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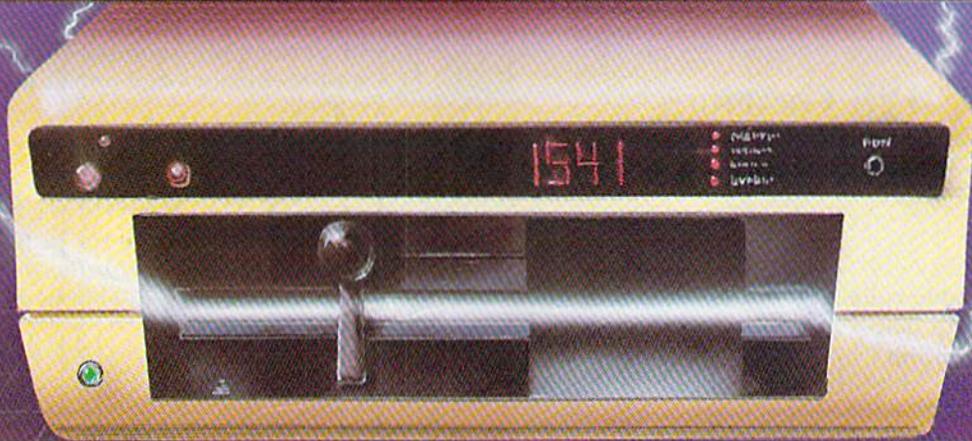
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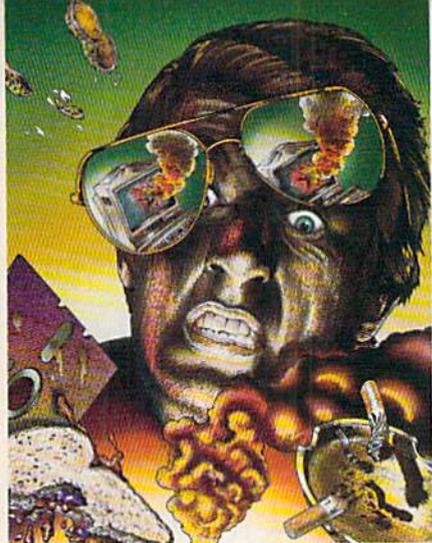
Unlock your C-128's capability to run CP/M programs, which are numerous and virtually free.

*By Cheryl Peterson*

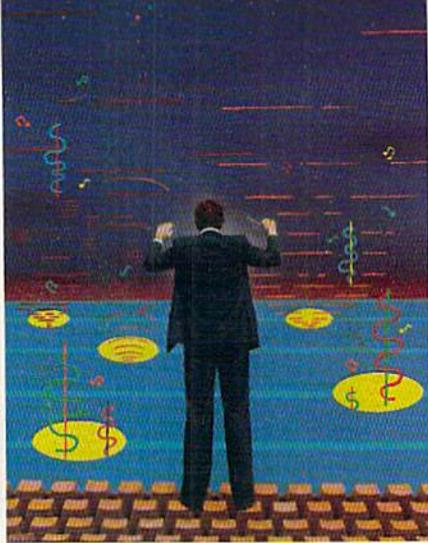
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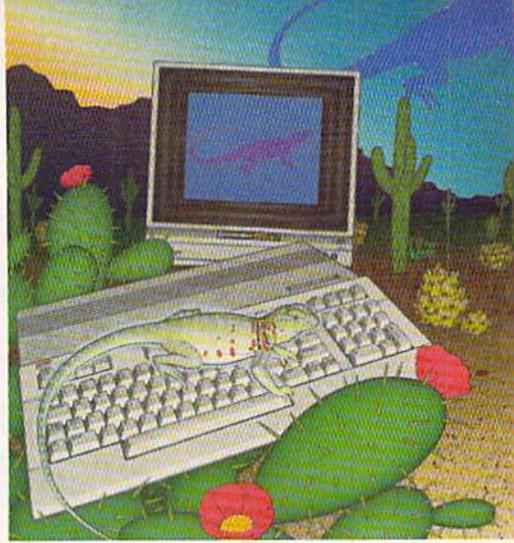
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## Special Issue Highlights

In any professional sport, it is difficult to duplicate back-to-back championship seasons. In recent years, neither the Dodgers, Redskins nor Celtics could do it.

But we think that we have assembled a repeat winner in this 1986 version of the *RUN* Special Issue.

For the second year in a row, we are presenting an all-star collection of authors and programmers to address the needs of today's Commodore home-computer user.

This Special Issue contains valuable information—introductory articles and handy reference material—that our readers will want to refer to again and again throughout the coming year.

For example, you'll witness the "magical" talents of Lou Sander, who serves up 72 pages of computing hints and tips—all of the "tricks" published in the 1985 issues of *RUN*, plus over 200 never-before-published tricks developed especially for this issue. For your easy reference, these tricks are indexed and organized by topic—disk tips, programming techniques, printer hints, etc.

You'll also recognize some other regular contributors to *RUN*—such as Margaret Morabito, Cheryl Peterson and Louis Wallace—who have prepared articles to familiarize readers with the features of both the C-64 and C-128. Every facet of Commodore computing—programming, music and sound, graphics, telecommunications, computer maintenance—is explored in this issue.

Every programmer worth his function keys will want to make room on his wall for this year's wall chart filled with easy-reference material—whether he programs in Commodore Basic 2.0, Basic 7.0, or any version in between. All the reference material programmers are constantly seeking out in manuals—keywords, commands, programming codes—is featured in one visually attractive chart.

This Special Issue comes at a particularly appropriate time for C-128 owners desperate for information about their new computer. We've featured articles that guide new owners through the uncharted territory of CPM and

enhanced Basic, as well as telecommunications, music and sound and graphics.

Whether you're a new C-128 owner, a long-time or intermediate C-64 user or a novice—this issue promises to be a big hit among Commodore computing fans.

db

## Something Special

Welcome to the second annual edition of *RUN*'s Special Issue!

The introduction and shipment of Commodore's new C-128 was certainly the most significant event in the Commodore computing world in 1985. With this computer, Commodore targets a whole new audience of computer users, while still addressing the concerns of loyal C-64 users by making the machine 100% C-64 compatible.

Besides the extra 64K of memory, the new C-128 features CPM mode, enhanced Basic 7.0, additional function keys, a numeric keypad and other features that make this machine a user's delight. Owners of the C-128 also share (in C-64 mode) the C-64's outstanding software base and potential for enhanced applications.

In this issue, the editorial staff has assembled articles that speak to the interests of both C-64 and C-128 users. Included is a variety of useful and pertinent reference material for every aspect of Commodore computing.

In addition, there are over 500 helpful computing hints and tips from the popular Magic column, a helpful glossary that defines—in easy-to-understand terms—computer expressions and terminology, a comprehensive list of Commodore clubs and a convenient pull-out wall chart that provides programmers with handy reference material.

This Special Issue will serve as a convenient reference source throughout the year. We are confident that it fully meets the standards you have come to expect from *RUN* magazine.

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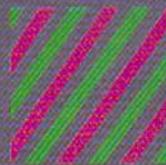
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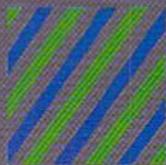
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# Programming Primer

*Take charge of your computer  
and begin writing your own  
programs. You need only learn  
some fundamentals.*

By DAVID A. HOOK

In the good old days of microcomputers (1978, in my case), non-business software was nowhere to be found. If you didn't learn to write it yourself, you were out of luck. Nowadays, there is plenty of software available, but there is also a revival of people interested in programming.

This article is dedicated to the beginning programmer. For guidance and practice, consult the manual that came with your computer. And please type in the example programs, as you cannot hope to learn without *doing!*

## **Programming, or Playwrighting**

Regardless of the computer language used, a program is just a series of instructions to be performed. Once you turn on your Commodore computer, the Basic language is available to you. If you follow its rules of grammar, then you can instruct the computer to complete a task for you.

The computer can perform only two fundamental processes: arithmetic and logic. It can calculate very quickly and can compare whether one value is "bigger" than another. Depending on the results of the calculation and comparison, it can appear to "automatically" handle a wide variety of cases.

This illusion of "thinking" is, of course, performed by the program. The challenge of programming is to reduce such a process to the limited vocabulary of a computer language. The C-64 and C-128 share about 60 key words that form the Basic language, and their syntax is quite rigid—one error can cause a program to fail.

A computer program can be thought of as a play. Its

instructions represent the script, and you are acting as the playwright.

Like a play, a program must have an introduction, provide some development and reach a conclusion. In the data-processing world, however, you would use the terms input, processing and output. The Basic language has many instructions that will fit into one of these three parts. If your program has been well-organized, these distinctions are clear. Within this framework, we define two categories: commands and instructions.

Basic commands are words that apply to the whole play. Instructions, or program statements, form part of the play itself. This distinction is often confusing to the beginner, so I'll start by giving a summary of Basic's commands.

## **Basic Commands**

*Load*—The script resides on a disk, and you wish to use it. Get it from the library and install it within the machine so it's available.

*Save*—You're finished with the script for the time being. Prepare a permanent copy (on a disk) so it will survive until next time.

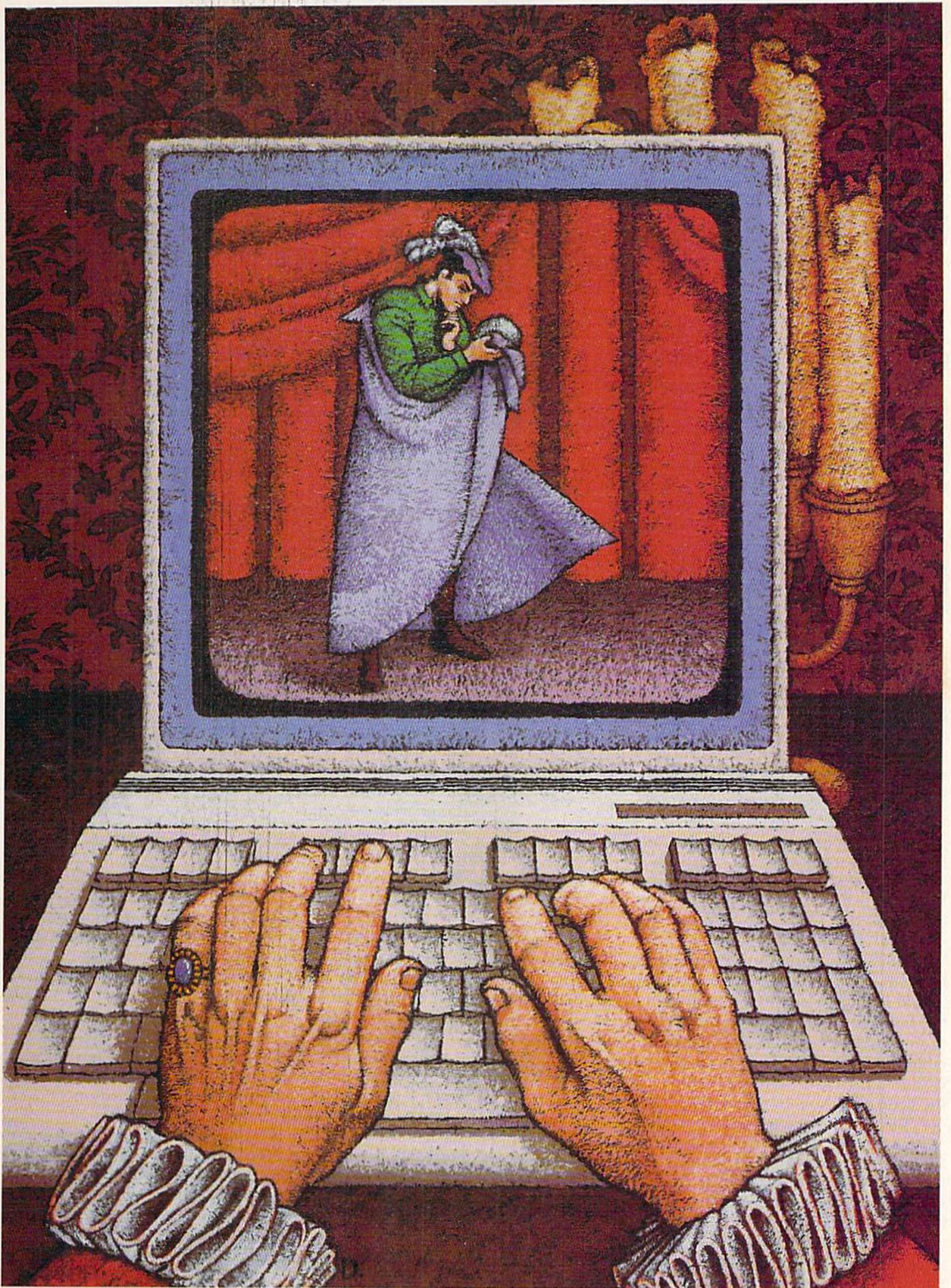
*Verify*—You've just saved such a copy and want to be sure that it is a good one before you turn off the power.

*List*—The script is in the computer's memory area. We want to have a look at it. It's probably time for some revisions to the script before opening night.

*Run*—House lights down; open the curtain. It's time to perform the play and see how it comes out. Now you're not just the playwright; you assume the director's role and want some action!

**RUN It Right**

C-64; C-128 (In C-64 mode)



**CONT**—Stands for Continue. In the middle of running the program, you paused the play for intermission. Resume the action from where you left off.

**New**—You don't want to work on this play any more, so forget it. (You did save a copy first, didn't you?) Clear the set to get ready for the next play's opening.

These commands are found in all versions of Basic and will cover the minimum needs. Some dialects have additional commands. For instance, Basic 4.0 (PET/CBM) adds commands (and instructions) for the convenience of working with the disk drive. Basic 7.0 for the Commodore 128 includes these and others to help you with your program editing. Many commercial packages, and public domain ones, too, have Basic enhancements.

### Basic Instructions

The rest of this article will introduce the main programming instructions that you'll encounter. You will use these *inside* your programs, as part of the script.

As you embark on this programming tour, please perform the preparatory step of typing the **New** command after you have finished with any program. This allows you to start each time with a clean slate. It's truly spooky to have an old program instruction haunting a new program. And don't forget to press the return key, or the computer will never "see" your entry.

All the programs will be shown in uppercase text. If the power-up message is in lowercase, simultaneously press the Commodore and shift keys. If you really prefer lowercase, just remember not to use the shift key when entering the text.

While most of us stress the importance of well-organized programs, most of us also desire instant results. Let's just assume that we will supply all the information needed (input) and eliminate the need for calculation (processing). That way, we can concentrate on the results (output).

Basic has but one output keyword, called **Print**. Naturally we will need it to handle many possibilities. So, **Print** has several options to handle the job.

Enter the following program:

```
300 PRINT "FRIENDS, ROMANS, COUNTRYMEN..."
310 PRINT 3.14159
320 PRINT "COL 1 "; "COL 2 "; "COL 3 "
330 PRINT -1 ; 2 ; 3
340 ? "COL 1 ", "COL 2 ", "COL 3 "
350 PRINT 10 , 20 , -30
```

When you make a typing mistake, use the delete key to erase it or hit the return key and retype the line.

Enter the **List** command, and your script should read the same as the above. If it doesn't, make the corrections (don't forget to press the return key) and reissue the **List** command until it does. If a stray, incorrect line number is there, just enter that number on a new line and press the return key. When you reenter the **List** command, the old line will have magically disappeared.

Perhaps you have noticed that the "?" character in line 340 refuses to stay that way after you issue the **List** command. The "?" character is an abbreviation for **PRINT**, and when a program is listed, it always translates it into the written word.

As you recall, the **List** command just redisplay the script, showing line numbers and Basic instructions. You haven't yet *performed* the play by issuing the **Run** command. Do that now, and you should see this on the screen:

FRIENDS, ROMANS, COUNTRYMEN...

```
3.14159
COL 1 COL 2 COL 3
-1 2 3
COL 1 COL 2 COL 3
10 20 -30
```

There's a lot here for discussion. Observe first that the line numbers, instructions and punctuation (quotes, semicolons and commas) are not displayed when a program is run. When you run a program, the computer performs the Basic instructions; it does *not* repeat them.

Notice line 300. The characters are enclosed in quotation marks. This is called a "string." A string can include numbers, punctuation and special symbols—a string of characters, literally. If you want such characters to be printed out, they must be enclosed in quotation marks.

If you are performing operations with numbers, you do not need to enclose them in quotes. Look at the result of line 310, and you will note that a space character precedes the first digit. Even if the number is not negative, space for a sign is always provided.

The first two program lines caused the results to be placed on separate lines. You may sometimes want to list several items side by side, on the same line. In the above program, lines 320–350 accomplish this through the use of semicolons and commas. Semicolons create a smaller space between items, or fields, and commas create a larger space. (In fact, the columns in lines 340 and 350 are ten characters wide, like preset tabs on a typewriter.) If the information doesn't fit within the ten spaces allowed, then the next tab setting (multiples of ten spaces) would be used.

You may mix and match amongst string literals, numbers, semicolons and commas, all on the same output line. Add the following line to the program, then run it.

```
360 PRINT 100 ; "DEGREES C =" , 212 ; "DEGREES F"
```

A semicolon or comma at the end of a **Print** statement line will suppress the normal carriage return, so the output from the next **Print** statement will be shown on the same line. Add the following lines to the program; then run them.

```
370 PRINT -40 ;
380 PRINT "DEGREES F =" ,
390 PRINT -40 ;
400 PRINT "DEGREES C"
```

That's about it for the **Print** statement. I would encourage you to try several examples of your own creation before proceeding to the next topic. Understanding the flexibility of the **Print** statement will allow you to make your program displays look quite slick.

### 1 Plus 1 Is 2

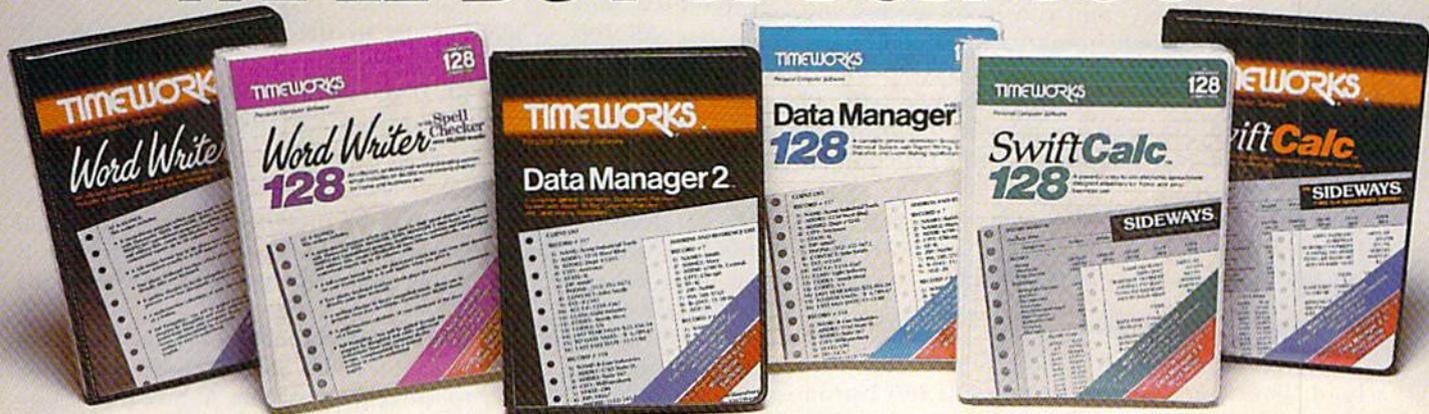
Let's take a slight detour here, to review a few rules of arithmetic. Addition (+) and subtraction (–) signs are as expected, but the symbols for multiplication (\*) and division (/) differ from the usual convention.

Algebraic logic, where multiplication and division are performed before addition and subtraction, applies. Parentheses are used to force operations to be done in a specific order. The calculations are done in a left-to-right order, with operations in parentheses being performed first.

Type **NEW** to clear the program memory, then enter the lines below.

```
300 PRINT "1 + 1 =" ; 1 + 1
```

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```

310 PRINT "14 - 3.96 = " ; 14 - 3.96
320 PRINT "2 * 6 = " ; 2 * 6
330 PRINT "3 / 7 = " ; 3 / 7
340 PRINT "2 + 3 * 6 = " ; 2 + 3 * 6
350 PRINT "(2 + 3) * 6 = " ; (2 + 3) * 6

```

Observe the use of string literals in each line. That way, both the problem and the answer will be printed out.

The operation priority is demonstrated in lines 340 and 350. Try to understand the computer's answer before you proceed. You could have enclosed the  $3 * 6$  in parentheses (line 340), but it was unnecessary. Retype this line with parentheses (and run it) to see for yourself. If you're not sure which operation the computer will do first, you are free to add parentheses—no harm done. And you're not limited to using a single pair. The computer can handle many pairs, all nested within each other. Don't use `[]` or `<>`, as they do not function as parentheses.

One last point: In line 350, you could write `"(2 + 3)6"` if this were algebra instead of Basic. However, you cannot omit the multiplication sign in Basic.

### A Little Painless Algebra

Many people develop an aversion to algebra in high school. This won't be all that painful, and I promise not to use  $x$  for the unknown quantity. We can't do without a little algebra in Basic. Programming involves problem solving, so you'll have to use symbols to represent quantities that you haven't yet determined. This is the role of "variables" in Basic.

You can use single letters of the alphabet to represent little compartments that can hold one number at a time. This cell can represent a number value as large as 10 to the 38th power (1 followed by 38 zeroes) or as small as 1 divided by 10 to the 38th power. The numbers are accurate to about nine digits.

The values held in these compartments, or boxes, can change. You assign values using Basic instructions. In fact, there are only three such instructions: Let, Input and Read. Each has its benefits and drawbacks, so there's a place for each in a program.

In previous examples, you knew the values in advance, so no input section of the program was required. You also didn't perform any calculations, hence no processing section. Variables give you the power to do more useful work with a program.

The Let statement is used for both input of values and processing, as in the example program:

```

100 LET A = 4
110 LET B = 8
200 LET C = A * B
300 PRINT , "ARITHMETIC"
310 PRINT
320 PRINT "ANSWER IS" ; C

```

The first line assigns a box, labeled A, to hold a number. The value 4 is put there. Line 110 does the same for B, storing "8" there. This completes the input phase, as you have the necessary values for the calculation.

Line 200 represents the processing. Take the contents of box A and multiply by the contents of box B. Create a box C to hold the answer, and put that value in it. Note that line 200 does not depend on numbers; it simply looks in boxes A and B, takes whatever is there and uses it to find what to put into box C. Hence the name "variable," as the answer can vary, depending on what was found in box A and box B.

The output section has a title, followed by a blank line. Line 320 is also independent of boxes A and B, as it reports only what was stored in box C.

Run the program to see the results. Only the final answer is shown—the starting values and the calculation are invisible to you. To show the values used, you have to write the program instruction yourself. Add this line:

```
315 PRINT A ; "TIMES" ; B
```

When you run it again, you will see the improvement. Once again, you've used the variable *names*, rather than their *values*.

All this is leading up to the issue of generality. A program that multiplies 4 by 8 is not very practical after the first time through. If you could vary the starting values, it would be more useful. How can this be done? Type in a new line 100.

```
100 LET A = 3.14159
```

Run it again, and you'll see the effect. Change line 100 to some other value for variable A. Do the same for B in line 110. Don't forget to run each of the versions you made.

Did you need to change any other lines in the program to make it come out right? Why not? Because lines 200, 315 and 320 refer to the *contents* of box A, box B and box C. If you change box A, box B, or both, then all the rest is performed automatically. This is the essence of programming: If you find a way to change the input values, then the processing and output stages survive without alteration.

Try this example:

```

100 LET FAHRENHEIT = 212
200 LET CELSIUS = 5 / 9 * (FAHRENHEIT - 32)
300 PRINT , "TEMPERATURE CONVERSION"
310 PRINT
320 PRINT "DEG. F" , "DEG. C"
330 PRINT FAHRENHEIT , CELSIUS

```

This one looks a shade more interesting. If line 100 defines a value for the variable FAHRENHEIT, then line 200 can use this value in its formula. Since this is the correct formula for the conversion, the variable CELSIUS will hold the Celsius equivalent. Line 330 takes the contents of the two boxes and displays them side by side.

Now change the Fahrenheit value in line 100 to -40. You needn't make any other changes to the program, as the conversion continues to be correct. Again, it should be stressed that variables used in the processing and output sections make this possible.

With two precautions, you may use longer names, rather than single letters, for the variables. Basic reserves certain words for its own use, and a long name may tread on one. For example, the following program would contain Syntax errors.

```

100 LET FORD = 99408
110 LET CHEVROLET = 153303
120 LET CHRYSLER = 102477
200 LET TOTAL = FORD + CHEVROLET + CHRYSLER
300 PRINT "TOTAL CARS =" ; TOTAL

```

With your knowledge of Basic so far, you might notice in line 110 the word LET (within CHEVROLET). Because this is also a Basic keyword, the computer will interpret it as such and give you a Syntax error. Also, FOR and TO (embedded in FORD and TOTAL) are Basic keywords and will cause trouble.

The second caution in using longer variable names can be demonstrated by the following.

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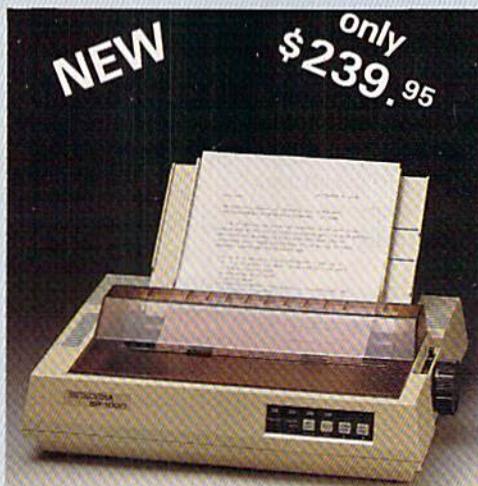
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```

100 LET APPLES = 2
110 LET PEACHES = 4
120 LET PEARS = 3
200 LET FRUITSALAD = APPLES + PEACHES + PEARS
300 PRINT "TOTAL FRUITS =" ; FRUITSALAD

```

Enter and run this to see if you can understand the answer. Basic looks only at the first two characters of a name to distinguish it. PEACHES and PEARS match, so line 120 redefines variable PE, causing the value in line 110 to be lost forever.

### Defining Variables Quickly

The above two shortcomings are addressed by the Input statement. While the Let statement has its place, the Input statement may be used to advantage in many circumstances. Try this program:

```

100 LET RADIUS = 10
200 LET CIRCUMFERENCE = 3.14159 * RADIUS * 2
300 PRINT "IF RADIUS = " ; RADIUS
310 PRINT "CIRCUMFERENCE = " ; CIRCUMFERENCE

```

Run it and then change values for the radius. Clumsy, isn't it? Now make the following change to the above.

```
100 INPUT RADIUS
```

When run, the program comes to a screeching halt, yielding nothing but a cryptic question mark and the cursor blinking away to its right. The question mark is meaningful—the program is waiting for you to supply a value. Provide a number (your choice), and after you have hit the return key, the action is completed. If you run it again, you get to choose again, and so on.

The Input statement causes the value you give to be assigned to the variable box named RADIUS. Then the contents of that box are used by the rest of the program, just as before. Now the program does not depend on a preselected value; the computer lets you supply one for which you wish an answer.

Suppose you or someone else uses this program at a later date; how will you know which value is expected? Let's add another line to prompt the forgetful or uninformed user of your program:

```
90 PRINT "ENTER THE RADIUS" ;
```

Now a helpful message, called a prompt, tells what to supply. For a shorter, combined form, omit line 90 and retype this:

```
100 INPUT "ENTER THE RADIUS"; RADIUS
```

For some reason, you cannot leave a space after the closing quotes (before the semicolon), though spaces are almost always ignored by Basic.

### The Goto Statement

Computers can do repetitive tasks well. Pretend you have a long list of radius values that require circumference answers. Add the following lines to the latest version.

```
320 PRINT
400 GOTO 100
```

Now run the program, and you'll see an endless loop in action. Every time you supply a value, you receive the answer, and then another question! The stop key is ineffective while the computer is waiting for an Input response. To exit the program, simultaneously press the run/stop and restore keys.

The Goto statement must be followed by some line number in the program. It is referred to as a "branching" instruction because it changes the order in which the

lines are executed. In this case, the branch is *unconditional*, since every time the program arrives at line 400, it is sent to line 100.

Keep a copy of the final version of this program. We'll refer to it later.

### Entering Text

Variables are needed when referring to text information. For a fill-in-the-blank form letter, try the following program.

```

100 PRINT "FORM LETTER"
110 PRINT
120 INPUT "DATE"; D$
130 INPUT "FIRST NAME"; F$
140 INPUT "LAST NAME"; L$
150 INPUT "CITY"; C$
160 INPUT "STATE"; S$
170 INPUT "KIDS' NAMES"; K$
200 PRINT
210 PRINT , , D$
220 PRINT
230 PRINT "DEAR " ; F$;
240 PRINT
250 PRINT " HOW ARE THE " ; L$ ; "S OF THE " ;
260 PRINT "GRAND OLD STATE OF " ; S$ ; " THIS YEAR ?"
270 PRINT
280 PRINT " THINGS ARE QUIET IN BARRIE, BUT I " ;
290 PRINT "BET YOU ARE BUSY IN " ; C$ ; " ;
300 PRINT
310 PRINT " ANDREA AND MICHAEL ARE FINE. " ;
320 PRINT "HOW ABOUT " ; K$ ; " ?"
330 PRINT
340 PRINT " MERRY CHRISTMAS,"
350 PRINT " THE HOOKS."
360 PRINT

```

When you run this, you'll be asked to provide six items, which can include alphabetic, numeric and special characters. (Do not use commas, colons or double quotes in your response—they confuse Basic, and you'll get strange results.) The data you have typed will then be used in the form letter. If the output had been directed to a printer, you could have printed your letter. To generate another letter to someone else, simply reissue the Run command and input new data.

As with number variables, no other changes to the program are required. New string information brings you another finished letter. If a variable is followed by \$ (for example, D\$), you have a string variable. You cannot do arithmetic with these.

String variables can contain up to 255 characters. They can be assigned in Let statements, too:

```

100 LET A$ = "COMMODORE"
110 LET B$ = "LIKE"
120 LET C$ = "I"
300 PRINT C$ ; " " ; B$ ; " " ; A$

```

The quotation marks surrounding the string definition are essential. Otherwise a Type Mismatch error occurs. The quotes make LIKE into a string literal—similar to those used in Print statements. Now a string of characters is assigned to a string variable. Note how strings are spaced when semicolon punctuation is used. Drop the extra spaces in line 300 and see what happens.

### Decisions, Decisions

We have had an example of a loop already, although it was a clumsy one that needed unusual steps to abort. Using the If...Then statements, you can streamline this process.

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Reload the copy of the radius/circumference program that you saved. Add the following lines.

```
110 IF RADIUS = 0 THEN 500
500 END
```

The End statement terminates a program. It is usually optional, though it is sometimes required. To be on the safe side, I suggest you always include it in your programs.

List the program. After the radius has been input, you are testing it to see if a zero has been entered. If a zero has been entered, making the test true, then the program skips to line 500. The line number following THEN is the destination if the test is true. Any other value for the radius allows the program to continue, just as if no test had been done. Thus, the false result of the test points at the next line number.

The above example is a *conditional* branch, meaning that the branch is performed only if the test succeeds. In place of the Then statement, you may use Goto or THEN GOTO.

