IFA$="J"THEN240
210 PRINTTAB(19)B$:GOTO180
220 PRINTTAB(19)C$
230 SYS 49356:GOTO180
240 PRINTTAB(19)D$:SYS49229
250 GOTO180
260 REM*******************************
270 REM{7 SPACEs}POKE IN DATA{7 SPACEs}
280 REM
290 PRINTCHR$(147)SPC(252)"{CTRL 1}WAIT 20 SECONDS"
295 PRINT"{CRSR DN} AFTER SCREEN APPEARS PRESS"
296 PRINT"{4 SPACEs}J TO SCROLL RIGHT
297 PRINT"{4 SPACEs}K TO SCROLL LEFT
300 FORZ=0TO411:READA:POKE49152+Z,A:NEXT
310 FORZ=0TO719:READA:POKE51200+Z,A:NEXTZ
330 RETURN
340 REM******M/L DATA*****************
350 REM
360 DATA169,0,133,253,169,200,133,254,162,0,160,5,177,2
    53,157,192,7,136
370 DATA177,253,157,152,7,136,177,253,157,112,7,136,177
    ,253,157,72,7,136
380 DATA177,253,157,32,7,136,177,253,157,248,6,232,224,
    39,240,14,165,253
390 DATA24,105,6,133,253,144,205,230,254,76,10,192,169,
    0,141,52,3,169
400 DATA200,141,53,3,96,216,169,248,133,251,169,6,133,2
    52,160,38,177,251
410 DATA200,145,251,192,1,240,5,136,136,76,88,192,165,2
    51,24,105,40,133
420 DATA251,144,2,230,252,165,251,201,232,208,223,173,5
    3,3,133,252,173,52
430 DATA3,56,233,6,133,251,176,2,198,252,165,251,201,0,
    165,252,233,200
440 DATA144,3,76,155,192,169,202,133,251,133,252,165,25
    1,141,52,3,165,252
450 DATA141,53,3,160,5,177,251,141,192,7,136,177,251,14
    1,152,7,136,177
460 DATA251,141,112,7,136,177,251,141,72,7,136,177,251,
    141,32,7,136,177
470 DATA251,141,248,6,96,234,169,248,133,251,169,6,133,
    252,160,1,177,251
480 DATA136,145,251,192,38,240,5,200,200,76,214,192,165
    ,251,24,105,40,133
490 DATA251,144,2,230,252,165,251,201,232,208,223,173,5
    3,3,133,252,173,52
500 DATA3,24,105,6,133,251,144,7,173,53,3,133,252,230,2
    52,165,251,201
510 DATA203,165,252,233,202,176,3,76,32,193,169,0,133,2
    51,169,200,133,252
520 DATA165,252,141,53,3,133,254,165,251,141,52,3,24,10
    5,234,133,253,144
530 DATA2,230,254,165,253,201,203,165,254,233,202,176,3
    ,76,118,193,165,253
540 DATA56,233,202,133,253,144,10,165,254,56,233,202,13
    3,254,76,92,193,165
550 DATA254,56,233,203,133,254,165,253,24,105,250,133,2
    53,176,10,165,254,24
560 DATA105,199,133,254,76,118,193,165,254,24,105,200,1
    33,254,160,5,177,253
570 DATA141,231,7,136,177,253,141,191,7,136,177,253,141
    ,151,7,136,177,253
580 DATA141,111,7,136,177,253,141,71,7,136,177,253,141,
    31,7,96
590 REM*******************************
600 REM{5 SPACEs}SCREEN DATA
610 REM
620 DATA32,32,32,254,160,160,32,32,123,160,160,160,32,3
    2,233,160,206,160
```

More

gram to your monitor.

Save the M/L routines to disk by typing

.s "SCROLL.EXE" 08 C000 C094

for the ZOG scrolling routine, or

.s "SCROLL.6.EXE" 08 C000 C19C

for the longer routines in Color Scroll (see Listing 2). This will save them as binary files that can be loaded from your Basic program by the following technique. At the beginning of your program, type in

```
10 IF F=0 THENF=1:LOAD"SCROLL.
   EXE",8,1
```

You might like to precede this by printing a line to the screen saying, "Please wait xx seconds for data to load."

Machine Language Routines

If you're interested in machine language, here's a rundown of the routines. The listing for ZOG is typical of what you might get if you have a simple monitor. In its four fields, it lists the memory location (in hexadecimal), the op code, the mnemonic (LDA, etc.) and the operand.

A breakdown of the ZOG routine is as follows:

C000–C006 put the screen location that is at the top left of the screen (hex 0400) into zero-page work registers (FB, FC).

C008 sets a counter for the 38 rows you want to scroll right (26 hex = 38 decimal).

C00A–C00D take one block of data and move it via indirect addressing one block to the right. Notice that you started by moving column 38 into 39 in order to scroll right. If you'd started by moving column 0 into column 1, then column 1 into column 2, etc., you wouldn't scroll the screen, but merely continue moving column 0 across the screen.

C00F checks to see if you've finished moving the top row across one column.

C011 increments the address in the zero-page registers to get the address of the first column into the next row.

C013–C014 move you back two columns.

C015 jumps you back to C00A to move that column one to the right.

C018–C021 do the actual row incrementing that was mentioned above.

C023–C027 check to see if you're finished scrolling all 25 rows. E8 is the low byte of the address that would be directly below column 1 of the bottom row.

Now that you've scrolled the screen right, you need to blank out any data in the leftmost column.

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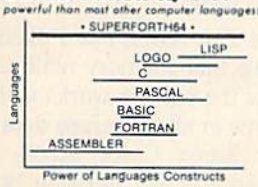

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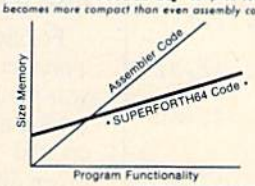

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```
630 DATA32,32,160,207,160,160,32,252,160,205,160,160,25
    4,160,160,160,205,160
640 DATA223,160,160,160,160,160,123,246,160,160,193,160
    ,32,233,160,160,160,160
650 DATA32,32,254,160,213,160,32,32,233,205,201,160,32,
    254,160,160,227,160
660 DATA32,98,160,206,205,160,32,111,160,208,160,160,32
    ,100,160,160,205,160
670 DATA32,32,32,223,160,160,32,32,108,254,213,160,32,3
    2,32,111,238,160
680 DATA32,32,32,32,205,160,32,32,32,233,160,160,32,32,
    32,32,247,160
690 DATA32,32,32,32,248,160,32,32,32,32,121,105,32,32,3
    2,32,100,32
700 DATA32,32,32,32,100,85,32,32,32,32,100,75,32,32,32,
    32,100,85
710 DATA32,32,32,32,100,75,32,32,32,32,100,85,32,32,32,
    32,100,75
720 DATA32,32,32,32,100,96,32,32,32,32,100,74,32,32,32,
    32,100,73
730 DATA32,32,32,32,100,74,32,32,32,32,100,73,32,32,32,
    32,100,74,32,32
740 DATA32,32,100,73,32,32,32,32,100,96,32,32,32,32,111
    ,95,32,32,32,32,100,160
750 DATA32,32,32,32,98,160,32,32,32,32,100,206,32,32,32
    ,32,88,206,32,32,32,32
760 DATA100,206,32,32,32,32,100,160,32,32,32,32,100,160
    ,32,32,32,32,102,160,32
770 DATA32,32,32,121,206,32,32,32,123,97,221,32,32,32,9
    3,252,205,32,32,32,32
780 DATA100,160,32,32,32,108,254,160,32,32,93,160,230,2
    05,32,32,32,32,252,205
790 DATA32,85,236,236,160,205,32,73,251,160,213,160,118
    ,118,118,254,201,160,32
800 DATA32,106,118,254,160,32,32,32,32,219,160,233,236,
    160,160,160,160,76,252
810 DATA215,225,225,160,32,32,252,213,221,160,32,32,32,
    201,221,160,108,230,230
820 DATA230,230,160,251,160,221,235,235,160,32,32,118,2
    43,243,160,32,32,108
830 DATA160,160,160,93,209,93,252,102,160,32,32,32,32,1
    60,160,32,32,111,32,98
840 DATA160,32,32,32,121,93,206,32,32,32,32,100,221,32,
    32,32,32,108,205,32,32
850 DATA32,32,100,160,32,32,32,32,65,160,32,32,32,32,88
    ,205,32,32,32,32,100
860 DATA205,32,32,32,32,104,205,32,32,32,32,122,160,32,
    32,32,32,160,160
870 DATA32,32,32,251,160,160,32,32,32,105,32,32,32,32,7
    8,76,32,81,32,32,76,111
880 DATA32,32,32,32,111,111,32,103,78,230,160,160,160,1
    63,120,230,160,74,32
890 DATA32,120,230,160,75,81,91,120,230,160,160,160,160
    ,120,230,160,160,160
900 DATA162,120,230,160,160,160,162,120,230,160,160,160
    ,163,120,230,160,74,32
910 DATA32,120,230,160,75,32,32,120,230,160,160,160,160
    ,77,230,32,99,32,101,32
920 DATA32,77,99,123,126,32,32,78,223,160,101,32,32,95,
    78,32,101,32,32,160,32
930 DATA209,32,32,78,223,32,209,32,78,32,47,32,209,32,7
    7,78,32,32,32,32,32,116
940 DATA116,101,160,102,32,32,32,91,160,102,32,32,233,9
    5,223,102,32,233,160
950 DATA105,81,102,223,105,32,32,32,32,32,77,78,236,160
    ,160,32,32,32,32,98,160
960 DATA32,32,32,32,121,160,32,32,32,32,252,205,32,32,3
    2,32,111,205,32,32,32
970 DATA32,100,205,32,32,32,32,100,160,32,32,32,32,100,
    160,32,32,32,32,121,160
980 DATA32,32,32,32,160,160,32,32,32,32,121,160,32,32,3
    2,32,160,160
```

C029–C02F load the address of row 1, column 1 back into the work register.

C031 is the counter for the 25 rows in column 1 that you'll fill with blank spaces.

C035 loads the accumulator with $20 (decimal 32), the ASCII value for a space.

C037–C047 put this space in column 1 of each of the 25 rows.

C049 returns us to the Basic program.

C04A–C093 are similar to the above, except that they scroll the screen left and fill the right column with blank spaces.

Scroll Test ABC (see Listing 3) has a much more ambitious scrolling routine. Although it only scrolls the bottom six rows of the screen, it gets its screen data from a table in memory, wraps the screen around and has a scene that is three screens wide.

For Scroll Test ABC, I've Poked the alphabet into that memory table to let you see how the routine works without having to type in all the screen data I've created for listing Color Scroll. The other difference is that in Color Scroll, lines 100–150 Poke different colors into screen memory for each of the six rows.

Scrolling Left—and Right

If you look over the source code for the machine language routines used in Scroll Test ABC and Color Scroll, you'll see that there are three main parts. The first is a routine to fill the bottom six rows with data from the screen data table that is stored starting at $C800 (decimal 51200). The screen data could've been Poked in at the beginning of the program, but that would have taken about two seconds. The fill routine does it almost instantly.

Since the comments in the source code explain what's going on, I won't repeat myself here. The scroll routines are almost identical to the ones used in the ZOG program. You might, however, be interested in the algorithm for accessing the correct data and figuring the wraparound of the screen.

Work registers are set up to point to the location in memory that holds the data presently in column 1, row 1 of the scroll area (the bottom six rows of the screen). That location, plus the next five, hold the data that will fill the left column of the scroll area.

To scroll right, you subtract six from that pointer to get the starting location for the six bytes of data that *precede* what is presently on the screen. You must check this location to see that it's within the data table. If it isn't, you must reset your pointers to six bytes be-

fore the end of the data table in order to wrap the screen around.

Scrolling left is a bit more difficult. Six has to be *added* to the pointer locating the data presently in the upper left of the scroll area. The check for wraparound is similar to that for scrolling right. Then you add 234 to the upper left pointer to get the location in the table for the data that will go into the top right of the scroll area.

You have to check that location to see if it's past the end of the data table. If it is, the top right pointer must be refigured by first determining how much past the end of the data table you are, and then adding that difference to the location six bytes before the beginning of the data table. If that all sounds confusing, it is.

But that's the beauty of these routines. You don't have to know how they work to use them in your Basic programs. There's work involved in designing a screen six rows high and three screens wide, but the added impact of a scrolling background may be worth the work.

Remember that the screen data is stored starting at C800 and runs for 720 bytes. The order for storing the data is a column at a time (see Fig. 1).

To change the rows that scroll is difficult from Basic. With a full-feature assembler, however, here are the steps:

- Change the addresses for the row label definitions at the beginning of the source code to the addresses of the rows you wish to scroll.
- In lines 0415 and 0425, and again in lines 0835 and 0845, change $06F8 to the hex address of the top left screen location of your six-row scroll area.
- In lines 0515 and 0935, change E8 to the low byte of the screen address for the location that's directly below the bottom row of column 1 in your scroll area.

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Listing 3. Scroll Test ABC program.

```
10 REM SCROLL TEST ABC - B.URSO
20 POKE53281,15:PRINTCHR$(147)
30 B$="{3 CRSR UPs}{3 SPACEs}{CRSR DN}{3 CRSR LFs}{SHFT
     *}{SHFT +}{SHFT *}{CRSR DN}{3 CRSR LFs}{3 SPACEs}
   "
40 C$="{3 CRSR UPs}{SHFT M}{2 SPACEs}{CRSR DN}{3 CRSR L
   Fs} {SHFT V} {CRSR DN}{3 CRSR LFs}{2 SPACEs}{SHFT
   M}"
50 D$="{3 CRSR UPs}{2 SPACEs}{SHFT N}{CRSR DN}{3 CRSR L
   Fs} {SHFT V} {CRSR DN}{3 CRSR LFs}{SHFT N}{2 SPACE
   s}"
60 M=51200:C=1:CL=56056
70 GOSUB250
80 FORZ=0TO239:POKECL+Z,1:NEXT
90 FORK=0TO120:FORZ=0TO5:POKEM+(6*K)+Z,C:NEXTZ
100 C=C+1:IFC>26THENC=1
110 NEXTK
120 POKE53281,15:POKE53280,12:PRINT"{SHFT CLR}{CTRL 1}{
    10 CRSR DNs}"
130 SYS 49152
140 GETG$:IFG$<>A$ANDG$<>""THENA$=G$
150 IFA$="K"THEN180
160 IFA$="J"THEN200
170 PRINTTAB(19)B$:GOTO140
180 PRINTTAB(19)C$
190 SYS 49356:GOTO140
200 PRINTTAB(19)D$:SYS49229
210 GOTO140
220 REM*****************************
230 REM{7 SPACEs}POKE IN DATA
240 REM
250 PRINTCHR$(147)SPC(252)"{CTRL 1}WAIT 20 SECONDS"
260 PRINT"{CRSR DN}{5 SPACEs}AFTER SCREEN APEARS,"
270 PRINT" THEN PRESS J TO MOVE LEFT "
280 PRINT"{12 SPACEs}K TO MOVE RIGHT"
290 FORZ=0TO411:READA:POKE49152+Z,A:NEXT
```

More

Listing 3 continued.

```
300 RETURN
310 REM*********************************
320 REM
330 DATA169,0,133,253,169,200,133,254,162,0,160,5,177,2
    53,157,192,7,136
340 DATA177,253,157,152,7,136,177,253,157,112,7,136,177
    ,253,157,72,7,136
350 DATA177,253,157,32,7,136,177,253,157,248,6,232,224,
    39,240,14,165,253
360 DATA24,105,6,133,253,144,205,230,254,76,10,192,169,
    0,141,52,3,169
370 DATA200,141,53,3,96,216,169,248,133,251,169,6,133,2
    52,160,38,177,251
380 DATA200,145,251,192,1,240,5,136,136,76,88,192,165,2
    51,24,105,40,133
390 DATA251,144,2,230,252,165,251,201,232,208,223,173,5
    3,3,133,252,173,52
400 DATA3,56,233,6,133,251,176,2,198,252,165,251,201,0,
    165,252,233,200
410 DATA144,3,76,155,192,169,202,133,251,133,252,165,25
    1,141,52,3,165,252
420 DATA141,53,3,160,5,177,251,141,192,7,136,177,251,14
    1,152,7,136,177
430 DATA251,141,112,7,136,177,251,141,72,7,136,177,251,
    141,32,7,136,177
440 DATA251,141,248,6,96,234,169,248,133,251,169,6,133,
    252,160,1,177,251
450 DATA136,145,251,192,38,240,5,200,200,76,214,192,165
    ,251,24,105,40,133
460 DATA251,144,2,230,252,165,251,201,232,208,223,173,5
    3,3,133,252,173,52
470 DATA3,24,105,6,133,251,144,7,173,53,3,133,252,230,2
    52,165,251,201
480 DATA203,165,252,233,202,176,3,76,32,193,169,0,133,2
    51,169,200,133,252
490 DATA165,252,141,53,3,133,254,165,251,141,52,3,24,10
    5,234,133,253,144
500 DATA2,230,254,165,253,201,203,165,254,233,202,176,3
    ,76,118,193,165,253
510 DATA56,233,202,133,253,144,10,165,254,56,233,202,13
    3,254,76,92,193,165
520 DATA254,56,233,203,133,254,165,253,24,105,250,133,2
    53,176,10,165,254,24
530 DATA105,199,133,254,76,118,193,165,254,24,105,200,1
    33,254,160,5,177,253
540 DATA141,231,7,136,177,253,141,191,7,136,177,253,141
    ,151,7,136,177,253
550 DATA141,111,7,136,177,253,141,71,7,136,177,253,141,
    31,7,96
```