The following two lines create a prompt that allows you to stop the program.

```
90 PRINT "ENTER '0' TO STOP"
95 PRINT
```

### Relational Operators

The line:

```
IF RADIUS = 0 THEN 500
```

is based on an "equals" condition. You can test for six conditions in all:

```
> greater than
<= not greater than (less than or equal to)
< less than
>= not less than (greater than or equal to)
<> not equal to
= equal to
```

The symbols are called relational operators because they compare two relations. The expression on either side of the operators can consist of constants and variables (numeric comparisons) or string literals and variables (string comparisons). The following program uses both types.

```
90 PRINT
100 PRINT , "MENU"
110 PRINT
120 PRINT "1. — START A NEW FILE"
130 PRINT "2. — ADD A NAME"
140 PRINT "3. — QUIT"
150 PRINT
160 INPUT "CHOOSE A NUMBER (1, 2 or 3)"; NUMBER
165 PRINT
170 IF NUMBER < 1 THEN 160
180 IF NUMBER > 3 THEN 160
190 IF NUMBER = 1 THEN 1000
200 IF NUMBER = 2 THEN 2000
210 IF NUMBER = 3 THEN 3000
220 END
1000 PRINT "START A FILE SECTION"
1010 PRINT
1900 GOTO 5000
2000 PRINT "ADD A NAME SECTION"
2010 PRINT
2900 GOTO 5000
3000 PRINT "QUIT SECTION"
3900 END
5000 INPUT "ARE YOU DONE (Y/N)"; ANSWERS$
5010 IF ANSWERS$ = "N" THEN 90
```

```
5020 IF ANSWERS$ <> "Y" THEN 5000
5030 END
```

This program is typical of a "menu" type that you have probably used before. The choices are offered, and the Input statement waits for a numeric response. Lines 170 and 180 send you back to the question unless you give an answer within the correct range. Then you are sent to one of three distinct sections, corresponding to the menu selection.

If someone enters 1.3 or another illegal value in line 160, then line 220 ends the program.

Once you have arrived at the correct section, a message is printed to signal what happened. If you choose to quit, the End instruction terminates the program. Otherwise, you may create or add to the file (not included here). After that, you are sent to line 5000, where you are asked another question.

Here the response is alphabetic, so a string variable is needed. An N sends you back to the menu. A Y sends you to line 5030, where the program ends. If you don't answer Y in line 5020, then the program returns to line 5000 and asks you again whether you are done.

In the example program, once the correct branch is taken, you must isolate that section from the others. Segments at lines 1000, 2000 and 3000 must never overlap. You can bring the alternate pathways together after the individual task is finished.

### What About Data?

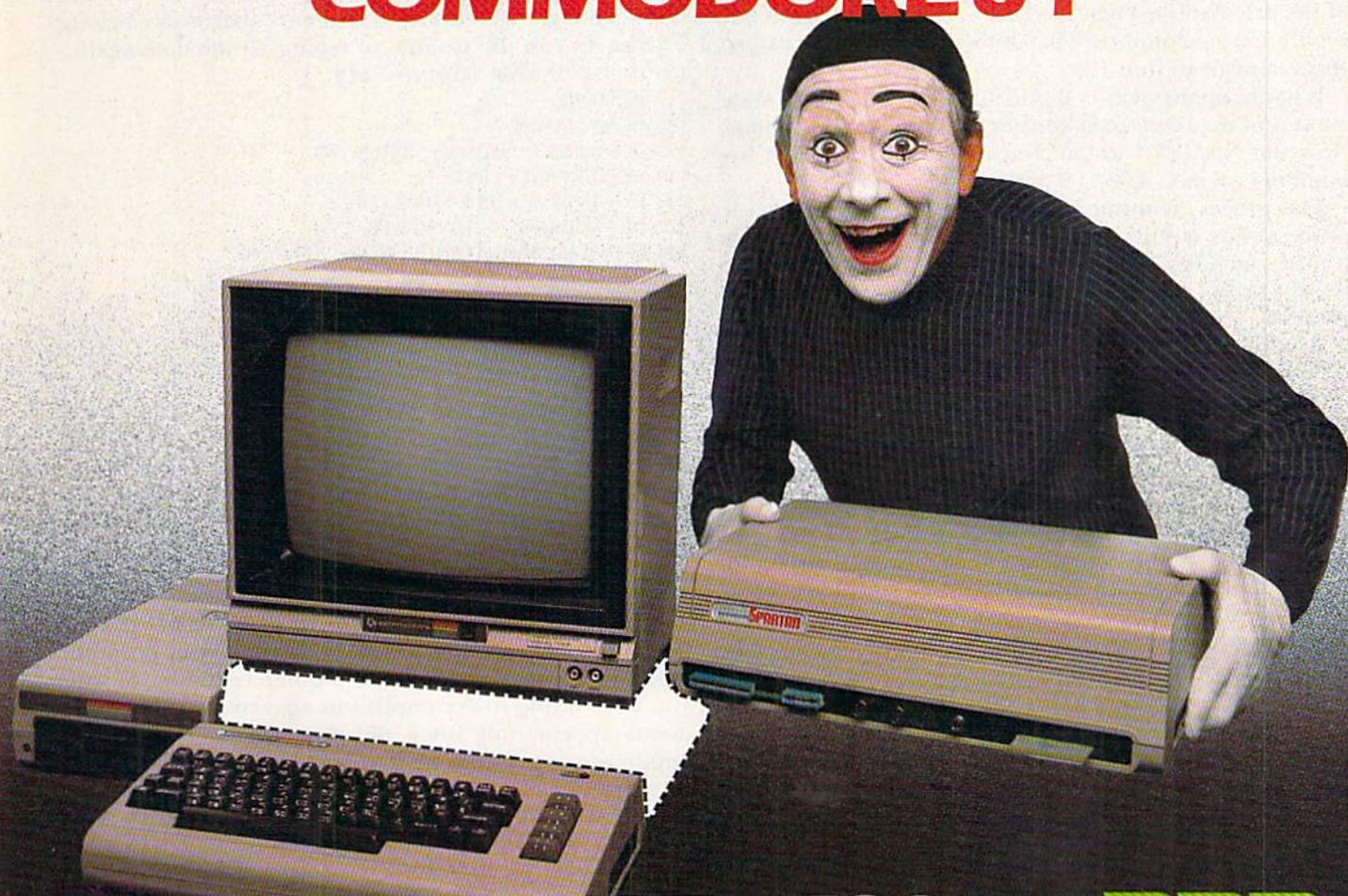
The third way of getting information into the computer is through the Read and Data statements. Data statements mark the spot where some information is to be found. Several items (numbers or strings) can appear on the same line, separated by commas. These items just sit there, waiting for the Read statement to pick them up as needed. Thus, Data statements can appear anywhere in a program, even after an End statement, and Read will still find them. Data is read from left to right, from the lowest line number containing data to the highest.

Let's look at an example:

```
100 PRINT "NAME" ; TAB(14) ; "AT BAT " ;
110 PRINT "HITS" ; TAB(29) ; "AVERAGE"
120 READ NAMES$
130 READ ATBATS , HITS
200 LET AVERAGE = HITS / ATBATS
300 PRINT NAMES$ ;
310 PRINT TAB(14) ; ATBATS ;
320 PRINT TAB(21) ; HITS ;
330 PRINT TAB(27) ; AVERAGE
400 GOTO 120
1000 DATA "MULLINIKS",244,81
1010 DATA "IORG",156,49
1020 DATA "OLIVER",70,21
1030 DATA "GARCIA",441,127
1040 DATA "BELL",404,115
1050 DATA "WHITT",261,72
1060 DATA "BURROUGHS",151,41
1070 DATA "FERNANDEZ",367,98
1080 DATA "BARFIELD",350,91
1090 DATA "UPSHAW",376,97
1100 DATA "MOSEBY",375,89
```

Lines 100 and 110 contain the Tab function, which lets you use a numeric value for the placement of the next field on the screen. If comma and semicolon punctuation is inadequate, you can use Tab values to set up the next column position. Don't forget to enter the semicolon after

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TAB(29) in line 110, or else the heading will take up two screen lines.

The Read statements in the next two lines pick up the three fields of information from the first Data statement. The string variable, NAME\$, gets the first item (MULLINIKS), and the number variables get the next two data items. Note that the data must be organized in the same order as the Read statements. Basic doesn't know which data goes with which variable—it just matches them as they come up.

A variable, AVERAGE, is established to hold the result of the calculation. Then the four variables are printed in evenly spaced columns. The Goto statement returns program control to line 120.

What happens next is significant. The *same* Read statement now reads *new* data, reusing the *same* variable names. Now the NAME\$ variable retrieves IORG, and his two numbers go into ATBATS and HITS.

The process continues until there is no more data to process, then it quits with an error message. You can make it tidier by adding the following lines to the program:

```
125 IF NAME$ = "DUMMY" THEN 500
500 END
9999 DATA "DUMMY",0,0
```

Now, every time another name is read into NAME\$, a check is done to see if it matches DUMMY. When it does, the program stops reading data. You must remember to include this special Data statement at the end of your program. This name isn't processed; it is merely a trigger to end the reading of data.

You could use Input in the above example by changing the Read statements. Then you must type in the data for

every player every time you run the example. On the other hand, you would not want to use the Let command, since you would have to change the program for every player (e.g., LET NAME\$ = "MULLINIKS"). Read/Data is the method of choice in instances where the Data values are known before the program is run and several cases must be handled.

There is a way to reuse the same list of data. The Restore statement resets the pointer, allowing the next Read statement to read the data again, from the first item. Enter the following program, *without* entering NEW first. Then list it and get rid of any statements that don't belong. This saves you the trouble of typing all the data again.

```
100 INPUT "PLAYER TO FIND "; PL$
110 RESTORE
120 READ NAME$
130 IF NAME$ = "DUMMY" THEN 500
140 READ ATBATS , HITS
200 IF NAME$ <> PL$ THEN 120
210 LET AVERAGE = HITS / ATBATS
300 PRINT NAME$ ; ATBATS ; HITS ; AVERAGE
310 PRINT
320 GOTO 100
500 PRINT "NAME NOT FOUND"
510 PRINT
520 GOTO 100
```

Now you are asked to give a player's name. If it is found in the data, the batting average will be calculated and the four fields will be displayed. The data will be exhausted in the loop between line 120 and line 200. The Restore statement in line 110 makes the whole list available for the next inquiry.

#### REM Statements

The Remark, or REM, statement lets you provide information or briefly document sections of your program. A REM statement can serve as a quick reminder of what you were trying to accomplish in a given area. The statements appear only when the program is listed. An example of some initial REM statements follows.

```
10 REM TAX PROGRAM — VERSION 2.01
20 REM AS OF AUGUST 9, 1985
30 REM D. A. HOOK, BARRIE, ONT., CANADA
50 REM — LIST OF VARIABLES —
55 REM I.....INCOME
60 REM T.....TAX DEDUCTED
199 REM DISPLAY MENU
```

Here, REM is used to identify the program, its version number and the date of last revision. As you program, you may end up with 17 versions of Blackjack, spread all over your disk library. When you go on a housekeeping blitz, this is a convenient way of keeping track of the most recent version. If you copied a program from a magazine, include the author's name and where it came from. That information will come in handy a year later, when you've forgotten what a particular program does.

Perhaps the two most useful benefits of REM are identification of the names of important variables, since Basic limits the length of variable names, and the identification of sections of the program (purpose of a routine or explanation of a clever trick).

#### For...Next Looping

You already know how to branch out of loops by using a dummy value with the If...Then statements. There are, however, many cases where you know the starting and ending values ahead of time, and how that value is to change each time through. Consider:



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```

300 PRINT "COUNTDOWN..."
400 FOR I = 10 TO 0 STEP -1
410 PRINT I
420 NEXT I
500 PRINT "BLAST OFF!"

```

The variable I is an index counter, defined to start at ten and finish at zero, counting backwards by 1. The end of the loop is marked by line 420, where the value of the index counter is checked. If it has not passed its ending value, everything between the FOR (line 400) and the NEXT (line 420) is performed again. After all permissible values of I have been handled, the loop exits at the bottom and processing continues with the next instruction.

Here is a delay loop that counts to 5000 while processing occurs.

```

200 FOR COUNT = 1 TO 5000
210 NEXT COUNT
220 REM RESUME PROGRAM AFTER DELAY

```

Here, COUNT is the index of the loop, and we want it to go from 1 to 5000. Since no STEP is mentioned, we will count upward by 1 each time. There is nothing between the FOR and NEXT lines, so the computer just counts, then exits. On the C-64, this process takes about 8.3 seconds. If you wish to display something on the screen for a given period, you can place this timing loop after the Print statements. The program will then resume its activity after the loop finishes.

You can use variables for the start, end and step values. This makes the loop extremely flexible. Here's another temperature-conversion program:

```

100 LET LOW = -40
110 LET HIGH = 100
120 LET CHANGE = 10
200 PRINT "DEG. F", "DEG. C"
210 PRINT
220 FOR FAHRENHEIT = LOW TO HIGH STEP CHANGE
230 LET CELSIUS = 5 / 9 * (FAHRENHEIT - 32)
240 PRINT FAHRENHEIT, CELSIUS
250 NEXT FAHRENHEIT

```

Run this, and you will see a whole table of values. Since the Let statements make things rather inflexible, change these three lines:

```

100 INPUT "START TEMP. IN DEG. F"; LOW
110 INPUT "END TEMP. IN DEG. F"; HIGH
120 INPUT "STEP SIZE"; CHANGE

```

Now you're ready to produce a table for any range.

Well, I hope you have been inspired to try some Basic programming on your own. Beyond these core instructions, remember to keep a Basic manual close at hand. I've also provided you with a list of some books you might find helpful. R

Address all author correspondence to David A. Hook, 215 Anne St. North, Barrie, Ontario, Canada L4N 4T4.

## References

*Armchair Basic* by Annie Fox & David Fox. Osborne/McGraw-Hill (1983). Superb introduction for absolute beginners.

*How to Program Your COMMODORE 64—BASIC for Beginners* by Carl Shipman. HP Books (1983). Excellent, comprehensive book written so that ordinary people can understand.

*BASIC and the Personal Computer* by Thomas A. Dwyer & Margot Critchfield. Addison-Wesley (1978). Very good, though slightly more technical.

*A Bit of BASIC* by Thomas Dwyer and Margot Critchfield. Addison-Wesley (1980). A revised and condensed version of the above, with fewer application programs.



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# C-64/C-128 Graphics You Won't Believe Your Eyes!

By LOUIS WALLACE

The C-128 and C-64 computers are well-known as high-powered, low-cost graphics systems. They share many graphics features, such as modes, resolution, animation and others. However, they differ radically in how you access these features from Basic. The commands of the C-128's Basic 7.0 support most of the graphics features of the C-128, while on the C-64 those same graphics capabilities must be accessed by Peek and Poke commands or machine language routines. This article will examine the various graphics modes and compare programming methods between the two computers.

Both the C-128 and C-64 have three major types of graphics: text, bit-map and sprites. All of the C-64 graphics (and most of the C-128's) are made possible by the VIC (video interface controller) chip. The C-128 also has a second graphics chip, the 8563, which allows for a higher resolution (80-column) display. This chip requires an RGB monitor to display properly its 640 × 200 resolution graphics, while those produced by the VIC chip can be used with any composite monitor or television set. It is also possible to use the 80-column output on a composite monitor, but the resolution isn't as clear, and the display will feature monochrome, not 16 colors.

## Text Modes

To begin, let's look at the normal Text mode of the C-64 and C-128. This is a 40-column by 25-line display, using up to 256 characters in any of 16 colors. The screen,

*When it comes to graphics, both the C-64 and C-128 offer some superb features. The trick is in accessing these features. Using sample programs, this article shows you how, and helps you better understand Commodore graphics programming.*

or background, color can also be independently set to any of the 16 colors.

The C-64 and C-128 offer two character sets from which you may choose. One is uppercase/graphics; the other is uppercase/lowercase. These can be toggled by simultaneously pressing the Commodore key and the shift key. The effect is apparent throughout the visible screen, and each character is changed to its counterpart in the other character set. You can also perform this with the Basic Print command.

PRINT CHR\$(14)

will switch the display to lowercase.

PRINT CHR\$(142)

will switch the display to uppercase.

Many of the C-64's and C-128's text features can be controlled by using the Print command. Examples are:

PRINT CHR\$(147) (clears the text screen)

PRINT CHR\$(19) (moves cursor to top-left of screen)

PRINT CHR\$(28) (changes text color to red)

When you use the Print command, these types of commands can also be included inside the string you wish to print. You can also include cursor-key commands, reverse-on or reverse-off and even INST/DEL. This can be very useful if you need to position text at a specific location, as the C-64 does not have any form of the Print At command for positioning your output.

The C-128's Basic 7.0, however, does have just such a



command—the CHAR command. Normally used for printing text on the high-resolution bit-map display, the CHAR command will also work in Text mode.

CHAR <color source>,x,y,string<,reverse flag>

Here the color source can be 0 for background and 1 for foreground. The location to print at is given in the x (columns 0-79) and y (rows 0-24) coordinates. The string is any statement up to 255 characters, including color, cursor keys, and so on, when you're in Text mode. The reverse flag is optional, with 0 meaning off and 1 being reverse-on.

The C-128 also has a very powerful form of the Print command, called Print Using. This allows the programmer to output numbers or strings in a fixed way, such as having two decimal places for printing values in dollars-and-cents form. On the C-64, formatting to two decimal places would require:

```
10 A = 123.45678
20 A = (INT(A*100)/100)
30 PRINT "A=";A
```

On the C-128, formatting to Basic would require two lines:

```
10 A = 123.45678
20 PRINT USING "###.###";A
```

Both programs would give A = 123.45, but the C-128 form is easier and more versatile.

There is more than one form of 40-column Text mode on these computers. Both have Multicolor and Extended-Color Text modes, which give you more flexibility in determining the color of the characters and their backgrounds. Before getting into those, however, it's important to understand more about what exactly defines a character to the computer.

Character graphics on the C-64 and C-128 are formed by an 8x8 grid of dots. The dots are actually bits ( $\frac{1}{8}$  of a byte) that are set (turned on) for display or unset (turned off) to show background color. Eight bytes are required to define a character (eight rows of eight bits each). Multiply that by the 256 characters in each character set, and you'll see it takes 2048 (2K) bytes to define each character set in memory.

When you Poke the screen memory with an ASCII value from 0 to 255, the computer looks up, in the character ROM, the location of the proper eight bytes that contain the definition and puts the pattern indicated into the screen cell you Poked.

### Multicolor Text

Multicolor Character mode is the second major Text mode on the C-64 and C-128. Here the C-128 is not supported by its Basic 7.0; instead, it, too, relies on the Peek and Poke commands.

In Multicolor Text mode, you may have, in each character cell, up to three different colors, plus background color. This allows for much more interesting-looking text. However, it does have a liability in terms of character resolution.

When you enter Multicolor mode, the number of dots in a cell is cut in half, making the characters 4x8 and, thus, somewhat coarser. Probably the most useful aspect of Multicolor Text mode is in designing custom characters. In fact, many of the objects used in games are not sprites at all; they're multicolor custom characters that can be used by themselves or combined to become larger screen objects.

To enable Multicolor mode on the C-64, you set bit 4 of the VIC-II control register at 53270 (\$D016) and Poke the colors you want into the proper registers.

```
POKE 53270,PEEK(53270) OR 16 : REM Activate MC mode
POKE 53282,MC1 : REM Multicolor 1
POKE 53283,MC2 : REM Multicolor 2
POKE COLOR RAM,MC3 : REM Multicolor 3
```

To set Multicolor 3, Poke the proper color RAM byte that corresponds to the screen location of the character in which you're interested. RAM is from 55296 to 56295.

To exit Multicolor mode on the C-64, enter POKE 53270 and deactivate bit 4:

```
POKE 53270,PEEK(53270) AND 239
```

On the C-128, you must approach this process somewhat differently. The C-128 operating system is putting data into several of the VIC-II's registers many times a second.

The information is taken from special system locations called shadow registers, which contain the information about the current graphics condition. These locations are 216 and 217 (\$D8-\$D9) and 2604-2606 (\$02AC-\$02AE). If you Poke 255 into 216, this automatic mapping of data is stopped, and you can control the VIC-II's registers as in the C-64. You must be careful to maintain the proper values in the other registers.

The following short program shows how to activate the normal character set in Multicolor mode on the C-128. Although most people won't use this, it is helpful to programmers who wish to create multicolor keyboard characters and custom characters. When it is run, you will see a screen of fuzzy-looking, brightly colored characters. This is the normal character set. However, since they weren't designed as multicolor characters (four pixels by eight lines), they appear strange. Anything you type will now be in Multicolor mode until you press the left-arrow key.

```
10 REM C128 MULTICOLOR CHARACTERS DEMO
20 SCNCLR0
30 C$="ABCDEFGH IJKLMN OPQRST UVWXYZ0123456789
  0+-{LB.}"
40 POKE53280,0:POKE53281,0
50 REM C128 SHADOW REGISTERS
60 A=PEEK(216):B=PEEK(217)
70 C=PEEK(2604):D=PEEK(2605)
80 E=PEEK(2606)
90 A1=53270: REM NORMAL VIC CONTROL REGISTERS
100 B1=216:REM $D8 GRAPHM = $D011
110 POKE53282,2: REM MULTICOLOR 1
120 POKE53283,7: REM MULTICOLOR 2
130 FORI=55296TO56295:POKEI,5:NEXT
140 FORI=0TO23:PRINTC$;:NEXT
150 POKE B1,255: REM DISABLE SHADOW REGISTERS
160 POKE A1,PEEK(A1)OR16: REM TURN MULTICOLOR ON
170 POKE 2604,C:POKE2605,D:POKE2606,E:POKE217,B: REM{3 SPACES}RESTORE VALUES
180 GETKEY A$
190 IF A$="{LEFT ARROW}"THEN210
200 PRINTA$;:GOTO180
210 POKE A1,PEEK(A1)AND 239:POKE216,A:REM MULTICOLOR MODE OFF, VIC RESTORED
220 END
```

For C-64 multicolor characters, type in the next program, which also fills the screen with multicolor characters. It allows you to vary their colors by pressing f1, f3 or f7. The f1 key changes multicolor 1; f7 changes multicolor 2; and f3 changes the color under the cursor. You



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can move the cursor with the normal cursor keys, leaving a colored trail through the characters. To exit, press the left-arrow key.

```
10 REM C64 MULTICOLOR CHARACTER DEMO
20 C$="ABCDEFGHIJKLMNPOQRSTUVWXYZ0123456789
   0+-(LB.)"
30 POKE53280,0:POKE53281,0:M3=8
40 S=55296: REM COLOR MEMORY
50 POKE 53270,PEEK(53270)OR16: REM MULTICOL
   OR ON
60 POKE53282,2:POKE53283,7:FORI=STOS+999:PO
   KEI,5:NEXT: REM SET COLORS
70 FORI=0TO23:PRINTC$;:NEXT
80 GET A$
90 IFA$="(LEFT ARROW)"THENPOKE53270,PEEK(53
   270)AND239:END
100 IF A$="{FUNCT 3}"THENM3=M3+1:IFM3=16THE
   NM3=0:A$=""
110 IF A$="{FUNCT 1}"THENPOKE53282,M1:M1=M1
   +1:IFM1=16THENM1=0:A$=""
120 IF A$="{FUNCT 5}"THENPOKE53281,M0:M0=M0
   +1:IFM0=16THENM0=0:A$=""
130 IFA$="{FUNCT 7}"THENPOKE53283,M2:M2=M2+
   1:IFM2=16THENM2=0:A$=""
140 IFA$="{CRSR DN}"THENS=S+40:IFS>56295THE
   NS=S-1000:A$=""
150 IFA$="{CRSR UP}"THENS=S-40:IFS<55296THE
   NS=S+1000:A$=""
160 IFA$="{CRSR RT}"THENS=S+1:IFS>56295THEN
   S=S-1000:A$=""
170 IFA$="{CRSR LF}"THENS=S-1:IFS<55296THEN
   S=S+1000:A$=""
180 POKES,M3
190 GOTO 80
```

### Extended Background Color Mode

Another aspect of the Text mode is Extended Background Color mode, which provides one additional color per cell, while retaining the same resolution as Standard mode. However, here you're limited to only 64 characters on the screen at any one time. To enter Extended Color mode, type:

```
POKE 53265,PEEK(53265)OR64
```

To exit this mode, type:

```
POKE 53265,PEEK(53265)AND191
```

The color information for each group of 64 characters is held in registers 53281-53284. A Poke to one of them will change the background color for its group.

### 80-Column Text

On the C-128, there is one more Text mode—80-column. In this mode, you have an 80-character by 25-line display. This is available if you have an RGB or composite monitor connected to the RGB video port by a specially designed cable.

In 80-column mode, you have full access to the Commodore character set as well as 16 colors for characters and background. It does not support sprites or Multicolor or Extended Color modes. The print commands like CHAR and Print Using work as before on the regular 40-column screen. The Color command has forms for the 80-column character, border and background colors.

On the C-128 and C-64, it's also possible to create custom character sets. By careful programming, you can replace the current set with your new definitions. It's much easier to do with a character editor, of which there are probably many in your local user's group's library.

### High-Resolution Graphics

Most people find high-resolution graphics more inter-

esting than text graphics, and it's here that the C-64 and C-128 have earned their reputations. Both have the same potential, but, due to the high level of Basic 7.0, the C-128 is far easier to use and more versatile because of its added memory.

High-resolution graphics is also called bit-mapping, because it involves turning on specific bits inside a byte. There are two bit-map modes on the computers. One is High-resolution mode, 320 × 200 dots, and the other is Multicolor (bit-map) mode, 160 × 200 dots. Here, as in Multicolor (character) mode, there's a 50 percent loss in horizontal resolution. But here, too, you gain by having four colors instead of two.

High-resolution graphics (320 × 200) allows for two colors: foreground (plotting) and background. The information about color is put into whatever 1000-byte section of memory you are using as screen, or text, memory. If you were to Poke 3 into each of the 1000 bytes of screen memory, you would have the color cyan for foreground and black for background. The formula is foreground color + (16 \* background color). For red dots on a white screen, you would calculate 2 + (1 \* 16). To get the desired color when you plot a dot, you would then Poke the answer, 18, into screen memory. By putting a different combination in each character cell, you can get many different combinations on the same screen.

To use high-resolution graphics on the C-64, you must perform several steps. First you must turn on Bit-map mode. Second, you must tell the computer which 8K (8000 bytes) of RAM are to be used as a bit-map screen.

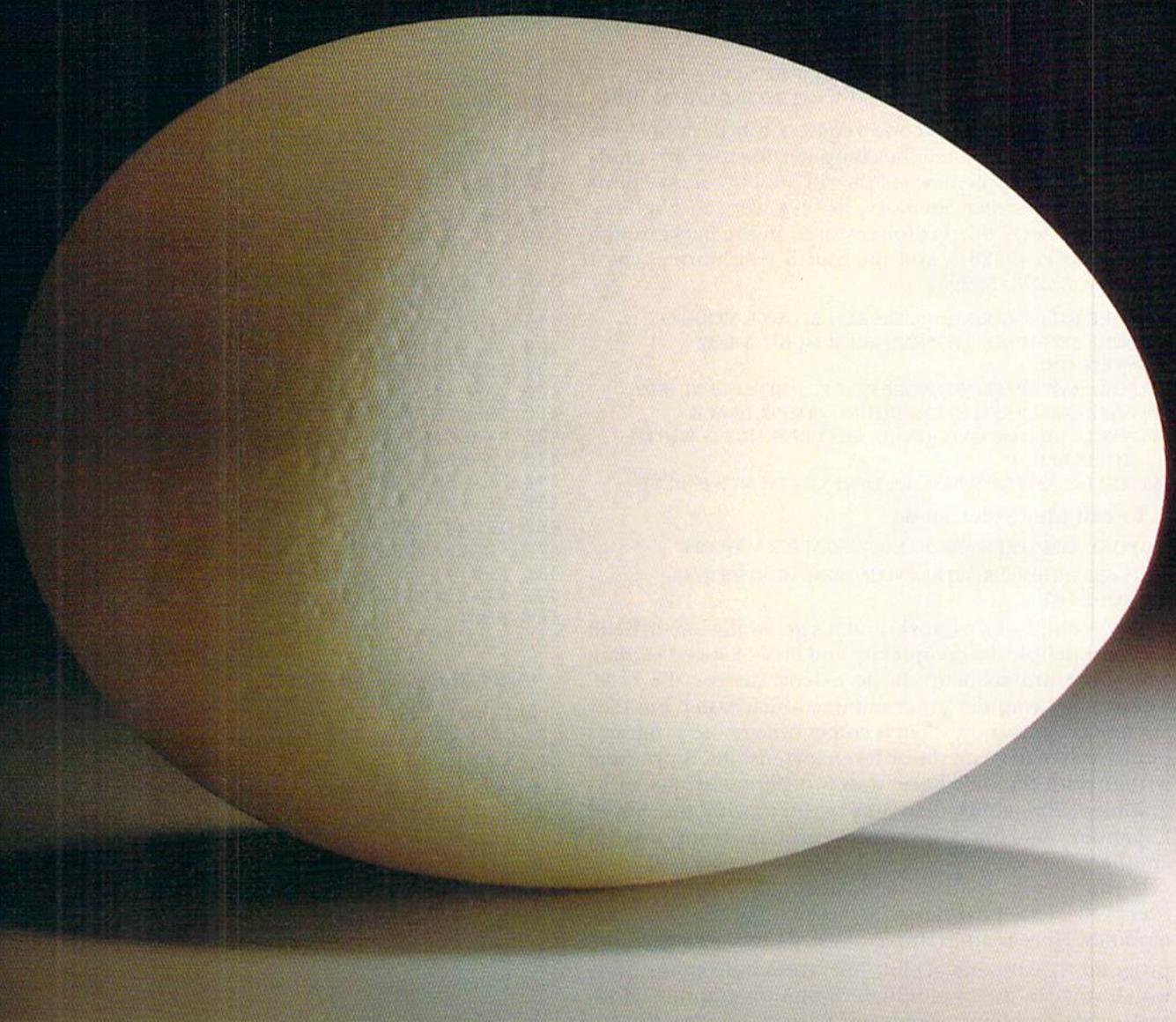
There are several places available, but no standard location. The *Commodore 64 Programmer's Reference Guide* uses location 8192 as its example, which is 6K above the start of Basic. To safely use this, the start of Basic must be moved up above the screen area, which results in a loss of 14K of Basic RAM.

A better, but more complex, option is to put the screen under the Basic or Kernal ROM. The VIC-II chip can utilize the RAM under the ROMs, so it's not too difficult to use it as a screen for hi-res graphics, leaving your Basic program space untouched. In fact, many programs do just that.

Displaying pictures under the ROMs from Basic is not difficult, but you must use machine language to plot graphics there. That's because the Kernal ROM must be shut off while plotting your points, thereby disabling Basic. You will have to use a machine language routine for this plotting. If you put your screen in normal system RAM, a Basic algorithm can be used for plotting points, but it will be painfully slow. Here is an example of such a Basic subroutine:

```
1000 REM PASS X,Y AND BASE ADDRESS VIA GOSUB 1000
1010 CH=INT(X/8)
1020 RO=INT(Y/8)
1030 LN=YAND7
1040 BY=BASE+RO*320+8*CH+LN
1050 BI=7-(XAND7)
1060 POKE BY,PEEK(BY)OR(21BI)
1070 RETURN
```

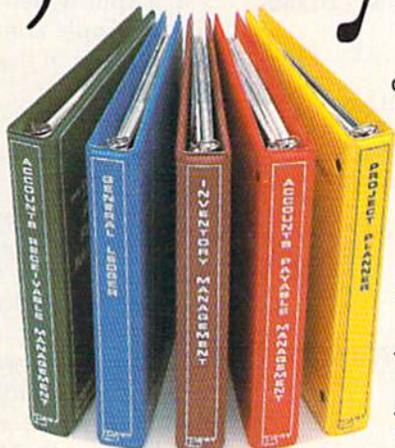
To determine which video bank your screen is in, you must set a bit in the proper register (56576). Before writing to this register, you must first tell Data Port 1 that the information is coming. Next, set the bank address. Following that, set the address of the 1000-byte screen you wish to use for color memory. In the case of a bit-map screen at 8192 (\$2000), the normal text screen (1024-



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2023) can be used for color information. Finally, set bit 5 of the VIC control register (53265).

```
100 POKE 56578,PEEK(56578)OR3:REM SET TO OUTPUT
110 POKE 56576, (PEEK(56576)AND252)OR3:REM SET BANK TO 0-16383
120 POKE 53272,PEEK(53272)OR8:REM PUT BIT-MAP AT 8192
130 POKE 53265,PEEK(53265)OR32:REM GO TO BIT-MAP MODE
```

To enter Multicolor mode requires a little more programming. You must tell the computer to enter this mode and specify what the new colors will be. Two of the colors are stored in screen memory, as they were in High-resolution mode. A third color is stored in the background-color register (53281), and the fourth is in normal color memory (55296-56295).

```
100 POKE 53265,PEEK(53265)OR32:REM BIT-MAP MODE ON
110 POKE 53270,PEEK(53270)OR16:REM MULTICOLOR MODE ON
120 POKE 53272,PEEK(53272)OR8:REM PUT BIT-MAP AT 8192
130 POKE 53281,0:REM BACKGROUND COLOR BLACK
140 FOR I=1024 TO 2023:POKE I,18:NEXT:REM MC1 IS WHITE, MC2 IS RED
150 FOR I=55296 TO 56295:POKE I,6:NEXT:REM MC3 IS BLUE
```

To exit Multicolor mode:

```
200 POKE 53265,PEEK(53265)AND223:REM BIT-MAP OFF
210 POKE 53270,PEEK(53270)AND239:REM MULTICOLOR MODE OFF
```

That's quite a lot of work, and it's generally too difficult for most people. Its complexity and lack of speed explain why there are so many Basic extensions for the C-64. These make graphics programming much easier, but they also create confusion when it comes time to use programs or pictures made with the different extensions. A program written with Simon's Basic uses a different syntax in its graphics commands than one written with the Super Expander, making conversion difficult from one to another.

If you wish to make your Basic totally compatible on every C-64, either use Basic 2.0 or write machine language modules. Here is an example of a C-64 Basic 2.0 graphics program. It contains a plot, line and circle subroutine, which you can use to plot high-resolution graphics. However, creating hi-res graphics in Basic 2.0 is very slow.

```
10 REM 64 HIRES PLOT, LINE AND CIRCLE
20 POKE53265,PEEK(53265)OR32: REM BITMAP ON

30 POKE53272,PEEK(53272)OR8: REM BITMAP AT 8192
40 POKE53281,2:POKE53280,2:BA=8192
50 FORI=1024TO2023:POKEI,18:NEXT:REM COLORS RED AND WHITE
60 FORI=BA TO BA+7999:POKEI,0:NEXT:REM CLEAR BITMAP
70 X1=160:Y1=25:X2=295:Y2=100:GOSUB320
80 X1=295:Y1=100:X2=160:Y2=175:GOSUB320
90 X1=160:Y1=175:X2=25:Y2=100:GOSUB320
100 X1=25:Y1=100:X2=160:Y2=25:GOSUB320
110 REM CIRCLE ROUTINE
120 CX=160:CY=100:SC=1.16:FL=0:RD=20
130 FOR CR=0 TO 6.4 STEP.1
140 X=RD*COS(CR):Y=RD*SIN(CR)
150 X2=SC*X+CX:Y2=CY-Y
160 IFFL=1 THEN180
170 X=X2:Y=Y2:GOSUB240:FL=1:X1=X2:Y1=Y2
180 GOSUB320:X1=X2:Y1=Y2
190 NEXT
200 GET KE$:IFKE$="" THEN200
210 POKE53265,PEEK(53265)AND223:POKE53272,2
1:REM HIRES OFF
```

```
220 PRINT" {SHIFT CLR}{CTRL 4}":REM CLEAR SCREEN
230 END
240 REM PLOT ROUTINE PASS X AND Y
250 CH=INT(X/8)
260 RO=INT(Y/8)
270 LN=YAND7
280 BY=BA+RO*320+8*CH+LN
290 BI=7-(XAND7)
300 POKEBY,PEEK(BY)OR(2{UP ARROW}BI)
310 RETURN
320 REM LINE ROUTINE PASS X1,Y1 X2,Y2
330 X4=(X1-X2):Y4=(Y1-Y2)
340 IF X4=0ANDY4=0 THENX=X1:Y=Y1:GOSUB240:RETURN
350 IF SGN(X4)=1 THENZX=-1
360 IF SGN(Y4)=1 THENZY=-1
370 IF SGN(Y4)=-1 THENZY=1
380 IF SGN(X4)=-1 THENZX=1
390 IFX4=0 THENR=ABS(Y4):GOTO430
400 TA=Y4/X4
410 TH=ATN(TA)
420 R=ABS(X4/COS(TH))
430 Y4=ABS(Y4)
440 X4=ABS(X4)
450 X3=X4/R*ZX:Y3=Y4/R*ZY
460 IFR=0 THEN510
470 FORL=1 TOR
480 X=X1:Y=Y1:GOSUB240:REM PLOT X AND Y
490 X1=X1+X3:Y1=Y1+Y3
500 NEXT
510 RETURN
```

### C-128 Hi-Res Graphics Commands

On the C-128, however, all of this can be done easily, quickly and in a standard manner, due to its built-in graphics commands, which will be the same from one program to another. In fact, the C-128's Basic 7.0 is capable of handling all the high-resolution graphics the VIC chip supports.

For example, to go to High-resolution (320 × 200) mode on the C-128, simply type:

```
GRAPHIC 1,1
```

The first 1 indicates High-resolution mode, and the second 1 means clear the screen. When this order is given, the screen immediately goes to Bit-map mode and clears the 8K of RAM, giving you a clean work area. If you had typed

```
GRAPHIC 2,1
```

the screen would have gone to High-resolution mode and cleared, but this time not all of the screen would be bit-map. The bottom five lines would be in Text mode, giving you a Split-screen mode, similar to the Split-screen mode on the Apple computer. Unlike the Apple, you can vary the location of the split screen by adding a third optional parameter:

```
GRAPHIC 2,1,12
```

The 12 indicates the split should be at row 12, making everything above it bit-map and everything below it text. You can vary where the split occurs, from 0 to 24.

Multicolor mode is just as easy to use. If the first parameter in the Graphic command is 3 or 4, the screen goes to multicolor Bit-map mode. Again, the optional third parameter can be used to set the split screen's location, if you want one.

You notice I didn't say anything about where in memory the bit-map screen is. The C-128 has a standard location for bit-map RAM (8192) and for color memories. No registers need to be set; the system takes care of it all.

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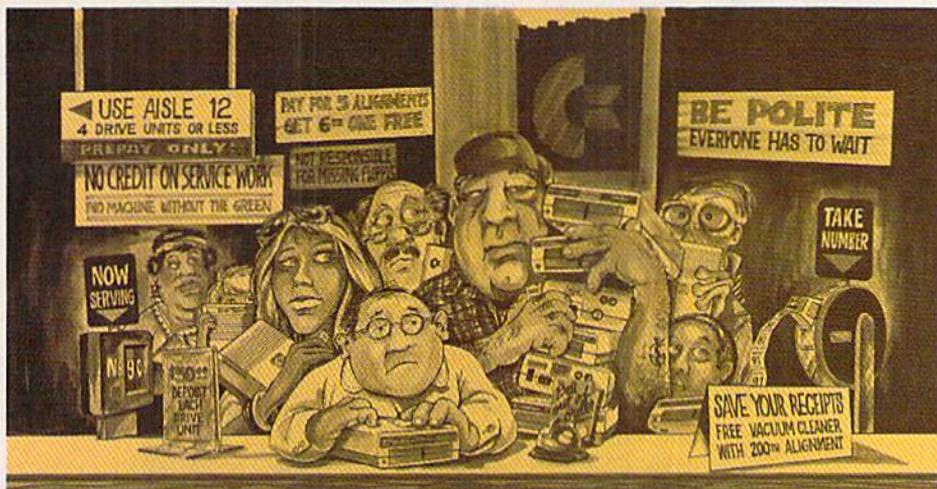
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The Graphic command is very useful, as it will switch you easily between the C-128's six graphics modes. To use, simply type GRAPHIC, followed by one of the six parameters (0-5), and the job is done.

Mode	Description
0	40-column text
1	Standard bit-map graphics
2	Standard bit-map (split screen)
3	Multicolor bit-map graphics
4	Multicolor bit-map graphics (split screen)
5	80-column text

The C-128 has many other useful high-resolution graphics commands. As mentioned earlier, there is the CHAR command, which allows you to put text characters and other symbols on the bit-map screen.

The Draw command is a general-purpose line routine you can use for drawing a point, line or several lines. Its syntax is:

```
DRAW <color source>,X1,Y1 <TO X2,Y2> <TO X3,Y3>...
```

One of the nice features of the C-128 is the use of optional parameters, or parameters with default values. The color source is one such parameter. If omitted, color source 1 (foreground color) is the default value, and, therefore, the one that is used. If color source is 0, then background color is used. A 2 or 3 could be used in Multicolor mode to access those extra colors. If you are just plotting a dot, only the first X and Y are required. Include X2 and Y2 to create a line, and X3 and Y3 to connect a second line, and so on.

Colors can be selected with the Color command:

```
COLOR source number, color number
```

Color	Source
0	40-column background
1	40-column foreground
2	Multicolor 1
3	Multicolor 2
4	40-column border
5	Text character color
6	80-column background color

You can change drawing colors in mid-program without affecting those already on the screen (unless you replot within the character cell area with a new color).

The Circle command gives you an easy way to make circles, of course, but it can also be used for ellipses, arcs and rotated versions of each. Its syntax is:

```
CIRCLE<color source>,X,Y<,Xr><,Yr><,sa><,ea><,angle><,inc>
```

Color source can be any of the four sources previously mentioned, and X and Y are the screen coordinates of the center of the circle. Xr is the X radius and Yr is the Y radius. Varying them gives different types of ellipses. Sa is the starting arc in degrees (0-360), and ea is the ending arc. Angle is the overall rotation to be applied to the figure, and inc is the number of degrees between segments. By changing the inc, you can draw polygons instead of circles.

Here is an example program of circles on the C-128, demonstrating many features of its flexibility:

```
10 REM CIRCLE COMMAND DEMO
20 COLOR0,1:COLOR4,1:COLOR1,6
30 GRAPHIC1,1
40 COLOR1,2
50 CHAR1,0,9,"CIRCLE"
60 CIRCLE1,22,100,15,13 : REM CIRCLE
70 COLOR1,3
80 CHAR1,0,24,"ELLIPSE"
```

```
90 CIRCLE1,70,100,8,99 : REM ELLIPSE
100 COLOR1,4
110 CHAR1,12,3,"OCTAGON"
120 CIRCLE1,124,52,20,18,,,,45: REM OCT
130 COLOR1,6
140 CHAR1,13,22,"DIAMOND"
150 CIRCLE1,131,148,20,,,,,90: REM DIAM
160 COLOR1,7
170 CHAR1,19,10,"TRIANGLE"
180 CIRCLE1,184,108,20,18,,,,,120:REM TRI
190 COLOR1,8
200 CHAR1,24,20,"ARC"
210 CIRCLE1,90,100,150,99,55,125:REM ARC
220 COLOR1,9
230 CHAR1,31,3,"ARC WITH"
240 CHAR1,33,10,"LINE"
250 CIRCLE1,275,58,20,16,90,360:REM STC
260 DRAW1,275,42 TO 275,58 TO 295,58
270 CIRCLE1,280,54,20,16,0,90:REM STC
280 DRAW1,280,38 TO 280,54 TO 300,54
290 COLOR1,13
300 CHAR1,32,22,"ROTATED"
310 CHAR1,32,23,"ELLIPSE"
320 FORI=0TO180STEP20:CIRCLE1,280,152,5,20,,,
I:NEXT
330 GETKEY A$
340 GRAPHIC0
350 END
```

Another special drawing command is Box, which allows you to draw a rectangle of any size, rotate it and fill it with color.

```
BOX<color source>,X1,Y1<,X2,Y2><,angle><,paint>
```

X1 and Y1 are the coordinates of the top-left corner; X2 and Y2 are those of the bottom-right corner. If X2 and Y2 are omitted, the current pixel cursor is used. The angle is the number of degrees of rotation you wish (default is 0), and the paint (0 or 1) indicates whether or not you want the box painted.

The Box command used with the angle parameter can be very effective and certainly unbox-like!

```
1Ø REM BOX DEMO
2Ø COLOR1,3:COLORØ,1:COLOR4,1:GRAPHIC1,1
3Ø CHAR1,14,1,"STANDARD BOX"
4Ø BOX1,45,22,265,188
5Ø SLEEP3
6Ø COLOR1,7
7Ø CHAR1,14,22,"ROTATED BOXES"
8Ø FORI=ØTO36ØSTEP1Ø:BOX1,9Ø,72,22Ø,128,I:N
EXT
9Ø GETKEY A$
1ØØ GRAPHICØ
11Ø END
```

The Paint command fills an area with the color you specify.

```
PAINT<color source>,X,Y<,mode>
```

X and Y indicate to the program the locations at which to start painting. The mode parameter indicates the kind of paint you wish. A mode of 0 paints an area defined by the color source. A mode of 1 paints an area defined by any non-background source.

The Scale command changes the scaling used for the bit-map graphics commands. You may increase the default values (320 x 200 in High-resolution mode and 160 x 200 in Multicolor mode) up to a maximum of 32767. This does not give you any extra resolution, but can be very useful in work that requires detailed calculation of graphics data.

```
SCALE n<,xmax,ymax>
```

The n signifies off or on (0 or 1); xmax and ymax set

the new upper values for the bit-map scale you want to use.

The SCNCLR command allows you to selectively clear your text, bit-map or multicolor screen without using the Graphic command.

One of the C-128's most unusual and potentially useful graphics commands is SSHAPE, which lets you save areas of the bit-map screen as string variables. You can then restore them to the graphics screen with the GSHAPE command or store them as sprites with the SPRSAV command, giving very powerful graphics capabilities.

SSHAPE string variable,X1,Y1<,X2,Y2>

The string can be any string variable, such as A\$ or B\$(159,6). X1 and Y1 are the upper-left-corner coordinates, while X2,Y2 are the opposite, lower-right-corner coordinates of the rectangle you want to save. A maximum of 255 bytes can be stored in a string, so the size of the rectangle is somewhat limited. Color information is also saved with the bit-map.

The GSHAPE command will write the rectangle back to the screen at the specified locations. Before doing so, it can perform a number of operations on it, such as inversion, reverse, ANDing and XOR.

GSHAPE string variable<X,Y><,mode>

The X and Y can be omitted, and the pixel cursor will be used for their values. The mode allows for reversing and altering the rectangle area before writing it. Here is a short program that demonstrates the SSHAPE and GSHAPE commands.

```
10 REM SSHAPE/GSHAPE DEMO
20 COLOR0,1:COLOR4,1:COLOR1,6
30 GRAPHIC1,1:C=1
40 COLOR1,13
50 CHAR1,32,23,"ROTATED"
60 CHAR1,32,24,"ELLIPSE"
70 FOR I=0 TO 180 STEP 30:CIRCLE1,15,15,4,15,,,I
   :NEXT
80 SSHAPE C$,0,0,30,30
90 SCNCLR1
100 FORY=6 TO 183 STEP 37
110 FORX=15 TO 299 STEP 49
120 C=C+1:IFC>16 THENC=2
121 COLOR1,C
130 GSHAPE C$,X,Y
140 NEXT:NEXT
150 GETKEY A$
160 GRAPHIC0
```

Other useful C-128 commands include BLOAD and BSAVE, for restoring and saving a screen to and from disk. In fact, the C-128 Basic 7.0 fully supports all aspects of the high-resolution graphics that the VIC-II can perform.

There is one more type of bit-mapping possible on the C-128—using the 80-column (640 × 200) screen. Commodore claims 80-column graphics are possible, but Basic 7.0 doesn't have any keywords to support this. As with the C-64, you will need special routines to use this mode. Once you access 80-column mode, however, you are at an advantage in that you can utilize the Fast command without having the screen become blank.

Another very important command on the C-128 is the sprite command, SPRSAV, which can either store into a string variable the contents of one of the sprite storage areas or store into the sprite storage area the data from a string. If that string was created with the SSHAPE command, you can then very easily pick up and animate

sections of the bit-map as sprites! This opens new areas of graphics applications on the C-128.

### Sprites

It isn't possible to discuss graphics on the C-64 and C-128 without spending some time talking about sprites, or movable object blocks. Both computers have this powerful feature, and both are capable of impressive animation. The C-128 uses keywords to let you create and manipulate sprite graphics in its Basic 7.0, while C-64 owners must use Peek and Poke statements to do this.

Programming sprites with the Peek and Poke statements isn't as difficult as programming bit-map graphics with them. In some respects, if you're talking about internal animation, not external motion, sprite animation can be fast enough from Basic using Peek and Poke statements.

Internal animation involves changing the pointers that define where in memory the sprite image resides. With a simple Poke, or sequence of Pokes, that image can appear to give way to a highly animated figure, such as a bird flapping its wings. Each frame of the animation is contained in memory in a separate sprite definition. By Poking the correct values into the sprite-pointer register, the image changes in sequence. In most cases, this is done only a couple of times a second, a speed easily handled by Basic.

External movement is a different matter. Here, you need machine language routines or Basic enhancements to give the fast, smooth motion most sprite programmers require. On the C-128, these commands are a standard feature, giving the programmer full access to sprites with a minimal effort. On the C-64, you must be a little more knowledgeable about the machine.

There are two types of sprites—standard and multicolor. Multicolor gives only half the horizontal resolution, while adding more colors. Normal high-resolution sprites are 24 pixels wide by 21 pixels long. They can each have one color, which can differ for each of the eight sprites. Multicolor sprites are 12 pixels wide by 22 pixels long and can have three colors per sprite. You may have eight tri-colored sprites on screen at a time, but each sprite must share two of the same colors. Also, on both the C-64 and the C-128, you may combine the sprite modes, simultaneously displaying some multicolor sprites and some standard ones.

Let's first talk about sprite programming on the C-64. While the information is applicable to the C-128, it isn't necessary, since you'll almost always use the C-128 sprite commands.

Fourteen registers, or memory locations, allow sprites to be defined, located, moved, animated and enabled. Most of the locations are in the VIC-II chip, and can be used by Poking the proper value in memory. The sprite-pointer registers are not located in the VIC-II area, but in the last eight bytes of screen memory in the video bank you are using. When the computer is switched on, they are at 2040-2047.

Let's go through creating and animating a sprite on the C-64; then we'll compare it to what is required on the C-128.

First, you must design the sprite. The *Commodore 64 Programmer's Reference Guide* and the user's manual provide examples on how to draw and calculate a sprite on paper. Do it this way once, to see what it entails; then get yourself a decent sprite editor, many of which are available from your local user's group; they will make sprite design much,

much easier. Once you have your sprite in the form of Data statements (usually done by the sprite editor), you can begin programming your sprite.

To begin, you must define the sprite's characteristics, such as color, mode, expansion and priorities. We'll work with sprite 0, the first sprite.

```

10 REM C64 SPRITE DEMO
20 V=53248: REM START OF VIC REGISTERS
30 POKEV+39,2:REM SPRITE 0 COLOR REGISTER (
  2=RED)
40 POKEV+23,0:REM NO Y EXPANSION
50 POKEV+29,0:REM NO X EXPANSION
60 REM SPRITE CHARACTERISTICS DEFINED
70 REM READ SPRITE DATA
80 FOR I=0TO62:READQ:POKE832+I,Q:NEXT
90 REM SET SPRITE POINTER
100 POKE2040,13:REM SPRITE POINTER VALUE =
  832/64=13
110 POKEV+0,0:REM POSITION SPRITE 0 AT X=0
120 POKE V+1,120:REM POSITION SPRITE 0 AT Y
  =120
130 POKE V+16,PEEK(V+16)AND(255-1):REM TURN
  OFF MSB
140 REM TURN ON SPRITE
150 POKEV+21,PEEK(V+21)OR1
160 REM MOVE SPRITE ACROSS SCREEN
170 FOR I = 0 TO 355
180 IF I > 255 THEN POKEV+16,PEEK(V+16)OR1:X=I-
  255
190 IF I < 256 THEN POKEV+16,PEEK(V+16)AND(255-
  1):X=I
200 POKEV+0,X
210 NEXT I
220 POKEV+21,PEEK(V+21)AND(255-1):REM SPRIT
  E OFF

```

```

230 POKEV+0,0:REM POSITION SPRITE
240 POKEV+16,PEEK(V+16)AND(255-1):REM TURN
  OFF MSB
250 GOTO140: REM LOOP AGAIN
260 REM SPRITE DATA
270 DATA 0,127,0,1,255,192,3,255,224,3,231,
  224
280 DATA 7,217,240,7,223,240,7,217,240,3,23
  1,224
290 DATA 3,255,224,3,255,224,2,255,160,1,12
  7,64
300 DATA 1,62,64,0,156,128,0,156,128,0,73,0
  ,0,73,0
310 DATA 0,62,0,0,62,0,0,62,0,0,28,0

```

On the C-64, all of this is required to define one multi-color sprite, position it, turn it on and move it horizontally on the screen. While the code may seem complex, it does get easier with practice. After a while, you find that it's not all that hard; it's just that external animation is slow. By successively changing the pointer register, you can achieve internal animation that is very fast (fine for frame-by-frame animation). However, for fast sprite motion, you must rely on machine code or Basic enhancements.

The equivalent code on the C-128 is:

```

10 REM C128 SPRITE DEMO
20 FOR I=0TO62:READS:POKE3584+I,S:NEXT: REM
  LOAD SPRITE DATA
30 MOVSPR1,0,120: REM POSITION SPRITE
40 SPRITE 1,1,8,0,0,0,0:REM DEFINE AND TURN
  ON
50 MOVSPR 1,90#15:REM AUTO ANIMATE SPRITE
60 GETKEY A$
70 MOVSPR1,90#0:REM TURN OFF ANIMATION
80 SPRITE 1,0: REM TURN SPRITE OFF
90 END
100 REM SPRITE DATA
110 DATA 0,127,0,1,255,192,3,255,224,3,231,
  224
120 DATA 7,217,240,7,223,240,7,217,240,3,23
  1,224
130 DATA 3,255,224,3,255,224,2,255,160,1,12
  7,64
140 DATA 1,62,64,0,156,128,0,156,128,0,73,0
  ,0,73,0
150 DATA 0,62,0,0,62,0,0,62,0,0,28,0

```

As you can see, the same feat was accomplished much more easily and required far less program code. This is a good demonstration of the amount of work you save by using a high-level language instead of a low-level language (and Basic 2.0 is a low-level language as far as graphics are concerned). Add the fact that a sprite editor is resident in the C-128, and you can see why sprite programming on the C-128 is so much faster and easier than on the C-64. With the proper enhancements, though, much the same can be done on the 64.

As you can see, the graphics modes on the C-64 and C-128 are very similar, and the C-64 has most of the same capabilities as the C-128. The differences lie in the programmer's ease of access when using Basic 7.0 and in the additional memory of the C-128. This additional space lets you store many graphics screens, while still retaining hundreds of sprites as variables in memory.

In spite of the programming differences, both the C-64 and C-128 have the VIC-II chip, and both can produce exceptional graphics. ®

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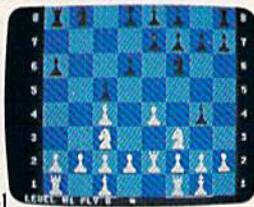
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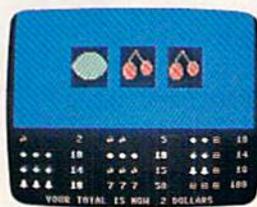
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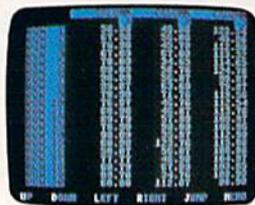


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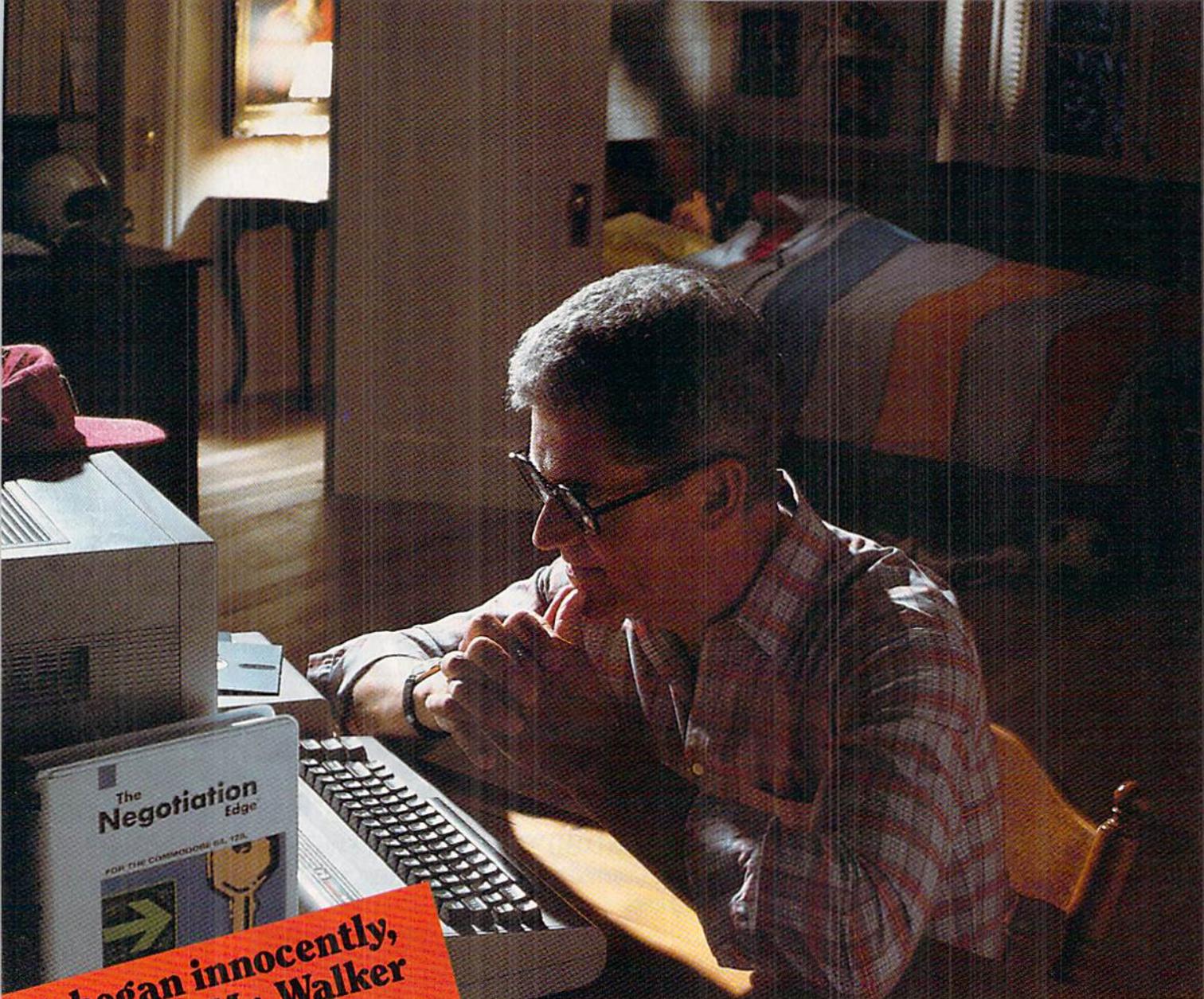
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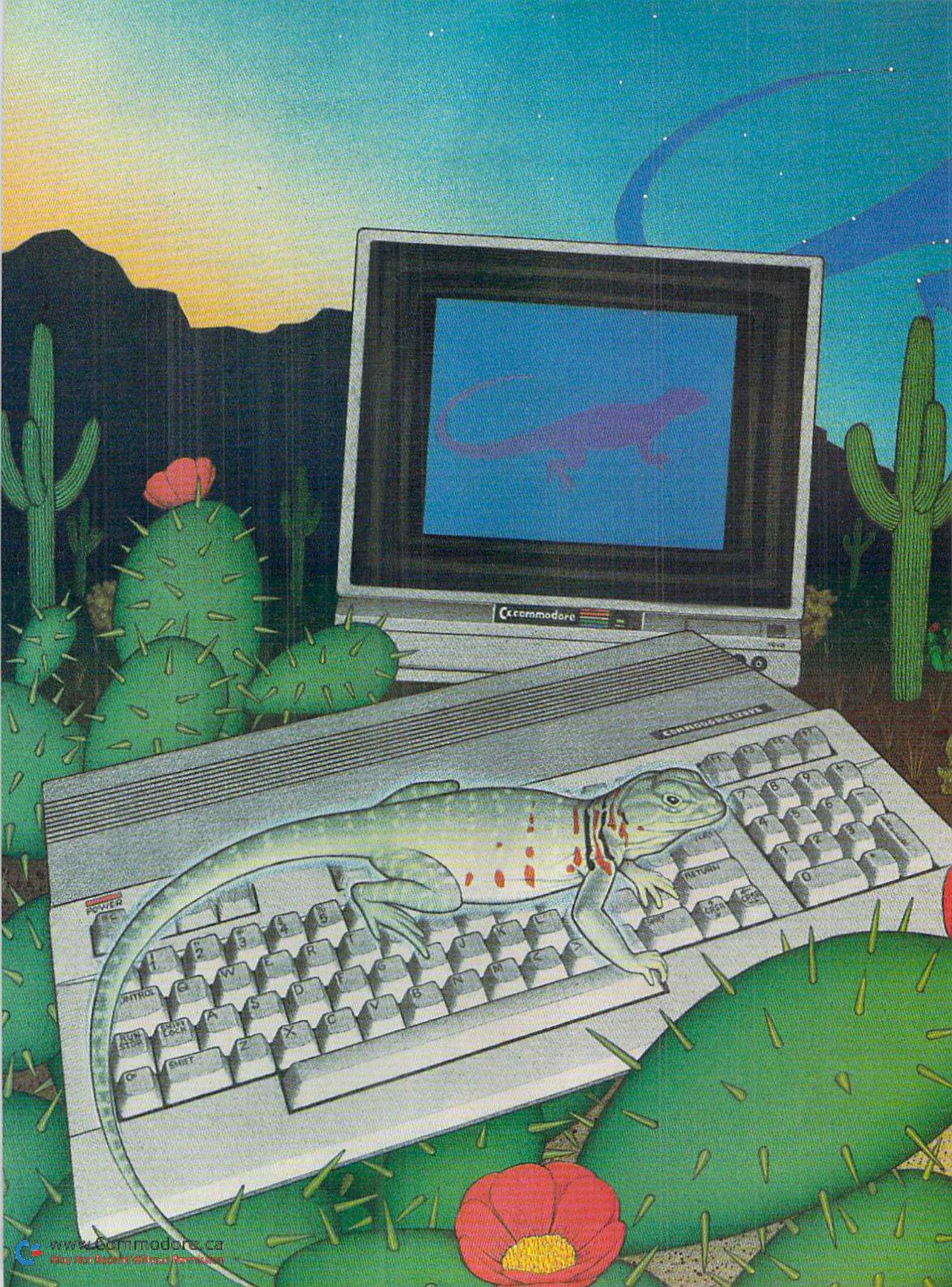
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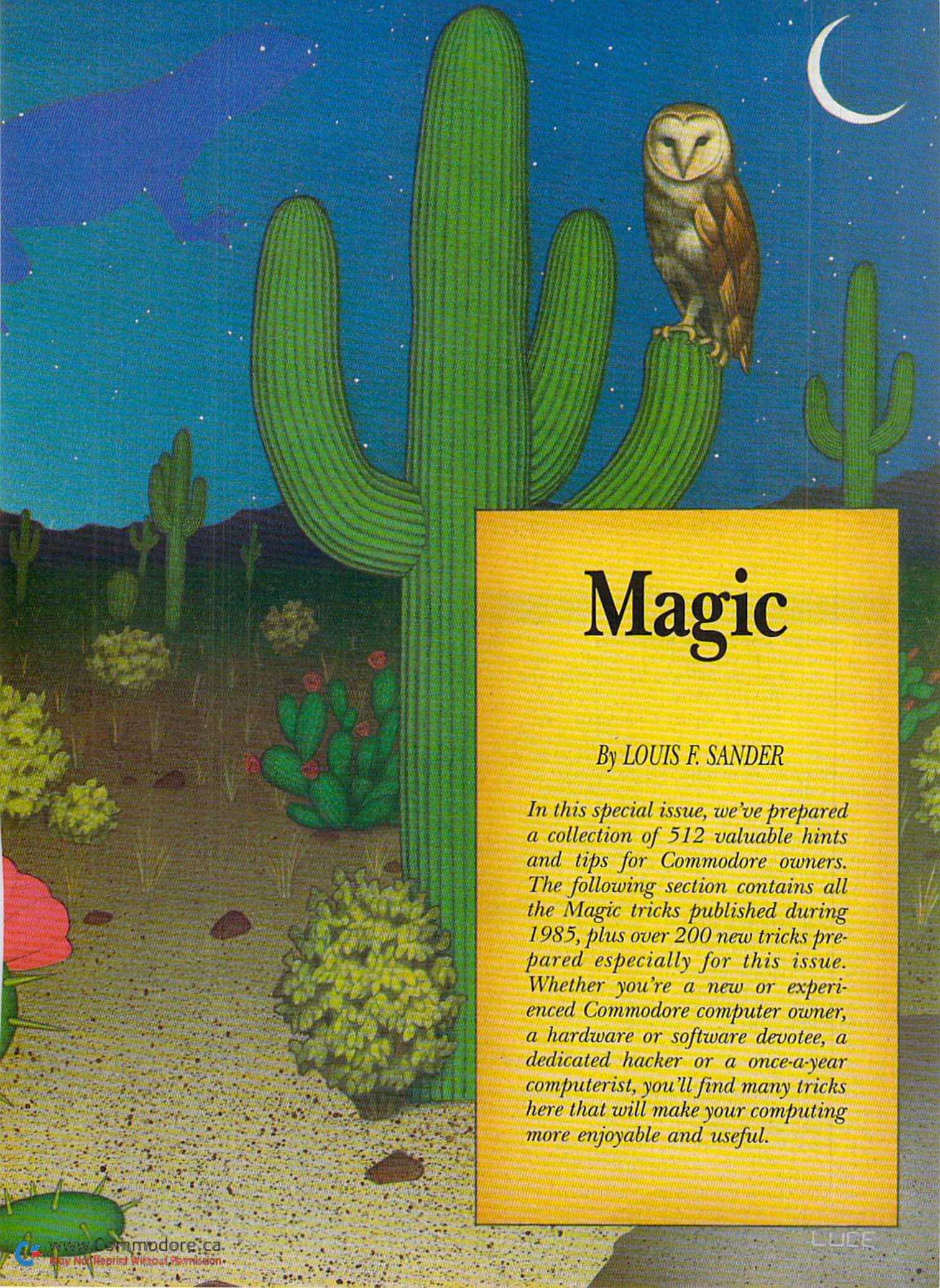
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# Magic

By LOUIS F. SANDER

*In this special issue, we've prepared a collection of 512 valuable hints and tips for Commodore owners. The following section contains all the Magic tricks published during 1985, plus over 200 new tricks prepared especially for this issue. Whether you're a new or experienced Commodore computer owner, a hardware or software devotee, a dedicated hacker or a once-a-year computerist, you'll find many tricks here that will make your computing more enjoyable and useful.*

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## 1. Computers—C-64

**DOS wedge command summary**—The accompanying table lists all the important wedge commands. In general, the @ can be followed by any command string recognized by the 1541 drive.

### DOS 5.1 Wedge Commands

COPY A FILE	@C:newname = oldname
DIRECTORY	@\$ or @\$: or @\$:filename
ERASE DIRECTORY FROM DISK	@N:diskname
FORMAT A DISK	@N:diskname,ID
INITIALIZE DISK DRIVE	@I
LOAD A BASIC PROGRAM	/filename
LOAD & RUN A BASIC PROGRAM	!filename
LOAD MACHINE LANGUAGE	%filename
QUIT THE WEDGE PROGRAM	@Q
READ ERROR CHANNEL	@
RENAME A FILE	@R:newname = oldname
SAVE A BASIC PROGRAM TO DISK	-filename
SAVE WITH REPLACE (dangerous!)	--@:filename
SCRATCH A FILE	@S:filename
SET ACTIVE DEVICE NUMBER	@#n
SPEED CHANGE—C-64 SPEED	@UI+
SPEED CHANGE—VIC-20 SPEED	@UI-
VALIDATE DISK	@V

### Notes

1. In using the wedge, the > symbol may always be substituted for the @ symbol.

2. This table uses FILE to refer to anything recorded on disk, whether it is a program or any type of datafile. Similarly, filename indicates the name of a program or datafile.

3. In general, the pattern-matching (\*) and wild-card (?) characters can be used in reading filenames, but not in writing them.

4. The material following the @ or other special symbol may be enclosed within quotes if desired. The quotes can be helpful when filenames include leading spaces or other unusual characters.

5. If you desire, 0 or 1 can be inserted, just before any colon, to

indicate the drive number in a multi-drive disk unit. Drive numbers are never necessary with the 1541 disk unit.

6. Use of the Save with Replace function is not recommended, since it occasionally corrupts a disk.

Louis F. Sander  
Pittsburgh, PA

**DOS wedge improver**—This program changes the C-64's DOS 5.1 program so it can be easily saved onto other disks. Here's how to use it:

- Put the test/demo disk into your drive
- Type LOAD "DOS 5.1",8,1 {RETURN}
- Type NEW {RETURN}
- Load and run this program
- Insert a formatted disk onto which you want to save DOS 5.1
- Type SYS 52224 {RETURN}
- Type SYS 52400 {RETURN}

DOS 5.1 will now be saved onto the disk in your drive, and the C-64 will be reset. If you want to save the DOS onto another disk at this time, just put the new disk in the drive, and resurrect your wedge by entering these commands:

```
SYS 52224 {RETURN}
@#8 {RETURN}
```

Then save it by typing SYS 52400 {RETURN}. You can repeat these steps as many times as you like; many people put a copy of DOS 5.1 on every disk they own.

Once DOS 5.1 has been saved on a disk, you can also save Test/Demo's Basic loader, named C-64 Wedge, if you choose to. Since C-64 Wedge is a Basic program, saving it is a simple matter. When loading DOS into memory, you don't need the loader at all if you type:

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```
LOAD "DOS 5.1",8,1 {RETURN}
NEW {RETURN}
SYS 52224 {RETURN}
```

When you see the DOS 5.1 prompt, you're in business, just as if you'd used the loader.

The best way to learn about the wedge is to read "Mysteries of the Wedge Revealed" (*RUN*, September 1984).

```
1Ø REM{2 SPACES}DOS IMPROVER
2Ø REM{2 SPACES}CREATED BY LOUIS F. SANDER
3Ø FORA=1TO69:READB:C=C+B:NEXT:RESTORE
4Ø IFC<>7162THENPRINT"DATA ERROR":STOP
5Ø FORA=1TO32:READB:POKE52346+A,B:NEXT
6Ø FORD=1TO37:READE:POKE52399+D,E:NEXT
91 DATA 141,Ø68,Ø79,Ø83,Ø32,Ø53,Ø46,Ø49
92 DATA Ø32,Ø45,Ø32,Ø83,Ø89,Ø83,Ø32,Ø53
93 DATA Ø5Ø,Ø52,Ø48,Ø48,Ø32,Ø84,Ø79,Ø32
94 DATA Ø83,Ø65,Ø86,Ø69,141,ØØØ,ØØØ,ØØØ
95 DATA 169,ØØ8,17Ø,16Ø,255,Ø32,186,255
96 DATA 169,ØØ7,162,124,16Ø,2Ø4,Ø32,189
97 DATA 255,169,ØØØ,133,Ø34,169,2Ø4,133
98 DATA Ø35,169,Ø34,162,Ø9Ø,16Ø,2Ø7,Ø32
99 DATA 216,255,Ø76,226,252
```

Louis F. Sander  
Pittsburgh, PA

**DOS wedge loader**—There are several ways you can improve the C-64 wedge loader program. First, you can change its name to something easy to load, like "I".

And you can add the following line, which will automatically print the directory command on screen, allowing you to load the directory just by pressing the return key.

```
25 PRINT "@$ {3 CRSR UP}"
```

If you have two drives, you can change the following line to have your wedge sense the active drive and load the DOS program from it.

```
10 IF A=0 THEN A=1:LOAD "DOS 5.1",PEEK(186),1
```

The change, of course, is to substitute PEEK(186) for 8.

Finally, if you'd rather your screen colors be something other than blue on blue, you can add a line to change the colors to your favorites.

David E. Cox  
Richmond, VA

**DOS wedge reactivation**—After a reset or the @Q command has deactivated the wedge, you can reactivate it by doing a SYS52224, then entering @#8. The SYS reenables the machine language program, while the @#8 assigns it to drive 8.

Mary Ivy Bayard  
Norristown, PA

**DOS wedge directory freezer**—When you use the wedge to list a directory to the screen, you can use the space bar to freeze the listing for your careful perusal. Pressing the space bar again will continue the listing.

William F. Sander  
Marietta, OH

**DOS wedge volume identifier**—Commodore's famous wedge program contains a not-so-famous way of organizing files on the disk. When using the wedge to save, if you end your filename with a single character enclosed in square brackets, that character will magically be moved to the sixteenth position in the filename!

In wedge jargon, that sixteenth character is called the volume identifier. If you save several files with the same volume ID, the wedge will let you access them as a group.

If you're saving without the wedge, you can manually put a volume identifier in the sixteenth position of your filename, so you can use it later on.

To use the volume identifier, you must be running the wedge, and you can use any wedge command, including @COPY, @RENAME, @SCRATCH and especially @\$\$. The wedge looks for the last character in each filename when you specify a volume ID between the square brackets. For example, you can save a file by entering:

```
{LEFT ARROW}HOUDINI[L]
```

It will list in the directory as

```
HOUDINI {8 spaces} L
```

and can be scratched with:

```
@S:HOUDINI[L] {return}
```

To get a directory of all files with volume identifier L, use:

```
@$:[L] {return}
```

You can scratch all the files with volume identifier L by using:

```
@S:[L] {return}
```

Beware: The dark side of this magic is that the wedge will report the sixteenth character of the filename as the volume ID, whether it is intended as such or not. Make your IDs unique (graphics characters, for instance) and this should be no problem.

Matthew J. McCaffrey  
Groton, CT

**DOS wedge commands in programs**—Wedge commands can be used from within Basic programs, as long as the proper syntax is used. The @, >, /, % or up-arrow symbol must be the first character in the statement, with no quotes around it. The rest of the command must be enclosed in quotes. The following routine, for example, will put a directory on the screen, read the error channel, print a message, then load a program.

```
200 @ "$"
210 @
220 PRINT "WIZARDRY, INDEED!"
230 / "THE LAND OF OZ"
```

With normal Program mode loads, you must be concerned about program length; with this one, you don't. The technique has worked with every wedge command we've tried it on.

Arnie Lee  
Abacus Software

**Drive not ready**—Some disk operations confuse the 1541 disk drive, resulting in a maddening Drive Not Ready error. If you're using the wedge, this can be easily remedied by typing @UJ. It causes the drive to reset itself and is an easy way out of most 1541 quirks.

John Patrick  
Bourbonnais, IL

**Reset buttons**—One feature that Commodore left off the VIC and C-64 was a reset switch. The reset line comes out to several connectors on both machines, and, if you rig a momentary switch to ground it, you'll have a reset button.



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The preferred approach is to wire the switch to a separate connector that you plug into the machine as needed. The undesirable alternative is to solder a switch directly to the computer. This may make it difficult to get repair service, should you ever need it.

Resetting either machine restarts it with the familiar Bytes Free message you see when you first turn on your computer. Basic's pointers are reset to their power-up values, but user memory isn't disturbed. So, a reset gets the computer out of any bizarre states in which you've put it and gives you a chance to recover your program. Here are your three choices on connecting the switch:

1. On either machine, between pins 2 and 6 of the serial I/O port. This is a good choice, because the connector can be inserted only one way and because this port is available on the computer *and* on the disk drive, if one is connected.

2. On either machine, between pins 1 and 3 of the user I/O port. This is less desirable, because some user port connectors can be inserted upside down, wiring your switch to an unintended, potentially disastrous place.

3. Between pins A and C of the C-64 expansion slot or between X and Z of the VIC expansion slot. Depending on your connector, this method may or may not share the hazards of the one above.

People find many locations for installing reset switches, such as inside a DIN connector or a defunct cartridge (cut the traces from the unused contacts); the serial bus cable, between the red and green wires; or in a modem or other external device.

**Tom Hoppe**  
Spokane, WA

**Safer reset switch**—When I installed a reset switch on my C-64, I wanted to be certain it would never be accidentally pushed. I therefore installed two push buttons in series; this requires that both be pushed at once for a reset to occur. I located them on the back of the computer, about 11 inches apart, so there's no danger of pressing them both by mistake.

**Charles Patterson**  
Tarrytown, NY

**Resets on newer C-64s**—The newer C-64 computers (manufactured around October 1984) will not reset with the usual serial port reset, because there was a change in the reset circuit. You can go inside the computer, however, to find a connection for your reset button. Near pin 8 of chip U20 (#556 chip) is capacitor C34, a 0.1 microfarad unit. Wire a momentary SPST normally open pushbutton across this capacitor, and you'll have your reset button. It has worked well for me with no ill effects.

**George M. Titus**  
Selden, NY

**C-64 warm/cold starts**—There has been much confusion over the proper SYS calls to reset the Commodore 64. While there may be variations due to differences in ROM versions, the following SYS calls perform as specified on my own machine and those of friends.

SYS 64759 acts the same as pressing stop/restore. It resets the video colors and sound chip, clears the screen and gives a Ready prompt. All programs remain untouched in memory.

SYS 64738 simulates turning the computer off then on, but neither destroys memory from start of Basic (2048 decimal) upward nor resets the serial bus or its peripherals. It overwrites the cassette buffer, destroying any machine language programs there. It does not destroy Basic programs, but because all pointers are reset, they appear to be erased. (An Unnew program will recover them.) If a cartridge is in place, this reset will restart it.

SYS 64760 does not destroy the cassette buffer or anything above it. It does not destroy Basic programs, but because all pointers are reset, they appear to be erased. (An Unnew program will recover them.) This SYS call disregards any cartridge that may be installed; initializes I/O vectors and resets colors; gives the Bytes Free message when finished; does not check for a cartridge and bypasses it if it is installed; and works very fast.

SYS 64763 works as 64760, but does not reset I/O vectors.

**Berthold Trenkel**  
Goepingen, West Germany

**Reset tip**—The C-64 Reset command SYS 64738 will not disturb most machine language programs in memory, but it does seem to wipe out anything in the cassette buffer, locations 828-1019 decimal. Safe areas for machine language programs are Basic RAM, 2048-40959, and alternate RAM, 49152-53247.

**Peter Heine Jorgensen**  
Aarhus, Denmark

**Pokepourri**—Here's a collection of C-64 Pokes that have been sent to us over the years. Although we've briefly tested each one, we can't guarantee them against unexpected side effects.

POKE	Effect
19,65	Inputs without question mark
19,0	Restores the question mark
22,35	Lists without line numbers (Syntax error restores them)
120,0	Mindless printing machine
198,0	Clears keyboard buffer
199,1	Prints in RVS mode
199,0	Turns RVS off
211,X	Cursor to row X
214,Y:PRINT	Cursor to column Y
212,0	Disables Quote mode
646,X	Changes cursor color (X = 0 to 15)
649,0	Disables keyboard
649,10	Enables keyboard
650,0	Normal repeat
650,64	No keys repeat
650,128	All keys repeat
657,1	Disables shift/Commodore keys
657,0	Enables shift/Commodore keys
774,0	Lists only line numbers
774,26	Resets the above
774,131:775,164	Disables List
774,226:775,252	List gives cold start
775,168	Disables List
775,191	Disables List
775,200	Disables List
775,167	Enables List
788,52:808,239	Disables Stop
788,49:808,237	Enables Stop
792,193	Disables Restore
792,71	Enables Restore
793,203	Disables Restore
808,127	Disables Run



808,234	Disables Stop/Restore/List
808,225	Disables Stop/Restore
808,239	Disables Stop (Stop/Restore ok)
816,157	Disables Load
816,165	Enables Load
818,131;819,164	Disables Save
818,226;819,252	Save gives cold start
818,32	Disables Save
818,237	Enables Save
819,246	Disables Save
819,245	Enables Save
819,245;818,32	Disables Save
819,245;818,237	Enables Save
53265,11	Turns off screen (Computer runs faster)
53265,27	Turns on screen (Alternative is Stop/Restore)
53272,21	Switches to Graphics mode
53272,23	Switches to Text mode
53280,X	Border color (X = 0 to 15)
53281,X	Screen color (X = 0 to 15)
56325,X	Changes cursor speed (0 = fast, 58 = normal, 255 = slow)

**Various Contributors  
All Across the Land**

**Easy RUN**—Are you tired of typing R-U-N over and over again while working with Basic? Enter POKE 816,32 and your weariness will vanish. After that Poke, pressing the shifted run/stop key will automatically run your program! You can return to normal by POKE 816,165 or by hitting the stop/restore combination.

**Craig Johnson  
Juneau, AK**

**No-RUN fix**—Occasionally, when working with machine language or screen memory, your machine may give a Syntax error in response to a Run or other Direct mode command. POKE 2048,0 usually cures the problem. This quirk occurs in many versions of Basic and arises because 2048 is the Start of Text position, which must always contain a 0.

**Scott Farrar  
Stockton, CA**

**C-64 uncrasher**—When your keyboard locks up while you are typing, try typing {SHFT 3}. The screen should respond with "Press Play On Tape," and if you follow those instructions then press the stop key, you should be able to continue your work.

**Douglas P. Oesterle  
Agana, Guam**

**Calculated Goto command**—On the C-64, you can use this one-liner to jump to any calculated line number within your program. Simply set the variable GL to the desired line number, then enter GOTO 1000.

```
1000 POKE 785,188 : POKE 786,168 : POKE GL,PEEK(GL) :
      GL =USR(0)
```

It may not look like it, but believe me, it works! [Yes, it does! Ed.]

**Randy Thompson  
Eugene, OR**

**Program executable List**—This lets you use the List command within a C-64 program, without halting the

program's execution. Substitute line numbers for the Xs or leave them out entirely.

```
100 POKE 768,174 : POKE 769,167 : LIST XXXX - XXXX : POKE
      768,139 : POKE 769,227
```

**Randy Thompson  
Eugene, OR**

**Simplest trace**—Whenever the C-64 executes a SYS 48578, it prints the word IN and the line number in which the command appears. By including these SYS calls at various points in your program, you can find what has been executed and when. An even slicker method is to set T = 48578, and execute SYST any time you want to trace.

**Dennis J. Spranger  
Eland, WI**

**Error messages**—Memory location 157 (\$9D) controls whether or not error messages and control messages will be displayed on the screen. In Direct mode, for instance, Loading, Searching and Found messages are displayed, while in Program mode they are suppressed, all because of different values Poked into location 157. You can control the display yourself as follows:

```
POKE 157,0—Suppress all messages
POKE 157,64—Enable error messages
POKE 157,128—Enable control messages
POKE 157,192—Enable error and control messages
```

**Mike Tranchemontaigne  
Nashua, NH**

**Closing files**—The well-known SYS65511, often said to close all files, really doesn't do that. It causes the computer to forget its opened files, but does *not* signal the peripherals to close them. While some may call this a minor difference in semantics, it can be disastrous when disk files are involved. The following one-liner is the easiest and most effective way I've found to close all open files at once, regardless of what files they are or when and where they were opened.

```
X = PEEK(152) : FOR J = 1 TO X : CLOSE PEEK(601) : NEXT
```

Location 152 contains the number of currently open files. The ten-byte queue starting at 601 contains their file numbers and works similarly to the keyboard buffer. As each file is closed, its entry is removed, and the rest are moved down one byte. If you enter the one-liner exactly as shown, you'll successfully close all files.

By the way, POKE 152,0 yields the same results as SYS65511. In fact, that is exactly what SYS65511 does.

**Charles Lavin  
Coral Gables, FL**

**ROMwriter**—It's often useful to write the C-64's ROM programs into the underlying RAM, usually by entering something like:

```
10 FOR J = 40960 TO 49151 : POKE J,PEEK(J) : NEXT
```

This takes over 30 seconds to accomplish, but there's a way to do it in less than a second, using Basic's own mass-move routine, located at 41919. Here's how:

```
10 POKE 95,0 : POKE 96,160
20 POKE 90,0 : POKE 91,192
30 POKE 88,0 : POKE 89,192
40 SYS 41919
```

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Line 10 points to the start of the code to be moved, and line 20 points to the byte one location higher than its end. Line 30 points to the byte one location higher than the end of its new position. (In this case, these are 40960, 41952 and 41952, respectively.) The SYS initiates the movement.

The same routine, with different pointers, of course, can be used to move other areas of memory. Because of the techniques used, moves in a downward direction will succeed only if the source and destination areas do not overlap.

**James Pellechi**  
Middle Island, NY

**False autostart**—This program will trick the computer into thinking that an autostart ROM cartridge is in place. Whenever the restore key is pressed, the computer will execute a machine language program pointed to in 32770-32771.

```
100 REM FALSE AUTOSTART-CURTIS NELSON
110 FOR J=32772 TO 32776:READ K:POKE J,K: NEXT
120 POKE 32770,0:POKE 32771,192
130 DATA 195,194,205,056,048
```

Line 110 tricks the computer by putting the word CBM80 starting at location 32772. Line 120, which you can change to suit your machine language program, tells the computer that the target machine language is at 49152.

**Curtis Nelson**  
Tremont, UT

**Program password**—I recently devised a security lock system for my programs. Now, persons not knowing the secret code are prevented from using my programs. The code is any number; where the program below says "code," just plug in a number. The program should be inserted before the main program.

```
1 POKE 800,100:POKE 819,245
2 INPUT "{SHIFT CLR}ACCESS CODE":A
3 IF A <> code THEN NEW
4 Continue the program here
```

**Sean Fitzpatrick**  
St. John's, Newfoundland  
Canada

**C-64 cursor tricks**—You can speed up your cursor with POKE 56341,1. You can slow it down with POKE 56341,255. If you combine these tricks with POKE 650, any value over 127, you'll discover some real fun.

**Harry I. Papatheofilopoulos**  
Peristeri, Greece

**Screen gem**—My junior high school students find it greatly entertaining and informative to enter POKE 53265,59 and then to type on the C-64 keyboard. Pressing the run/stop and restore keys gets you out.

**Katherine Prescott**  
Coos Bay, OR

**Split screen**—The following short routine, using what's called a raster interrupt, splits the C-64 screen into two different-colored sections. Lines 1-3 will detect typing errors in your Data statements; you should delete them

when the program asks you to, then save the remaining lines as your master routine. It will be compatible with most Basic programs, especially the ones not involving machine language.

Delete lines 1-3 and run your program. Any time after doing this, you can split the screen by executing SYS 40800. The split will remain until stop/restore cancels it; it can be recalled by repeating the SYS 40800.

You can change the top color by changing the sixth item (002) in line 21, or, after running the program, by entering POKE 40877,c (where c is the number for the color you want). You can change the bottom color by changing the eighth item (007) in line 18 or by POKE 40855,c. The screen split can be after any line, and its location is controlled by the fifth item in line 13 (010 = split occurs after tenth line). To change the split location on an already-split screen, enter POKE 40812,n:SYS40800 (where n is the number of lines to appear above the split).

```
Ø REM SPLIT SCREEN - RICHARD RAPPACH
1 FORJ=1TO89:READA:B=B+A:NEXT
2 IFB<>9955THENPRINT"DATA ERROR":STOP
3 PRINT"DATA OK. DELETE LINES 1-3.":END
1Ø POKE56,159:POKE52,159
11 FORJ=4Ø8ØØTO4Ø888:READA:POKEJ,A:NEXT
12 DATA 12Ø,169,127,141,Ø13,22Ø,169,ØØ1
13 DATA 141,Ø26,2Ø8,169,Ø1Ø,Ø42,Ø42,Ø42
14 DATA 1Ø5,Ø5Ø,141,Ø95,159,141,Ø18,2Ø8
15 DATA 169,Ø27,141,Ø17,2Ø8,169,137,141
16 DATA Ø2Ø,ØØ3,169,159,141,Ø21,ØØ3,Ø88
17 DATA Ø96,173,Ø18,2Ø8,2Ø5,Ø95,159,2Ø8
18 DATA Ø21,169,ØØØ,141,Ø18,2Ø8,169,ØØ7
19 DATA 141,Ø33,2Ø8,169,ØØ1,141,Ø25,2Ø8
2Ø DATA 1Ø4,168,1Ø4,17Ø,1Ø4,Ø64,173,Ø95
21 DATA 159,141,Ø18,2Ø8,169,ØØ2,141,Ø33
22 DATA 2Ø8,169,ØØ1,141,Ø25,2Ø8,Ø76,Ø49
23 DATA 234
```

**Richard Rappach**  
Youngstown, OH

**COL to the colors**—The following program makes it easy to set your C-64's border, screen and cursor colors. You can always set them by Poking locations 53280, 53281 and 646, but, when you hit the run/stop along with the restore key, your hues become blues, and you have to Poke again.

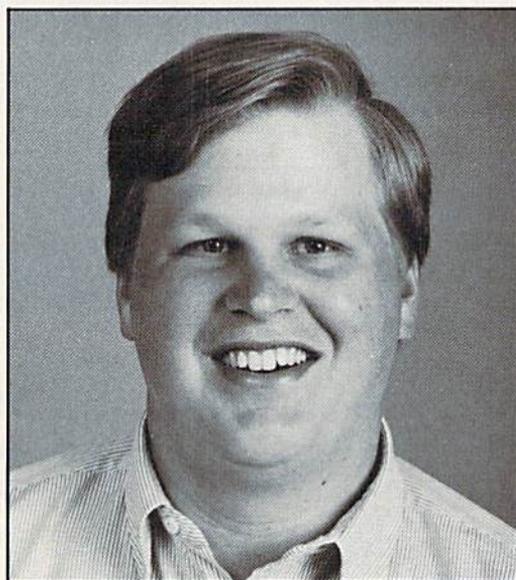
As printed, the program includes a checksum routine to verify the correctness of your Data statements. Run it, and if you get a Data Error message, check your typing. When your Data statements are correct, you'll be asked to delete lines 2-4. Do that, then save the resulting program.

When you run the data-verified program, it will ask for the colors you prefer; unless you like the defaults I've provided, you should respond with the Poke values of your favorite colors (see Appendix G of the user's guide). After that, any time you wish to set the colors, simply type COL and press the return key. The run/stop and restore keys will still give you the blues, but a COL will brighten your screen and your day. Unfortunately, COL doesn't work from inside a program. You can insert your own default values by plugging them into the initial statements of lines 50-70.

```
1 REM COL TO THE COLORS - ERIC BREAUPT
2 FORJ=1TO92:READK:CS=CS+K:NEXT
3 IFCS<>1Ø512THENPRINT"DATA ERROR":END
4 PRINT"DELETE LINES 2-4":END
1Ø FORJ=49152TO4923Ø:READK:POKEJ,K:NEXT
```

Continued on p. 92.

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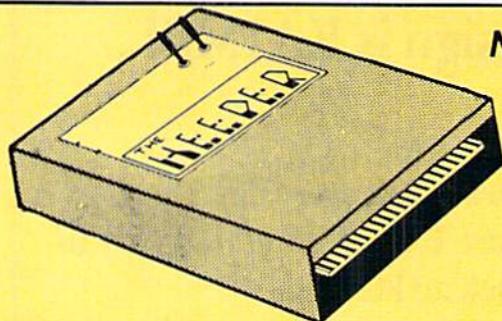
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Music Shop.....	?	105 sec.	105 sec.*	105*	21 sec.
Hitchhiker's Guide to the Galaxy.....	?	70 sec.	70 sec.*	N.G.**	68 sec.
On-field Football.....	?	149 sec.	66 sec.	63 sec.	56 sec.
EASY FINANCE I.....	?	58 sec.	13 sec.	13 sec.	11 sec.

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\*Will not fast load - defaulted back to regular load

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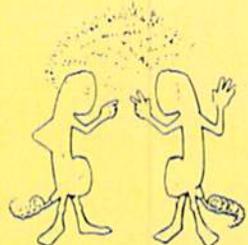
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# The Sound of C-128 Music

*Now, with the C-128's Basic 7.0, anyone can take full advantage of the sensational SID chip. Your C-128 can become a one-man band in no time.*

By MATTHEW STERN

The Commodore 128 shares the C-64's magnificent sound and music capabilities. However, with the C-128 you can use them more quickly, more easily and with less chance for error.

Both the C-64 and C-128 contain the sound interface device, or SID, chip. This sophisticated three-voice synthesizer is capable of creating three-part harmony, a wide variety of sound effects and even synthesized human speech.

Unfortunately, the Basic 2.0 programming language used in the Commodore 64 has no special commands for using the SID chip. Sounds must be programmed by Poking values into each memory location. This makes programming sound and music on the Commodore 64 a cumbersome task.

In the C-128, in C-128 mode, the SID chip uses the extended Basic 7.0, which adds six new commands exclu-

sively for controlling this chip. As you will soon see, these commands make it far easier for you to create sophisticated music and sound effects for your programs.

To begin, we'll take a look at how sound and music is created by the SID chip, and then how you can use Basic 7.0 to turn these sounds into the music or effects you want.

## *Making Sounds with Waves*

Sounds are created by vibrations. For example, to make music on a guitar, you pluck its strings, causing them to vibrate. Your Commodore computer produces sound with electrical waves. The pitch of the sound is determined by the *frequency*, or speed, that the waves move, or *oscillate*. The faster the frequency, the higher the pitch.

The type of sound is determined by the shape of the wave, called the

**RUN** It Right

C-128

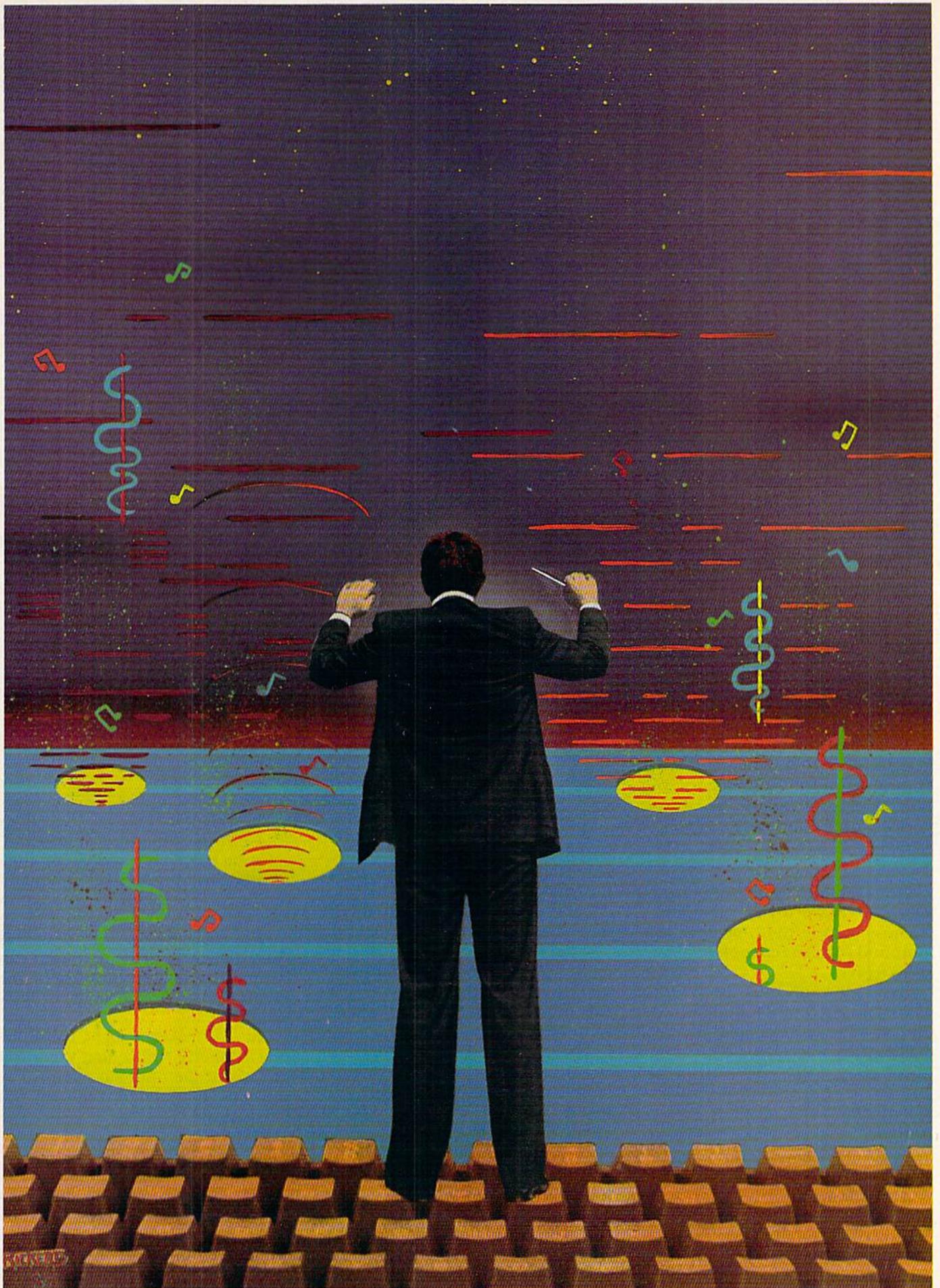


Illustration by David Rickard

*waveform*. When the waveform is changed, so, too, is the type of sound. The Commodore SID chip creates four types of waveforms: triangle, sawtooth, pulse and noise.