Listing 4. Machine language routines for the ZOG program.

```
,C000 A9 00     LDA #$00
,C002 85 FB     STA $FB
,C004 A9 04     LDA #$04
,C006 85 FC     STA $FC
,C008 A0 26     LDY #$26
,C00A B1 FB     LDA ($FB),Y
,C00C C8        INY
,C00D 91 FB     STA ($FB),Y
,C00F C0 01     CPY #$01
,C011 F0 05     BEQ $C018
,C013 88        DEY
,C014 88        DEY
,C015 4C 0A C0  JMP $C00A
,C018 A5 FB     LDA $FB
,C01A 18        CLC
,C01B 69 28     ADC #$28
,C01D 85 FB     STA $FB
,C01F 90 02     BCC $C023
,C021 E6 FC     INC $FC
,C023 A5 FB     LDA $FB
,C025 C9 E8     CMP #$E8
,C027 D0 DF     BNE $C008
,C029 A9 00     LDA #$00
,C02B 85 FB     STA $FB
,C02D A9 04     LDA #$04
,C02F 85 FC     STA $FC
,C031 A0 00     LDY #$00
,C033 A2 19     LDX #$19
,C035 A9 20     LDA #$20
,C037 91 FB     STA ($FB),Y
,C039 18        CLC
,C03A A5 FB     LDA $FB
,C03C 69 28     ADC #$28
,C03E 85 FB     STA $FB
,C040 90 02     BCC $C044
,C042 E6 FC     INC $FC
,C044 CA        DEX
,C045 E0 00     CPX #$00
,C047 D0 EC     BNE $C035
,C049 60        RTS
```

```
,C04A A9 00     LDA #$00
,C04C 85 FB     STA $FB
,C04E A9 04     LDA #$04
,C050 85 FC     STA $FC
,C052 A0 01     LDY #$01
,C054 B1 FB     LDA ($FB),Y
,C056 88        DEY
,C057 91 FB     STA ($FB),Y
,C059 C0 26     CPY #$26
,C05B F0 05     BEQ $C062
,C05D C8        INY
,C05E C8        INY
,C05F 4C 54 C0  JMP $C054
,C062 A5 FB     LDA $FB
,C064 18        CLC
,C065 69 28     ADC #$28
,C067 85 FB     STA $FB
,C069 90 02     BCC $C06D
,C06B E6 FC     INC $FC
,C06D A5 FB     LDA $FB
,C06F C9 E8     CMP #$E8
,C071 D0 DF     BNE $C052
,C073 A9 27     LDA #$27
,C075 85 FB     STA $FB
,C077 A9 04     LDA #$04
,C079 85 FC     STA $FC
,C07B A0 00     LDY #$00
,C07D A2 19     LDX #$19
,C07F A9 20     LDA #$20
,C081 91 FB     STA ($FB),Y
,C083 18        CLC
,C084 A5 FB     LDA $FB
,C086 69 28     ADC #$28
,C088 85 FB     STA $FB
,C08A 90 02     BCC $C08E
,C08C E6 FC     INC $FC
,C08E CA        DEX
,C08F E0 00     CPX #$00
,C091 D0 EC     BNE $C07F
,C093 60        RTS
```

Listing 5. Source code for Color Scroll program.

```
0005            .CT
0010            .CE
0015 ;FILE NAME "JMPSCRL.CTRL"
0020            .BA $C000
0025            .OS
0026            .LS
0030            .FI "JMPSCRL.M01"
```

More →

Listing 5 continued.

```
                0005 ;FILE NAME   "SCROLL.6.M01"
                0010 ;*********-DEFINE LABELS************************************
                0015 ;SET UP POINTERS TO THE MEMORY LOCATIONS WHICH
                0020 ;CONTAIN THE DATA THAT IS PRESENTLY IN THE
                0025 ;TOP RIGHT AND TOP LEFT OF THE SCROLL AREA
                0030 ;OF THE SCREEN.
                0035 TOPLFTLO   .DE $0334            ;LOBYTE
                0040 TOPLFTHI   .DE $0335            ;HIBYTE
                0045 TOPRGTLO   .DE $0336            ;LOBYTE
                0050 TOPRGTHI   .DE $0337            ;HIBYTE
                0055 DELAYREG   .DE $0338
                0060 X.SCRLREG  .DE $D016
                0065 ;*****DEFINE SCREEN LOCATIONS FOR LEFTMOST
                0070 ;COLUMN OF THE 6 ROWS THAT WILL SCROLL.
                0075 ROW1LFT    .DE $06F8            ;TOP ROW
                0080 ROW2LFT    .DE $0720
                0085 ROW3LFT    .DE $0748
                0090 ROW4LFT    .DE $0770
                0095 ROW5LFT    .DE $0798
                0100 ROW6LFT    .DE $07C0
                0105 ;DO THE SAME FOR THE RIGHT COLUMN
                0110 ROW1RIGHT  .DE $071F
                0115 ROW2RIGHT  .DE $0747
                0120 ROW3RIGHT  .DE $076F
                0125 ROW4RIGHT  .DE $0797
                0130 ROW5RIGHT  .DE $07BF
                0135 ROW6RIGHT  .DE $07E7
                0140 ;*******-FILL SCROLL AREA ROUTINE-************************
C000- A9 00     0145 FILLSCROLL LDA #$00             ;LOBYTE START SCREEN DATA
C002- 85 FD     0150            STA $FD              ;ZERO PAGE WORK REGISTER
C004- A9 C8     0155            LDA #$C8             ;HIBYTE START SCREEN DATA
C006- 85 FE     0160            STA $FE
C008- A2 00     0165            LDX #$00
C00A- A0 05     0170 FILCOL     LDY #$05             ;COUNTER FOR 6 ROWS
C00C- B1 FD     0175            LDA ($FD),Y          ;GET DATA & PUT IN
C00E- 9D C0 07  0180            STA ROW6LFT,X        ;SCREEN LOCATION ROW 6
C011- 88        0185            DEY
C012- B1 FD     0190            LDA ($FD),Y          ;GET NEXT DATA
C014- 9D 98 07  0195            STA ROW5LFT,X        ;PUT IT IN ROW FIVE
C017- 88        0200            DEY
C018- B1 FD     0205            LDA ($FD),Y
C01A- 9D 70 07  0210            STA ROW4LFT,X        ;ROW 4
C01D- 88        0215            DEY
C01E- B1 FD     0220            LDA ($FD),Y
C020- 9D 48 07  0225            STA ROW3LFT,X        ;ROW 3
C023- 88        0230            DEY
C024- B1 FD     0235            LDA ($FD),Y
C026- 9D 20 07  0240            STA ROW2LFT,X        ;ROW 2
C029- 88        0245            DEY
C02A- B1 FD     0250            LDA ($FD),Y
C02C- 9D F8 06  0255            STA ROW1LFT,X        ;TOP ROW
C02F- E8        0260            INX                  ;GET READY TO DO NEXT COL
C030- E0 27     0265            CPX #$27             ;ARE 40 COLS DONE?
C032- F0 0E     0270            BEQ ENDFIL           ;IF SO END ROUTINE
C034- A5 FD     0275            LDA $FD              ;GET POINTER TO SCREEN DAT
C036- 18        0280            CLC
C037- 69 06     0285            ADC #$06             ;ADD 6 TO FIGURE NEXT
C039- 85 FD     0290            STA $FD              ;COL ADDRS THEN PUT BACK
C03B- 90 CD     0295            BCC FILCOL
C03D- E6 FE     0300            INC $FE              ;UP THE HIBYTE
C03F- 4C 0A C0  0305            JMP FILCOL           ;DO ANOTHER ROW
C042- A9 00     0310 ENDFIL     LDA #$00             ;SET POINTER TO DATA
C044- 8D 34 03  0315            STA TOPLFTLO         ;IN TOP/LFT
C047- A9 C8     0320            LDA #$C8
C049- 8D 35 03  0325            STA TOPLFTHI
C04C- 60        0330            RTS
                0335 ;********-SCROLL RIGHT ROUTINE-*************************
C04D- D8        0410            CLD
C04E- A9 F8     0415            LDA #$F8             ;PUT POINTER TO DATA
C050- 85 FB     0420            STA $FB              ;BACK IN WORK REG
C052- A9 06     0425            LDA #$06             ;DO THE SAME WITH THE HIBY
C054- 85 FC     0430            STA $FC
C056- A0 26     0435 DOROW      LDY #$26             ;SET COLUMN COUNTER
C058- B1 FB     0440 DOCOL      LDA ($FB),Y          ;GET DATA FROM THE SCREEN
C05A- C8        0445            INY
C05B- 91 FB     0450            STA ($FB),Y          ;MOVE IT RIGHT ONE COLUMN
C05D- C0 01     0455            CPY #$01             ;IS THE ROW FINISHED
C05F- F0 05     0460            BEQ UPROW            ;IF SO MOVE ON
C061- 88        0465            DEY                  ;IF NOT MOVE LEFT TWO SPAC
C062- 88        0470            DEY                  ;AND GET SET TO MOVE THAT
C063- 4C 58 C0  0475            JMP DOCOL
C066- A5 FB     0480 UPROW      LDA $FB              ;GET LOBYTE OF TOPLFTSCREE
C068- 18        0485            CLC                  ;FROM WORK REGISTER AND
C069- 69 28     0490            ADC #$28             ;ADD 40 TO IT TO GET SCRN
C06B- 85 FB     0495            STA $FB              ;FOR COL 1 OF NEXT ROW
C06D- 90 02     0500            BCC OFFSCREEN
C06F- E6 FC     0505            INC $FC              ;IF CARRY IS SET UP THE HI
C071- A5 FB     0510 OFFSCREEN  LDA $FB              ;GET LOBYTE
C073- C9 E8     0515            CMP #$E8             ;IS IT ROW 70E8(BELOW SCRE
C075- D0 DF     0520            BNE DOROW            ;IF NOT DO ANOTHER ROW
                0525 ;****-FILL LEFT COLUMN WITH NEW DATA-*********************
C077- AD 35 03  0530            LDA TOPLFTHI         ;PUT HIBYTE(LOCATION OF SC
C07A- 85 FC     0535            STA $FC              ;IN TOP LFT OF SCROLL AREA
C07C- AD 34 03  0540            LDA TOPLFTLO         ;GET LOBYTE
C07F- 38        0545            SEC
C080- E9 06     0550            SBC #$06             ;GET MEM LOCATION FOR STAR
C082- 85 FB     0555            STA $FB              ;DATA FOR NEXT COLUMN & PU
C084- B0 02     0560            BCS TOOLOW           ;IF NOT LESS THAN 0 MOVE O
C086- C6 FC     0565            DEC $FC              ;IF LESS THAN 0 DECREASE T
                0570 ;*****-DOUBLE COMPARE TO SEE IF DATA IS WITHIN DATA TABLE*
                0575 ;****-IF NOT, WRAPAROUND TO GET DATA FROM END OF TABLE.***
C088- A5 FB     0580 TOOLOW     LDA $FB              ; IS POINTER TO
C08A- C9 00     0585            CMP #00              ;IS DATA IN UP/LFT
C08C- A5 FC     0590            LDA $FC              ;LESS THAN $C800
C08E- E9 C8     0595            SBC #$C8
C090- 90 03     0600            BCC RESET            ;IF LESS RESET
C092- 4C 9B C0  0605            JMP SETPOINTER
C095- A9 CA     0610 RESET      LDA #$CA             ;SET TOP/LFT PNTR
C097- 85 FB     0615            STA $FB              ;TO$CACA
C099- 85 FC     0620            STA $FC
C09B- A5 FB     0625 SETPOINTER LDA $FB              ;PUT NEW DATA MEMORY LOCAT
C09D- 8D 34 03  0630            STA TOPLFTLO         ;INTO POINTERS
C0A0- A5 FC     0635            LDA $FC
C0A2- 8D 35 03  0640            STA TOPLFTHI
                0645 ;********FILL LEFT COLUMN WITH NEW DATA*******************
C0A5- A0 05     0650            LDY #$05             ;COUNTER -6 BYTES
C0A7- B1 FB     0655            LDA ($FB),Y          ;GET A BYTE
C0A9- 8D C0 07  0660            STA ROW6LFT          ;PUT IN COL 1 ROW 6
C0AC- 88        0665            DEY                  ;DECREMENT THE COUNTER
C0AD- B1 FB     0670            LDA ($FB),Y          ;GET NEXT BYTE
C0AF- 8D 98 07  0675            STA ROW5LFT          ;PUT ON SCREEN TOO
C0B2- 88        0680            DEY
C0B3- B1 FB     0685            LDA ($FB),Y          ;ETC.
C0B5- 8D 70 07  0690            STA ROW4LFT
C0B8- 88        0695            DEY
C0B9- B1 FB     0700            LDA ($FB),Y
```