The sound can also be altered by changing the volume patterns of each of the waves. Each sound goes through four volume changes. The first phase carries the sound from the lowest to the highest volume. This is called the *attack rate*. From the highest volume, the sound decreases to a middle level. This rate of decrease is called *decay*. *Sustain* is the middle volume in which the note is played. The note then decreases from the middle volume to zero at the rate of *release*. The four volume controls—attack, decay, sustain and release—are called the *ADSR registers*.

You create and control sounds on the SID chip by inserting specific values into the appropriate memory locations, or registers. With Commodore 64 Basic 2.0, you have to insert numbers into each register with Poke commands. Basic 7.0 does all that extra work for you.

### No More Poking Around

Volume is represented by the SID chip with a value from 0 to 15, with 0 as no volume and 15 as the loudest. To control volume in Basic 2.0, you have to Poke it directly into the volume control register, like this:

```
POKE 54276,15
```

Basic 7.0's VOL command Pokes the value into the register for you. The command shown below performs the same function as the above command.

```
VOL 15
```

However, with the VOL command you don't have to worry about remembering the right memory location, and you can find potential bugs a lot easier.

Basic 7.0 commands also perform tasks that couldn't be done directly in Basic 2.0. For example, Basic 2.0 has no easy way to set the *tempo*, or speed, of your song. Basic 7.0 lets you use the Tempo command, which is entered like this:

```
TEMPO n
```

(n is a value from 0 to 255, with 255 being the fastest tempo.)

The advantages of Basic 7.0 become even more apparent when you try to create sounds. For example, if you wanted to play a middle C in Basic 2.0, you had to program the following:

```
5 FORL=54272TO54296:POKEL,0:
NEXT:REM CLEARS REGISTERS
10 POKE54296,15:REM SETS THE
VOLUME AT HIGHEST RATE
20 POKE54277,16:POKE54278,24
8:REM SETS ADSR
25 POKE54273,16:POKE54272,19
5:REM SETS FREQUENCY
30 POKE54276,17:REM SETS THE
WAVEFORM
35 FORN=1TO250:NEXT:REM THIS
LOOP DETERMINES DURATION
40 POKE54276,16:REM TURN OFF
NOTE
```

A real pain, isn't it? But Basic 7.0 has a command that does all that programming with a single command, called Sound. Type the following line and press the return key.

```
SOUND1,4291,25
```

As you can hear, it created a sound at the same pitch as the program above, but with six fewer lines.

### The Sound Command

Three numbers were used in the Sound command shown above. The first value, 1, selects one of the three voices.

The second value, 4291, is the frequency. It is the same frequency as was Poked into the Basic 2.0 program, except you can express it as one value (instead of two) from 0 to 65535.

The third number, 25, is the duration of the note, which is measured in 60ths of a second. This note played for 25/60ths of a second, which is about the same duration as the For...Next loop in line 35 in the Basic 2.0 program.

What about the values for volume, ADSR and waveform? You needn't enter those values to play the sound. Basic 7.0 has certain set values, called *defaults*, which, if you don't specify any others, are used automatically. You can change these default settings to fit your needs. The Sound command has additional parameters you can use to create more interesting sound effects.

The complete Sound command is shown below. The parameters in boldface are required to use the command. The parameters in regular type are optional.

```
SOUND v, f, dur, dir, min, sv, wf, pw
```

You are already familiar with the first three: v is for voice; f is for frequency; and dur is for duration.

The middle three parameters—dir, min and sv—affect the *sweep*, which changes the pitch during the sound, so you can make wailing

sounds like a siren, rising sounds like a rocket taking off or falling sounds like a bomb dropping.

The dir value controls the direction of the sweep: 0 makes the frequency increase; 1 makes the frequency decrease; and 2 oscillates the frequency up and down. The min parameter is the minimum frequency (from 0 to 65535) used in the sweep; sv is the step value that the frequency changes. If you enter 0 for direction and 10 for step value, then the frequency is increased by 10 each step. The greater the steps, the faster the pitch changes.

The last two parameters, wf and pw, let you set the waveform. For wf, you enter a number from 0 to 3, representing the waveform.

```
0 = triangle
1 = sawtooth
2 = pulse
3 = noise
```

If you enter pulse as a waveform, you need to enter the width of the pulse wave under pw.

As an example of how the Sound command works, type in the program and run it:

```
10 FORN=1TO42000STEP50
20 VOL(15-INT(N/3500))
30 SOUND1,N,1,0,0,0,3,0
40 NEXT
50 VOL6
60 SOUND1,42000,420,1,0,75,0
,0
70 FORP=1TO250:NEXT
80 VOL15
90 SOUND1,1024,60,0,0,0,3,0
```

The first part of the program, lines 10–40, shows how you can use variables in the Sound and VOL commands. The loop in lines 10 and 40 increases the frequency played in line 30.

Line 20 decreases the volume as the frequency increases. You can change the volume throughout the program, as was also done in lines 50 and 80.

Line 70 makes a slight pause between sounds. Notice that when you use any of the optional parameters, you must enter 0s for the ones you don't use.

### The Play Command

With Basic 7.0's Play command, you don't need to Poke values into memory locations. You just enter the notes you want played. If you can read music, you can play a song. For example, type the following line and press the return key.

PLAY"C D E F G A B"

You don't need to set the waveform, ADSR, volume or even the voice, duration and octave of the notes. Those are all defaults. Of course, you want more control over what you want played, so the Play command lets you enter additional control characters.

To finish our C scale, for example, you want to play the C in the next octave up. To do this, you enter an element—O followed by a number from 0 to 6, representing the octave. PLAY"C D E F G A B O5 C"

Basic 7.0 also has a series of elements to represent the length of the note:

- W—whole note
- H—half note
- Q—quarter note
- I—eighth note
- S—sixteenth note
- .—dotted note

Again, the duration elements precede the note played. All of the notes after the duration element are played at the same length until another duration code appears. Enter this line: PLAY"O4 QC D E F G A B W O5 C"

Rests are played by entering an R. Like a note, you can precede it with any of the duration elements.

Of course, Basic 7.0 lets you play sharps and flats. Sharps are played by preceding the note with a number sign (#), and flat notes are preceded with a dollar sign (\$). For example, this line plays a D scale:

PLAY"O4 D E #F G A B #C O5 D"

The Play command has four other control characters for playing music. All of these controls are represented by a letter followed by a number.

Voice (V) lets you select which of the three voices you want to play. For harmony, you can use three voices in a single Play command. Envelope (T) lets you select from ten preset instrument sounds, numbered from 0 to 9. You can play one part of your song with a flute by preceding the notes with T4, and you can play another part with a trumpet by using T8. Volume (U) lets you change the volume during a song. Like the VOL command, it uses a value from 0 to 15. Filter (X) lets you turn the sound chip's filter on (with a 1) or off (with a 0) to change sound quality. You can further define the filter settings with the Filter command (which I'll discuss later).

The complete Play command looks like this:

PLAY"Vn On Tn Un Xn notes"

The notes include rests, sharps and flats, and note-duration characters. Since all of these elements are enclosed in quotes, you can use them as a character string. This allows you to use variables and string functions with the Play command.

As an example of what you can do, run the following program:

```

1 REM ODE TO JOY-BEETHOVEN
5 TEMPO10
10 PLAY"V1 T7 U15 O5 HE QF Q
   G QG QF QE QD QC QC QD QE
   QE QD HD"
20 PLAY"HE QF QG QG QF QE QD
   QC QC QD QE QD QC HC M"
30 PLAY"U5 T4 QD QD QE QC QD
   IE IF QE QC QD IE IF QE Q
   D QC QD HG M"

```

40 PLAY"U15 T7 HE QF QG QG Q
 F QE QD QC QC QD QE .HD Q
 C WC"

### Envelope and Filter

The other two sound-control commands in Basic 7.0 let you further define your sound's tone and quality.

The Envelope command controls the shape and the ADSR of the waveform, so you can create a variety of sounds. You can select one of ten preset sounds, which can be further defined by changing the ADSR, waveform and pulse width.

The Envelope command is entered as follows, with the required parameters in boldface, the optional ones in regular type:

ENVELOPE e,a,d,s,r,wf,p

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E is one of the ten preset sounds used in the Play commands; a, d, s and r parameters are the attack, decay, sustain and release rates. Each is represented with a value from 0 to 15, with 0 as the lowest level or rate and 15 as the highest. For wf, you enter a number representing the type of waveform: 0 for triangle, 1 for sawtooth, 2 for pulse, 3 for waveform.

If you enter 4, you are using ring modulation, a special form of harmonics that uses the pitch in one voice to modify the tone in another. If you use the pulse waveform, you need to enter the pulse width under p as a value from 0 to 4095.

The Filter command lets you refine your sounds with the SID chip's filter. You can filter through some frequencies while deadening others.

By cutting off the high frequencies with the low-pass filter, you create a muffled sound. The band-pass, or mid-range, filter allows only a narrow band of frequencies to pass through, creating a nasal sound. The high-pass filter permits only high frequencies to pass through, creating a tinny sound.

You can also adjust the resonance, which determines how much the filters affect the sound. The higher the resonance, the sharper the sound.

The Filter command is entered in this way:

FILTER cf,lp,bp,hp,rs

CF is the cutoff frequency, represented by a value from 0 to 2047. The lp, bp and hp parameters are the low-pass, high-pass and band-pass filters, respectively. To turn them on you enter a 1 in those positions; to turn them off you enter a 0. You can turn on more than one filter. RS is the resonance, which is entered as a value from 0 to 15, with 15 as the greatest resonance. When you use this command, enter values for all five parameters.

### For More Information

This article is meant to be a brief introduction to the SID chip and the C-128's Basic 7.0 commands used to operate it. If you want more information, read the *Commodore 128 Personal Computer System Guide* (included with your computer), *Commodore 128 Programmer's Reference Guide* and *Complete Course in Basic* (both available this fall). ®

Address all author correspondence to Matthew Stern, 6434 Amigo Ave., Reseda, CA, 91335-6001.

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# Get On-Line!

## Discover the World of Telecommunications

By PEGGY HERRINGTON

It used to be that on-line enthusiasts were professionals in the computer industry, but, now, hundreds of thousands of users have discovered the delights of telecommunicating. On evenings and weekends, they're just people having fun, chatting or gathering information and programs—people just like you.

Being on-line means that you're connected by phone to another computer. In addition to a computer with monitor or TV and a disk drive, you need terminal software, a modem and, of course, an operating telephone—preferably without call-waiting service, because the tone that is produced by an incoming call will disconnect you from a BBS or commercial network. (If you have call-waiting and live in an Equal Access area, ask your local telephone company for the number to dial to temporarily disable it.)

Terminal programs disable your computer's ability to compute. Working with one is much like using a word processor—the primary difference being that what you type is sent to the modem instead of a printer.

A modem is a peripheral device that connects your telephone and computer—and, therefore, you—to the outside world. It plugs into the RS-232 user port and is so named because it MODulates the computer's digital bit streams (zeros and ones) into the analog signals that phone lines carry, and DEModulates them back again.

Once on-line, you can participate in several activities, most of which fall into one of the following categories.

### **Gathering facts and information**

Extensive on-line databases contain current as well as

*With a Commodore computer and modem, you can bring the exciting world of telecommunications to your fingertips. This article introduces you to that world, familiarizes you with its terminology, reviews Commodore's modems and provides a list of the major commercial networks available.*

---

reference material. You can download (receive into your computer) current news, sports and stock market reports, or get information from encyclopedias, old newspapers and government publications.

Upon being received by your computer, all this information can be quickly transferred to disk, and you can sign off the host computer (important because networks charge by the minute) and study your findings at your leisure. Information on subjects ranging from personal computing to hobby and professional topics is often enhanced by messages from other users, to whom you can leave comments or questions. Through The Electronic University, for example, you can even earn a college degree without leaving home.

### **Downloading computer programs**

One of the best reasons to get involved in telecommunications is the huge library of public domain programs you can download and call your own, usually at no charge beyond network connect-time fees. The entire Commodore Public Domain Series, which is available in retail outlets, for instance, is now available on both CompuServe and QuantumLink. Even that collection, however, is dwarfed by the many quality programs contributed by users through electronic bulletin boards, networks and user's groups during the past two or three years.

Public domain programs are never copy-protected. You can study their structure and programming techniques and even personalize and enhance them. They are devoted to every subject you can imagine, in all programming languages available on Commodore computers.

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## *Have fun!*

"Talk"—in real time, by typing on your computer—with people from all over the Western world. The bulk of them are from North America, but I've chatted on-line with users in England, France and the Netherlands. On-line conversation comes in two modes: public and private. In the former, whatever you type appears on the screen of whoever happens to be in the same area (sometimes called channel, or room), while, in the latter, what you type appears only to whom you have directed it.

Messages (text saved by the host system) work the same way—public or private—and can be made available to everyone who's interested, forwarded to someone in a different area or saved for a specific person until he or she logs onto the system at another time. A command of English and typing skills are valuable assets, because telecommunicating offers advantages to the quick and literate (physical barriers, such as age and appearance, are broken down).

Forums, clubs and special-interest groups (SIGs) help users find others who share their interests. They also make the possibilities for a network like CompuServe, with its 250,000 subscribers and dozens of SIGs (each with its own conference, or talk area) almost inexhaustible.

For all kinds of computers, standard telecommunications fare has long included SIGs, complete with programs to download, SYSOPs (system operators) to help you with computer-related problems and even on-line programming lessons.

As the user base has broadened, so, too, have SIG offerings. Many SIGs now offer a variety of hobby and professional areas, such as medicine, religion, music and literature. Also, there's the famous CB simulator, where fantasy is the order of the moment—an area on CompuServe so popular it inspired the talk-oriented network, PeopleLink and others.

Playing on-line games with people across the country as easily as across town is fun. But don't be fooled: The colorful graphics on your screen aren't coming from the host system; they are actually loaded from disks sent to you when you join a service like PlayNet or QuantumLink.

Viewtron, the first national network to offer on-line graphics to Commodore telecomputers, uses NAPLPS technology (North American Presentation Level Protocol Syntax) to send graphics over telephone lines, a method similar to ASCII (the American Standard Code for Information Interchange), which standardized numerical values for letters, numbers and punctuation.

### *Purchase merchandise and services*

You can buy almost anything on-line, including software, computers and peripheral devices, televisions, appliances, radios, stereos, telephones, clothing, musical instruments, record albums and sheet music, books, magazines, furniture and more. You can get astrological or weather forecasts, study commercial airline schedules or file your own flight plan. You can even pay your bills with on-line banking.

With all this—and much, much more—as readily available to people in the boondocks as those living in major metropolitan areas, it's no wonder many analysts see telecommunications as a solution to the declining interest in personal computing.

Instead of encouraging tunnel vision and inhibiting human interaction (as some have accused the computer of doing), the computer, through the marvels of telecom-

munications, has become a gateway to the outside world. It can broaden intellectual horizons while providing the means for relationships between people who otherwise may have never met.

Some analysts see the telecommunications-equipped computer work station as the emergence of the long-heralded home information and control center. This electronic resource is predicted to coordinate a family's shopping, entertainment, communications and financial management within the community in which they live.

### *Telecommunications Hosts*

In general, there are three outlets for telecommunications. The first involves connecting your C-64 or C-128 to a commercial network. Many of these same principles are implemented when you log-on to a mainframe computer operated by a business or university.

The second outlet, which is much less complex in all respects, is connecting your computer to a friend's. With telephones and the proper equipment on each end, your computer can dial the phone number and let the two of you talk via the keyboard or exchange programs or text files. This is easiest to accomplish if you both use the same terminal program.

The third outlet is bulletin board systems (BBSs). There are thousands of privately operated BBSs across the country that you can access for the price of a long-distance phone call—or for nothing, if they're located in your local calling area. (User's groups and computer stores usually have BBS phone numbers.) These systems are hosted by personal computers of all kinds and have message and program libraries you can access.

Since computers communicate with ASCII for text, you can participate in message areas on all brands of host systems, not only Commodore, with just about any terminal program. However, to upload (send) or download (receive) programs and ensure accuracy of transmission, your terminal program must offer the same method of error-checking employed by the host computer. Commodore computers use a slight variant of ASCII (in which the values for upper- and lowercase letters are switched). This is accommodated by an error-checking method developed by Steve Punter.

When accessing a BBS hosted by a Commodore computer, the protocol most often in use will be Punter; nearly all other host systems use a set of rules or protocols known as Xmodem.

### *Commodore's Modems*

Commodore Business Machines has produced four asynchronous, direct-connect modems, although only the two most recent models are now being manufactured.

#### **1600 VICModem**

Commodore's first modem, the 1600 VICModem, was introduced back in 1982 but is nonetheless entirely compatible with the C-64 and C-128. The software provided on tape with the 1600 VICModem is a "dumb" terminal for the VIC-20, meaning you can't upload or download files with it.

The 1600 itself is not capable of dialing a phone (you must do that yourself), nor will it answer an incoming call. It can only be used with a modular telephone that allows the dialing mechanism to remain within the system once you've dialed the number, removed the headset and manually plugged the phone cord into it. In other words,

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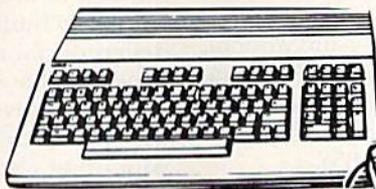
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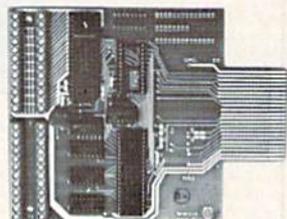
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it is operable primarily with an old-fashioned modular desk phone.

However, on the 1600, all communications parameters are adjustable through software control, including a transmission or baud rate of up to 300 bps (bits per second). With appropriately upgraded terminal software (widely available both commercially and from the public domain), the 1600 will operate on all types of host systems and provide accurate program transfer in both directions.

### 1650 AutoModem

Commodore's second offering, the 1650 AutoModem, includes all the hardware features of the 1600 VICModem, plus a switch that lets you select full- or half-duplex and the ability to automatically dial and answer a telephone (the latter is a necessity for using it on a BBS).

It is designed to work with any type of modular telephone (including a Trimline). The incoming phone line is plugged into the modem, and a phone wire, included with the unit, connects the 1650 to the base of the phone, where the incoming line would normally be. A data/telephone switch allows the phone to remain within the system, regardless of whether or not the 1650 is in use.

Like the 1600, the 1650 is limited to a maximum of 300 baud, and both have a small red light that, when lit, indicates the presence of the carrier signal from the host system; it will go out if call-waiting service or some other interruption "dumps" you.

A Basic terminal program for the C-64, called Term 64, is provided with the 1650, again on tape. By modifying Term 64's program listing, you may store up to ten phone numbers, which can then be dialed automatically. The screen colors are changeable, there is no resident buffer

in which to capture incoming data and you cannot send or receive program or text files.

### 1660 Modem/300

The 1600 VICModem was replaced by the more sophisticated 1650 AutoModem, which was, in turn, superseded by a third Commodore modem—the 1660 Modem/300. Like its predecessor, the 1660 operates at 300 baud and has automatic answer and dial capabilities, but can be used with Touch-Tone or rotary phones and features a built-in speaker that lets you hear the call being dialed or, more importantly, a recording or busy signal. It doesn't have a red indicator light.

Accompanying the 1660 is a disk containing HiggyTerm 64. This machine language terminal program can be used with other Commodore modems and offers 16 programmable function keys, memory for ten telephone numbers, an on-screen clock, changeable display colors and a 40K capture buffer, the contents of which can be printed or saved to disk.

There are no upload/download error-checking protocols incorporated in HiggyTerm. Although it is possible to capture a program file in sequential form with the buffer, the file must then be later translated back with a separate utility program, which is not provided. This method is error-prone and recommended only as an exercise in frustration.

### 1670 Modem/1200

Commodore's most recent addition, the 1670 Modem/1200, although not available for review at press time, promises to incorporate all features of the new 1660 Modem/300 and to handle data at the rate of 1200 bps—strikingly faster than any previous Commodore modem. This will substantially reduce the time required to download programs and information. Although most commercial networks increase connect-time charges for 1200 bps access, this increase will be offset by a savings on long-distance charges, since the transfer rates are so fast. One situation, however, won't be enhanced at 1200 bps and that's real-time conversation. For this, the 1670 can be switched on command to 300 bps.

#### Enhanced Terminal Software

The modem controls functions such as maximum transmission speed and automatic telephone answering/dialing. By and large, however, the terminal program determines what you can and cannot do on-line. All Commodore modems work with software from independent third-party developers, and, in the case of the earlier three modems, you'll need to obtain this additional software to transfer programs on-line.

Remember to match the error-checking protocol in your program with that used by the host system you plan to access (Punter for Commodore BBSs, Xmodem for others; for CompuServe, Xmodem with their "B" protocols).

When you're ready to upgrade your terminal software, here are some other important features to consider:

**Compatibility.** Software won't give a modem talents it doesn't possess. For instance, the 1600 VICModem won't dial a phone, although programs with auto-dial/auto-answer will work with it. Overall, software compatibility with Commodore modems isn't a problem. (It could be with other brands.)

**Adjustable communication parameters.** Duplex, parity, baud rate, word length and stop bits are software controllable on Commodore modems. Make sure the terminal pro-

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Following is a list of major commercial networks that you can access. For an in-depth look at these services, refer to RUN's monthly Telecommunications series, which started in May 1985.

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# C-128 Programmer's Aid

*The C-128 is a programmer's delight. Its enhanced Basic features many more programming aids than the C-64, so you can take command of your programming with ease.*

By MORTON KEVELSON

The Commodore 128 has one of the most powerful and comprehensive Basics of any personal computer currently on the market. Numerous commands result in direct access to the computer's sound and graphics capabilities, so you needn't Peek and Poke your way around the hardware.

Basic's direct memory commands were originally intended as a link to machine language. This link permits access to hardware-dependent features that are beyond the capabilities of Basic. The advent of the C-128 and Basic 7.0 has greatly diminished the need for this link.

However, having an extended Basic also puts a greater burden on you, the programmer, to learn numerous additional commands. The syntax for many of these commands reflects the inherent complexity of the tasks they are designed to do. Also, with more commands to enter, the greater are your chances of making errors.

Fortunately, Basic 7.0 provides additional commands to ease the task of program composition and to assist you in exterminating the unavoidable bugs. Several housecleaning commands will promote neater, more structured programs.

Since these commands relate to all aspects of Basic programming, it is important to take a detailed look at how each one works. It is to your advantage to become familiar with these commands so that their use becomes a matter of habit.

## *Automatic Line Numbers*

Let's begin with line numbers. Aside from being a convenient place to hang a Goto or Gosub statement, line

numbers have little to do with the logic of your program. In fact, there are languages that are specifically designed to eliminate line numbers entirely. Pascal is an excellent example.

Code written in Pascal has an elegance that would only be hindered by the use of line numbers. Basic 7.0 has adopted some of Pascal's program structures.

Think of how many keystrokes are devoted to line numbers in an average Basic program. The C-128 allows for 160 characters (as you shall soon see), but the typical Basic line is less than 40 characters long. Given an average of three digits for a line number, you'll spend nearly eight percent of your keystrokes on line numbering. The C-128 allows you to do away with all this. Basic 7.0's Auto command will automatically generate the line numbers for you. The full syntax is

AUTO increment

where the increment is the numerical difference between line numbers.

If you enter AUTO 10, followed by a carriage return, nothing noticeable happens until the next time you enter a Basic program line. Then Basic 7.0 will automatically display the next program line, incremented by 10.

To stop automatic line numbering without turning it off, hit the return key on an empty line number. Later, you can restart this function simply by entering a line with a new line number. Or, if you prefer, you can change the increment by reissuing the Auto command. To turn off this function completely, simply enter it without a line number.

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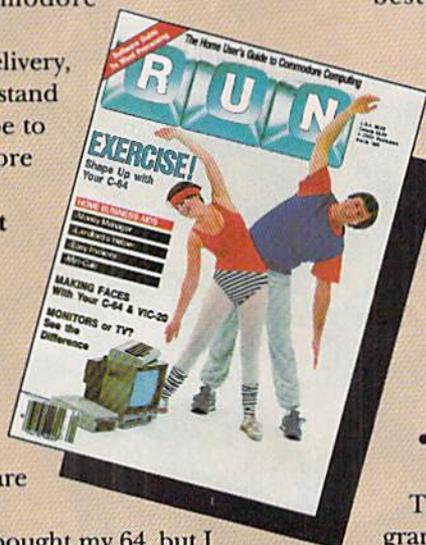
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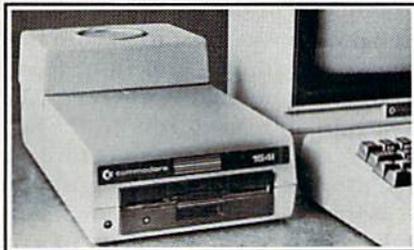
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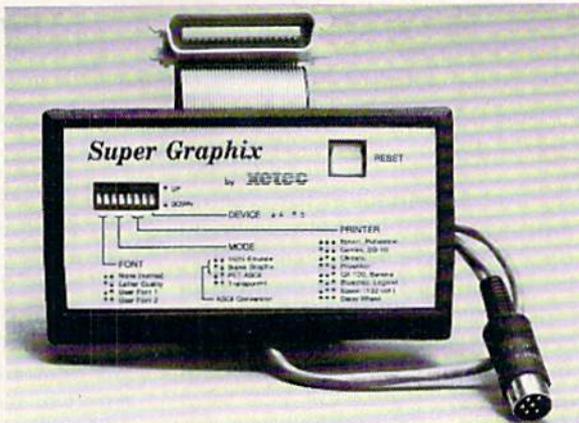
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# Missing Link Uncovered!

*Here's a C-128 command that the Commodore engineers omitted—Basic Append, which lets you link together Basic program files.*

Basic 7.0 has some very useful commands for creating and editing programs, but it lacks a command for combining Basic programs once they have been saved to disk. This article will provide you with a Basic Append command that will let you add program lines to the end of any Basic program in memory. (Do not confuse this command with the built-in Basic 7.0 Disk Append command, which combines sequential files.)

To implement this command on the C-128, you need only a basic understanding of how a program is stored in memory.

On the C-128, Basic program storage starts at address 7168 in RAM bank 0. Basic requires that the content of this address is always a zero. The next two bytes act as a pointer, or link, to the start of the next line of Basic. These bytes are actually the start of the Basic line. The fourth and fifth bytes contain the Basic line number. The last byte of the line is always a zero. This pattern repeats itself until the end of the program. Basic reminds itself where the program ends by storing two zeroes as the last line link.

As part of Basic's organization, the start and end of program text are also stored in zero-page to help the operating system keep track of data for its own various purposes. You can take advantage of this knowledge to fool Basic in regard to where the program is stored in memory. A little cleverness on your part can even cause Basic to append the next program.

The only restriction to this process is that the appended program's line numbers must be greater than the line numbers of the program in memory. This is easily accomplished, since you can use the C-128 Renumber command to give the existing program low line numbers. Just remember always to save your Basic program modules with high line numbers.

To append a program, you must change the contents of memory locations 45 and 46. This is where the pointer to the start of the Basic program is kept, in low-byte, high-byte format. To calculate the start address, you have to multiply the contents of 46 by 256 and add the result to the contents of 45. In Basic, this can be easily done by:

```
PRINT PEEK(46)*256 + PEEK(45)
```

Changing the contents of locations 45 and 46 changes the start-of-Basic pointer. However, before you can do this, you have to know just two more bytes of information, involving where the program ends.

Memory addresses are stored in a two-byte format, since a single byte can only contain values that range from 0 to 255. To store any of the possible 65536 addresses that the 8501 microprocessor can look at, two bytes are required.

## *Ready to Append*

On the C-128, the end of the Basic program is stored in addresses 174 and 175. You need only transfer this

information to locations 45 and 46 and you can proceed with the Basic Append command.

However, the address stored in 174 and 175 actually points to the location immediately after the two zero bytes at the end of the Basic program. This is two bytes further than you want. You will have to be careful how you decrement this address. Remember, the address is stored in two parts.

First check to see if the content of 174 is greater than 1. If it is, simply subtract 2 and Poke the result into address 45, then Poke the contents of 175 into address 46. If 174 contains a 0 or a 1, then add 256 before subtracting two. You will also have to decrement the content of 175 by 1 before transferring it to 46.

The following Basic program will do the job for you:

```
1 IF PEEK(174)>1 THEN POKE45,PEEK(174)-2:POKE46,PEEK(175):  
ELSE POKE45,PEEK(174)+256-2:POKE46,PEEK(175)-1  
2 END
```

Note how the program uses Basic 7.0's If...Then...Else structure.

Run the program. When the Ready prompt appears, just load in the module you wish to append.

To complete this process, the start-of-Basic pointer in locations 45 and 46 has to be restored to its original state. A simple

```
POKE 45,1:POKE 46,28
```

will restore the start of Basic to the default values.

The simplest way to implement the Append command is by placing the two-line program at the start of your main program. Whenever you wish to append something to your main program, load and run your main program. Then load the module you wish to add. Next, restore the start-of-Basic pointers. (Always remember to do this before adding any other modules.) Also, be sure to keep your program lines in proper order, using the Renumber command.

The following briefly outlines the sequence of commands when appending programs.

```
1. LOAD and RUN APPENDER  
2. LOAD "MOD 1",8  
3. POKE45,1:POKE46,28  
4. RUN  
5. LOAD "MOD 2",8  
6. POKE45,1:POKE46,28  
7. RUN  
8. LOAD "MOD 3",8  
9. POKE45,1:POKE46,28  
10. RUN  
11. LOAD "MOD 4",8  
12. POKE45,1:POKE46,28
```

If you list after steps 1, 4, 7 and 10 there will appear to be no program in memory. If you enter RUN 10 after steps 3, 6, 9 and 12, the combined programs will execute.

virtual elimination of the new-screen-line syndrome. This occurs when you enter a line that requires the entire width of the screen; the cursor then moves automatically to the beginning of the next line.

A weary programmer will often type the next line number without hitting the return key. This enters the second line as part of the first. Even the listed line may not reveal the problem, as the screen display will usually appear as two separate lines. Having the computer do the numbering is a sure way to avoid this particular problem.

### *Calling for a Recount*

Unless you're one of those rare individuals who possess a flawless sense of logic, combined with the patience to flowchart every detail, you'll soon find yourself in the Basic programmer's bind.

As a program develops, additional lines are often inserted between existing line numbers. Before you know it, you may exhaust the possibilities. This invariably happens in the middle of a long program, making manual renumbering a tedious chore.