More →

Listing 5 continued.

```
C0BB- 8D 48 07  0705            STA ROW3LFT
C0BE- 88        0710            DEY
C0BF- B1 FB     0715            LDA ($FB),Y
C0C1- 8D 20 07  0720            STA ROW2LFT
C0C4- 88        0725            DEY
C0C5- B1 FB     0730            LDA ($FB),Y
C0C7- 8D F8 06  0735            STA ROW1LFT
C0CA- 60        0740            RTS
C0CB- EA        0745            NOP
                0750 ;**********.SCROLL LEFT SUBROUTINE.**********************
C0CC- A9 F8     0835            LDA #$F8            ;LOAD TOP LEFT POINTER
C0CE- 85 FB     0840            STA $FB             ;INTO WORK REGISTERS
C0D0- A9 06     0845            LDA #$06
C0D2- 85 FC     0850            STA $FC
C0D4- A0 01     0855 DOROW2     LDY #$01            ;SET COUNTER FOR ROWS
C0D6- B1 FB     0860 DOCOL2     LDA ($FB),Y         ;GET DATA FROM SCREEN
C0D8- 88        0865            DEY
C0D9- 91 FB     0870            STA ($FB),Y         ;MOVE IT TO THE LEFT ONE C
C0DB- C0 26     0875            CPY #$26            ;ALL COLUMNS DONE?
C0DD- F0 05     0880            BEQ NEXTROW         ;IF YES DO NEXT ROW
C0DF- C8        0885            INY                 ;MOVE FORWARD 2 COLUMNS
C0E0- C8        0890            INY
C0E1- 4C D6 C0  0895            JMP DOCOL2          ;AND MOVE IT TO LEFT ALSO
C0E4- A5 FB     0900 NEXTROW    LDA $FB             ;GET LOBYTE POINTER
C0E6- 18        0905            CLC                 ;TO TOP LEFT DATA
C0E7- 69 28     0910            ADC #$28            ;ADD 40(NEXT ROW ADDRESS)
C0E9- 85 FB     0915            STA $FB             ;PUT BACK IN POINTER
C0EB- 90 02     0920            BCC CHECKROW        ;IF NO CARRY MOVE ON
C0ED- E6 FC     0925            INC $FC             ;IF A CARRY UP HIBYTE
C0EF- A5 FB     0930 CHECKROW   LDA $FB
C0F1- C9 E8     0935            CMP #$E8            ;ARE WE PAST BOTTOM ROW
                0940            ;LOCATION $70E8
C0F3- D0 DF     0945            BNE DOROW2          ;IF NOT DO ANOTHER ROW
                0950 ;********-UP THE POINTER TO DATA-************************
C0F5- AD 35 03  0955            LDA TOPLFTHI        ;GET HIBYTE POINTER
C0F8- 85 FC     0960            STA $FC             ;PUT IN WORK REGISTER
C0FA- AD 34 03  0965            LDA TOPLFTLO        ;GET LOBYTE
C0FD- 18        0975            CLC
C0FE- 69 06     0980            ADC #$06            ;ADD 6 TO GET START OF
C100- 85 FB     0985            STA $FB             ;DATA FOR NEXT COLUMN
C102- 90 07     0990            BCC TOOHI           ;IF NO CARRY MOVE ON
C104- AD 35 03  0995            LDA TOPLFTHI        ;IF CARRY UP HIBYTE OF POI
C107- 85 FC     1000            STA $FC
C109- E6 FC     1005            INC $FC
                1010 ;******-DOUBLE COMPARE POINTER TO END OF DATA-************
C10B- A5 FB     1015 TOOHI      LDA $FB             ;COMPARE POINTER TO DATA
C10D- C9 CB     1020            CMP #$CB            ;TO END OF DATA ($CACB)
C10F- A5 FC     1025            LDA $FC
C111- E9 CA     1030            SBC #$CA
C113- B0 03     1035            BCS RESET2          ;IF LARGER THEN RESET
C115- 4C 20 C1  1040            JMP SETPOINTR       ;IF NOT THEN MOVE ON
C118- A9 00     1045 RESET2     LDA #$00            ;IF PAST END OF DATA
C11A- 85 FB     1050            STA $FB             ;RESET TO $C800 FOR
C11C- A9 C8     1055            LDA #$C8            ;WRAPAROUND OF SCREEN
C11E- 85 FC     1060            STA $FC
C120- A5 FC     1065 SETPOINTR  LDA $FC
C122- 8D 35 03  1067            STA TOPLFTHI        ;RESET WORK REGISTERS
C125- 85 FE     1070            STA $FE
C127- A5 FB     1075            LDA $FB
C129- 8D 34 03  1080            STA TOPLFTLO
C12C- 18        1085            CLC
                0035            .FI "SCROLL.6.M02"
```

```
                1205 ;FILENAME "SCROLL.6.M02"
C12D- 69 EA     1210            ADC #$EA            ;ADD 234 TO TOP/LFT
C12F- 85 FD     1215            STA $FD             ;TO GET LOCATION OF
                1220            ;DATA IN TOP/RT
C131- 90 02     1225            BCC OVERRT          ;IF NO CARRY MOVE ON
C133- E6 FE     1230            INC $FE             ;IF CARRY INC HIBYTE
C135- A5 FD     1235 OVERRT     LDA $FD
C137- C9 CB     1240            CMP #$CB            ; ARE WE AT END OF DATA
C139- A5 FE     1245            LDA $FE             ;(LOCATION $CACA)
C13B- E9 CA     1250            SBC #$CA
C13D- B0 03     1255            BCS FIGRT           ;IF OVER REFIGURE TOP/RT
C13F- 4C 76 C1  1260            JMP LOADATA         ;IF NO, LOAD DATA TO SCRN
C142- A5 FD     1265 FIGRT      LDA $FD
C144- 38        1270            SEC                 ;SUBTRACT $CACA FRM UP/RT
C145- E9 CA     1275            SBC #$CA            ;POINTER ($FD-FE) TO FIND
C147- 85 FD     1280            STA $FD             ;HOW FAR OVER END
                1285            ;OF DATA WE ARE.
C149- 90 0A     1290            BCC UPHIBY
C14B- A5 FE     1295            LDA $FE
C14D- 38        1300            SEC
C14E- E9 CA     1305            SBC #$CA            ;IF CARRY SET SUBRTACT
C150- 85 FE     1310            STA $FE             ;CA FROM HIBYTE
C152- 4C 5C C1  1315            JMP ADDTO
C155- A5 FE     1320 UPHIBY     LDA $FE
C157- 38        1325            SEC                 ;IF CARRY CLR INC #$CA
C158- E9 CB     1330            SBC #$CB            ;AND SUBTRACT FROM HIBYTE
C15A- 85 FE     1335            STA $FE
C15C- A5 FD     1340 ADDTO      LDA $FD             ;NOW ADD DIFRNCE TO $C7FA
C15E- 18        1345            CLC                 ;TO GET NEW TOP/RT
C15F- 69 FA     1350            ADC #$FA
C161- 85 FD     1355            STA $FD
C163- B0 0A     1360            BCS UPHI            ;IF CARRY UP THE HIBYTE
C165- A5 FE     1365            LDA $FE
C167- 18        1370            CLC
C168- 69 C7     1375            ADC #$C7
C16A- 85 FE     1380            STA $FE
C16C- 4C 76 C1  1385            JMP LOADATA
C16F- A5 FE     1390 UPHI       LDA $FE
C171- 18        1395            CLC
C172- 69 C8     1400            ADC #$C8
C174- 85 FE     1405            STA $FE
                1410 ;*******PUT NEW DATA IN RIGHT COLUMN**********************
C176- A0 05     1415 LOADATA    LDY #$05            ;SET COUNTER FOR 6 ROWS
C178- B1 FD     1420            LDA ($FD),Y         ;GET DATA POINTED TO
                1425            ;BY $FD/$FE
C17A- 8D E7 07  1430            STA ROW6RIGHT       ;STORE IN LAST COL ROW 6
C17D- 88        1435            DEY
C17E- B1 FD     1440            LDA ($FD),Y         ;GET NEXT DATA
C180- 8D BF 07  1445            STA ROW5RIGHT       ;PUT IN LAST COL ROW 5
C183- 88        1450            DEY
C184- B1 FD     1455            LDA ($FD),Y         ;ETC.
C186- 8D 97 07  1460            STA ROW4RIGHT
C189- 88        1465            DEY
C18A- B1 FD     1470            LDA ($FD),Y
C18C- 8D 6F 07  1475            STA ROW3RIGHT
C18F- 88        1480            DEY
C190- B1 FD     1485            LDA ($FD),Y
C192- 8D 47 07  1490            STA ROW2RIGHT
C195- 88        1495            DEY
C196- B1 FD     1500            LDA ($FD),Y
C198- 8D 1F 07  1505            STA ROW1RIGHT
C19B- 60        1510            RTS
                0040            .EN
```

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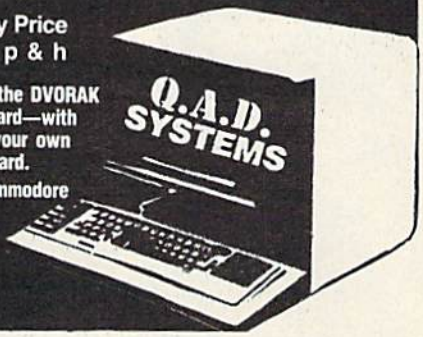

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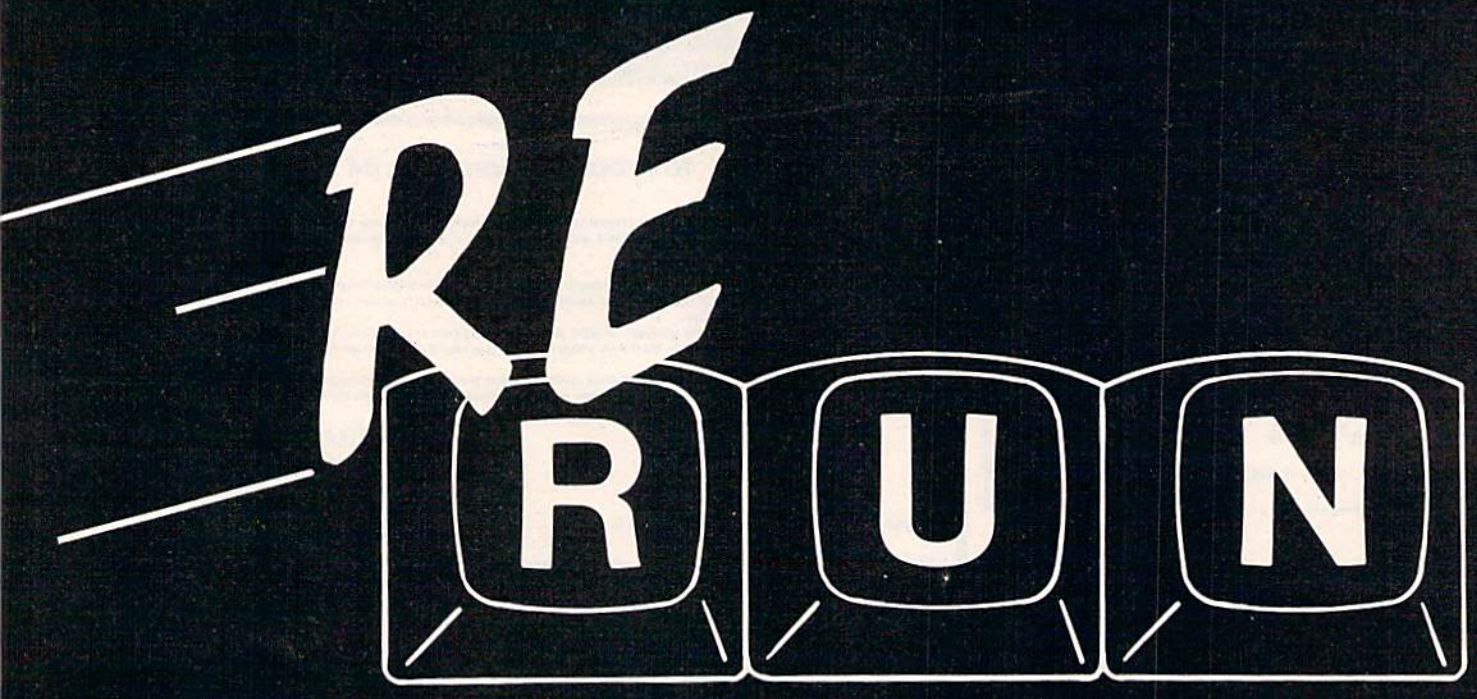

Your favorite programs from RUN magazine.

EASY TO USE — CONVENIENT FUN

RUNningRuminations

(from p. 6)

VIC, half way down the list to show where the C-64 programs end and the VIC-20 programs begin.

Though obvious to most people, programs written for the VIC-20 will probably not work on a C-64 and vice-versa. You may be able to load them and list them, but if they were meant to run on both machines, we would have told you.

If you can figure out how to make a particular VIC-20 program work on a C-64 or a C-64 program work on a VIC-20, then send us your conversion and we might publish it for everyone else. If you have any questions about a program (how it works, what the requirements are and so on), refer to the original article before contacting us (you can learn a lot just by reading the instructions).

To load the programs on tape, make sure the tape is rewound all the way to the beginning and that you have the correct side up (VIC-20 or C-64, depending on which computer you own), then type

```
LOAD "entire-program-name"
```

and press the return key. The computer will respond with PRESS PLAY ON TAPE.

After you've pressed the play button, the computer will search the tape until it finds the program, and then will load it (some C-64s, before they load the program, require that you press a key when the program is found). When the program is loaded, type RUN and press the return key, and you're on your way.

If you're a disk user, just type

```
LOAD "entire-program-name" , 8
```

then press the return key and the program should load.

When we say "entire-program-name," we mean *either* the entire name, including the month and page number, just the way it appears on the box, or the "wild-card" method, the first few letters followed by an asterisk.

For example, if you want to load the program DISK-O-VIC, you must type it *exactly* as we show it on the box—DSKOVIC JAN P102—or, if you're lazy (like me), you can type the first four or five letters of the name and add an asterisk (*) as a wild card. So to load DISK-O-VIC, you would only have to type

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

(check your manuals for more on how to load programs).

We could go on and on about ReRUN—how wonderful the programs are, how inexpensive, how easy, how to load and run them, how much work we put into this and so on, but all you have to do is order a copy, try a few of the programs and see for yourself. After all, if you didn't think that *RUN* magazine was worthwhile, then you wouldn't be reading this now, would you?

GW

Programs for the First ReRUN

Filename	Article	Month	Page	System
ZELAZ64 JAN P42	Canyons of Zelaz	January	42	C-64
SYM-CODE JAN P92	The Riddle of the Symbol Code	January	92	C-64
DSKOVIC JAN P102	DISK-O-VIC	January	102	VIC-20
DBASE/3K FEB P48	Database Deluxe	February	48	VIC-20
DATABASE FEB P48	Database Deluxe	February	48	C-64
FUNCTKEY FEB P70	Fancy Fingering on the Function Keys	February	70	VIC-20
FNCTKEY FEB P70	Fancy Fingering on the Function Keys	February	70	C-64
KNGDM20 FEB P76	Iron Hand or VIC-20?	February	76	VIC-20
KINGDOM FEB P76	Iron Hand or VIC-20?	February	76	C-64
SPRITEN FEB P124	Spriten Up!	February	124	C-64
VICASSO FEB P132	Create a VICasso	February	132	VIC-20
SRPNT/3K MAR P58	Serpent of Death	March	58	VIC-20
BAHA1000 MAR P68	Baja 1000	March	68	VIC-20
BOMBER MAR P106	Mad Bomber	March	106	C-64
FUNKEY APR P58	Funky Monkey	April	58	VIC-20
REPEAT MAY P82	Repeat the Sequence	May	82	C-64
CAVES MAY P90	Caves of Alpha-Ceti	May	90	VIC-20
TLMUSIC MAY P132	Total Music	May	132	C-64
DSK-O-64 JUN P54	DISK-O-64	June	54	C-64
DOODL/3K JUN P98	Doodle on Your VIC	June	98	VIC-20

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COMPUTER INTERFACES

IEEE — 488

RS — 232

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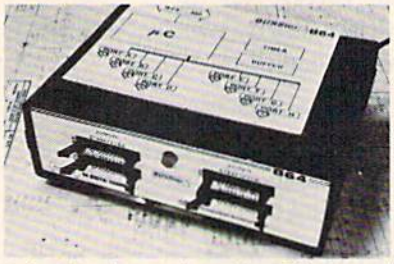

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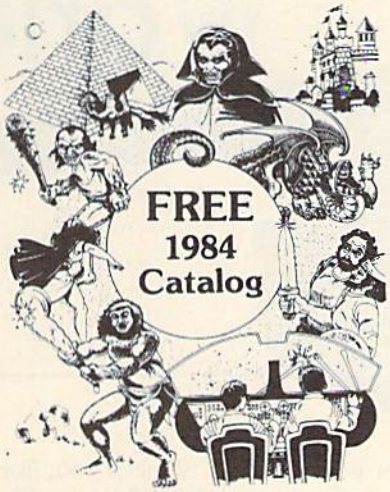

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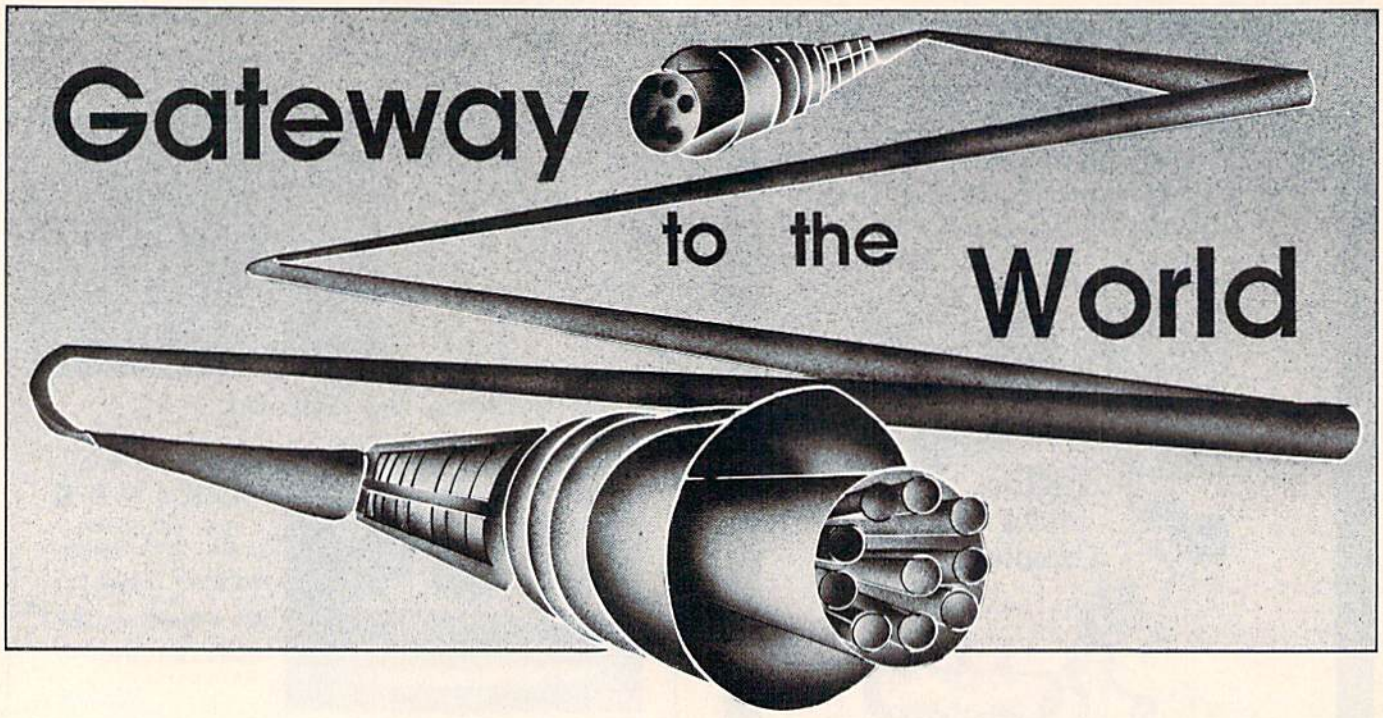

If you have a vacant RS-232 port, learn how you can put that connection to work and increase the effectiveness of your Commodore.