At this point, the notorious Goto statement comes into play. In fact, it is this local shortage of available line numbers that leads to the most horrible examples of convoluted code. If you are like most programmers, you will also find that the line you accessed with the Goto statement soon succumbs to a similar bind.

Basic 7.0 provides a way out. The Renumber command will automatically resequence the entire program, starting with line 10 and incrementing by 10. The full syntax of this command is

```
RENUMBER new number, increment, old number
```

where "new number" is the new starting line number, "increment" is the same as for automatic line numbering, and "old number" is the old line number at which to start renumbering.

This is a fully implemented renumbering, where proper treatment is given to line numbers in Goto and Gosub statements. This property of renumbering leads to a highly desirable side benefit of the Renumber command.

Just think of how much debugging time is spent on resolving all those Goto and Gosub statements that no longer refer to valid program lines. How about those memory-wasting, but otherwise innocuous, line references that remain after some routines are eliminated. Aside from the space they take up, these can be a real nuisance when you're trying to analyze a program.

The Renumber command will flag these for you in all Gosub and Goto statements that no longer call existing line numbers. They will cause the renumbering function to abort with an

```
?UNRESOLVED REFERENCE ERROR IN (line number)
```

message. This is an ideal way to head off these errors in a single pass.

Of course, all this will work wonders when it comes to opening up space in your program for additional code. Also, remember that you don't need to renumber the entire program. The old-number parameter takes care of that. The only missing feature is the ability to renumber a range of line numbers within a program.

### *Try It Out*

If you haven't already typed in a short program, I suggest you do so at this time. Things are going to get a

little more complicated, and being able to work along will be a great help. Just go into Auto mode and type in some Print statements separated by some Goto statements. Try out the Renumber command until you get a feel for it. When you're ready, read on.

### *The Function Keys*

If you've been practicing, you may have found yourself typing the Auto and Renumber commands several times. It may have occurred to you that a lengthy programming session could result in many repetitions of these commands. Well, you can let the C-128 do the bulk of this work for you. The Key command lets you assign any string, up to a total of 255 characters, to the function keys.

When the C-128 is first turned on, the function keys are automatically assigned eight useful Basic phrases. These can be viewed by entering KEY without any parameters. The contents of all eight function keys will be listed to the screen. You may want to change the key assignments when you are planning a lengthy programming session. For example, by entering

```
KEY 1, "RENUMBER,100,10,1" + CHR$(13)
```

you can renumber your entire program in increments of ten, starting with line 100, every time you hit f1.

Examine the contents of the other function keys and compare them with your programming habits. You should be able to come up with suitable substitutions in a short time.

It may turn out that you need different function key patterns, depending on what you are doing. The Key command works under program control as well as in Immediate mode. Just save several sets of Key commands on disk for your various computing needs.

### *Trace That Code*

One of the more common programming problems is the bug that causes your keyboard to lock up. This is usually due to some unforeseen flaw in the program's logic.

Unlike the pervasive Syntax error, there's no way for the computer to warn you about flaws in your logic. Experienced programmers have learned to insert, during program development, numerous Print statements, which display the status of key variables at regular intervals. With the C-128, before you execute the line, the Trace commands let you continuously monitor your program's progress by automatically displaying the current Basic line number in square brackets. The disadvantage is that this sometimes changes the screen format. Nevertheless, it is an invaluable aid. The syntax is straightforward. Just execute TRON or TROFF in Immediate mode.

While tracing a program, it's helpful to keep a ready finger hovering over the no-scroll key, located in the center of the keyboard's top row. A quick jab at an opportune moment will freeze program execution. A second jab restarts program execution where it left off. The no-scroll key is also very useful for pausing program listings, and the like.

### *Catch Those Bugs*

The best thing to do with program bugs is trap them. It's no wonder Basic 7.0 includes the Trap command for that very purpose. Its use is straightforward. Just include it at or near the beginning of your program.

The Trap command uses a line number as a parameter. When a Syntax error is encountered, the program branches to the Trap command's line number and continues execution there. Add the following to your sample program:

```
1 TRAP 1000
1000 HELP
1010 SLEEP 5
1020 RESUME NEXT
```

This assumes that your last program line is less than 1000. If it's not, just use a higher line number or the Renumber command. Before running this program, include an error in one of the program lines. Try a print command without quotes, like:

```
:PRINT HELLO
```

Note the use of the colon as a separator.

Now run the program. When the error is encountered, the program will branch to line 1000. The Help statement will display the faulty statement with the error highlighted in reverse (underlined on the 80-column screen). At line 1010, the computer will pause for five seconds, after which it will resume execution with the line immediately following the error.

If you want to know more, add the following line:

```
1005 PRINT "ERROR":ER;" ":ERR$(ER):"IN LINE":EL
```

This will add to the display the Basic 7.0 syntax error number, the text of the corresponding error message and the offending line number. Note that ER and EL are reserved variables in Basic 7.0, so you should not use them as variables in your program.

Also, ERR\$ is a function that requires one of Basic's syntax error numbers as a parameter. You can use a simple For...Next loop to print out all the error messages.

The Resume command also includes built-in flexibility. A program line number can replace the Next command, allowing a branch to a specific line number. Both the Trap and Resume commands are properly identified by the Renumber command.

As a final word on this topic, keep in mind the help key at the top of the keyboard. You can always use it immediately after a Basic error to display the affected line in Immediate mode.

### *Cleaning Up*

I've saved the most destructive command for last. The Delete command permits wholesale decimation of program lines. It accepts one or two line numbers as parameters in the same format as the List command. Gone are the days of laboriously deleting program lines by entering one line number at a time. Entire ranges of lines will fall prey to the Delete command. Saving Basic routines is now a reality.

One word of caution about using the Delete command: Try listing the doomed lines just to make sure they are what you really do not want. This simple precaution may save much frustration. The syntax is:

```
DELETE # - #
```

### *The Full Screen Editor*

The C-128 has all the screen-editing features found on previous generations of Commodore computers. These include four-way cursor control, with the ability to insert or delete characters any place on the screen. In addition,

numerous enhancements to the screen editor bring it into the class of a full-featured word processor. As you might expect, the enhanced editor goes a long way towards easing the task of Basic program entry.

To begin with, the Basic input buffer will accept up to 160 screen characters for a single program line. This is two full screen lines in 80-column mode or four screen lines in 40-column mode. There's one catch. The screen linker does not know where to stop. It will continue to link screen lines beyond the 160-character limit.

Any attempt to enter this text results in a String Too Long error. This may be a blessing in disguise compared to, for example, the Commodore 64. When faced with this situation, it simply acts on the two most recent screen lines, and the results aren't always what you would expect.

If you're not familiar with the concept of linked screen lines, don't be overly concerned. It's a built-in feature of the full-screen editor on all Commodore computers. The line linker remembers the start of the Basic line that is being entered on the screen. It lets you write program lines that are longer than the width of the screen.

On the VIC-20, up to four lines, or 88 characters, can be linked. On the C-64, the limit is two lines, or 80 characters. The C-128 allows the entire screen to be linked. However, only 160 characters will be accepted by the Basic parser.

The most useful editor enhancements are in the form of ESC-key command sequences. Each command is executed by pressing the ESC key, followed by the appropriate keyboard character. The most popular enhancements for Basic programmers are the Insert mode (ESC A), Insert Line (ESC I) and Delete Line (ESC D).

The first of these inserts all text at the current cursor position, while pushing the remainder of the screen ahead. Note that the Insert command does not place the editor in Quote mode. The Insert Line command opens up a single screen line (40 or 80 columns). The Delete Line command removes an entire linked line, so use it with care.

Other ESC key commands that will be popular with Basic programmers clear all or part of the screen or all or part of a linked line. Veteran Commodore users will definitely appreciate the Cancel Quote Mode (ESC O).

Last, but not least, the C-128 provides several ways for you to write brief notes or reminders on the display. Simply type your message on one part of the screen and set up a window using the ESC T (top-left corner) and ESC B (bottom-right corner) commands. All subsequent screen operations will be restricted to the designated window without disturbing the message area.

If you're fortunate enough to have both a 40- and 80-column monitor, or if you are using the new Commodore 1902 monitor, then one of the displays can be reserved as a scratch pad while you use the other for program entry. Screen output can be rapidly directed as desired by using the ESC X command.

The C-128 is equipped with separate 40- and 80-column video display chips. Each of these has its own video RAM. Thus, text on one of the displays is not disturbed by video activity on the other.

With all of these features, you will find it hard to ask for more. The C-128 is a delight. ®

---

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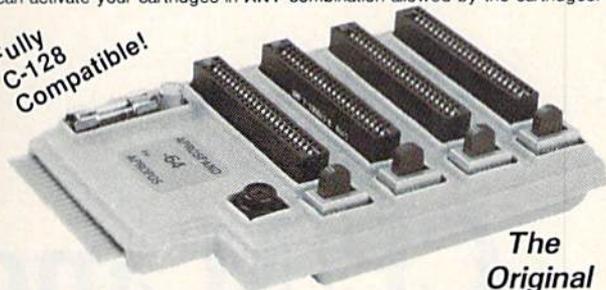
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# CP/M and the C-128

*Here's an introduction to the wide world of CP/M, along with a discussion of its numerous applications and software.*

By CHERYL PETERSON

Until the proliferation of MS-DOS computers, CP/M (Control Program for Microcomputers) was the largest-selling computer operating system available for non-mainframe computers. Most of the earliest desktop, or small-business-size, computers could run CP/M.

Developed by Gary Kildall of Intel for a thrown-together collection of hardware, CP/M eventually became the keystone of a multi-million-dollar corporation called Digital Research.

Although Digital Research originally offered only a plain-vanilla version of CP/M, Lifeboat Associates modified it to run with TRS-80, Altair, Heathkit and other early 8080 and Z-80 microprocessor-based computers. Soon, other manufacturers started offering it with their computers.

Although Altos, Exidy, Vector and Onyx all offered CP/M with their computer systems, the most noteworthy "bundler" was Osborne Computer Corp. By offering the operating system and useful software packages with the Osborne 1 transportable computer, Osborne opened the door to true computing power for thousands of non-technical people who wanted to use a computer without first having to earn a degree in computer science.

An interesting testimony to the popularity of CP/M is the estimation that the largest family of CP/M computers in existence today are Apple IIs. According to one industry expert, the most frequently purchased add-on product for an Apple II is a CP/M card.

During its short life, CP/M has gone through changes and improvements, but has generally kept an upwardly mobile structure. Its latest incarnation, CP/M Plus, can run most programs created with earlier versions of CP/M. This means that the software base for CP/M computers also just keeps growing.

Though it performs some functions of a programming language, CP/M itself is not a language. Using a couple of utilities that are frequently offered with CP/M (ED and ASM), it's possible to write machine language programs. However, this type of programing is beyond the novice computer user.

An operating system controls all communication between the different parts of a computer system: monitor, drives, keyboard, serial port and all other input/output ports. In early computer systems, input and computer response were done via a series of switches and lights on what was called a console. In some CP/M books, you may still see the primary I/O devices referred to as the console.

Later, a typewriter-style I/O interface was used. This evolved into the CRT and keyboards that today we use and call terminals. Some CP/M software manuals refer to terminal emulation in their specifications. Most software that supports the Lear Siegler ADM3A or ADM31 terminals should work fine with the Commodore 128.

One big advantage to using CP/M is the great amount of software already available. The sales of most new computers suffer from an initial lack of useful programs. And since software developers are reluctant to program on machines that don't have a large number of users, these machines may never gain the necessary software base.

Another advantage is the existing user base. There are hundreds of CP/M-machine-based user's groups across the country. If you run into a problem, someone from your local group may be able to provide a solution. Local user's groups are also good sources of purchasing recommendations. Other users may be aware of the perfect software package to suit a particular need. User's group newsletters frequently provide hints and tips on how to get more use out of your computer.

```

AND HANDS. DIRECT ME WITH COMMANDS OF 1
I SHOULD WARN YOU THAT I LOOK AT ONLY TH
LETTERS OF EACH WORD, SO YOU'LL HAVE TO
AS "NE" TO DISTINGUISH IT FROM "NORTH".
STUCK, TYPE "HELP" FOR SOME GENERAL HINT
MATION ON HOW TO END YOUR ADVENTURE, ETC

THIS VERSION IMPLEMENTED BY CHUCK CRAYNE
FEEDBACK REQUESTED.

YOU ARE STANDING AT THE END OF A ROAD BE
BUILDING. AROUND YOU IS A FOREST. A SMALL
OF THE BUILDING AND DOWN A GULLY.
e
I DON'T KNOW THAT WORD.
E
YOU ARE INSIDE A BUILDING, A WELL HOUSE
THERE ARE SOME KEYS ON THE GROUND HERE.
THERE IS A SHINY BRASS LAMP NEARBY.
THERE IS FOOD HERE.
THERE IS A BOTTLE OF WATER HERE.
R A13 03

```

A public domain program called ADVENTUR runs on the 128. It is similar to the Zork series of games from Infocom.

Local user's groups may also control a library of public-domain programs that are both useful and inexpensive. In fact, most user's groups ask little more than a copying fee that covers the cost of the disk and the time it takes someone to make the copy. Generally, the proceeds from such sales are used to finance hardware purchases needed to keep the user's group working.

Because of its wide acceptance over the years, CP/M is most useful to those with small-business applications such as accounting, financial modeling, word processing, spreadsheets and databases. In general, it is most useful in applications that use words and numbers as opposed to pictures.

Unfortunately, few CP/M programs exist that make extensive use of graphics. Although packages can be written and tailored to specific machines, graphics applications are difficult to write and have a limited market. Since there isn't any C-128 CP/M graphics software currently available, business users who need charts and graphs made from CP/M accounting, spreadsheet or database information would be at a disadvantage running the 128.

### Compatibility Problems

The amount of compatibility depends on several factors. Standard CP/M as offered by Digital Research must be customized, depending on a system's disk drive, peripheral interface and keyboard. As mentioned earlier, terminal emulation affects the appearance of data on the screen. In the case of the 128, there are unique chips that must also be addressed.

As the Commodore 64 uses the Kernal tables to handle most of the internal communication, CP/M uses two tables called BIOS (Basic Input/Output System) and BDOS (Basic Disk Operating System).

```

1 | This is a Sample SuperCalc Worksheet
2 |
3 |
4 |
5 | ASSETS
6 | Acct.s Receivable 1000.00 1050.
7 | Cash 300.00 500.
8 | Unsold Goods 250.00 262.
9 |
10 | Total Assets 1550.00 1812.
11 |
12 | LIABILITIES
13 | Acct.s Payable 1000.00 916.
14 | Storage Costs 50.00 50.
15 | Labor 100.00 105.
16 | Materials 50.00 52.
17 |
18 | Total Liabilities 1200.00 1124.
19 |
20 | NIBT 350.00 688.
21 | Dep. Allowance 100.00 100.
22 |
23 |
24 |
25 |
26 |
27 |
28 |
29 |
30 |
31 |
32 |
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80 |

```

This is a spreadsheet being viewed with SuperCalc. It shows approximately half of the 80-column screen.

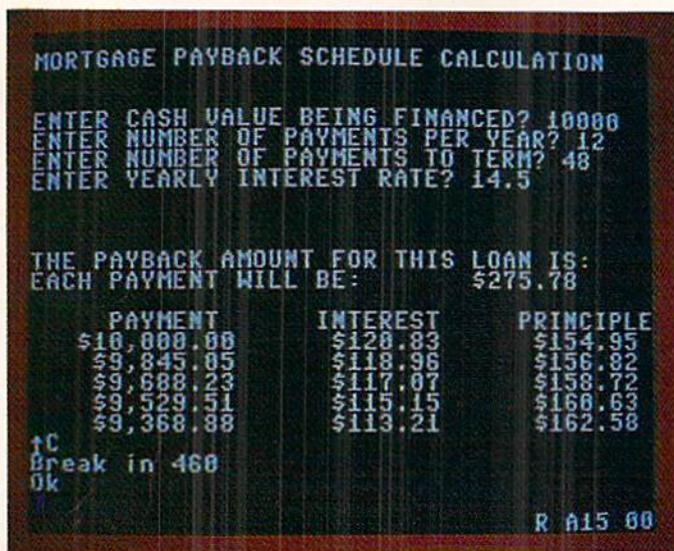
In order for a CP/M program to be easily transported from one machine to another, calls to these tables must conform to a minimum standard. These routines may have been altered (improved) to make the C-128 function more efficiently, but such improvements can reduce compatibility. As far as I've seen, however, the 128 is compatible with existing software.

Another incompatibility centers on the disk drive. The track and sector information used for different CP/M systems can vary widely, even within the product line of a single company. When transporting software between machines, this can be the biggest headache. If incompatible disk formats are used, then the main way to get software into a new machine is by using one of the ports, such as the serial port, with a modem. The other alternative is to rewrite the software specifically for the new computer.

However, Commodore has done an admirable job in designing the 1571 disk drive for maximum flexibility. The 1571 will read CP/M disks that have been created with a variety of machines.

Disks created using the GCR format of the C-64 CP/M cartridge are compatible. While this gives you more CP/M programs to choose from, the GCR format won't prove to be popular with most 128 owners, since many companies do not plan to offer their CP/M software in that format. Several MFM-formatted products written for the Osborne 1 computer will run on the C-128. (See Table 1.) For those who have public-domain programs or other packages already in GCR format, it's comforting to know that the Commodore 128 will run those programs without further modification.

Besides the GCR format, the 128 also reads the IBM MFM format. Several computers, including the Epson



This mortgage program is running under Microsoft BASIC 5.0 Osborne 1 format.

Program	Manufacturer
WordStar	Micropro
SuperCalc	Sorcim
Spellguard	Sorcim
Electric Webster	Cornucopia
The Word Plus	Oasis Systems
Punctuation & Style	Oasis Systems
Grammatik	Aspen
MBASIC	MicroSoft

Table 1. Osborne 1 MFM-formatted software that runs on the C-128.

QX-10, Kaypro 2, Kaypro 4 and both the Osborne 1 and Executive, use this format.

To date, I have tried over a dozen Osborne 1 software packages that worked straight out of the box. These include Micropro's WordStar and MailMerge, Sorcim's SuperCalc and Microsoft's MBASIC. NewWord, a WordStar clone that sells for \$100, seemed to work well.

I have run three different spelling checkers (Electric Webster, Spellguard and The Word Plus) and two grammar checkers (Punctuation & Style and Grammatik). Also, two database programs, Filebase and File-It, ran flawlessly.

Kaypro software didn't fare as well. I tried WordStar and NewWord. Although they loaded properly and seemed to work, the screen formatting was incorrect. Evidently, the Kaypro terminal is not set to emulate the ADM31, so the data contains random characters. In a word processing file, the extra characters would drive anyone batty. I understand that an installation program is available to change the terminal emulation; however, since the Osborne format requires no modification, it seems wise to just stick with that.

#### Running CP/M

Most CP/M computers (including the 128) will check the default disk drive and load the operating system with

the push of a key. The 128's auto-load key is the on/off switch. When first activated, the 128 checks device number 8 to see if a CP/M disk is loaded there. If so, it attempts to load the operating system. If not, it leaves the computer at the 128-mode Ready prompt.

To load CP/M after you've turned on your computer without first putting a CP/M disk in the drive, you need only insert a CP/M disk in drive 8 and type BOOT. For regular CP/M users, this command will be easy to remember, since loading CP/M is usually called "booting the system."

Since Commodore computers use Basic, their users are accustomed to typing Load commands from the Ready prompt. CP/M works a little differently. When CP/M has finished loading, you'll see the A> prompt. This means that the system is waiting for a command and that drive A is active. While Commodore computers use device numbers to designate drives, CP/M uses letters. Drive A is set as device 8, drive B as device 9, drive C as device 10, and so on.

As with Commodore computers, CP/M allows you to run a program that is not on the active drive by typing in the drive identifier. Unlike Commodore computers, however, CP/M lets you change the active drive by typing the letter of the drive and a colon and pressing the return key. For instance, B:<return> would make the B drive the active drive. Any commands typed would then affect the B drive. You could still access a program on the A drive by typing an A: in front of the name of the program.

Loading a program with CP/M is done by typing the program's name, which is limited to eight characters. File names consist of the program name followed by the three-character extender COM preceded by a period (for example, TYPER.COM). This is the standard format, whether you're dealing with program files or datafiles.

When first loaded, CP/M contains some useful commands—STAT, DIR, TYPE, ERA, REN, SAVE and LOAD—that perform some of the functions of the DOS wedge program distributed with Commodore disk drives.

*With the vast library of C-64 and CP/M software available, the C-128 may well have the broadest software base of any personal computer on the market today.*

STAT gives the status of any device. DIR gives the directory listing. TYPE prints a file to the screen. ERA erases a file. REN renames a file. The Save and Load commands, although they work somewhat differently than their Basic counterparts, do just what their names imply.

Most beginning users won't need to use these commands nearly as much as they'll need the Format, PIP and Copy programs. Unlike Commodore software, which is increasingly being copy-protected, CP/M software is rarely under lock and key. In fact, most CP/M manuals begin with instructions on how to make a backup copy and the admonition to never use your distribution disks for actual work.

The Format and Copy programs work much like their counterparts in a DOS wedge program. The Format program prepares the disk to receive programs and data; Copy duplicates an entire disk; and PIP (peripheral interchange program) is used to duplicate individual files.

To format disks, you must enter the Format command. The C-128 assumes you want to format using device 8, so it checks to see if device 8 is a 1541 or a 1571. If it's a 1541, you have the options of formatting the disk using Commodore 64 or C-128 CP/M format. If the drive is a 1571, the choice of C-128 double-sided format is added.

Each format makes available a different amount of disk space. The C-64 format disk has 136K of data space available; the 128 format has 170K; the double-sided format has 340K.

To make your format selection, highlight it by using the arrow keys. Next, hitting return displays the instruction to place the disk to be formatted in the A drive. When formatting is complete, you'll be given the opportunity to format another disk. That's all there is to it.

Using the Copy and PIP programs can be bothersome when operating only one disk drive. To emulate a double-disk drive, designate drive E as the place to store the new files, and the program will prompt you to make disk changes when necessary.

For those who have a 1541, though, there's an easier way. Cut the trace to make your 1541 device 9, and use it as a B drive. The second 1541 will be able to read and write C-128 format disks. You can't use double-sided disks with the 1541, however, so you'll have to settle for 170K.

Another alternative is to use the DIP switches in the 1571 to make that the B drive and to use your 1541 as the A drive. This has the advantage of not requiring any hardware modifications, since no traces need to be cut. Using the DIP switches on the back of the 1571 will also allow it to become drive C or D.

Therefore, if you have two 1541s set up as devices 8 and 9, you could easily just add the 1571 to them. You won't, however, be able to take advantage of the 1571's speed when loading the CP/M system, since the system is always loaded off the A drive.

#### Benefits Galore

The many benefits to having the CP/M capability of the 128 are obvious to anyone familiar with CP/M. Besides the vast library of Commodore 64 software available, you also have access to a wide variety of CP/M applications. With the large number of programs available from the public domain and from electronic bulletin boards, the C-128 may well have the broadest software base of any personal computer on the market today.

The CP/M capabilities of the 128 make it an ideal machine, whether or not you're a programmer. R

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# How to Avoid Computer Disaster

*Whether you're a new C-128 computer owner or a long-time C-64 owner, you'll want to heed these tips to prolong the life of your computing system.*

By ANNETTE HINSHAW

Computers are frustrating when they don't work. So many things can go wrong in a computer system that almost all computer owners experience problems sooner or later. Whether these problems are disasters or mere annoyances depends on how well you take care of your Commodore equipment.

You know from experience that preventive maintenance and good driving habits keep your car running longer. In the same way, taking care of both hardware and software prolongs the life of your system components. If you form good computer habits, your system will be more fun, more reliable and less expensive. Should your luck fail and your system crash in spite of your care, the disaster is usually limited to manageable proportions.

Most measures that improve the life of your Commodore system are free or inexpensive. They are simple,

common-sense operations that anyone can do with only a little extra care and time. In return, you save money, avoid frustration and prevent computer downtime.

This article covers both hardware and software. We'll discuss the enemies of hardware—heat, voltage spikes and dirt—along with some suggestions for preventing, identifying and fixing problems. The things that zap your software are damage to the metal oxide surface of disks or tapes, dirt and EMF (electromagnetic fields).

## *Computers Like It Cool*

When you're copying important disks, does your 1541 or 1571 disk drive ever act strangely or lock up due to overheating?

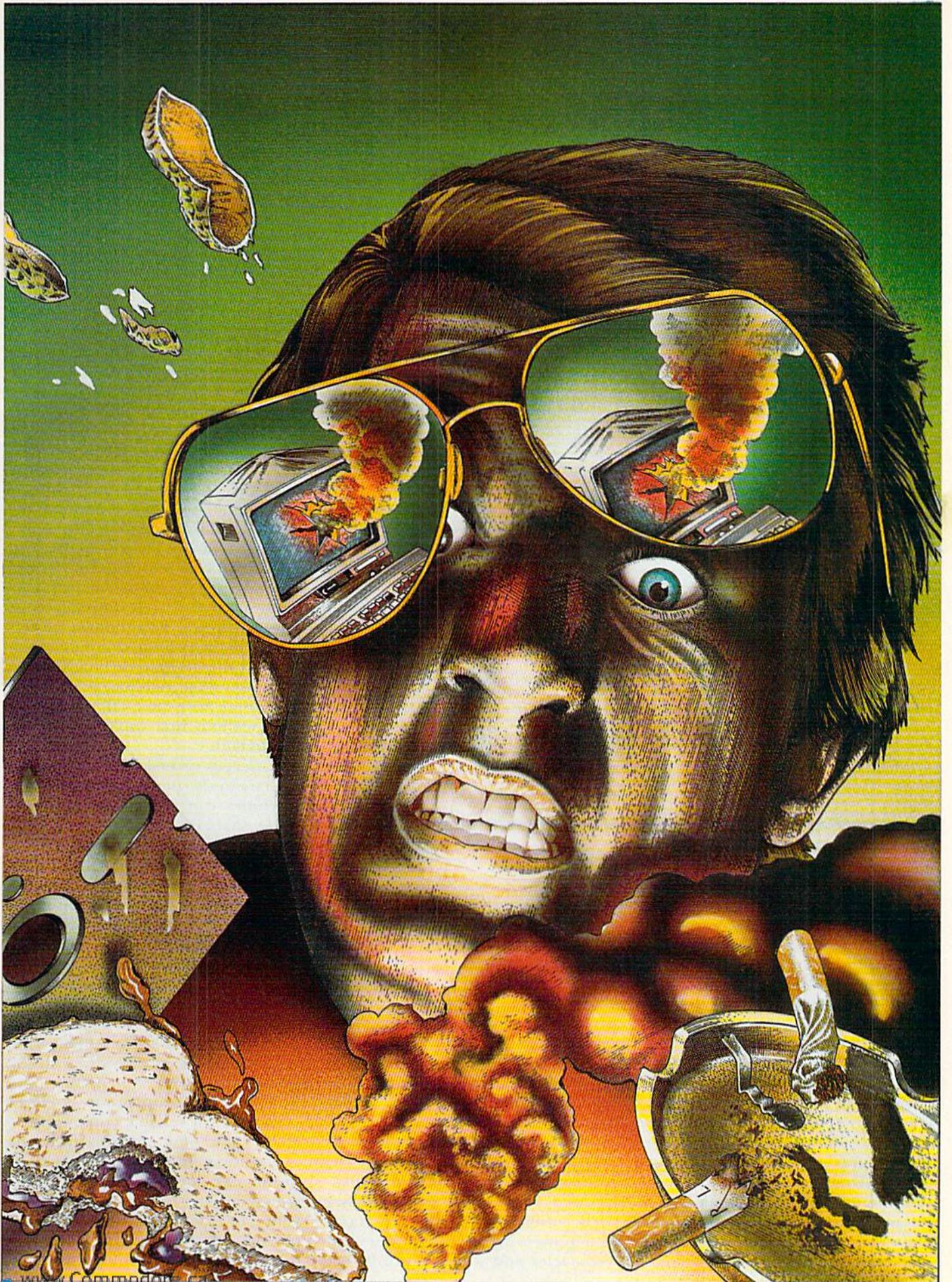
Computer chips work only within a certain temperature range. When they get too hot, they take a siesta, and the device quits talking to you.

If the chips get too hot for a long period of time, they may become permanently damaged.

Fortunately, overheating is easy to control. Don't hide your computer in a closed space or crowd the parts of your system together. Set up your computer so air can flow around it. Never block vents on any of your equipment.

If you must work in a confined space, place a fan so it moves air over your computer, printer and disk drive as they operate. Some computer accessory stores sell small fans that sit on the disk drive and draw out hot air through its vents. I made a paper chimney from poster board and taped it over my disk drive's vent. It draws warm air up and away from the drive and doesn't cost a penny to run.

When my family's equipment gets past the warranty period, we cut out a few of the crossbars in the vent grill



# Checklist for Many Happy Returns

Your Commodore computing system will last longer if you:

- Provide plenty of ventilation for your computer and its peripherals.
- Use a surge suppressor.
- Use a power strip.
- Turn on peripherals before powering-up computer.
- Keep your computer equipment clean.
- Don't smoke, eat or drink around your computer system.
- Keep disk drive heads clean.
- Keep disks clean. Never place a dirty disk in a disk drive.
- Keep connector plugs clean.
- Keep disks away from magnetic sources, temperature extremes and direct sunlight.
- Keep computer hardware away from windows to prevent exposure to direct sunlight and weather elements.
- Make backups of your software.
- Keep computer equipment covered when not in use.
- Never unplug or turn the power strip off or on while the computer or any peripheral is on.
- Turn off the computer before disconnecting peripherals.
- Unplug the power supply when you're not using the computer.

to provide additional ventilation. That mars the appearance of the case, but we have less computer downtime.

Try to place your equipment so air can flow under it. Electronics stores usually sell rubber feet you can attach to the bottom of equipment. We use blocks of scrap wood or cut holes in the desktop or shelf on which the computer or disk drive sits.

If you put rubber feet or wooden blocks under your Commodore, provide support for your modem or anything else that attaches to the user port to prevent strain on the connectors. Don't prop up your computer equipment with metal, which can generate a magnetic field that may destroy data or interfere with your machines.

Overheating that doesn't immediately destroy a chip decreases its life. In the meantime, mysterious, intermittent problems that cause your system to lock up may stop when you improve ventilation around your equipment.

## *Voltage Spikes Destroy Chips*

I give my sick Commodores to Farrell Thrasher of Soft Corps in Tulsa, Oklahoma. He told me that the most common preventable problems he sees in Commodore computers all relate to voltage spikes. He gave me several recommendations.

► Use a surge suppressor. This is a circuit built into a single receptacle or a power strip (box with several receptacles and a power cord) that

you place between your equipment and house power outlet. You can buy one for as little as \$10 at electronics or computer stores. It diverts line voltage (house power) to ground when the voltage gets too high.

Normal line voltage varies between about 110 and 130 volts. Abnormal conditions, such as a lightning storm, can jump the voltage much higher. We turn off all our computers during storms as an extra precaution. Spikes can happen to anyone. Why take a chance?

► Unplug your power supply (the black box that plugs into the wall). The user's manual advises unplugging the main power supply to your computer whenever the machine is not in use. Thrasher told me that the most frequent power-supply problem he sees comes from not following this advice. Turning off the computer does not turn off the supply. On many Commodores, the power unit fails after a time if it is on continuously. It stops regulating voltage, which could cause one or more of the computer's major chips to burn out.

► Use a power strip with its own switch and fuse to isolate your entire system from the wall. This arrangement also effectively unplugs your power supply. Power-down procedure is to turn off the computer, then the peripherals that are plugged into the power strip, and finally the power strip itself. *Never* turn off your power strip without first turning off your equipment.

Power-up reverses the process. Simultaneously powering up several machines can cause a brief power surge that, electronically speaking, hammers on your machines. I lost a C-64 to this practice myself.

Surge suppressors and power conditioners range in price from a few dollars to very expensive. Unless you can't be without your Commodore, due to business or some other activity, the expensive units are probably not cost effective. Spending \$100 on a power conditioner to protect a machine you repair for less than \$100 is not economical. However, a \$30 power strip with switch, fuse and built-in surge suppression is cheap insurance for reliable computing.