By Jim Grubbs

RUN It Right

Commodore 64
or
VIC-20

Address all author correspondence to Jim Grubbs, PO Box 3042, Springfield, IL 62708.

All of the add-on equipment, or peripherals, must be connected to your VIC-20 or C-64 so they can communicate with the main processing board. Each manufacturer is free to design any type of interconnection, which is usually based on a previously established standard.

There are several gateways on your computer. Even the socket used to connect your joystick is an interface to something happening in your world, for through it you relay positioning information to the computer.

The serial bus is another popular means of connecting peripherals to your computer. You probably have a disk drive or a printer connected here, but you could hook up other devices by using the serial port.

Your computer also makes the parallel bus, or expansion port, available to you. This is where you connect additional memory for the VIC-20 or plug in a game cartridge. There are lots of things to explore here, but this month our port of call is the user port, or RS-232 port.

As you view your computer from its rear, this connector is located on its far right side. In your computer, the user port and the RS-232 port are one and the same. Last month we talked about some simple uses of the user port, and with this month's installment, we'll begin to consider the RS-232 functions that are possible at these same connections.

The Importance of the RS-232

You may already be using this connection for plugging in your VIC-Modem. Some of you, like myself, may have an RS-232 type printer plugged into this connection.

By and large, the most common addition to the VIC or C-64 is the telephone modem, which requires you to use the RS-232 port. What is a modem and what kind of software goes with it?

Simply, a modem is an interface between your computer and your telephone. Your computer speaks a digital language consisting of rapidly changing voltages, but your telephone deals with sounds in the voice frequency range. The modem converts one means of transmittal into the other by using only hardware.

So you're all set once the modem is plugged in, right? Not quite. Your computer is faster than the fellow in the Federal Express commercial. The telephone lines have a lot of difficulty handling the normal speed of the computer, so you must introduce a controlling program to format the data so it can effectively pass through the modem to the telephone line.

Additionally, your Commodore machine speaks an enhanced version of ASCII, so if you want to communicate with standard ASCII machines, minor modifications are necessary. You might also want to save the information you receive through your modem, or perhaps you'd like to send previously created files.

A terminal program can accomplish all of these tasks. The terminal program formats data and controls speed and other factors through software; it sends a digital signal to the modem to convert

to tones when you are sending, and performs the reverse when you're receiving.

Setting the Standards

Where did the term RS-232 come from? It actually was originated when a group of prestigious engineers established standards for the necessary connections that would enable computers to communicate not only with each other, but with printers, disk drives, instrumentation packages and other peripheral devices. Unfortunately, the RS-232 is not the only standard. Standards like the IEEE-488 have also been established. Your computer can't meet these standards without some help.

Actually, the Commodore machines are not capable of real RS-232 communication, but the limitations are easily overcome. Just like the many variations on the old "Kansas City" standard for cassette storage of data, the Commodore RS-232 standard is a bit different from *the* standard.

A great deal of the integrated-circuit technology in today's computers employs transistor-transistor logic (TTL). TTL devices represent the two binary states, with a positive five-volt signal for a 1 and a ground or near-ground potential—zero volts—for binary 0.

Commodore felt it a logical extension to utilize these already available TTL-compatible signals on its pseudo-RS-232 port. Real RS-232 standards call for signals of positive nine to 12 volts for a one, and negative nine to 12 volts for a zero. A simple voltage-conversion circuit will take care of this problem, and several such interfaces are available on the commercial market.

But if you're using a Commodore-manufactured product, such as the VIC-Modem, or if you design your own circuitry, no such adjustment in signal levels is necessary. Chances are, though, if you wish to use a non-Commodore product, you'll need an interface.

Physically, connections are made to the RS-232/user port via a 24-pin edge connector. These can be a bit difficult to locate. I've included one source in Table 3. If you're stuck, a similar connector with more pins can be pared down to size with a hacksaw. Of course you'll have to use caution when installing it to make sure you line up the pins properly. Always do this with the power *off*!

Open to Function

A very powerful Open statement and some built-in communications software that Commodore has provided are the keys to using the RS-232 functions. It's

Actually, the Commodore machines are not capable of real RS-232 communication, but the limitations are easily overcome.

really no different than opening a cassette or disk file, but in this case the file drawer you open in your computer's electronic office is labeled RS-232.

There are several important considerations when opening an RS-232 channel. First, you only have one of them! If you try and open another one, you simply reset the pointers and still end up with only one. Therefore, opening an RS-232 channel should be the first thing that you do in your program.

Two things happen when an RS-232 channel is opened. First, an automatic Clear instruction is issued, meaning that all of your variables and memory pointers are zeroed. (I learned that one the hard way.) Second, and just as important, 512 bytes of memory are immediately set aside for receive and transmit buffers. It makes no difference if you only want to use this port for one-way communication—the full 512 bytes are set aside. If you don't have enough room left, the program doesn't alert you. Of course, if you plan ahead, you won't have that problem.

The Open statement takes the form of: OPEN lfn,2,0,(control register) (command register) (optional baud low) (optional baud high). Now, what does that mean?

Just as with all files, you choose a file number from 1 to 255. There's one caution here. If you select a file number above 128, a line-feed symbol will be sent with every carriage return. You may not always want this feature.

The file number is followed by the device number, which, for RS-232, will always be a 2. This is your signal to the computer program that you're opening an RS-232 channel. The 0 is simply a placeholder. The meat-and-potatoes part of setting the parameters comes in the next two statements—the control and command registers, which I'll explain to you this month.

Control Register

The control register is a single-byte (eight-bit) register that stores several of the parameters you'll need when using an RS-232 channel. An image of the control register resides at memory location 659 decimal.

The actual chips used for the user/RS-232 port are not the same in the VIC as in the 64. The VIC uses the VIA (versatile interface adapter), a 6522 chip, while the 64 uses a CIA (complex interface adapter), a 6526 chip. The control and command registers actually live on these chips, but for programming purposes, we put a duplicate image of the on-board chip registers in memory so that they're easier to get to. Stored in these eight bits are three important pieces of information.

Cruising Along

First you define the baud rate, or speed of transmission, which you can think of as the RS-232 "cruise control." This is the speedometer that tells your computer how fast to send and receive information over an RS-232 channel. The term baud is derived from a scientist named Baudot, who invented some early forms of data transmission. Next time, we'll create a modem program that uses Baudot code.

You set the cruise control in the first four bits of the control register. Remember, when counting bits you always start at 0 with the rightmost bit and move to the left. The software in your computer comes with most normal baud rates already calculated for you. Most of you are familiar with 300 baud, a common speed when communicating via modem, and 1200 baud, another popular speed for telecomputing.

Let's define baud rate. The baud rate is the total number of bits sent in one second. This is sometimes abbreviated bps. ASCII codes exist in both eight-bit and seven-bit versions.

Let's assume you're using the standard seven-bit ASCII. Each symbol you send will consist of seven bits, plus one or two stop bits, which equals about 400 words per minute for 300 baud. At 1200 baud, something a bit less than three times as much information can be transmitted in the same period of time.

As the speed increases, so does the bandwidth of the data signal. This requires more electronics to recover the signal. It also implies the need for a better quality link between the computer and whatever device it's talking to. Problems often result when a standard phone line is used.

To give you an idea of different bandwidths, consider that a Morse-code signal, keyed slowly (about 10 words per minute), has a theoretical

3	2	1	0	Speed (baud rate)
0	0	0	0	User Rate
0	0	0	1	50 baud
0	0	1	0	75 baud
0	0	1	1	110 baud
0	1	0	0	134.5 baud
0	1	0	1	150 baud
0	1	1	0	300 baud
0	1	1	1	600 baud
1	0	0	0	1200 baud
1	0	0	1	1800 baud
1	0	1	0	2400 baud
1	0	1	1	3600 baud
1	1	0	0	4800 baud
1	1	0	1	7200 baud
1	1	1	0	9600 baud
1	1	1	1	19200 baud

Table 1. The baud rates implemented on the VIC-20 and C-64.

6	5	Word Length
0	0	8 Bit words
0	1	7 Bit words
1	0	6 Bit words
1	1	5 Bit words

Bit 4 is unused

Bit 7—If this bit is a 0, then one stop bit is sent. If this bit is a 1, then two stop bits are sent.

Table 2. Word length options available.

Bit 0—If this bit is set to a 0, 3-line handshake is implemented. If set to 1, X-line handshake is used.

Bits 1, 2 and 3 are all unused

Bit 4—If this bit is set to 0, full-duplex operation is implemented. If set to a 1, half-duplex operation is used.

7	6	5	Parity
0	0	0	Parity disabled
0	0	1	Odd parity
0	1	0	undefined
0	1	1	Even parity
1	0	0	undefined
1	0	1	Mark transmitted, parity disabled
1	1	0	undefined
1	1	1	Space transmitted, parity disabled

The 24-pin user port connector, such as a Sullins 06SUL1224E5, is available from Priority One Electronics, 9161 Deering Ave., Chatsworth, CA 91311.

Table 3. The parity options available.

bandwidth on the order of a few cycles, while the digital equivalent of regular voice frequencies has a bandwidth on the order of hundreds of thousands of cycles.

Table 1 shows the baud rates implemented on the VIC-20 and the C-64. Note that the speeds above 2400 baud, though they've been defined for future use, aren't actually available in your machine.

Bit 4 (the fifth bit) is unused. Bits 5 and 6 define the word length. RS-232 transmissions are serial in nature—as in a TV soap opera, where one episode follows another.

The other method of communication is parallel in nature. Its TV equivalent would consist of having eight TVs side by side, each tuned to a different episode of the same show, so you'd be watching the programs in parallel.

You select word lengths of 5, 6, 7 or 8 bits. (In an upcoming installment, we'll use Baudot code to ASCII as an example of code conversion and will set the word length to 5 bits.) Table 2 shows the options available.

Finally, in the last bit—bit 7—you indicate whether one or two stop bits will be used. A 0 indicates one stop bit, a 1 indicates two stop bits. This is the synchronizing signal between devices, so that we know when one character stops and the next one begins.

What about start bits, and why do we need start and stop bits at all? Each character you send has a start bit in it. One start bit is standard, so you don't need to tell the computer how many to send (that's pre-programmed).

The origin of start and stop bits was long before World War II, when all data transmission was mechanical. Teleprinter machines consisted of many whirring gears, all driven off one big motor. Due to all of the play inherent in mechanical devices (which gets worse as the gears wear), it was necessary to send a synchronizing signal at the beginning and end of each character.

With today's technology, the start and stop bits really aren't needed, since your computer is capable of synchronizing itself to incoming data in other ways. But for now, virtually all methods of data transmission that you're likely to encounter require a start bit and one or more stop bits. Just remember the churning gears as you program this parameter.

You are now half way home. The rest of the parameters you control are set in the command register.

Command Register

Now that we've seen how baud rate, word size and stop bits are set using the control register, let's look at what we can accomplish using the command register.

You really don't have to do anything with the command register. Conveniently, Commodore has set the default value for this register (all zeroes) to conform with most communication needs. Just like the control register, there's a single-byte image of the register present at address 660 decimal.

Let's first consider how computers, in a sense, shake hands with one another. Imagine two persons from very different places. One speaks very quickly, the other sounds a bit like a 45 rpm record played at 33. Although they speak the same language, the slower speaker has trouble keeping up with the fast talker. They agree, therefore, that the slower of the two will reach out and shake hands with the faster one when he is ready for the next sentence. A zero in bit zero in address 660 indicates a three-line handshake, a one indicates an X-line handshake.

Bits 1, 2 and 3 are all unused. Bit 4, however, is important, for with it you decide whether the "duplex" should be full or half. Normal data communication allows two-way simultaneous

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```
5 REM INSERT OPEN STATEMENT IN LINE 10
10 OPEN 3,2,0,CHR$(6+32)+CHR$(32+128)
20 REM SETS SCREEN FOR C-64 ONLY:POKE 53280,1:POKE 5328
     1,1:PRINT"{CTRL 1}"
30 PRINT"{SHFT CLR}{CRSR DN}REGISTER PEEKER"
40 PRINT"{CRSR DN}ENTER THE ADDRESS"
42 PRINT"(IN DECIMAL)"
45 PRINT"OF THE REGISTER"
50 PRINT"YOU WISH TO VIEW"
60 INPUT R
70 I=PEEK(R):PRINT"{CRSR DN}THE CURRENT DECIMAL":PRINT"
     CONTENT IS:";I
80 GOSUB 500
90 PRINT"{CRSR DN}THE BINARY LAYOUT IS:"
100 PRINT:PRINT R7$+R6$+R5$+R4$+R3$+R2$+R1$+R0$
110 PRINT"{CRSR DN}DO YOU WISH TO VIEW"
130 PRINT"ANOTHER REGISTER(Y/N)"
140 GET A$:IF A$="" THEN 140
150 IF A$<>"Y" THEN END
160 GOTO30
500 R0$="0":R1$="0":R2$="0":R3$="0":R4$="0":R5$="0":R6$
     ="0":R7$="0"
505 IF I AND 1 THEN R0$="1"
510 IF I AND 2 THEN R1$="1"
520 IF I AND 4 THEN R2$="1"
530 IF I AND 8 THEN R3$="1"
540 IF I AND 16 THEN R4$="1"
550 IF I AND 32 THEN R5$="1"
560 IF I AND 64 THEN R6$="1"
570 IF I AND 128 THEN R7$="1"
580 RETURN
600 REM *************
610 REM *
620 REM *
630 REM * JIM GRUBBS
640 REM * PO BOX 3042
650 REM * SPRINGFIELD
660 REM * IL. 62708
670 REM *
680 REM *************
```

Listing 1. How to effectively use the Open statement with the RS-232 port.

transmission of information, which is logically called full-duplex operation.

If only one side of the communications link can transmit at a time, though each side is capable of both transmitting and receiving, then you have half-duplex operation. Finally, a one-way-only path, with a dedicated transmitter on one end and a dedicated receiver on the other, would be called simplex transmission.

You implement full duplex on your machine by setting bit 4 to 0. A 1 indicates half duplex. Historically, a great deal of early data communication was one-way at a time because both ends of the link had to share the same two wires. Unlike today, when tones are piggybacked or multiplexed to allow full-duplex operation over a single pair of wires in your phone, early transmissions consisted of interrupting an electrical current in the wire. Total confusion would have resulted if both stations had tried to transmit at the same time.

Now let's consider parity. You mark parity, or the lack of it, in bits 5, 6 and 7. Table 3 shows your available options. Parity-checking is one method devised by data engineers to ensure that the transmitted information is correct when received. As mentioned earlier, sometimes phone lines or other hookups between units aren't what we'd like them to be.

You perform a simple check on your data and calculate whether you have an even or odd number of binary 1s in each data word. If you use even parity, the total number of 1s should be an even number. If it's not, then you make the "parity bit" a 1 so the total comes out even. Conversely, if you use odd parity, you always want the total to be odd. If it comes up even, you make the parity bit a 1 so that the total is still odd.

This is done on the transmitting signal. The receive unit is instructed to expect even or odd parity. If the proper condition isn't received, the program

With a few more Basic commands, you'll be ready to write the terminal software you need to communicate through the RS-232 port.

can mark the information as questionable and discard it. Table 3 outlines the settings for the command register.

The form of the Open command needs a little more explanation. Let's use an example.

OPEN 3,2,0,CHR$(6+32)+CHR$(32+128)

Looks kind of cryptic, doesn't it? Where on earth did that CHR$ nonsense come from? Not to panic. As already discussed, you opened file 3, an RS-232 device, on channel 0. So far so good. The next statement should be the setting for the control register.

The string CHR$(6+32) really means that you wish to set the bits in the control register that correspond to decimal 6 and 32. Converting 6 to binary, you get 0110 (bits 1 and 2). The decimal 32 becomes 100000 in binary (bit number 5). By checking the charts, you'll find that when bits 1 and 2 are set, 300-baud operation is indicated. Bit number 5 alone indicates that seven-bit words will be used. It's beginning to look like just what we want for a modem program!

CHR$(32+128) comes next. This is the information for the command register. Following the same procedure, the 32 converts again to 100000 (bit 5) and 128 converts to 10000000, or bit 7. As you can see in Table 3, this particular combination indicates mark transmitted, parity check disabled. You might review last month's installment if you're not sure how to isolate particular bits within a word or are having trouble with statements like CHR$(6+32).

At this point, you'll need only a few more Basic commands before you'll be ready to write the terminal software you need to communicate through the RS-232 port.

The rest of the commands associated with the RS-232 channel—Close, CMD, Input#, Get# and Print#—work much as they do with any other file. Next month

we'll look at how to put them to work in a program. I'll cover implementing non-standard baud rates and take a look at code conversion, so you can make your computer communicate to old teletype machines or perhaps to electronic typewriters.

The program in Listing 1 is designed as a learning aid to help you understand how to effectively use the Open statement with the RS-232 port. When the program's loaded, you'll be able to "see" the chip control and command registers when set for varying parameters.

To keep the program as simple as possible, enter your Open statement in line 10. The example we discussed is contained in the listing. By running the program and answering the address prompt with 659 and 660, you'll be able to view the registers.

Try creating your own Open statements for different parameters, then use the program to see if you get the expected results. This program can be used to look at any address in your machine, so you might want to save it as a simple utility program. See you next month! R

(from page 16)

leading spaces won't. To have a completely blank line, enter the line number, a shifted letter, a space and another shifted letter. Neither of these procedures will affect execution of your program in any way. Editing an indented line will remove the indentation.

Ronald LaPread
Detroit, MI

$7D Chips—If you'd like to know about the silicon chips that make your computer tick, the October 1982 issue of *National Geographic* is a good place to start. Most of that issue was devoted to explaining what chips are, how they are made and how they work. If you don't have that back issue yourself, check with your public library.

L.F.S.

$7E Waiting for input—At some time or another, most programs need to pause to give the user time to read instructions or other information on the screen. Usually, programmers use a Get loop to allow this pause, but there's a much better way: Use the statement WAIT653,1 to freeze the computer until the shift key is pressed.

If there are several pages of instructions with a WAIT653,1 at the end of each page, you can rapidly skip through the pages just by holding down the shift key. If you want to avoid this, put WAIT653,1,1 after each WAIT653,1. This requires you to press and release the shift key before proceeding.

Randy Palermo
Fort Jones, CA

$7F Centered printing—Centering lines of text between the left and right edges of the screen can be time-consuming, especially if you want to center more than a few lines. You can let the computer do the work for you by using the following subroutine. For a VIC, use 22 instead of 40 in line 1010.