► Never unplug anything from the expansion port (game cartridge port) or the user port (modem port) while your computer is turned on. Arrange your power cords, cables and other plug-ins so you can't trip over them and accidentally unplug the com-

puter. (We killed our first VIC by accidentally disconnecting the modem with the power on.) Don't plug in a printer or disk drive, either at the computer or the peripheral, while the peripheral is turned on. You can plug into the joystick port with the computer on.

► Make sure all plugs are firmly seated and have no pressure on the plug. For example, the weight of your printer interface hanging from the printer stresses the plug. A plug that is in crooked may make poor contact or cause a short (an unwanted connection). Shorts are almost always disastrous.

Good electrical practices sound obvious, but Thrasher tells me he regularly sees computers that died because someone unplugged a cartridge with the power on. The chips in your computer use very little power. That also means they are very sensitive to relatively small changes in power. Don't take chances.

#### *Cleanliness Is Next to Reliability*

Dirt is an enemy of both hardware and software. On hardware, normal dust and tarnishing prevent good contacts and reliable operation on plugs, cartridges and keys. Particles of tobacco smoke or tiny fragments of metal oxide from tapes and disks can keep your drives from accurately loading and saving programs. You can't build a "clean" room in your home just to keep your Commodore running, but you can take steps to hold back the tide.

Don't keep your C-64 or C-128 in the kitchen where greasy smoke and steam can affect it. Be very careful if you eat, drink or smoke around your computer. Crumbs on the keyboard can filter down and cause some of your keys to operate erratically. Spilled drinks can cause shorts in the electronics. (Placing a sheet of Saran Wrap over your keys might be effective protection in keeping out foreign elements.)

If you spill even plain water on a disk, the disk is no longer reliable. Never touch the magnetic surface on a tape or disk. Today's thumbprint can destroy tomorrow's data. Tobacco smoke can leave particles on the drive heads or on your disks and cause problems that may not surface for days.

Clean read/write heads occasionally. Cleaning heads is usually more important for tape drives than disk drives, especially if you use inexpen-

sive tapes. I don't like head-cleaning cassettes because they are abrasive. For less than \$2, Radio Shack has a cassette-head cleaning kit that includes an alcohol cleaner, a head lubricant and some cotton swabs. If you have a tape drive, it's the best bargain in town. Ask someone to show you how to clean the heads if you've never done it. We clean tape heads about every four hours of run time or when we get two Load or Verify errors in a row.

Commodore disk heads are epoxied and don't need cleaning often unless you use "flippies" (disks notched and turned over to record on the back) or a disk disintegrates. Thrasher recommends taking the drive apart once in a while and gently cleaning the head with alcohol and a cotton swab. Dampen rather than soak the swab. (For an explanation on how to clean your drive head, see "Keep It Clean," p. 50, *RUN*, July 1985.)

If you are uncomfortable about taking the machine apart, you can buy a commercial disk-head cleaning kit. I recommend a wet cleaner instead of a dry one, because the latter is abrasive. Radio Shack has one for \$14.95. Follow the instructions and use the Initialize disk command several times to run the head over the cleaning disk.

I prefer the kit from Nortronics (8101 Tenth Avenue North, Minneapolis, MN 55427), but it costs \$39.95. It comes with software that gives you step-by-step instructions, and it runs the drive the right amount of time to clean the heads thoroughly. It also has refillable disk covers for the cleaning disks and comes packaged in a nifty 15-disk storage box.

Clean the plugs in the expansion, user and cassette ports with the power off. The contacts on the connectors tarnish in time. Alcohol on a swab works fine. Be sure you don't leave particles of cotton behind, or they'll make new problems. Your cartridges and other plug-ins work better without the corrosion. The contacts on the keys are fairly easy to clean, if you are confident enough to take the keyboard apart.

If you suddenly have trouble loading programs that have been working fine, try cleaning the read/write heads and connectors before you assume you have an alignment problem.

#### *Software Needs Special Handling*

Physically, disks are fragile. While

tape is not quite so fragile, everything I say about disks also applies to tape. The metal oxide on the disk surface reacts to electromagnetic signals; this is how the disk saves information. If you damage the surface, the disk won't read or write reliably in the damaged area. Sometimes weeks go by before you discover a problem. If you write on a disk with a ballpoint pen, you may not suffer for your carelessness for quite a while. Generally, anything that puts pressure on the disk surface may damage it.

The biggest enemy of your software is uncontrolled radiation, especially electromagnetic radiation (EMR) from a motor or TV tube. Never store your disks, even for a moment, near a motor. Keep them away from refrigerators, stereos, your disk drive and the vacuum cleaner. Avoid cathode-ray tubes.

Your TV or monitor can be lethal to disks. Keep disks away from the telephone; the ringer or the magnets in the handset can zap a disk to unreadability with one ring. Metallic objects, such as screwdrivers, can develop enough magnetism to damage software. Don't store them around your computer work area. Small permanent magnets and coiled electric cords are also dangerous. Don't leave disks in the drive when you turn the power on or off.

Heat and light are also forms of radiation that can harm your disks. Don't leave your magnetic media in the sun or in the trunk of your car on a hot day. Disks are sensitive to extremes of both heat and cold. Enough heat might change information stored on the disk. Cold can shrink the disk material enough to change the location of data. If your disks have been exposed to temperature extremes, wait at least a day before you use them, so they can return to normal.

Store your disks upright in moderate temperatures, protected from light and dust. Store them away from motors, electric cables and other magnetic-field sources. Store your backups somewhere removed from your working disks.

Speaking of backups, backing up data and program disks is the single most important protection against disaster. Can you afford to be without a program for the time it takes to replace it, possibly from the manufacturer?

Develop a personal backup policy and stick to it. You may not be able

to copy-protect software, but you can choose to buy programs that can be backed up or easily replaced. Don't take a chance with data disks for applications like word processing, spreadsheets or databases. Each disk represents hours of your time, even if you can recover the data. I strongly advise that you make frequent backup copies. You're really gambling if you back up your data only infrequently.

### Identifying Problems

Sooner or later, you will have computer problems. They may be small and irregular, such as Load errors, problems in saving or reading data and system lockups. Such problems may not be more than momentary glitches from heat or drops and rises in voltage. Your equipment may be fine.

On the sad day you decide you are having regular problems, the first thing to do is identify the source. If your Commodore doesn't come on (the red power indicator will be out), open the case and check the fuses. If the filament in a fuse is broken, replace the 1½-amp fuse and see if that cures the problem. Otherwise, your computer will need professional help.

Deciding what's wrong is not always easy. The same apparent symptoms can happen because of bad software, a misaligned drive or a bad chip in the computer. A good first step is to keep a diary of your problems. Record, as closely as you can, the disk, the program, the time of day, the date and exactly what you did just before your problem occurred. You may eventually find a pattern. Record lockups of the computer or disk drive, loading problems and disk errors and system resets. You will know if the system has reset if you see the initial display screen and lose your program.

The system reset is the easiest to diagnose; it occurs when power to the computer is interrupted, and you lose whatever was in your computer. It could result from a momentary lapse in your house power. Garbage may be written to the disk, thus damaging your software. However, your system as a whole is probably all right. If this reset happens regularly, double-check to see that all your plugs are firmly connected. Also, check to see that your house wiring is sound. If the computer resets several times in a few minutes, it has

lost its voltage regulation. Turn it off and take it and its power supply to a specialist.

Computer malfunctions are due to operator error, software failure, hardware failure or all of the preceding.

Operator error happens to even the most experienced computerists. Computer systems are so complex that you can easily hit the wrong series of keys and lock up the computer. Errors like unplugging cartridges at the wrong time or removing a disk when the drive is running can harm your system, but hitting the wrong keys shouldn't damage anything.

The log I suggested will help you find what, if anything, you are doing wrong. Find a user's group so you can ask more experienced people for help and advice. As you become more acquainted with your system, problems caused by your mistakes will decrease.

Software failure can result from physical or electrical damage or wear on a frequently used disk. Your problem log is the easiest way to identify a bad disk or a bad program, because you only have problems when you use them. Thrasher told me he often gets drives in for repair that are perfectly all right; the problem lies in the software.

If you suspect software failure, try a backup disk if you or a friend has one. Also, try your disk in a friend's drive. The idea is to eliminate the variables. When problems are confined to a single program, try saving it to another part of the disk, if you can load it. People at a user's group meeting may have other suggestions. When your problems occur only in one routine of a particular program, the software may contain bugs. Write the manufacturer for help.

Identifying which piece of hardware is in trouble works the same way as swapping disks and disk drives. If possible, take your whole system to the home of someone whose system works. Try your drive with his computer, your computer with his drive, and so on, until you duplicate your problem and find out what hardware needs repair. Hardware swapping is fairly safe, with one exception. If you suspect that your power supply is bad, don't use it on a friend's system. A bad supply might damage chips in his computer.

Let me say a word about diagnostics. You can buy programs that check the major chips and ports in your computer or the alignment on your

disk drive. For the accomplished do-it-yourselfer, these programs are valuable for alerting you to problems, but they're not cost-effective unless you have a lot of technical skill.

### Where to Get Your System Fixed

The best way to find reliable repair services is through the combined resources of a user's group. Other users share their experiences with repairs, and savvy repairmen who work on Commodores advertise in newsletters and interact with user's groups. Don't give your computer or disk drive to people who don't have Commodore experience. Repair documentation from Commodore does not always reflect changes in the printed circuit board, and getting repair parts is difficult for anyone not already working with the company.

If you can't find a local technician, call Commodore at 215-436-4200 to find out where your local Commodore service center is located, or consult the service center list in the July, August, September and November issues of *RUN*.

When you damage commercial software, check the user's manual that came with it. The manufacturer may replace a blown disk for much less than the cost of brand new software. The manufacturer may also offer support services to recover data disks or remove bugs. Always register your software, so the publisher can find you if the company issues an update or recalls buggy programs. One of the best and most self-interested reasons to avoid pirated software is that you can't ask for help if you need it.

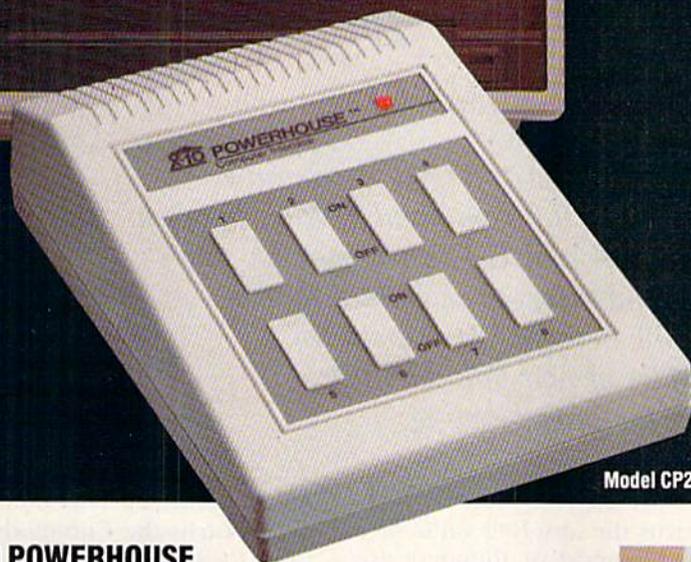
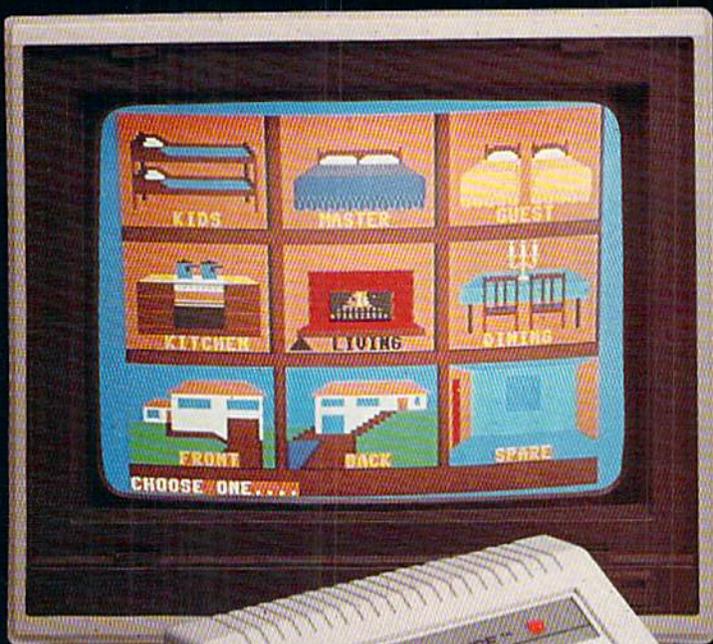
### Postscript

When cars first came out, dealing with inevitable machine failures was traumatic. After decades of car use, breakdowns are still a pain, but we've learned to control them and deal with maintenance and repairs. You need only realize that computers are just another kind of machinery and set out to learn the rules of keeping them running, and many of the hassles of living in the computer age will drop away. R

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# Definitions Demonstrations

## *C-64/C-128 Terms Explained*

By MARGARET MORABITO

*Is your head spinning from trying to distinguish between Basic 2.0 and Basic 7.0 commands? Well, here's a comprehensive list of C-64 and C-128 commands, statements, functions and reserved variables that is sure to set you straight. Also included are examples of how you may use them for programming.*

The following glossary includes all of the C-128's Basic commands, statements, functions and reserved variables. Among these are the Basic 2.0 commands from the 64 mode and the Basic 7.0 commands from the 128 mode.

Each word is described and illustrated either with the actual syntax (form to follow), an example (in Immediate mode or in Programming mode) or both. Some parameters are optional within the syntax of certain terms. Optional parameters are placed within brackets, [ ]. In places, there are two ways of entering the same parameter. For instance, when you see <ON,>, you may either enter ON or just the comma. These parameters always exist within inequality signs, < >.

If you're trying to learn Basic, you'll find typing in the programming examples to be helpful. The graphics commands, for example, hold programming lines that can be combined into a useful demo program. An asterisk to the left of a term indicates that it is only active in 128 mode. Each term is directly followed, in brackets, by its abbreviation.

**ABS [A Shift B].** This numeric function returns the absolute value of a number. All negative numbers are translated into positive.

Syntax: ABS(X)

Example: PRINT ABS(-3.587)  
3.587

**AND [A Shift N].** This logical operator lets the computer calculate the truth of several logical expressions. It is also used to turn off selected bits.

Example: IF X<5 AND X>10 THEN  
GOTO 100

**\*APPEND [A Shift P].** This command opens an existing sequential file on disk and sets the pointer at the end of the file, so that subsequent Print# (write) statements will append new data to the end of the old file.

Syntax: APPEND #Logical file number,"File-Name"[,Ddrive number][<ON,>Udevice number]

Examples: APPEND #8,"SAMPLE FILE"

This prepares "Sample File" for receiving new data.

APPEND #1,"ANOTHER FILE",  
D0,U9

This prepares "Another File" on drive 0, device 9, for receiving additional data.

**ASC [A Shift S].** This numeric function returns the Commodore ASCII value (0-255) of the first character of a string.

Syntax: ASC(N\$)

Example: N\$="RUN"  
PRINT ASC(N\$)  
82

**ATN [A Shift T].** This numeric function returns an angle (measured in radians) that has the tangent (N).

Syntax: ATN(N)

Example: N=9  
PRINT ATN(N)  
1.46013911

**\*AUTO [A Shift U].** This command turns on and off automatic line numbering. After entering a line of Basic, press the return key, and the next line number will be displayed.

Syntax: AUTO [Line#]

Examples: AUTO 10

This sets the program's line numbers in increments of 10, starting at the first line number that you type in for your program.

AUTO

Without a number, AUTO turns off the line-numbering feature.

**\*BACKUP [BA Shift C].** Used with a dual disk drive, this command will copy the entire contents of one disk to another.

Syntax: BACKUP D Source drive TO D Destination drive[ <ON,>Udevice]

Examples: BACKUP D0 to D1

This copies all files from the disk in drive 0 onto the disk in drive 1. For use on dual drive unit 8.

BACKUP D0 to D1,U9

Same as above, but for use on dual drive unit 9.

**\*BANK [B Shift A].** This statement designates one of 16 memory banks within the C-128. The default bank is 15. Type BANK N (0-15) from within Basic to switch banks.

Syntax: BANK number

**\*BEGIN/BEND [B Shift E/BE Shift N].** This is a conditional statement that is structured to allow for including several programming statements.

Example: 5 INPUT Y  
10 IF Y = 5 THEN BEGIN:PRINT "Y IS 5."  
20 PRINT "BECAUSE Y IS 5, THE STATEMENTS UNTIL BEND WILL BE EXECUTED."  
30 BEND:PRINT "THE BEGIN/BEND STRUCTURE HAS BEEN FULFILLED.":GOTO 100  
40 PRINT"Y DID NOT EQUAL 5, SO THE PROGRAM BRANCHED AROUND THE BEGIN/BEND STRUCTURE."  
:GOTO 100  
100 PRINT"THE END OF THIS SAMPLE"

**\*BLOAD [B Shift L].** This command loads a binary file (program or data) into a specified location in memory. The binary file is a file that has been previously saved from the machine language monitor or from within Basic using BSAVE.

Syntax: BLOAD"Filename"[D,drive number][U,device number][B,bank number][P,start address]

Example: BLOAD "SPRITE",D0,U9,B1,P4096

This loads the data for "Sprite" from drive 0, unit 9, into bank 1 at the starting location of 4096 in memory.

**\*BOOT [B Shift O].** This command loads and executes a machine language program from disk, beginning at the predefined starting address.

Syntax: BOOT"Filename"[D,drive number][<ON,>Udevice number]

Examples: BOOT

This will search for an executable

machine language program on drive 0, unit 8. Then it will load and run that program automatically.

BOOT "MUSIC SAMPLE",D1,U9

This will load and run "Music Sample" from drive 1 on unit 9.

**\*BOX [none].** This graphics statement is used for drawing any sized rectangle or a filled polygon.

Syntax: BOX[Color source],X1,Y1[,X2,Y2][,Angle][,Paint]

Color source can be 0-3 (0 = background; 1 = foreground; 2 = multi-color 1; 3 = multicolor 2).

X1 and Y1 are the top-left coordinates; X2 and Y2 are the bottom-right coordinates; Angle is the amount of the object's clockwise rotation in degrees (this is based on the center point of the rectangle); Paint is used to designate whether to fill the shape in (1) or leave it empty (0).

Example: 10 GRAPHIC 1,1  
20 BOX 1,25,25,100,100

This draws an unfilled rectangle.

**\*BSAVE [B Shift S].** This command is similar to BLOAD, but it's used for saving binary files to disk. When using BSAVE, you specify the starting and ending addresses in memory.

Syntax: BSAVE"Filename"[D,drive number][U,device number][B,bank number],Pstart addressTOPending address

Example: BSAVE "SPRITE", B0,P3584 TO P4096

**\*BUMP [B Shift U].** This function determines which sprites have collided since the last check.

Syntax: BUMP (N)

N is a number between 0 and 7, corresponding to sprites 1 through 8.

**\*CATALOG [C Shift A].** This command will read and display the disk directory without disturbing any programs in memory.

Syntax: CATALOG[Ddrive number][<ON,>Udevice number][,wildcard string]

Example: CATALOG

(Default drive 0 on device 8.)

**\*CHAR [CH Shift A].** This statement displays a character on the screen, whether in Bit-mapped mode or in Text mode.

Syntax: CHAR[Color source],X,Y[, "STRING"][,Reverse flag]

Reverse flag:0 = off/1 = on

Example: 30 CHAR 0,2,20,"SAMPLE TEXT",1

This will print the words "Sample Text" at column 2, row 20, with a reversed background.

**CHR\$ [C Shift H].** This string function returns the string character of a Commodore ASCII code number.

Syntax: CHR\$(X)

Example: PRINT CHR\$(74)  
J

**\*CIRCLE [C Shift I].** This statement is used for drawing circles, ellipses, arcs, triangles, octagons and other polygons.

Syntax: CIRCLE[Color source],X,Y[,XR][,YR][,SA][,EA][,Angle][,Inc]

See BOX for description of color source. X,Y is the center point of the circle; XR,YR are radii; SA is the starting angle; EA is the ending arc angle; Angle is the rotation in degrees clockwise; Inc is the increment in degrees between line segments.

Example: 40 CIRCLE1,150,100,55,10  
50 CIRCLE1,75,45,25,18

**CLOSE [CL Shift O].** This statement closes a file that was opened with OPEN or DOPEN.

Example: CLOSE15

This closes file number 15.

**CLR [C Shift L].** While leaving a program untouched, this statement clears the variables in memory.

Example: CLR

**CMD [C Shift M].** This command redirects screen output to another device, such as a disk drive or a printer.

Example: OPEN 4,4  
CMD4:LIST  
PRINT#4  
CLOSE4

This redirects output to the printer while a program listing is being made.

**\*COLLECT [COLL Shift E].** This command frees up disk space that has been allocated to improperly closed files. It also deletes references to those files from the directory.

Syntax: COLLECT [Ddrive number][<ON,>Udevice]

Example: COLLECT D0

**\*COLLISION [COL Shift L].** This statement detects sprite collisions and specifies an action to be taken subsequent to that collision. Usually, the action is a branch to a predefined subroutine.

Syntax: COLLISION type[,statement]

Types: 1 = sprite-to-sprite  
2 = sprite-to-display  
3 = light pen (40-column mode).

Statement: The line number of a subroutine in Basic.

Example: COLLISION 1500

**\*COLOR [COL Shift O].** This statement assigns colors to one of the seven screen color areas on the C-128. Sixteen different colors can be used.

Syntax: COLOR Source number, Color number

Sources are: 0 = 40-column background; 1 = 40-column foreground (graphics); 2 = multicolor 1; 3 = multicolor 2; 4 = 40-column border (text or graphics); 5 = character color in 40/80 columns (text); 6 = 80-column background.

Colors are 1 to 16.

Example: 5 COLOR 0,5

This colors the background light-purple in 40-column mode.

**\*CONCAT [C Shift O].** This command merges, or concatenates, two sequential datafiles that already exist on disk.

Syntax: CONCAT "Second file" [,Ddrive number] TO "First file" [,Ddrive number] [

Example: CONCAT "FILE 2", D0 TO "FILE 1",D1

This will merge files 1 and 2, placing FILE 2 at the end of FILE 1, while retaining the FILE 1 name.

**CONT [64:C Shift O/128:none].** This command restarts program execution after it has been halted by STOP or END, and resumes where the break occurred.

Example: CONT

**\*COPY [CO Shift P].** This command copies a single file or all files from one disk to another. It is also used in single-drive systems for making a copy onto the same disk, but under a different name.

Syntax: COPY [Ddrive number,] "Source filename" TO [Ddrive number,] "Destination filename" [

Example: COPY D0,"SOURCE FILE" TO D1,"DESTINATION FILE"

This copies the Source file from the disk in drive 0 to the disk in drive 1 and also renames the file as Destination file.

**COS [none].** This function returns the cosine for an angle specified in radians.

Example: PRINT COS(N)

**DATA [D Shift A].** This statement defines the data that is to be input into memory by a Read statement. Numbers and words can be placed in a Data statement. All items must be separated by commas. Words must be placed within quotation marks.

Data statements can be located anywhere in a Basic program. See Restore.

Example: 100 DATA 12,"Ralph",01345,"NY"

**\*DCLEAR [DCL Shift E].** A command that closes and clears all open channels on a specific disk drive and device number. This is similar to OPEN 15,8,15,"I0":CLOSE15

Syntax: DCLEAR[Ddrive number] [<ON,> Udevice]

Example: DCLEAR D0

**\*DCLOSE [D Shift C].** This command closes one or all files that are open on a disk drive.

Syntax: DCLOSE[#Logical file number] [<ON,>Udevice number]

Example: DCLOSE

**\*DEC [none].** This numeric function calculates the decimal value of a hexadecimal string.

Example: PRINT DEC("FF00")  
65280

**DEF FN [64:D Shift E/128:none].** This is the Define Function. It lets you define special-purpose formulas that will be used frequently within a Basic program.

Syntax: DEF FN name(variable) = expression

Example: 5 DEF FNC (X) = 3.14159265\*r12

In this sample, the name of the function is FNC. X is a dummy numeric variable. The expression after the equals sign is the formula for calculating the area of a circle.

**\*DELETE [DE Shift L].** This command deletes lines from a Basic program.

Syntax: DELETE[First line][Last line]

Example: DELETE 10-70

This deletes lines 10 through 70.

**DIM [D Shift I].** This Dimension statement reserves memory space for array variables. It also defines an array as having one or more dimensions to it. All arrays having more than 11 items must be dimensioned with DIM.

Example: DIM X(20)

This defines a one-dimensional array named X to accommodate 21 items.

**\*DIRECTORY [DI Shift R].** The F3 key on the C-128 is predefined to display the disk directory for drive 0, device 8. Any drive's directory can be viewed using this command.

Syntax: DIRECTORY[Ddrive number] [<ON,> Udevice number] [,"Wildcard"]

Example: DIRECTORY D1,U9

**\*DLOAD [D Shift L].** A command that loads a Basic program from disk.

Syntax: DLOAD "Filename" [,Ddrive number] [,Udevice number]

Example: DLOAD "MEMO"

**\*DO/LOOP/WHILE/UNTIL/EXIT [none/LO Shift O/W Shift H/U Shift N/EX Shift I].** The Do/Loop statement is a looping technique similar to For/Next. All statements between the DO and the LOOP in a program are continuously executed unless WHILE, UNTIL or EXIT are encountered.

If the Exit statement is encountered, program execution passes to the statement following the Loop statement. If the Until statement is encountered, the program loops until a condition is met. The While statement is the opposite of Until: The program continues while a certain condition is true. When the condition becomes false, program execution passes to the statement following the Loop statement.

Example: 5 Y = 15

```
10 DO UNTIL Y = 30
15 Y = Y + 1: PRINT Y
20 LOOP
30 PRINT "THIS LOOP ENDED
WHEN Y BECAME 30."
```

**\*DOPEN [D Shift O].** This command opens a disk file (sequential, relative or random access) for reading and/or writing.

Syntax: DOPEN#Logical file number, "Filename" [,<S/P>] [,Lrecord length] [,Ddrive number] [<ON,>Udevice number] [,W]

S = Sequential file; P = Program file; L = Record length in a relative file; W = Write operation.

Example: DOPEN#1,"CHECKS"

This opens a sequential file number 1, named Checks, for read access.

**\*DRAW [D Shift R].** This graphics statement is used for drawing dots, lines and other shapes on screen.

Syntax: DRAW[Color source],X1,Y1 [TO X2,Y2] ..

X1 and Y1 are starting coordinates from 0,0 to 320,220, and X2 and Y2 are ending coordinates.

Example: 60 DRAW 1,120,120 TO 300,120

**DS and DS\$ [none/none].** These system variables are used for reading the disk drive command channel after an error has occurred. DS returns the status of the drive's command channel to find the cause of an error. DS\$ defines the error in words.

Example: PRINT DS\$

**\*DSAVE [D Shift S].** This command saves a Basic program to disk. Function key 5 activates this command.

Syntax: DSAVE "Program name" [,Ddrive number] [<ON,>Udevice number]

Example: DSAVE "MY PROGRAM"

**\*DVERIFY [D Shift V].** This command checks a program on a specified disk drive against a program in memory.

Syntax: DVERIFY "Filename" [,Ddrive number] [<ON,>Udevice number]

Example: DVERIFY "My Program"

**\*EL [none].** This system variable is used for error trapping. EL will identify the line in which an error has occurred.

**END [64:E Shift N/128:none].** This statement stops a program's execution and returns the computer to Immediate mode.

**\*ENVELOPE [E Shift N].** This statement is used to define a musical instrument by setting the envelope number(N), attack rate(A), decay rate(D), sustain(S), release(R), waveform(WF) and pulse width(PW).

Syntax: ENVELOPE N[,A][,D][,S][,R] [,WF][,PW]

N = 0-9/A = 0-15/D = 0-15/S = 0-15/  
R = 0-15/WF: 0 = triangle;  
1 = sawtooth; 2 = variable pulse  
(square); 3 = noise; 4 = ring  
modulation/PW = 0-4095.

**\*ER [none].** This system variable used in error-trapping holds the definition of the most recent error encountered.

**\*ERR\$ [E Shift R].** This function is used for reading an error message from an error encountered in a Basic program.

Example: PRINT ERR\$ (ER)

**\*EXIT.** (See DO/LOOP/WHILE/UNTIL/EXIT).

**EXP [E Shift X].** This numeric function calculates the mathematical constant e (2.7182813) to an indicated power of N.

Syntax: EXP(N)

**\*FAST [none].** This command puts the C-128 into 2 MHz mode of operation for speedier operations. This turns off the 40-column screen until the Slow command is given.

**\*FETCH [F Shift E].** This statement is used for getting data from the RAM expansion module on the C-128.

Syntax: FETCH #Bytes, Start of Host RAM, Expansion Bank, Start of Expansion RAM.

**\*FILTER [F Shift I].** A music statement for programming the SID chip's various filters.

Syntax: FILTER [Frequency] [,Low Pass][,Band Pass][,High Pass][,Resonance]

FN. (See DEF FN).

**FOR/TO/STEP/NEXT [F Shift O/none/ST Shift E/N Shift E].** A looping statement structure that is used to count the number of times a portion of a Basic program is executed.

Example: 10 FOR T = 1 TO 100 STEP 5  
20 PRINT T  
30 NEXT T

**FRE [F Shift R].** This numeric function computes the number of free bytes available for Basic programs (N = 0) and Basic variable storage (N = 1).

Example: PRINT FRE(0)

**GET [G Shift E].** A programming statement that sends one character at a time from the keyboard to memory whenever a key is pressed. If a key is not pressed, then the program will continue execution automatically.

**\*GETKEY [GETK Shift E].** This statement receives input data from the keyboard one character at a time. It waits for the user to type a character before letting the program continue execution.

Example: 10 GETKEY N\$

**GET# [none].** This statement requests data, one character at a time, from a tape, disk or the RS-232 port. A file has to have been opened.

Example: 10 GET#15,N\$

**GO [none].** This dummy statement is always used with TO. GO and TO are usually combined into a one-word statement: GOTO. (See GOTO.)

**\*GO64 [none].** This command is used for accessing 64 mode from 128 mode on the C-128.

Example: GO64 <RETURN>  
Are you sure?

**GOSUB/RETURN [GO Shift S/RE Shift T].** This statement calls for execution of a subroutine that appears in another location within a Basic program. Once the subroutine has been completed, program execution returns to the line following the GOSUB statement.

Example: 10 GOSUB 300  
20 PRINT "THIS IS WHERE  
THE PROGRAM CONTIN-  
UES AFTER THE GOSUB  
ROUTINE HAS FINISHED"  
30 :  
40 END  
300 PRINT "HERE IS THE SUB-  
ROUTINE":RETURN

**GOTO [G Shift O].** This statement transfers program execution to the line number specified.

Example: 10 IF X = 1 THEN GOTO 50

**\*GRAPHIC [G Shift R].** This statement puts the C-128 into one of six graphics modes.

Syntax: GRAPHIC Mode[,Clear][,S] or GRAPHIC CLR

The six graphics modes are: 0 = 40-column text; 1 = standard bit-mapped; 2 = standard bit-mapped split-screen; 3 = multicolor bit-mapped; 4 = multicolor bit-mapped split-screen; 5 = 80-column text. Clear can be set to 1 for clearing the screen. S indicates the starting line number in Split-screen mode.

Example: 10 GRAPHIC 1,1

This activates the standard bit-mapped graphics mode and clears the screen.

**\*GSHAPE (See SSHAPE).**

**\*HEADER [HE Shift A].** This command is for formatting a disk.

Syntax: HEADER "Diskname" [,i.d.number] [,Ddrive number] [<ON,>Udevice number]

**\*HELP [none].** This command is available for use when a Basic programming error has occurred. HELP will list the erred line and highlight the line segment where the error happened.