```
100 A$="CENTER":GOSUB1010
120 A$="THIS":GOSUB1010
130 A$="MATERIAL, PLEASE":GOSUB1010
140 END
1000 REM ** CENTERING SUBROUTINE **
1010 PRINTTAB((40-LEN(A$))/2)A$:RETURN
```

Works like a charm.

Michael Berry
Kewanee, IL

$80 Rounding off—The function FNR(N) may be used to round a number, N, to any required decimal position, DP. As with all user-defined functions, you must execute the Definition statement before using the function. And if there's an error in the Definition statement, the error message won't show it—it will indicate an error in the first line where the function is *used*! Here's the function:

```
10 DEF FNR(N) = INT(N/DP+.5)*DP
```

As an example, to round the value of Y to the nearest one-hundredth, type:

```
105 DP=.01 : Z=FNR(Y) : PRINT Z
```

and to round 27 times X to the nearest ten, type:

```
201 DP=10 : T=FNR(27*X) : PRINT T
```

Chuck McGaffin
Ballston Lake, NY

$81 String Handling—One little-known use of the MID$ function is remainder string. If the third parameter of the MID$ function is omitted, the resulting string will be every character to the right of the specified start position for the string being operated on.

For example, if A$="123456789", then MID$(A$,2,4) is "2345". But MID$(A$,2) is "23456789".

This is not the same as RIGHT$, since that function returns an absolute number of characters starting from the rightmost position. This application works best when the right-hand portion of a string is wanted and the string length is not known.

The Transactor

$82 Printing numbers—When the computer prints a positive number, it always prints a leading space (where the sign would be if the number were negative), and a trailing space (to set the number off from whatever is printed next). If this is annoying in your application, use

```
N$ = MID$(STR$(N),2)
```

Where N is the number, N$ will be its string equivalent, less the extra spaces. To put the spaces back in, use N = VAL(N$).

Don Saito, Jr.
Torrance, CA

$83 Graceful exits—Many programs execute Pokes to pointer locations for the purpose of setting up custom characters or reserving space for machine language subroutines. If these programs are simply terminated with End or a keyboard stop/restore, the pointers remain set to their new positions. When the next program is loaded and run, you may get an Out Of Memory error or other strange effects. To avoid the problem, try adding the following routine to your program at a logical point.

```
5010 PRINT "C=CONTINUE Q=QUIT"
5020 GET A$
5030 IF A$="C" THEN (the appropriate line number)
5040 IF A$="Q" THEN SYS64802 (or 64738 for a C-64)
5050 GOTO 5020
```

When your program encounters the routine, if you select Q, you'll cause a cold start, resetting all pointers, color, sound and so on to the "seed" state, and you'll also re-initialize the program. This is a tidy way to exit a program and will save wear and tear on your power switch.

Allan E. Wheeler
Paso Robles, CA

$84 VIC to 64 conversion—If you have some VIC programs that you want to run on your C-64, add this line:

```
PRINT"{SHFT CLR}":IF FRE(X)<0 THEN POKE 53280,3 : POKE 53281,1
```

It will set the C-64 colors to the VIC defaults—white screen with cyan border. The If...Then statement allows the program to run on either computer, since the FRE function is negative on the C-64 for programs that use less than 32K bytes of memory.

Calvin C. Guild
Houston, TX

$85 Computed GOTO—This routine will let you go to a computed line number, that is, to a line number held in a variable. It prints to the screen, so it's not usable in all circumstances. If AA is the computed value, type:

```
100 PRINT"{SHFT CLR} {3 CRSR DNs} GOTO"
    AA "{HOME}" : POKE 198,1 : POKE 631,13: END
```

The PET Gazette

$86 Delay loops—If your program has many For...Next loops to create delays, you can put them in subroutines to save time and memory. Here's an example for delays of various lengths:

```
900 REM DELAY LOOPS
901 FOR I=1 TO  1000 : NEXT : RETURN
902 FOR I=1 TO 2000 : NEXT : RETURN
903 FOR I=1 TO 3000 : NEXT : RETURN
```

Now when you want a delay in your program, just type GOSUB 901 or GOSUB 902 and so on. Notice how the line numbers make it easy to remember the length of the delay.

You should write subroutines only for delays that you'll use at least twice in the program; otherwise, it's not worth the extra effort of setting up this system.

William W. Braun
Arnold, MO

$87 Slow printing—To have your computer print letters individually at a slow rate of speed, type:

```
10 A$="your message here":GOSUB1000
999 END
1000 FOR A=1 TO LEN(A$):PRINT
MID$(A$,A,1);:FOR B=1 TO 40:NEXTB,A:
RETURN
```

To print at different speeds, just change the high value of B in the For...Next loop.

Chris Brellochs
Ithaca, NY

$88 Another PRINT@—To place the cursor anywhere on screen without using the Print statement, use:

```
10 POKE 781,X : REM X POSITION
20 POKE 782,Y : REM Y POSITION
30 POKE 783,0 : SYS 65520
40 PRINT "message"
```

This works with the VIC and the C-64. The leftmost screen column is X position 0, and the top screen line is Y position 0.

A variation on the above lets you use a single number to specify the X,Y screen position. The home position is 0, the next is 1, and so on up to the end of the screen. The lower right-hand screen position is 461 for the VIC, or 999 for the C-64. Here's the code that will do it for the VIC:

```
100 P=250 : GOSUB 1000 : PRINT "message" :
    REM P=POSITION
999 END
1000 POKE 781,P/22 : POKE782,P-22*PEEK
    (781) : POKE 783,0 : SYS 65520 : RETURN
```

For the C-64, the subroutine is:

```
1000 POKE 781,P/40 : POKE782,P-40*PEEK
    (781) : POKE 783,0 : SYS 65520 : RETURN
```

Marcia D. Lakes
Rowland Heights, CA

$89 Universal VIC programs—You can write your VIC-20 programs to work with any memory configuration from the minimum up to fully expanded, just by using this line:

```
S=4*(PEEK(36866)AND128)+64*(PEEK
(36869)AND112):C=37888+4*(PEEK
(36866)AND128)
```

The variable S is the starting location of screen memory, and C is the starting location of color memory. If you Peek and Poke to the screen by using these two variables, you won't have to be concerned with finding the start of screen or color memory.

Michael Caldwell
Burlington, WV

$8A Self-modifying programs—It's easy to make programs work differently each time they're run. Our example is for an unexpanded VIC, but the equivalent of 4101 for your own computer can be found by

```
EQ=4+PEEK(43)+256*PEEK(44)
```

List #1

```
0 REM 200
100 Routine #1 goes here.
199 POKE 4101,137 : END
200 Routine #2 goes here.
```

List #2

```
0 GOTO 200
100 Routine #1 goes here.
199 POKE 4101,137 : END
200 Routine #2 goes here.
```

List #1 shows routine #1 ending with a Poke statement. Location 4101 is the address of the first token in the first program line, in this case, REM. The value Poked, 137, is the token value for the GOTO statement.

List #2 shows the result after the first program is run. The REM is now a GOTO, thanks to the previous Poke. Any runs thereafter will proceed according to List #2. Adding POKE 4101,143 to the end of Routine #2 will cause the program to self-modify back and forth between List #1 and List #2 each time it's run. There are many possible uses of this trick, if it's properly understood.

Gerald Mallonee
Simi Valley, CA

$8B Restarting programs—Sometimes a program will crash unexpectedly after you've entered a lot of valuable data—you may have hit a bad bit of code, forgotten to connect a peripheral or done something else that you can avoid or correct next time. The problem often arises that you want to get back into the program without losing your data, but CONT won't execute for some reason, and Run will reset all your variables.

The secret to starting in the middle is using GOTO in Direct mode to return to a specific point in the program. Unlike Run, GOTO has no effect on variables by itself. Possible entry points include the very beginning (unless it initializes the variables you want to protect), a menu display or the routine you got kicked out of.

Some cautions: Making any changes to program lines will wipe out your variables, so save your data before correcting any bad sections of code. Depending on where you reenter the program, some variables could be changed. If you understand the program thoroughly, you can use the GOTO command, which will avoid this. If not, you should consider starting over from the beginning.

Howard M. Mesick
Hartly, DE

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The Mail RUN

HAM SOS

Could any *RUN* readers help me find a homebrew or commercial program for the VIC-20 and/or C-64 that would enable these computers to operate as electronic mailboxes (RBBS, MSO and so on) for use on amateur radio and MARS radio?

I'd prefer disk access from on-the-air users, so text could be input and output without having the owner of the RBBS/MSO present. I use an expanded VIC-20 with 28K+ free RAM, and a C-64, with MFJ TU.

Gary Kohtala, DA2XF
USAFS-A, Box 1415
APO, NY 09458

Reaching Out—An Addendum

The response to my autodialer program for the C-64 (*RUN,* February 1984, p. 128) has been overwhelming. Many of you are very interested in interfacing the 64 to the phone line so you won't need to hold the telephone up next to the monitor speaker. Fig. 1 is a simple schematic diagram of the interface that I am using. It's only one of many ways to accomplish the connection.

As stated several times in my article, an interface of some kind is absolutely necessary for direct connection. Your telephone line has 48 volts dc across it at all times! That's nearly ten times more voltage than your computer needs. When someone rings your telephone, a 130-volt ac ringing current is applied to your telephone line to make the bells ring. The presence of either of these voltages inside your computer will almost assuredly cause serious damage.

That is why, in my article, I suggested the acoustic method of interfacing, and why the caveat in the last section suggests that interfacing may be difficult for those unfamiliar with electronics.

The audio from the C-64 may not be enough to directly drive the phone coupler in Fig. 1. If you find this to be the case in your application, any small audio amplifier can be used to bring the volume up to the desired level. I use one channel of an old stereo amplifier. Connect the speaker output of the amplifier to the input of T1 on the coupler, and adjust volume on the amplifier so that you break dial tone when the autodialer dials.

The former Bell System companies had a coupler available at an additional monthly charge. It's referred to by its USOC (universal service order code) designation, which is QKT. Check with your local phone company if you're interested in going this route.

Many have asked about the possibility of using the VIC-Modem, or 1650, to couple the tones to the phone line. This really isn't practical since it would require physical modification to the circuitry inside the modem itself.

Most inexpensive autodial modems do not use touch-tone dialing, but employ a small relay to simulate dial-pulse dialing. This has the advantages of being easier to implement and somewhat less costly than a tone dialer. Dial-pulse dialing is also universal, whereas you must pay an additional fee for a touch-tone line. It's difficult to send the tones generated by the C-64 through the modem because there's no audio connection on the RS-232/user port. All of the connections at this port are at computer logic levels. All of the tones sent and received through the modem are generated and decoded in the modem itself and translated into binary data.

If you're familiar with electronics, there may be many ways to accomplish the connection. You might buy an inexpensive phone (selling for as little as $5 these days). Regardless of what route you take, it is imperative that you ensure that your computer is isolated from the voltages present on the phone line. If you are *not* electronically oriented, then I strongly suggest you stay with the acoustic method or enlist the aid of someone who is knowledgeable. Remember, it takes only one wrong connection to send your pride and joy up in smoke!

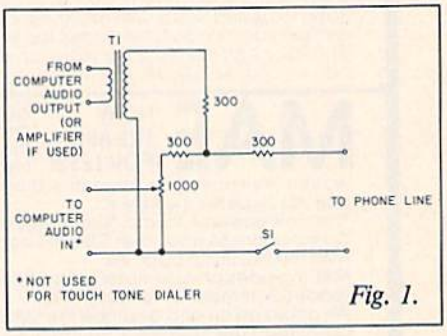

Fig. 1.

Parts List

3—300 ohm ½-watt resistors
1—1000 ohm variable resistor
1—Single-pole, Single-throw Switch (S1)
1—audio transformer (T1) i.e., Radio Shack 273-1380

When the dialer is not in use, make sure that the switch is in the off position. To dial, take the telephone receiver off the hook, put switch S1 in the on position, adjust the volume on the amplifier (if one is used) so that the tones coming from the computer through the monitor cord to the amplifier just break dial tone. Keep all connections above ground. Construction of the interface in a plastic box will help accomplish this.

Jim Grubbs
Springfield, IL

Check It Out

Last December I mailed my subscription to *RUN* magazine anticipating just another computer journal. As a professional librarian familiar with what's available, I had little reason to believe *RUN* would be any more useful than the other C-64 magazines on the market. I was wrong.

Each month, you've published more and more useful tips, utilities and information. I think I've already gotten my money's worth out of the first four issues. Thanks!

Larry B. Hlavsa
St. Paul, MN

Interplanetary Applications

I really enjoyed your article, "In Search of a Tenth Planet" (*RUN*, March 1984), as it showed computer applications to be one of the occupations on the third planet.

I'd like to see more articles on computer applications from different professions and occupations.

Hans-Jurgen A. Wiegand
Peoria, IL

We know that many of our readers use their computers for out-of-this-world applications. Send them in!

Editors

Mad Money

Congratulations on *RUN*. I learned more about the C-64 by reading your first two issues than I did by reading a year's subscription of three other national magazines. Guess who's going to buy software for the Commodore with the money I saved?

John Shimwell
San Francisco, CA

Your wife?

Editors

Spread It Around

Congratulations! *RUN* gets passed around in this family more than the butter dish, so we bought two subscriptions!

Lorraine Richards-May
Leesburg, IN

Index of *RUN* Articles

Have you considered the reader interest value of an annual index of articles published in *RUN*? Such an index could be divided into categories such as games, programming, utilities, educational and so on.

Robert V. Taylor
Little Rock, AR

RUN*'s December issue will feature an index of articles published during that year. As you suggest, for easy use by our readers, the index will be divided into the kinds of articles published.*

Editors

RUN Wants You!

We're not looking for just a few good articles. We're not even looking for a lot of good articles. We are looking for a lot of *great* articles! You have them and we want them! *RUN* magazine is going to be the best magazine ever for the Commodore 64 and VIC-20. We have a little ways to go, and we need your help. Send us that clever programming technique you stumbled upon, that fantastic game you designed, that utility program that is going to revolutionize the way people use their computers.

Write it down! Mail it to us! We pay *real* money for articles *if* they are good enough.

What sort of articles? Any and everything under the Commodore sky.

You and your computer have gone through a lot together, and you must have learned quite a few things along the way. Share that knowledge with the rest of us.

What sort of unique tricks, styles, applications, experiences did you pick up on the way to where you are now? What do you do with your Commodore 64 or VIC-20 that no one else does? What programs have you written that are really marvelous?

Basic programming or programming in Basic, humor or satire, cartoons or games, assembly language or assembling projects, tips, trips, high scores, numbers, user groups, sorts, soups, nuts, facts and even fictions.

Send your submissions to:

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For a copy of the *RUN* author's guidelines, send us a self-addressed, stamped envelope.

How to type listings from RUN magazine

Typing in listings can be difficult enough without having to worry about strange graphics characters, charts or tables. That's why we decided to make it easy to enter listings from RUN by translating everything we thought might be confusing in any program.

When you see something between the curly brackets, all you have to do is press the keys indicated. For example:

{SHIFT L}—means hold down the shift key and press the L key at the same time.
{COMD J}—means hold down the Commodore key (it is on the lower left side of the keyboard) and press the J key at the same time.
{SHIFT CLR}—hold down the shift key and press the CLR/HOME key.
{HOME}—press the CLR/HOME key without shifting.
{CTRL 6}—hold down the control key and press the 6 key.
{FUNCT 2}—function 2 (in this case, you hold down the shift key and press the function 1 key).
{CRSR UP} {CRSR DN} {CRSR LF} {CRSR RT}—these are the four cursor directions.
{UP ARROW}—means the arrow key (the one with the pi sign under it).
{LB.}—the British pound sign (£).
{PI}—the pi sign key (π); (shift and press the up arrow key).

In some instances, when a large number of characters or spaces are repeated in a listing, we will represent them this way: {22 spaces} or {17 CRSR LFs}.

We hope this system will make it easier to enter the listings without having to remember or refer to any charts or conventions. If you have any suggestions as to how we might improve the system to make it even easier, drop us a letter.

RUN Amok

Following are a number of corrections to the program listing for Maze of Intrigue, by John Stilwell, that appeared in the April issue, p. 76.

```
303 PRINT"{COMD M}{SHFT M}{CRSR DN}{CRSR LF}{COMD G}{SH
    FT M}{CRSR DN}{2 CRSR LFs}{COMD G}{COMD M}{CRSR DN}
    {2 CRSR LFs}{COMD G}{COMD M}{CRSR DN}{2 CRSR LFs}{C
    OMD G}{SHFT N}{CRSR DN}{3 CRSR LFs}{COMD M}{SHFT N}
    ":RETURN

325 PRINT"{HOME}{CRSR RT}{4 CRSR DNs}{3 COMD Ts}{SHFT P
    }":FORI=1TO10:PRINT"{CRSR RT}{3 SPACEs}{COMD M}":NE
    XTI:PRINT"{CRSR RT}{3 COMD @s}{SHFT @}":RETURN
327 PRINT"{HOME}"TAB(20)"{5 CRSR DNs}{SHFT N}{CRSR DN}{
    2 CRSR LFs}{SHFT N}{CRSR DN}{CRSR LF}{COMD G} ":FOR
    I=1TO4:PRINTTAB(19)"{COMD G} ":NEXTI

335 PRINT"{HOME}"TAB(17)"{4 CRSR DNs}{SHFT O}{3 COMD Ts
    }":FORI=1TO10:PRINTTAB(17)"{COMD G}{3 SPACEs}":NEXT
    I:PRINTTAB(17)"{SHFT L}{3 COMD @s}"
336 RETURN

415 PRINT"{CRSR UP}{2 SPACEs}{CRSR UP}{CRSR LF}{SHFT M}
    {18 SPACEs}{SHFT N}{CRSR DN}{CRSR LF} ":GOSUB665

435 PRINT"{HOME}"TAB(207)"{2 COMD @s}{CRSR DN}{3 CRSR L
    Fs}{COMD M}{2 SPACEs}{COMD G}{CRSR DN}{4 CRSR LFs}{
    COMD M}{2 SPACEs}{COMD G}{CRSR DN}{4 CRSR LFs}{COMD
     M}{2 SPACEs}{COMD G}{CRSR DN}{4 CRSR LFs}{COMD M}
    '{COMD G}{CRSR DN}{4 CRSR LFs}{COMD M}{2 SPACEs}{CO
    MD G}{CRSR DN}{4 CRSR LFs}{SHFT @}{2 COMD @s}{SHFT
    L}"

**** DELETE LINE 436 ****

441 PRINT"{HOME}"TAB(228)"{SHFT O}{2 COMD Ts}{SHFT P}{C
    RSR DN}{CRSR LF}{COMD M}{CRSR DN}{CRSR LF}{COMD M}{
    CRSR DN}{CRSR LF}{COMD M}{CRSR DN}{2 CRSR LFs}{SHFT
     N}{COMD M}{CRSR DN}{CRSR LF}{COMD M}{CRSR DN}{CRSR
     LF}{COMD M}{CRSR DN}{CRSR LF}{COMD M}{CRSR DN}{CRS
    R LF}{SHFT @}{4 CRSR LFs}{SHFT L}{2 COMD @s}{3 CRSR
     LFs}{CRSR UP}{CRSR LF}{COMD L}{COMD G}{CRSR UP}{CR
    SR LF}{COMD G}{CRSR UP}{CRSR LF}{COMD G}{CRSR UP}{C
    RSR LF}{COMD G}{CRSR UP}{CRSR LF}{COMD G}{CRSR UP}{
    2 CRSR LFs}{COMD L}{COMD G}{CRSR UP}{CRSR LF}{COMD
    G}"

**** DELETE LINE 442 ****

443 RETURN

645 FORI=1TO15:R=INT(RND(G)*DC+1):PRINT"{HOME}{2 CRSR R
    Ts}DIE ROLL{5 SPACEs}":PRINT"{HOME}{2 CRSR RTs}DIE
    ROLL"R

663 PRINT"{HOME}{3 CRSR RTs}AGAINST{CRSR RT}WALL":FORI=
    1TO900:NEXTI:PRINT"{HOME}{3 CRSR RTs}{7 SPACEs}{CRS
    R RT}{4 SPACEs}":GOTO161
```

Clubs

Oahu, HI

20/64 Hawaii is a non-profit club that supports Commodore enthusiasts. Located on the island of Oahu, the club meets on the second Thursday of each month and offers its members discounts from 12 local stores and a public domain library with over 1500 titles of free software.

For more information, contact Jim Snodgrass, Planning Committee Chairman, 20/64 Hawaii, PO Box 966, Kailua, HI 96734, 808-836-6888. Or call Club President Ed Ellenson at 808-941-3901.

Charleston, SC

The Charleston Computer society offers an extensive public domain library, computer education instruction, a monthly newsletter and an on-line bulletin board.

This Commodore user's group meets on the third Tuesday of each month at 7:00 PM at the North Charleston City Hall, room 517. Contact Jack Furr at 803-747-0310, or write to Charleston Computer Society, PO Box 5264, N. Charleston, SC 29406.

Rupert, ID

The User's Group of Lower Idaho (UGLI) publishes a monthly newsletter and holds its meetings Tuesday nights at 6:30 PM, at Club President Sean Brixey's house. If interested, contact Sean Brixey, UGLI, Rt. 4, Box 67, Rupert, ID 83350, 208-436-4283.

West Bend, WI

CHIPS (Commodore Hobbyists Involved in Personal Systems) is a Commodore user's group that offers its members an expanding public domain library and meets on the second Wednesday and fourth Thursday of

each month, at West Bend Riverside Park Pavilion. Family membership dues are $20 per year.

Write Richard M. Kohn, 1017 Kilbourn Ave., West Bend, WI, 53095. Or call: days 414-338-1609, evenings 414-334-2494.

Davenport, IA

The Quad Cities Commodore Computer Club has 70 paid members, living in both Illinois and Iowa. This two-year-old club hosts many first-time users of the VIC-20 or C-64 and holds meetings on the third Tuesday of each month at the Community Center in Bettendorf, IA.

For more information, contact Quad Cities Commodore Computer Club, Mike Hoeper (President), PO Box 3994, Davenport, IA 52808, 319-242-1496.

Baton Rouge, LA

The 64 Club, based in Baton Rouge, LA, would like to change its listing to 5200 Corporate Blvd., Baton Rouge, LA 70808, 504-925-5870, c/o Tommy Parsons.

Newark, DE

The Newark Commodore User's Group (NCUG) has been meeting once a month, at the Newark High School, since October 1983. The 30 (and growing)-member group is mainly made up of C-64 and VIC-20 users.

For more information, contact NCUG, 210 Durso Drive, Newark, DE 19711, or call Bob Black at 302-737-4686.

Pennsylvania

The Worldwide Commodore User's Group (WWCUG) is currently forming and is accepting new members in the Pennsylvania area. The WWCUG is an independent, non-profit organization formed for the purpose of assisting Commodore computer users of every ability.

Affiliated groups are now forming in the following Pennsylvania cities: Norristown, Montgomeryville, Pottstown, Boyertown and Reading.

For information, write WWCUG, PO Box 337, Blue Bell, PA 19422.

Coming Next Month

FEATURES

Check It Out!—You can bank on this financial management program, which will balance your checking account, keep track of your transactions and help you to better budget your finances.

Play Ball!—Keep track of your team's offensive baseball statistics (hits, runs, walks, batting average, etc.) with this recordkeeping program for the Commodore 64.

Radio-Active Software—Learn why more and more ham radio operators are using Commodore computers in their radio hamshacks. This article surveys 13 amateur-radio-related applications of the Commodore and lists sources of amateur radio software. Also included is a VIC-20/C-64 program to help the ham radio operator send and receive Morse code quickly and accurately.

PROJECTS

Chatterbox—Here's a hardware project that lets you interface synthesizer ICs to your VIC-20 or C-64. Soon you'll have your computer talking back to you loud and clear.

Don't Go Without Any Longer!—For the times when the VIC-20 or C-64 keyboard is inadequate, you can add your own auxiliary keyboard that will include the features you need, such as a numeric keypad.

TUTORIALS AND UTILITIES

The Art of Programming—Creative tips to help you write better and more efficient programs.

Screen Squeezers—A bag of tricks, twists and teasers to help the VIC owner expand his understanding of his machine's potential.

Sprite Editor—A handy program that aids in the design of sprites for the C-64. It allows you to rotate, move or flip over the sprite as you are designing it on a large grid.

GAMES

For the less serious-minded Commodorist, the July issue will feature some exciting action games, including Tennis Ace (a two-player tennis game for the VIC-20), Tank Defense (shoot incessantly falling bombs out of the sky to save a defenseless community) and Space Rescue (test your navigational ability as you try to rescue 18 astronauts lost in space).

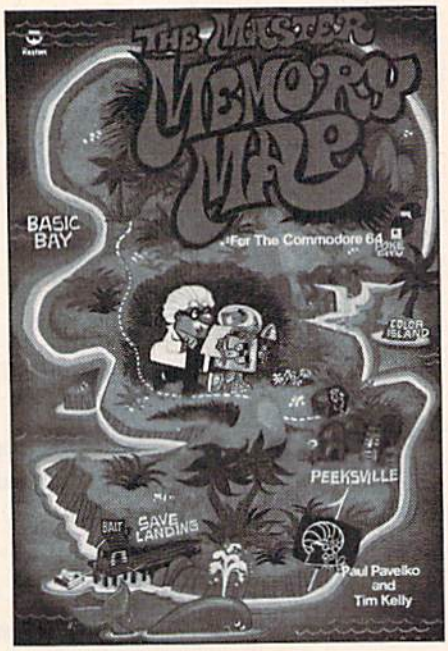
In addition, each month *RUN* features reviews, applications and columns to help readers get the most out of their Commodore computing systems.

Book Gallery

Compiled by Shawn Laflamme

The Master Memory Map

Paul Pavelko and Tim Kelly
Reston Publishing Co., Inc.
11470 Sunset Hills Road
Reston, VA 22090
Softcover, 186 pp., $14.95



There are various reasons why programmers use machine language, whether it's for a special capability not found in Basic, or because of the memory constraints of their computers or because of the need for greater speed. *The Master Memory Map for the Commodore 64* gives a detailed description of machine language for the C-64.

Authors Pavelko and Kelly state at the beginning that the book is for both the beginner and expert programmer. The reader is then exposed to a glossary of terms that are used throughout. The main body of the book contains a list of every memory location in the Commodore 64, what each location is used for, and the usable values for each location. It concludes with several appendices that provide more detailed information about machine language, the most notable of which is the information relating to sound and color.

The authors have set before themselves a very difficult task by trying to describe what machine language is and how to use it in such a way that the book is useful to the beginner and expert alike. For the programmer who already has an understanding of machine language (bits and bytes, binary and octal notation, etc.), all of the information necessary to program in machine code on the Commodore 64 is present. Even though the book lacks an index, the experienced programmer can extract from the book any information that he may need.

Unfortunately, the beginner may have some difficulties with this book. Although an excellent attempt is made to describe a very complex subject in simple terms, some sections are beyond the grasp of the novice. There are also a few errors in the book, which may be inevitable in a work of this magnitude. However, this can be very confusing for the novice.

The authors wisely suggest that you read this book while sitting at your computer, so that you can try things as they are covered. Also, unless you're an expert, you'll have to go through the book more than once—there is entirely too much information to absorb the first time through. (You won't become an expert overnight!)

Overall, in spite of a few shortcomings, *The Master Memory Map* is a good value for any C-64 owner who is interested in either a detailed understanding of the workings of the computer or in developing machine language programs.

Gerald D. Gelvin
St. Simons Island, GA

How to Program Your Commodore 64

Carl Shipman
HP Books
1019 W. Prince Road
PO Box 5367
Tucson, AZ 85703
Softcover, 336 pp., $9.95

How to Program Your Commodore 64: Basic for Beginners is for Commodore owners who have just taken their new computer out of the box. However, intermediate users who may know a little about Basic and who now want to learn more programming techniques will also benefit from this book.

Author Carl Shipman uses a relaxed, conversational style for easy reading. As you sit at your keyboard and work through the book, Shipman gives you a private lesson in Basic programming.

The book begins with a guided tour of the computer keyboard, and proceeds to explain how you can write your own simple programs. The Print statement, numbers and strings, program lines, and the Basic commands List and Run are introduced.

Programming fundamentals such as branching (Shipman calls it "decision-making") and loops are covered next.

Shipman then explains how to enter and edit your program lines, giving useful instructions on using the Commodore 64 screen editor. ASCII codes and the ASC( ) and CHR$( ) functions are featured next, followed by screen display codes and the Peek( ) and Poke statements. The Basic statements Input, Get, Read and Data are covered in a chapter that explains how to input data from the keyboard. A variety of topics are discussed in the following chapters, such as: arrays, string functions, mathematical functions and sorting routines. Detailed descriptions of the disk drive,

cassette recorder and printer are also given.

In preparation for programming sprites and music, Shipman gives a detailed discussion of binary numbers and logical operators, followed by an explanation of sprites and bit graphics on the printer. Sound and music are covered next.

The book concludes with Shipman's comments on program development and debugging techniques. The five appendices contain: a table of ASCII codes and screen display codes, a dictionary of Basic keywords, a list of abbreviations for Basic words, DOS error messages and Basic error messages.

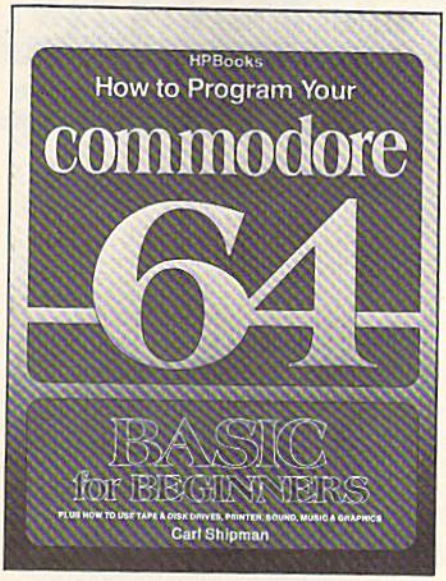
One of the book's strengths is the numerous examples. Shipman frequently uses one-line statements that can be entered into the computer in the Immediate mode to illustrate a new technique. Some Immediate mode examples are also used to demonstrate programming errors.

Longer example programs are given in many places, with accompanying line-by-line explanations. Some of the example programs are repeated with modifications to show new programming techniques.

The longest example programs are introduced in small segments. A few lines of the program are given, followed by an explanation of what those lines will accomplish. The text may also discuss a new programming technique or computer feature; next comes a line or two to be added to the growing program. This build-a-program technique is effectively used in the later chapters of the book.

There are three sections that deserve special praise. The first is the section in Chapter 5 on the Commodore 64 screen editor. The screen editor is a powerful feature of the C-64, but many texts give the screen editor too little attention. Shipman covers the screen editor in detail and gives information on other important features that effect how programs are entered into the computer.

Also, I was particularly impressed with the chapter on string functions. Most Basic programmers use a lot of string functions in their programs, so I was pleased to see this topic covered in depth. There are sections on each of the functions and example programs that illustrate programming techniques such as searching through a long string to find a shorter string, and changing strings (for example, to remove com-



mas that might be interpreted by a program as delimiters).

Lastly, while other books on programming pay little attention to binary arithmetic and the logical operations needed to peek and poke computer memory locations effectively, Shipman devotes an entire chapter to developing these skills, and it's one of the best chapters in the book. It begins with a discussion of numbering systems; uses for the binary number system are then mentioned and conversion programs are given. Two-byte numbers and hexadecimal numbers are also discussed. Logical operators are explained in detail and are used to change specific bits in a byte.

I could find only one deficiency in this book: There are no instructions on how to use the Commodore 64 joystick ports. I think many beginners are interested in joystick programming techniques. A discussion of joysticks would have made an excellent addition to the chapter on binary and logical operations.

If I were to teach a programming course to C-64 users, I'd want to use this book as a required text. The programming techniques are presented in a logical order, and the reading is light and occasionally seasoned with Shipman's dry humor. The excellent index gives the book additional value as a reference tool.

I give *How to Program Your Commodore 64* a very high rating, and I would recommend it to anyone interested in learning to program in Basic on the Commodore 64.

David Scott Saari
Elkhart, IN

An Introduction to the Commodore 64

Nevin Scrimshaw and James Vogel
Birkhauser Boston, Inc.
380 Green St.
Cambridge, MA 02139
Softcover, 124 pp., $11.95

An Introduction to the Commodore 64 is a supplement to, not a replacement of, the Commodore 64 User's Guide. As you work with this book, you'll need your user's guide for further explanations of many of the topics under discussion.

It is difficult to determine for what audience this book is intended. It includes very basic concepts such as the READY prompt and on-screen editing, but it also explains the concept of redefining variables in only one sentence. Even when the material smooths out to a beginner/intermediate level, the presentation is not in very logical order.

Bits and bytes are introduced early on, and cursor controls in Quote mode are covered chapters before TAB is mentioned. The use of the percentage sign for integer variables is presented immediately, while string variables wait until halfway through the book.

A beginner may find this volume hard to cope with; in addition to the order in which material is presented, few fundamental programming techniques are *thoroughly* explained, and some are never mentioned. String functions are allotted only five pages, with LEFT$ and RIGHT$ never getting a mention. Logical operators are missing altogether.

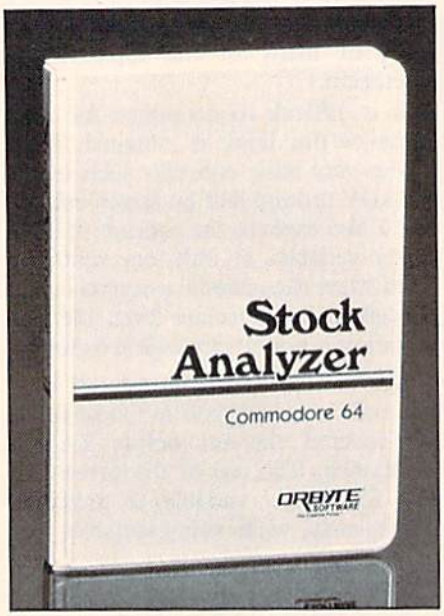
On the plus side, the book is full of example programs that, more often than not, explain things better than the text. The best, and most thorough sections, are on sprite graphics and sound. In fact, the sound section may alone be worth the price of the book. Even here, though, the beginner may be at a loss; terms such as real-time and waveform gate are used with no explanations. Sprite graphics are reasonably well-explained, but there is no mention of the C-64's Hi-res mode.

You might consider adding this book to your collection of C-64 programming volumes, but don't make it your first, or only, purchase.

Sharon Aker
Sussex, NJ

New Products RUNdown

Compiled by Shawn Laflamme



Take Stock

Stock Analyzer is an investment analysis program designed for both the professional investor and the "dabbler." It maintains records on common stock, preferred stock and mutual funds.

The program helps you keep track of stocks that are on an upswing, as well as those that may be best to sell. It allows you to keep a portfolio of files on up to 250 stocks. In each of these files, you can record the company name, cost basis, total shares, average cost per share, your stop/loss level and target price. You can make up to 12 buy/sell transaction entries for each stock.

Stock Analyzer is available on disk for the Commodore 64. It retails for $59.95. Orbyte Software, PO Box 948, Waterbury, CT 06720.

Check Reader Service number 417.

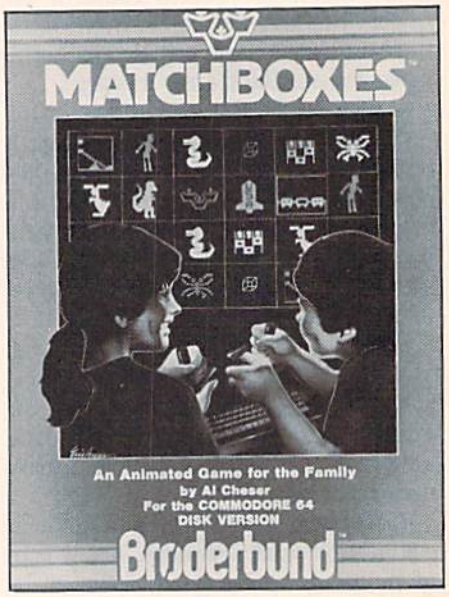
Meet OSCAR!

OSCAR (Optical Scanning Reader) is an optical bar code scanner from Databar Corp. (10202 Crosstown Circle, Eden Prairie, MN 55344). It is compatible with the C-64 and the VIC-20.

OSCAR is similar to the scanning systems found in many retail stores. Special bar code software program pages contain digitally encoded data to be read by OSCAR. A plastic template fits over a bar code program page. Grooves in the template guide a palm-sized box attached to the unit (OSCAR's "wand") across the page. By skimming the wand over all the lines of bar code pages, you enter an entire program into your computer without keyboard entry.

OSCAR is available for $79.95, which includes the premiere issue of Databar, The Monthly Bar Code Software Magazine. Each issue contains eight bar code software programs. (These and other OSCAR programs are also available in retail stores for about $10 each.) OSCAR owners can join the Databar Club and receive 12 issues of the magazine for a membership fee of $120 per year.

Check Reader Service number 433.



New Games From Broderbund

Broderbund Software, Inc. (17 Paul Drive, San Rafael, CA 94903) has released two new games for the Commodore 64.

Matchboxes is a matching game that tests your powers of recall. The game fills your screen with a grid of 36 numbered boxes. Hidden behind each box is a character, creature or object, each with its own tune. Your goal is to match identical squares. It is available on disk for $29.95.

Operation Whirlwind is a war strategy game. You must move your battalion through a series of skirmishes and battle maneuvers. Your ability to command, give orders and move your troops skillfully determines the success or failure of your combat operations. It is available on disk for $39.95.

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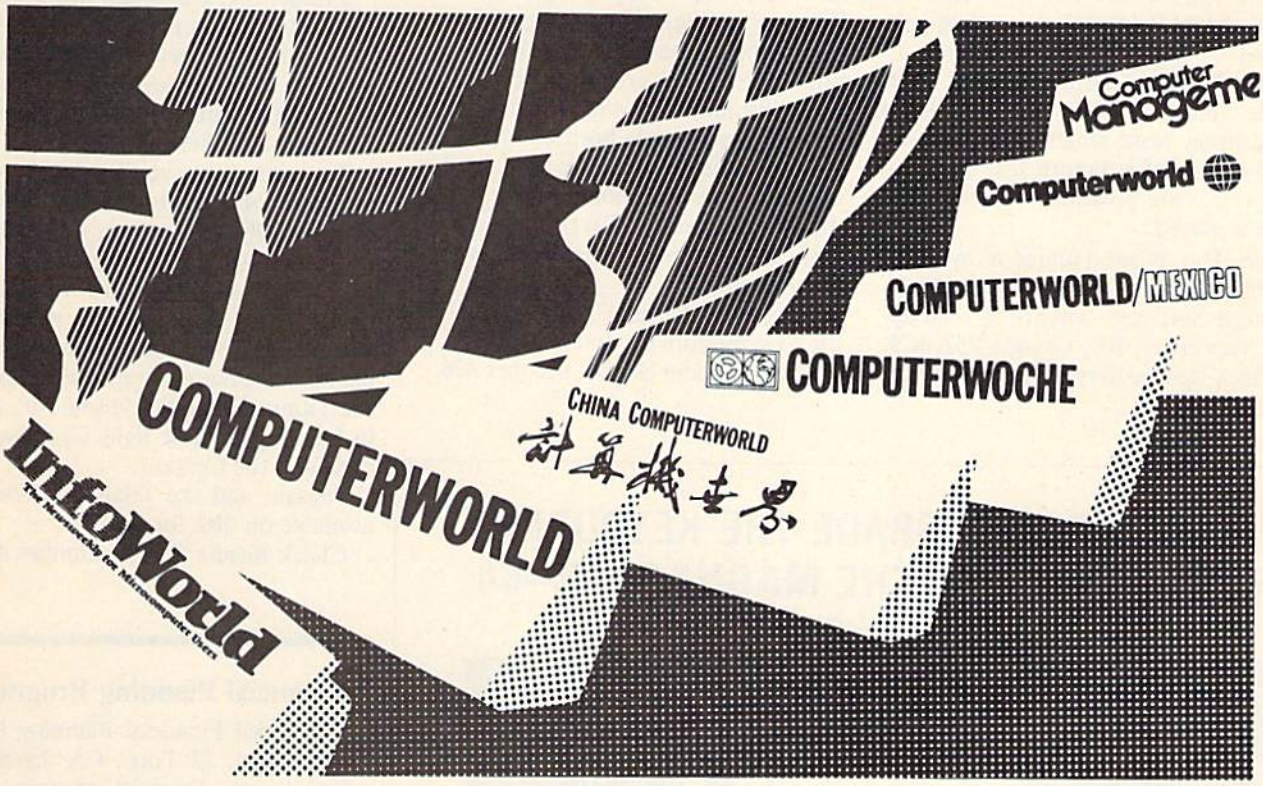

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375 Cochituate Road, Box 880, Framingham, MA 01701
(617) 879-0700

Underwater Word Hunter

Fay: The Word Hunter is a word search game designed to reinforce spelling skills. It is designed for students in grades 3 to 10.

Under the student's direction, Fay searches in an underwater world for nine words listed at the bottom of the screen. These same words are hidden in a forest of letters on the upper part of the screen. The player directs Fay to pinpoint the hidden words with her laser beam. Extra points can be won in a "bonus run" where Fay must fend off crabs, sharks and a jewel-stealing submarine.

The program contains over 3000 words. There are six difficulty levels based upon word length and the complexity of word structure and meaning. New words are presented each time the game is played.

Fay: The Word Hunter is available on disk for the C-64. It costs $34.95. Didatech Software, 549-810 W. Broadway, Vancouver, BC, Canada V5Z 4C9.

Check Reader Service number 407.

Western Adventure

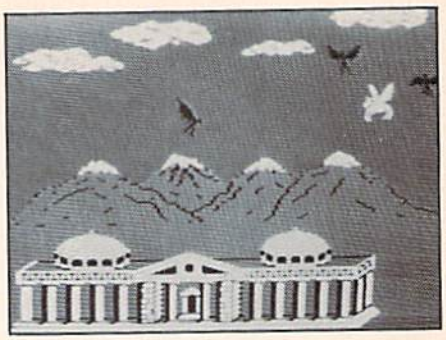
Spinnaker Software (215 First St., Cambridge, MA 02142) has introduced Ranch, a graphics program for children aged 5 to 10. It is designed to teach the rudiments of selecting, retrieving and manipulating data using a simple command menu. It encourages children to experiment with composition, design and spatial relationships.

With Ranch, players can create their own computer-generated Western adventures. A variety of people, objects and "critters," each indigenous to a Western setting, can be accessed with the joystick. The child can create a picture filled with cowboys, campfires, wild mustangs and other objects.

Once a scene has been composed, it can be animated using the joystick. The scene can also be colored with a variety of different hues. Players can choose from three musical themes to accompany the scene.

Ranch is available on cartridge for the Commodore 64. It costs $39.95.

Check Reader Service number 426.



Treasures of the Gods

Tymac, Inc. (129 Main St., Franklin, NJ 07416) has introduced Pegasus and the Trials of Perseus for the Commodore 64. The game combines words, music and sound effects without the need for a synthesizer.

The game puts you in search of the treasures of the gods. You have the favor of Olympus as you ride Pegasus, the great winged stallion. On your steed, you soar skyward to perform heroic deeds. Following the riddled advice of Zeus, you then fly over the rolling hills of Greece toward the temples of the Titans. When you dismount, sword in hand, you must fight Cyclops, Medusa and the Centaur.

Pegasus and the Trials of Perseus is available on disk for $34.95.

Check Reader Service number 427.

Financial Planning Programs

Advanced Financial Planning (20922 Paseo Olma, El Toro, CA 92630) has released two financial planning programs for the Commodore 64.

Retirement Planning is designed to help you establish a retirement financing plan that takes into account your personal situation relative to inflation, investment returns, current assets, yearly savings and other factors.

Life Insurance Planning is designed to help you determine the amount of life insurance that you need to cover your living expenses. Inflation, as well as present and future sources of income, are accounted for in all calculations. Projected life insurance needs may be calculated for any future year.

Both programs are available on disk for $29.95 each. They can be purchased together for a total price of $49.95.

Check Reader Service number 415.

Multiplan

Human Engineered Software (150 North Hill Drive, Brisbane, CA 94005) has released the Commodore 64 version of Microsoft's Multiplan.

Multiplan is a spreadsheet program designed to help you answer questions in areas ranging from personal finance to investment analysis. The program's features include built-in arithmetic, financial and trigonometric functions, screen windows, variable column widths, alphabetic and numeric sorting, the capability to link worksheets and flexible formatting for screen displays and reports.

An on-line reference guide provides help as you work with the program. English commands are listed on the screen, and computer prompts explain your next step. You can lock critical formulas and numbers in place, preventing accidental erasures.

Multiplan is available on disk for $99.95.

Check Reader Service number 403.

Have a "House Party"

HomeComputer Software, Inc. (1307 S. Mary, Suite 209, Sunnyvale, CA 94087) has released Art Linkletter's Kids Say the Darndest Things...to Computers. It is based upon Linkletter's best-selling book, *Kids Say the Darndest Things.*

The program asks children to help Linkletter create humorous stories by supplying words and numbers in response to questions he asks through the computer. The program offers ten different stories, each involving a fantasy or a realistic situation.

Children are asked to pick one of the stories, which the program then personalizes for them by using their name, the names of friends and pets, and their answers to Linkletter's questions. The stories often end with a moral that can be used to reinforce values.

The program is available on disk for the Commodore 64. It costs $39.95.

Check Reader Service number 410.

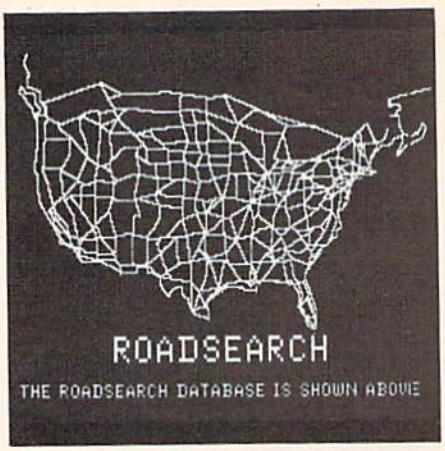
When Superpowers Collide

Strategic Simulations, Inc. (883 Stierlin Road, Bldg. A-200, Mountain View, CA 94043) has introduced When Superpowers Collide, a series of war strategy games for the Commodore 64.

In the first game, Germany 1985, battalions of Soviet infantry, tanks, artillery units and paratroopers have invaded West Germany. NATO forces must contain and repel the Red invasion. Germany 1985 contains a rulebook that is applicable to both games in the series. It is available on disk and retails for $59.95.

In the second game, RDF 1985, Soviet forces have seized control of an oil-rich area along the Persian Gulf in Saudi Arabia. The U.S. responds by sending its Rapid Deployment Force. The primary targets of the RDF are the airfields that allow the Soviets to gain air superiority and bring in troops and equipment. RDF 1985 is available on disk for $34.95.

Check Reader Service number 428.



Computerized Road Atlas

Columbia Software (5461 Marsh Hawk Way, PO Box 2235, Columbia, MD 21045) has released Roadsearch and Roadsearch-Plus. The two programs are designed to simplify the process of determining driving routes for travelers who use the interstate highway system.

Roadsearch can determine the shortest practical route between two cities; other routes can be developed to suit your specific needs. The program also computes distance, travel time and fuel usage for each route. The Roadsearch database contains 406 cities and road junctions and roughly 70,000 miles of highway throughout the United States and Canada.

Roadsearch-Plus offers the features of Roadsearch, plus a roadmap development system that lets you customize your roadmaps. You can add up to 50 towns and 100 road segments anywhere in North America.

Both programs are available on disk for the Commodore 64. Roadsearch retails for $34.95 and Roadsearch-Plus retails for $74.95.

Check Reader Service number 412.

Rainbows, Butterflies and Windmills

The Learning Company (545 Middlefield Road, Suite 170, Menlo Park, CA 94025) has released Juggles' Rainbow for the Commodore 64.

The program was developed for children aged 3–6. It uses dancing rainbows, butterflies and windmills to teach reading and math skills and spatial concepts.

Juggles' Rainbow is available on disk for $29.95.

Check Reader Service number 404.

Develop Machine Language Programs

Assembler/Monitor 64, from Abacus Software (PO Box 7211, Grand Rapids, MI 49510), allows you to develop machine language programs on your Commodore 64.

The assembler's functions include full screen editing of source program and source file chaining capabilities. The object code assembles to memory, disk or tape.

The monitor's capabilities include disassembling code and transferring blocks of data. It can also coexist with the assembler.

Assembler/Monitor 64 is available on disk for $32.95.

Check Reader Service number 406.

Master Composer

Access Software, Inc. (925 East 900 South, Salt Lake City, UT 84105) has released Master Composer, a music utility program for the Commodore 64.

The program allows you to compose your own musical scores, experiment with different arrangements and instruments or type in your favorite sheet music. You can also add your compositions to Basic or machine language programs.

Master Composer is available on disk for $39.95.

Check Reader Service number 411.

The Bottom Line

Clockwork Computers, Inc. (4612 Holly Ridge Road, Rockville, MD 20853) has released the Bottom Liner, a personal and small business accounting system for the Commodore 64.

The system contains a ledger file with an annotation area that allows you to explain each transaction. The ledger file is linked to the accounts, client and project files.

The accounts file can contain up to 700 user-defined accounts. The client file allows you to maintain names, addresses, contact persons and phone numbers for up to 500 individuals or companies. The project file allows you to define up to 500 projects.

The Bottom Liner is available on disk for $74.95.

Check Reader Service number 418.

Phi Beta Filer

Phi Beta Filer is a C-64 home management program from Scarborough Systems, Inc. (25 N. Broadway, Tarrytown, NY 10591).

The package contains two disks and may be used with one or two disk drives. The first disk is primarily used to develop and maintain files; the second is a data disk containing forms for a variety of home-oriented activities.

Among the prepared files on the data disk are forms for: listing credit cards and home inventories for insurance purposes; cataloging various sports records and collections; tracking tax deductible expenses; scheduling and tracking birthdays, anniversaries and other family occasions.

Phi Beta Filer's Quiz Master mode allows you to develop games or prepare for exams. The package costs $49.95.

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Shutterbug 64

Shutterbug 64 is designed to help photographers organize photo and inventory files.

The program consists of six modules that supply you with information on film selection, film characteristics and processing equipment. The package includes programs designed to catalog photo prints and equipment into a database system.

Shutterbug 64 is available on disk for the Commodore 64. It costs $39.95. Quality Input, Inc., 309 West Beaufort, Suite 8, Normal, IL 61761.

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C-64 Reset Switch

Bytes & Pieces (550 N. 68th St., Wauwasota, WI 53213) has introduced a reset switch for the Commodore 64.

If a program is hung up in Basic, there is no way to regain control except to turn off the C-64 and lose the data that has been entered. The reset switch allows you to regain control of the program and recover the entered data.

The switch attaches with two solder connections. It can be externally mounted in a separate box or mounted through a hole drilled in the computer cover. It is available for $9.95.

Check Reader Service number 432.

Your Prescription is Ready!

Softsmith Corp. (1431 Doolittle Drive, San Leandro, CA 94577) has released 64 Basic Rx for the Commodore 64.

The program is designed to overcome some of the major editing weaknesses encountered with Commodore Basic programming. Its features include global search and replace, deletion of a range of lines, automatic line-numbering and four parameters of line-renumbering. With the program merge capability, two programs can be combined into one.

64 Basic Rx is available on disk for $29.95.

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Give 'Em the Shaft!

In Shaft Raider, you are one of Zadar's Shaft Raiders, an elite team of warriors, en route to the planet Phoebe 2. This planet has the most sophisticated defense system in the galaxy—you must penetrate it and then destroy the planet.

The defense system, built by the Droids, extends deep into the planet via winding shafts. Your task is to maneuver through the treacherous shafts to the underground city where you must plant a bomb. You must avoid the space mines, missiles and laser screens that block your path.

Shaft Raider is available on disk and cassette for the Commodore 64. It costs $29.95. Program Design, Inc., 95 East Putnam Ave., Greenwich, CT 06830.

Check Reader Service number 425.

Outsmart J.R.!

In The Dallas Quest, based on the *Dallas* television saga, you are a detective hired to find a missing map that reveals the location of a multi-million-dollar South American oil field. Using a system of clues, you must solve the challenge of each scenario in order to move to the next scene and closer to discovering the map. Dangers and impediments are presented by the perilous South American jungle and the crafty J.R. Ewing.

The Dallas Quest is available on disk and cassette for the Commodore 64. It retails for $34.95. Datasoft, Inc., 19808 Nordhoff Place, Chatsworth, CA 91311.

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Micro Mailer

The APB Mailer is a mailing list program for the Commodore 64. It is designed for small business or home use.

The program can handle several hundred file entries. Entries can be added, modified, deleted, displayed, printed, searched, re-sorted and saved to tape or disk.

Entries are automatically recalled in alphabetical order; they can also be re-sorted according to zip code, city, state, account no., etc.

The APB Mailer is available on disk for $20 and cassette for $17.50. A.P.B. Systems, 805 S.E. 50th St., Oklahoma City, OK 73129.

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80-Column Adapter

Batteries Included (186 Queen St. West, Toronto, Ontario, Canada M5V 1Z1) has released the B.I.-80 Column Adapter for the Commodore 64.

The B.I.-80 is a plug-in module that can be used with the 1701 or 1702 Commodore color monitors or any monochrome video monitor. It is self-initializing, with an 80-column operating system and built-in Basic 4.0. It can be switched from 40- to 80-column display at any time.

The B.I.-80 Column Adapter is available for $200.

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Arcademia

DLM Teaching Resources (One DLM Park, Allen, TX 75002) has released the Arcademic Skill Builders in Math series for the Commodore 64.

The six programs in the series are designed to teach fundamental math skills using the action and graphics of arcade games. Game control options can be selected for speed, content, time and paddle or keyboard control.

The six programs in the series are: Alien Addition, Minus Mission, Meteor Multiplication, Demolition Division, Alligator Mix (addition and subtraction) and Dragon Mix (multiplication and division).

Each program is available on disk for $34.

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Take Control!

The VIC Relay cartridge lets you use your VIC-20 or Commodore 64 as a control device for burglar alarms, garage doors, door locks, electric radiators, lamps, transmitters and many other appliances.

The cartridge contains six relay outputs and two inputs of the optocoupler type. It is available for $39.95. Handic Software, Inc., 5090 Central Highway, Suite 7, Pennsauken, NJ 08110.

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Cassette Interface and Duplicator

Omnitronix (PO Box 12309, Seattle, WA 98111) has released the Cassette Interface and Duplicator (CID) for the C-64 and the VIC-20.

The CID plugs into the cassette port of the computer, allowing you to save and load programs using a standard portable cassette recorder. Tapes made with the CID can load on a Datassette, and vice versa. Backup copies of cassette programs can also be made by connecting two cassette recorders together through the CID and copying from recorder to recorder.

The Cassette Interface and Duplicator is available for $34.95.

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"The One-Man Joystick Band"

Dancing Feats, from Softsync, Inc. (14 East 34th St., New York, NY 10016) allows you to play music instantly on your Commodore 64, regardless of your musical knowledge.

You can compose rock, blues, jazz or any of your own creations. Menus allow you to choose the bass, beat, style, tempo and ending of your composition. You then use your joystick to choose a melody. As you play, the notes and chords are displayed on the screen. You can save and play back any tune you compose.

Dancing Feats is available on disk for $29.95 and cassette for $24.95.

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Timestar

Timestar is a C-64 program designed for use in the photographic darkroom, kitchen, laboratory, classroom and other environments where a sequence of events must be accurately timed and controlled.

In the darkroom, Timestar can time and control the steps involved in processing film or paper. In the kitchen, it can remind you which of several dishes must be removed from the oven, or basted, etc.

Timestar is available on disk and cassette for $24.95. f/22 Press, PO Box 141, Leonia, NJ 07605.

Check Reader Service number 414.

For Puzzlemaniacs Only!

Epyx, Inc. (1043 Kiel Court, Sunnyvale, CA 94089) has released PuzzleMania for the Commodore 64.

The game presents a series of video puzzles; you must rely on trial and error, logic, concentration, observation and sound recognition to solve them. There are seven different types of puzzles, each with varying degrees of difficulty. These are part of a larger puzzle, requiring an overall solution.

PuzzleMania is available on disk for approximately $35.

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Around the Industry

By Mike Apsey

Jack Tramiel, the controversial entrepreneur who founded and brought Commodore to the fore, left the company in January. Will his departure mean a change of direction for the number-one personal-computer manufacturer?

One of Commodore's strengths has been in keeping the industry guessing. Strength, because competitors for the home computer dollar must know what's going on if they are to compete, and Jack Tramiel was one of the few people at Commodore who knew the score. Now, Jack Tramiel is gone from his company after 25 years, resigning suddenly in January.

Jack Tramiel began Commodore in 1955, in Canada, making typewriters and adding machines. He was not your typical corporate executive, but a one-man band.

The advantage was Tramiel's ability to make decisions quickly and react almost instantly to what he felt was the pulse of the home computer market. He's credited with outsmarting his competitors and sometimes sinking the competition's ships, while steering Commodore into the number one spot as the leader in the home computer market. Sales for the 1983 calendar year topped $1 billion.

Address author correspondence to Mike Apsey, Box 91, West Peterborough, NH 03568.

Jack Tramiel was a controversial manager. He came from a home torn by the rise of Fascism in Poland, and spent World War II in Auschwitz.

He seemed attracted to Japanese business management ideas and is reported to have spent four months of every year at his home in Hong Kong.

Tramiel believed in lowering prices when he could, unlike other manufacturers who react only when it becomes necessary. He believed in sharing the efficiencies he created with the end-consumer as soon as possible.

In answer to complaints that he alienated his dealers, Tramiel replied that he was trying to place computers in homes like razors. The dealer's future was in the sale of blades (peripherals and software). Many dealers, either disagreeing or failing to perceive the meaning of the statement, divorced themselves from Commodore—more money for K-Mart and Montgomery Ward.

Why Did He Go?

It appears that Jack Tramiel, although Chief Executive Officer and President, was only Vice Chairman of the Board of Directors. When the going got tough, Tramiel had a boss named Irving Gould—Chairman of the Board and a principal stockholder. With Tramiel's resignation, the job of finding a new leader fell to Mr. Gould, who announced the appointment of the stable and established 54-year-old management executive named Marshall Smith.

Marshall Smith is well liked by those who have worked for and with him, but he doesn't have any particular understanding of the home computer market, which causes me to think that Irving Gould intends to run the show. Gould, after all, is the appoint*er*—not the appoint*ee*.

Perhaps Commodore is stalking big blue game and feels it needs more management skills than grass-roots skills. Those who watched IBM turn loose the chicklet-keyboard PCjr are still convinced that IBM does not yet understand the home market.

What of the 264 & 364?

Perhaps there are things you just don't do in a billion dollar business. Consider the following scenario.

You develop what you believe is a marketable computer. It's like a previous model, but includes software and has a new face. Also included in your new machine are some minor improvements over the earlier versions. You

decide to take it to the famed CES to show it off.

A funny thing happens at CES. Reaction to your new product is not what you had hoped. Several criticisms are heard. So you decide to scrap the idea, at least until you have something a bit more exciting, and head back with the bad news.

When your bomb is dropped, you're attacked. "You just don't do things like this!" exclaims one. "We've got to carry this thing through!" shouts another. "This will destroy our image!" chirps a third. Now you've done it. First the never-released Max, then the short-lived Commodore B, and now the 264 and 364. There's a serious argument. Business sits on one side of the table, grass roots on the other. You resign. Business wins.

The above speculation is pure guesswork, but it's possible that Jack Tramiel did not kill the Max or the Commodore B; perhaps he didn't have the final say. All I have are rumors. That's how most Commodore news works—or did, up to now.

What Now?

There's an old saying: "He who runs too fast, trips over nothing." To me, withdrawing a machine that doesn't measure up is nothing—and it's done frequently in the fast-moving electronics industry. In the above scenario, it is probably nothing to Jack Tramiel, either. Perhaps, though, it was the last straw on the back of the big-business, committee-designed camel.

Commodore has survived many similar foul-ups. We all know the problems of the recalled disk drives. The book on that headache is still not closed. The elusive SX machine still sports only one drive, supporting speculation that two Commodore disk drives won't work together—at least not reliably. Still, Commodore survives as a home and small business computer.

In answer to the Commodore twin vs. single disk headaches, a few third-party manufacturers have created dual drives that work. Why doesn't Commodore do that? Probably because they can't do it cheaply. Third-party dual drives cost nearly double the price of a C-64. Commodore knows how to make dual drives, and has been doing it for years for their larger machines—most of which sell better overseas than here.

Jack Tramiel used to be quoted as saying, "Business is war." At the same time, he seemed to realize the best way to succeed was to offer the consumer a bargain—even if it meant catching the wrath of (and losing) his dealers. If you play war in business, you need a four-star general to plan the surprise attack on the competition. I get the feeling that Commodore has traded its general for a committee.

Had Jack Tramiel not ambled through, an Atari 800 might still cost $1000, and I and millions of Americans might still be dreaming of the day we could afford a computer with a real keyboard. Thank you, Jack—for the VIC-20 and the C-64. R

Michael D. Apsey is Publications Coordinator at Wayne Green Enterprises, Inc., in Peterborough, NH. Before entering publishing, he had a distinguished career in radio, television and film, both behind and in front of microphones and cameras.

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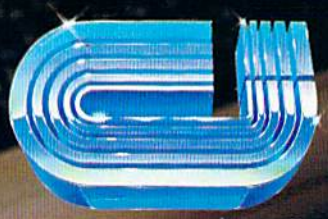

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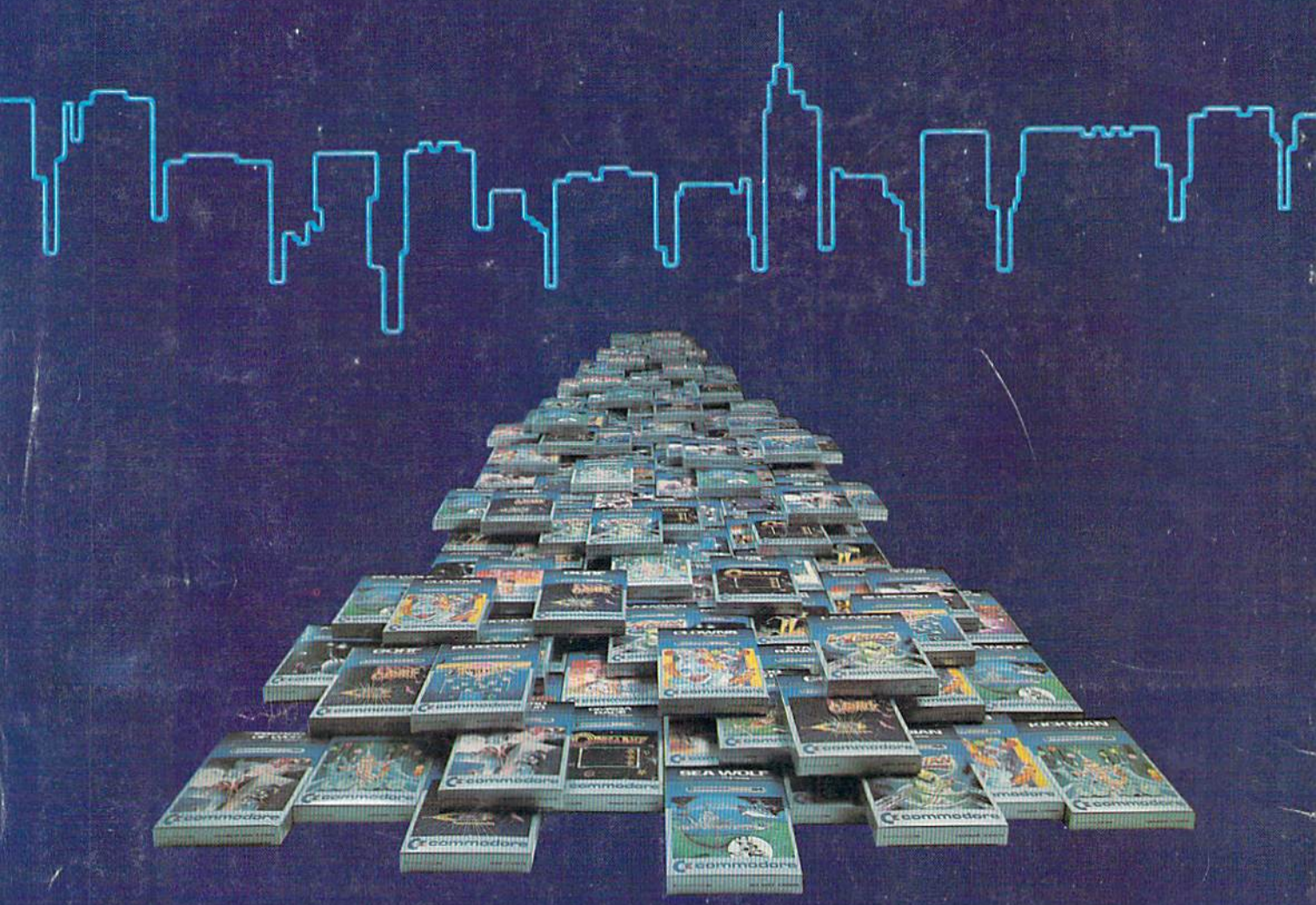

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