**\*HEX\$ [H Shift E].** This function displays a four character hexadecimal number from a decimal number.

Syntax: HEX\$(N)

**\*IF/THEN/ELSE [none/none/none].** This statement evaluates a Basic expression and takes one of two actions. When the If expression is true, the Then statement is executed. When the If expression is false, then program execution falls to the next line number, unless an Else clause is present. When an Else clause is present on the same line as the If/Then, it is executed when the If expression is false.

Syntax: IF <expression> THEN <statement>:[ELSE clause]

```
Example: 5 INPUT Y
          10 IF Y=5 THEN GOTO 20:
            ELSE GOTO 5
          20 PRINT "Y IS 5."
```

**INPUT [none].** This statement asks the user to type in specific information. The program displays a question mark on screen, then waits for the user to enter a response and press the return key.

```
Example: 5 INPUT "GUESS A NUMBER
           BETWEEN 1 AND 10:";N
          10 IF N=3 THEN PRINT"YOU
           GUESSED IT!";GOTO 20
          15 PRINT" NO. TRY AGAIN.";
           GOTO 5
          20 END
```

**INPUT#.** This Input statement gets its information from a disk or tape file rather than from the user. The information is then used in a Basic program.

```
Example: 5 OPEN 15,8,15
          10 FOR T=1 TO 25
          20 INPUT#15,A$,X$,B$
          30 NEXT T
          40 CLOSE 15
```

**\*INSTR [IN Shift S].** This function will search for the location of a string within another string and display the numeric value of its starting position.

```
Example: PRINT INSTR("WHERE IS IT?","IS")
          7
```

**INT [none].** This numeric function converts a numeric expression to the nearest whole number, which is less than or equal to the expression. INT displays the integer value.

```
Example: PRINT INT(2.156)
          2
```

**\*JOY [J Shift O].** This function displays the position of a joystick and the status of the fire-button.

```
Example: JOY(2)=129
```

**\*KEY [K Shift E].** This statement is used to define the purposes of the eight function keys.

Syntax: KEY [key number,string]

```
Example: KEY 1,"OPEN4,4:CMD4:LIST"+
          CHR$(13)
```

This defines F1 to list to the printer the current Basic program in memory.

**LEFT\$(LE Shift F).** Left string is a function that returns a specified number of the leftmost characters of a string.

```
Example: 10 X$="WHAT IS IT?"
          20 PRINT LEFT$(X$,4)
          RUN
          WHAT
```

**LEN [none].** This function determines the length of a string.

```
Example: X$="RUN MAGAZINE"
          PRINT LEN(X$)
          12
```

**LET [L Shift E].** This is an optional statement used for defining a variable.

```
Example: LET X=100
```

This could be written X=100.

**LIST [L Shift I].** This command will display on the screen all of the statements in a Basic program or those specified by the user.

Syntax: LIST [First line][ - Last line]

```
Example: List 10-40
```

**LOAD [L Shift O].** This command is used for loading programs from either tape or disk.

Syntax: LOAD "Program"[,Device number] [,Relocate flag]

```
Examples: LOAD "DISK PROGRAM",8
           LOAD "TAPE PROGRAM"
```

**\*LOCATE X,Y [LO Shift C].** A graphics command that lets the user place the pixel cursor anywhere on a high-resolution screen. X and Y coordinates can range from 0,0 to 320,200.

```
Example: LOCATE 100,100
```

**LOG [none].** This function returns the natural logarithm of a positive number.

Syntax: LOG(X)

**LOOP.** (See DO/LOOP/WHILE/UNTIL/EXIT)

**MID\$ [M Shift I].** MID String is a function that locates a substring within a larger string by specifying its starting position and length.

```
Example: X$="RUN IT RIGHT"
          PRINT MID$(X$,5,2)
          IT
```

**\*MONITOR [MO Shift N].** This command is used for entering the C-128's built-in machine language monitor.

Syntax: MONITOR

**\*MOVSPR [M Shift O].** A statement used for positioning or moving a sprite on screen.

```
Example: MOVSPR 1,100,100
```

This will position sprite #1 at screen location 100,100.

**NEW [none].** This command erases a Basic program from memory and clears all variables.

**NEXT** (See FOR/TO/STEP/NEXT)

**NOT [N shift O].** An operator that calculates the logical NOT of an expression. It results in negative 1 minus the original value.

**ON [none].** This conditional statement is used with GOTO and GOSUB to branch to a specified line number when a certain condition is met. ON allows program execution to branch to the line numbers listed, depending on the value of the expression following ON.

If the expression is valued at 1, then the program branches to the first line number; if the expression is 2, then the program branches to the second line number; and so forth. ON...GOTO/GOSUB is actually a method for using several IF conditions in one program line.

```
Example: 10 INPUT K$
          20 ON K$ GOSUB 100,200,300,400
```

**OPEN [O Shift P].** This statement is used for opening a disk, tape, printer or screen for file input or output.

```
Example: OPEN 15,8,15
```

The logical file number is 15, the device number is 8 (disk drive), and the secondary address is 15.

**OR [none].** A logical operator that calculates conditions as true or false.

**\*PAINT [P Shift A].** A graphics statement used for filling an area with a specified color.

Syntax: PAINT[Color Source],X,Y[,Mode]

See RCLR for discussion of Color Source. Modes: 0 = defined by color source; 1 = defined by non-background source. X,Y is the starting coordinate from 0,0 to 320,200.

```
Example: 70 PAINT 1,149,101,0
```

This will fill in a circular shape built with the BOX, CHAR, CIRCLE, COLOR and DRAW examples in this glossary.

**PEEK [64:P Shift E/128:PE Shift E].** This numeric function returns the contents of a specified memory location.

```
Example: PRINT PEEK(53280)
```

**\*PEN [P Shift E].** This function reveals the coordinates of a light pen.

**\*PI [pi symbol,  $\pi$ ].** This variable returns the value of pi (3.14159265).

**\*PLAY [P Shift L].** This musical statement lets you select the voice, octave, envelope, volume and notes that you want played within a Basic program.

Syntax: PLAY "Voice, Octave, Tune Envelope, Volume, Filter, Elements"

**\*POINTER.** This function is used for finding the address of a specific variable.

Example: X = POINTER(Y)

**POKE [64:P Shift O/128:PO Shift K].** This statement changes the value of any memory location in RAM.

Example: POKE 53280,1

This places 1 in memory location 53280.

**POS [none].** This function is used for finding the current cursor column position within a defined window.

Example: PRINT POS(X)

**\*POT [P Shift O].** This function can tell both the direction of a game paddle and whether the fire-button has been pressed.

Example: PRINT POT(N)

**PRINT [?].** A commonly used statement that outputs words and numbers to the screen.

Example: PRINT "THIS IS THE SPECIAL ISSUE."

**PRINT# [P Shift R].** This statement outputs information to peripherals such as printers, disk drives and cassette players.

Example: OPEN4: CMD4  
PRINT#4,"HERE IT IS"  
CLOSE4

**\*PRINT USING [? US Shift I].** This statement defines the format of words and numbers for printing to the screen, printer or other device.

Syntax: PRINT [#Filename] USING "format";list to be printed

**\*PUDEF [P Shift UE].** This statement allows redefinition of any of four symbols used in a Print Using statement: blanks, commas, decimal points and dollar signs.

Example: PUDEF "\*"

This places an asterisk where any blank occurs.

**\*RCLR [R Shift C].** This function gives the specific color of any requested color source.

Syntax: RCLR(X)

X is the color source 0-6.

Example: PRINT RCLR(0)

This would print the color (1-16) of a background in 40-column mode.

The color source numbers are as follows:

- 0 40-column background
- 1 bit-mapped foreground
- 2 multicolor 1
- 3 multicolor 2
- 4 40-column border
- 5 40/80-column characters
- 6 80-column background

**\*RDOT [R Shift D].** This function is used to locate a pixel cursor on a high-resolution screen and to tell its color.

Syntax: RDOT(X)

0 = X coordinate, 1 = Y coordinate, 2 = color source

Example: PRINT RDOT (0)

**READ [64:R Shift E/128: RE Shift A].**

This statement reads the numbers and text held within a Basic program's Data statements.

Example: 5 READ X  
10 PRINT X  
15 IF X = 5 THEN END  
20 GOTO 5  
30 DATA 1,2,3,4,5  
40 END

**\*RECORD [R Shift E].** This is used with relative files. For reading or writing data, it positions a relative file pointer at any specified byte of data within a record.

Syntax: RECORD#Logical file number,Record number [,Byte number]

Example: RECORD#2,22,4

**REM [none].** This statement is used with a Basic program for personal commentary about it. All the REM statements are ignored by the computer and are never executed.

Example: 10 REM PROGRAM WRITTEN BY MARY DOE

**\*RENAME [RE Shift N].** This command is used for changing the name of a file on disk.

Syntax: RENAME [,Ddrive number] "Old name" To "New name"[,Udevice number]

**\*RENUMBER [REN Shift U].** This command renumbers the lines of a Basic program.

Syntax: RENUMBER [New start][,Increment] [,Old line]

**RESTORE [RE Shift S].** This statement resets the Read pointer so that previously read data can be read again.

Syntax: RESTORE [line number]

Example: RESTORE 100

This resets the pointer to line 100, where old Data statements will be reread.

**\*RESUME [RES Shift U].** This is an aid to programmers when an error has been encountered within a Basic program. This statement tells the computer where to continue program execution after an error has been trapped.

Syntax: RESUME [Line number/NEXT]

Example: RESUME 10

**RETURN [RE Shift T].** This is used with a Gosub statement and returns program execution to the next statement after the occurrence of the Gosub.

Example: 10 GOSUB 500: PRINT"BACK AGAIN?"  
20 END  
500 INPUT"PRESS ANY KEY TO CONTINUE";X\$:RETURN

**\*RGR [R Shift G].** This function tells which graphics mode the computer is in.

Example: PRINT RGR(0)

**RIGHT\$ [R Shift I].** This string function elects the rightmost set of characters within a predefined string variable.

Example: X\$ = "SPECIAL ISSUE"  
PRINT RIGHT\$(X\$,3)  
SUE

**RND [R Shift N].** This function is used to generate a random number between 0 and 1.

Example: X = INT (RND(1)\*5) + 1

X will be a whole number between 1 and 5.

**\*RSPCOLOR [RSP Shift C].** This function identifies the color values of a multicolored sprite.

Syntax: RSPCOLOR (Register 1 or 2)

**\*RSPPOS [R Shift S].** This function identifies the speed and position of a sprite.

Syntax: RSPPOS Sprite#,Position/Speed

**\*RSPRITE [RSP Shift R].** This function identifies the six characteristics of a sprite. These characteristics will have been previously specified in the Sprite command.

Example: 5 FOR X = 0 TO 5  
10 PRINT RSPRITE (1,X)  
20 NEXT X

**RUN [R Shift U].** This command executes a Basic program in memory. It can be used with a line number to begin execution at that line. It can also be used to load and execute a Basic program from disk.

Syntax: RUN [Line number]  
RUN "Filename"[,Ddrive number]  
[,Udevice number]

Example: RUN "MY PROGRAM"

**\*RWINDOW [R Shift W].** This function identifies the size of a screen window. The number of lines (0), rows (1) and whether the display is 40 or 80 columns (2) are returned.

Syntax: RWINDOW (X)

where X is 0, 1, or 2.

**SAVE [S Shift A].** This command is

used for storing programs on disk or tape. Without a specified filename, SAVE automatically tries to store the program to tape.

Syntax: SAVE ["Filename"],[device number] [,EOT flag]

A device number of 1 is tape; 8 is a disk drive. If EOT is 1, then the end of tape flag is set.

Example: SAVE "MY PROGRAM",8  
SAVE "MY PROGRAM"

**\*SCALE [SC Shift A].** This statement changes the scaling of bit-mapped images in Multicolor and High Resolution modes.

Syntax: SCALE N[,X max,Y max]

Example: SCALE 1 Turns on scaling.  
SCALE 0 Turns off scaling.

**\*SCNCLR [S Shift C].** This statement clears the screen in the graphics mode specified.

Syntax: SCNCLR Mode # (0-5)

**\*SCRATCH [SC Shift R].** This disk command erases a file from disk and deletes its reference from the disk directory.

Syntax: SCRATCH "Filename",[Ddrive number],[Udevice number]

Example: SCRATCH "RUNFILE",D1

In a dual disk drive system, this deletes the file "Runfile" from the disk in drive #1.

**SGN [S Shift G].** This function identifies the sign (positive, negative or zero) of a number.

Example: PRINT SGN(X)

**SIN [S Shift I].** This function identifies the sine of a number measured in radians.

Example: PRINT SIN(X)

**\*SLEEP [S Shift L].** This statement delays program execution for a specified number of seconds (0 to 65535).

Syntax: SLEEP N

**\*SLOW [none].** This statement returns the computer to 1 MHz speed of operation after the Fast command.

**\*SOUND [S Shift O].** This statement is used for creating sounds and music on the C-128. Seven parameters can be defined with this statement.

Syntax: SOUND V,F,D[,DIR],[M],[S],[W],[P]

V = voice; F = frequency; D = duration; DIR = stop direction; M = minimum frequency; S = step value; W = waveform; P = pulse width:

**SPC [64:S Shift P/128:none].** This function is used for the spacing of characters within Print and Print# statements.

Example: PRINT "HI";SPC(10);"THERE"

**\*SPRCOLOR [SPR Shift C].** This statement is used for setting multicolor 1 and/or 2 for sprites.

Example: SPRCOLOR 5,6

sets multicolor 1 to purple and multicolor 2 to green for all sprites within a Basic program.

**\*SPRDEF [SPR Shift D].** This command is used to enter the C-128's built-in sprite editor.

**\*SPRITE [S Shift P].** This statement activates and deactivates sprites' colors, expands sprites and sets the screen priorities for any of eight sprites.

Syntax: SPRITEF <#>[, On(1)/Off(0)]  
[, Foreground color (1-16)][,Priority (0—in front of screen objects/1—in back of)][,Horizontal expansion (1—on/0—off)]  
[, Vertical expansion (1—on/0—off)]  
[, Mode (0—standard/1—multicolor)]

Example: SPRITE 2,1,8,0,0,1,0

**\*SPRSAV [SPR Shift S].** This statement transfers 63 bytes of sprite data from a text string variable into a storage area in memory. A sprite image can be stored as a string variable; the data within a string variable can be transferred into a sprite; and one sprite's data can be duplicated in a second sprite.

Syntax: SPRSAV <Origin>,<Destination>

**SQR [S Shift Q].** This function identifies the square root of a number.

Example: X = 81  
PRINT SQR (X)  
9

**\*SSHAPE/GSHAPE [S Shift S/G Shift S].** These two statements are used for saving and loading rectangular areas of high-resolution/multicolor screens to and from Basic string variables. After you've drawn a figure on the screen, you use SSHAPE to save its bit-mapped image and location.

Syntax: SSHAPE Variable, X,Y corner coordinates[,X2,Y2 opposite corner coordinates]

Syntax: GSHAPE Variable[X,Y corner coordinates][,Replacement mode (0—place as was saved; 1—invert shape; 2—OR shape with the area; 3—AND shape with the area; 4—XOR shape)]

**ST [none].** This system variable defines the status of the system after an input/output operation has occurred.

**\*STASH [S Shift T].** This statement is used with the RAM memory expander. It moves the contents of memory into the expansion RAM.

**\*STEP (See FOR/TO/NEXT/STEP) STOP [64:S Shift T/128:ST Shift O].** This statement stops execution of a Basic program and displays on screen a Break message, identifying the line number where the stop occurred.

Example: 10 X = X + 1  
20 PRINT X  
30 IF X = 25 THEN STOP  
40 GOTO 10

**STR\$ [ST Shift R].** This string function converts a number into a string so that the number could be edited for output.

Example: 5 X = 255.1  
10 PRINT "\$";STR\$(X) + "0"

This will display the number X as \$225.10 rather than as \$225.1

**\*SWAP [S Shift W].** This statement is used with the RAM memory expander. It swaps the contents of internal RAM with the contents of the external RAM expander.

Syntax: SWAP #Bytes, Starting address of host RAM (0-65535), 64K RAM expansion bank # (0-3), Starting address of RAM expansion (0-65535).

**SYS [S Shift Y].** This statement calls and executes a machine language subroutine from within a Basic program or from Immediate mode.

Syntax: SYS Address  
or SYS Address [,A][,X][,Y][,S]

A is accumulator; X, Y and Status are registers.

**TAB [T Shift A].** A statement used in Print and Print# statements for placing an expression at a specific horizontal position on screen.

Example: PRINT TAB(5);"THESE WORDS  
ARE INDENTED FIVE SPACES"

**TAN [none].** This numeric function identifies the tangent of an angle in radians.

Example: PRINT TAN(X)

**\*TEMPO [T Shift E].** A musical statement that defines the speed of a song to be played.

Syntax: TEMPO X  
where X is 0-255.

**TI and TI\$ [none/none].** These are system variables used for reading the 24-hour real-time clock built into the computer. TI is the current numeric value of the clock in  $\frac{1}{60}$  seconds. TI\$ is the string that reads TI as a 24-hour clock.

Example: TI\$ = "121005"

This is 12:10 PM and 5 seconds.

**TO (See FOR/TO/STEP/NEXT)**

**\*TRAP [T Shift R].** This statement is an error detector within a running Basic program. When a bug is discovered, program execution is transferred to a pre-specified line number. The EL variable will identify the line in which the error occurred; ER will specify the error condition; and ERR\$ will actually display the error message.

**\*TROFF [TRO Shift F].** This statement turns off Tracing mode.

**\*TRON [TR Shift O].** This statement turns on Tracing mode for use when debugging Basic programs. When activated and a program is running, the line numbers of the program are displayed before each line is executed, so that the programmer can easily see where an error occurs.

**UNTIL (See DO/LOOP/WHILE/UNTIL/EXIT)**

**USR [U Shift S].** This function transfers program execution from Basic to a machine language program. Variables can be passed between Basic and machine language using this function.

**VAL [none].** This function translates into a number a string that's holding numbers. It specifies the numeric value of the string by searching for numbers from left to right. Upon encountering an invalid character, it halts.

Example: X\$ = "15 MILES"  
PRINT VAL(X\$)  
15

**VERIFY [V Shift E].** This command verifies that a program in memory is the same program as the one on disk or tape. This is a safety feature that lets you ensure that the program you saved has really been saved in its entirety. For tape users, the Verify command is used for determining the free space on tape for the next program to be saved.

Syntax: VERIFY "Program name"  
[,Device number],[Relocate flag (0 loads to the start of Basic; 1 loads to where the program was originally saved from)]

**\*VOL [V Shift O].** A musical statement that defines the volume of sounds produced with the Sound and Play statements. Volume can be set from 0 to 15.

**WAIT [W Shift A].** This statement pauses program execution while the computer monitors the status of the

Input/Output registers searching for a particular value. The Wait command is used when performing certain I/O operations.

Syntax: WAIT <Location>, <Mask 1>  
[, <Mask 2>]

**WHILE (See DO/LOOP/WHILE/UNTIL/EXIT)**

**\*WIDTH [WI Shift D].** This statement determines the width of the pixel cursor used for drawing lines with the graphics commands.

Syntax: WIDTH 1 sets a single width.  
WIDTH 2 sets a double width.

**\*WINDOW [W Shift I].** This statement is used for identifying a screen

window in 40- or 80-column Text mode. Coordinates range from 0-39/0-79 horizontally, and from 0-24 vertically.

Syntax: WINDOW top-left column, top-left row, bottom-right column, bottom-right row[,Clear (1 to clear the window)]

Example: WINDOW 50,10,70,20,1

Defines and clears a window whose top-left point is 50,10 and whose bottom-right point is 70,20 (in 80-column mode).

**\*XOR [X Shift O].** A function that provides the exclusive OR of two specified argument values.

Syntax: XOR (X1,X2)

X1 and X2 range from 0-65535. 

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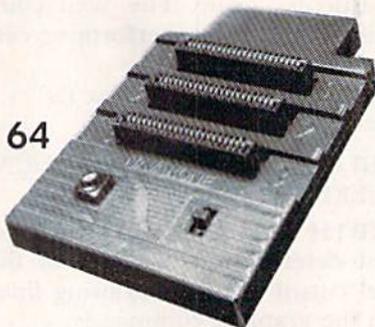
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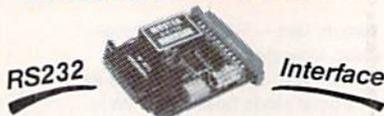
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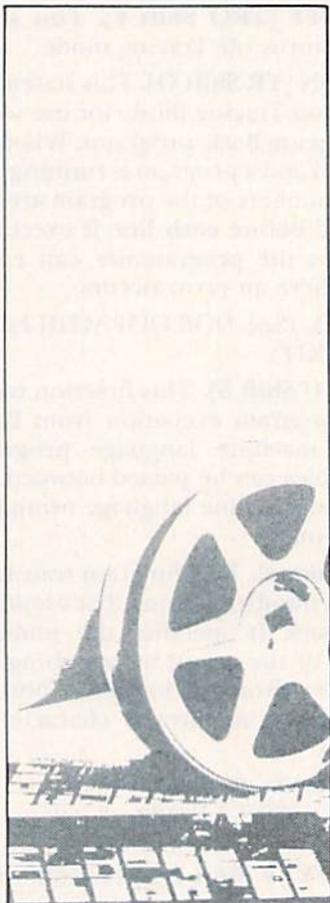
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From p. 44.

```
20 FORJ=828TO840:READK:POKEJ,K:NEXT
30 PRINT"COLOR POKES FOR COL COMMAND:{CRSR
DN}"
40 PRINT"(RETURN GIVES GREY/BLU/GRN){CRSR D
N}"
50 B=12:INPUT"BORDER";B:POKE49174,B
60 S= 6:INPUT"SCREEN";S:POKE49179,S
70 C=13:INPUT"CURSOR";C:POKE49184,C
80 SYS828:PRINT"NOW TYPE COL <RETURN>"
81 DATA 173,000,002,201,067,208,030,173
82 DATA 001,002,201,079,208,023,173,002
83 DATA 002,201,076,208,016,169,012,141
84 DATA 032,208,169,006,141,033,208,169
85 DATA 013,076,048,192,234,230,122,208
86 DATA 003,076,119,000,076,121,000,096
87 DATA 141,134,002,169,000,162,007,157
88 DATA 255,001,202,240,004,076,055,192
89 DATA 234,096,234,234,096,000,251,000
90 DATA 251,000,251,000,251,000,251,169
91 DATA 076,133,115,169,000,133,116,169
92 DATA 192,133,117,096
```

Eric Breault  
Pawtucket, RI

**Screen reverser**—The accompanying C-64 program lets you reverse the entire screen by executing a simple SYS command. Characters in normal video are changed to reverse video, and those in reverse are changed to normal. Because of the speed of machine language, the change is instantaneous.

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```
1 FORY=1TO27:READZ:CS=CS+Z:NEXT
2 IFCS<>4345THENPRINT"DATA ERROR":STOP
3 PRINT"CHECKSUM OK. DELETE LINES 1-4,"
4 PRINT"THEN SAVE THE PROGRAM.":END
10 REM SCREEN REVERSER - RICHARD MIU
20 REM SYS52992 REVERSES THE SCREEN
30 FORJ=52992TO53018:READK:POKEJ,K:NEXT
31 DATA 169,000,133,251,169,004,133,252
32 DATA 162,004,160,000,177,251,073,128
33 DATA 145,251,200,208,247,230,252,202
34 DATA 208,240,096
```

Richard Miu  
Mansfield, OH

**Supersound**—This is a continuous sound effect that goes on in the background while you program or do anything else with your computer. You can shut it off by pressing the run/stop and restore keys or by Poking off voices 1 and 3. You can change the sound dramatically by using different values for the variables in lines 110-140. Use the values indicated in the REM statements.

```
10 FORJ=1TO9:READK:CS=CS+K:NEXT
20 IFCS=1125THENPRINT"{CRSR DN}DATA OK. ERA
SE LINES 10-40, THEN SAVE.":END
30 PRINT"{CRSR DN}DATA STATEMENT ERROR!":ST
OP
40 :
100 REM SUPERSOUND - MILIND S. PANDIT
110 SF=15 :REM FINE SPEED
120 SC= 0 :REM COARSE SPEED. 0 BEST.
130 V1=17 :REM VOICE 1: 17,33,OR 129
140 V3=33 :REM VOICE 3: 17,33,OR 129
150 FORJ=1TO24:POKE54272+J,0:NEXT
```

```
160 POKE54296,15:POKE54286,SF:POKE54287,SC:
POKE54277,0:POKE54278,255
170 POKE54290,V3:POKE54276,V1
180 FORJ=1TO9:READK:POKE49151+J,K:NEXT
190 POKE56333,127:POKE788,0:POKE789,192:POK
E56333,129
200 DATA173,027,212,141,001,212,076,049
210 DATA234
```

Milind S. Pandit  
Houghton, MI

**Beeper**—Here's a clean, non-clicky beep routine that can be used in Basic, compiled Basic and machine language programs. Include this loader subroutine in your program, and call the beep with a simple SYS 50000. The resulting sound is a cross between a beep and a bell, and it's really pleasing to the ear.

```
10 FORJ=1TO82:READK:CS=CS+K:NEXT
20 IFCS=10822THENPRINT"{CRSR DN}DATA OK. ER
ASE LINES 10-40, THEN SAVE.":END
30 PRINT"{CRSR DN}DATA STATEMENT ERROR!":ST
OP
40 :
100 REM BEEPER - BRUCE JAEGER
110 FORJ=50000TOJ+81:READA:POKEJ,A:NEXT
120 DATA032,133,195,169,009,141,005,212
130 DATA169,030,141,015,212,169,130,141
140 DATA001,212,169,015,141,024,212,169
150 DATA040,141,004,212,169,007,141,163
160 DATA195,032,145,195,169,031,141,004
170 DATA212,169,020,141,163,195,032,145
180 DATA195,032,133,195,096,162,000,138
190 DATA157,000,212,232,224,024,208,248
200 DATA096,165,162,024,109,163,195,141
210 DATA162,195,165,162,205,162,195,208
220 DATA249,096
```

Bruce Jaeger  
St. Paul, MN

**Line bell**—Here's a typing aid for you. It produces a typewriter-like bell sound when your cursor reaches the 75th column. It can warn you when you're ready to fall out of a line while programming.

```
10 FORJ=1TO54:READK:CS=CS+K:NEXT
20 IFCS=5908THENPRINT"{CRSR DN}DATA OK. ERA
SE LINES 10-40, THEN SAVE.":END
30 PRINT"{CRSR DN}DATA STATEMENT ERROR!":ST
OP
40 :
100 REM LINE BELL - J. VAN DE PEPPEL
110 FORJ=0TO53:READK:POKE49152+J,K:NEXT
120 SYS49193
130 DATA169,009,141,005,212,141,006,212
140 DATA169,110,141,001,212,169,015,141
150 DATA024,212,169,017,141,004,212,169
160 DATA016,141,004,212,096,165,211,201
170 DATA075,208,003,032,000,192,076,049
180 DATA234,120,169,029,141,020,003,169
190 DATA192,141,021,003,088,096
```

Jurgen van de Peppel  
Ede, Holland

**Basic UNNEW for the C-64**—This program creates a single Basic line with an Unnew program embedded in a REM statement. Add the line to any other program, and you can resurrect a mistakenly erased program by entering SYS 2065.

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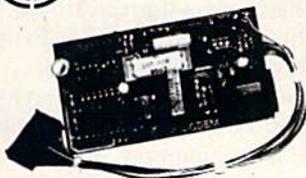


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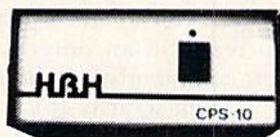


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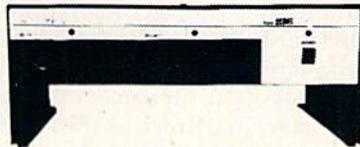
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Line 0 must be a REM, one quote, exactly 66 characters of any sort, then a closing quote. It cannot contain extra spaces. If you get an error when running the program, something is wrong with your Data statements. If all is well, the program will list a transfigured line 0, plus the numbers 11-23, with the cursor on the 11. Pressing the return key 13 times will delete all lines but 0.

Save line 0 for future use; you can add it to any program by using a merge or append utility, or by typing the other program after this one is in memory. This line can be renumbered, but it must always be the first line in your program.

```
0 REM"66 CHARACTERS - SEE TEXT"
10 FORJ=1TO66:READK:L=L+K:NEXT:RESTORE
11 IFL<>8939THENPRINT"DATA ERROR":STOP
12 FORJ=1TO66:READK:POKE2054+J,K:NEXT
13 PRINT"{SHFT CLR}{4 CRSR DNs}":FORJ=10TO23:PRINTJ:NEXT
14 PRINT"{HOME}";:LIST-1
15 DATA 085,078,078,069,087,050,048,054
16 DATA 053,058,160,003,200,177,043,208
17 DATA 251,200,200,152,172,187,255,145
18 DATA 043,165,044,200,145,043,133,060
19 DATA 172,187,255,132,059,174,187,255
20 DATA 200,208,002,230,060,177,059,208
21 DATA 244,232,224,003,208,242,200,208
22 DATA 002,230,060,132,045,164,060,132
23 DATA 046,096
```

Louis F. Sander  
Pittsburgh, PA

**Emergency UNNEW**—Under most conditions, the following C-64 Direct mode line will recover a Basic program so it can be listed on the screen or printer. This will, I hope, give you enough information to enter it again.

```
POKE 2050,1 : SYS 42291
```

Do not try to edit a program thus resurrected; doing so can result in an unrecoverable crash. You must use the New command with the resurrected program, then reenter it from scratch. If the program is short enough to list on a single screen, you can list it, use New again, then use your cursor and return keys to reenter each line.

Mike Oehrtman  
Stillwater, OK

**Filename finder**—On the C-64, SYS 62913 displays the name of the currently active file. Did you ever load a program or open a disk file, then later forget its name? Or have you saved something, then wondered what you called it? Try this magic SYS call, and the forgotten filename will materialize before your eyes! Usable in Direct or Program mode, it displays the filename at the current cursor position. JSR \$F5C1 is the machine language version.

Rick Crone  
Jackson, TN

**Autostart programs for the C-64**—Here's a simple routine that adds the autostart feature to Basic programs on tape or disk. Type it in and run it, and if your Data statements are correct, you'll be asked to delete lines 11-13. Delete them, then save the program.

Now, when you want to save an autostart version of a program, just run Autostart and follow the instructions on the screen. Once it is saved, a Syntax error message will appear on the screen; disregard it. At this point, your

computer is in an altered state, so you must reset it or turn it off then back on.

Programs saved in this manner must be loaded using the form:

```
LOAD"filename",8,1
```

They will run as soon as they are loaded, with no further action from you. Because the autostart process puts characters onto the screen, it's helpful if the saved program clears the screen as one of its first operations. (If you're using tape, change the 8 to a 1 in the Load statement and in the screen message in line 80.)

```
10 REM AUTOSTART - BILL GIEL
11 FORX=1TO48:READY:CS=CS+Y:NEXT
12 IFCS<>5991THENPRINT"DATA ERROR":STOP
13 PRINT"DELETE LINES 11-13":END
20 FORA=679TO726:READB:POKEA,B:NEXT
30 Q$=CHR$(34):PRINTCHR$(147)CHR$(18)"TO MAKE AN AUTOSTART COPY OF A PROGRAM:"
40 PRINT:PRINT"LOAD YOUR PROGRAM, CLEAR THE SCREEN,"
50 PRINT"AND MOVE THE CURSOR TO THE BOTTOM LINE.":PRINT
60 PRINT"THEN ENTER THIS AS A SINGLE COMMAND:":PRINT:PRINT"POKE43,166: ";
70 PRINT"POKE44,2:POKE770,167:POKE771,2:SAVE"Q$"FILENAME"Q$",8"
80 PRINT:PRINTCHR$(18)** YOU MUST ALWAYS LOAD"Q$"FILENAME"Q$",8,1 **
90 DATA 169,147,032,210,255,169,082,032
91 DATA 210,255,169,085,032,210,255,169
92 DATA 078,032,210,255,169,019,032,210
93 DATA 255,169,131,141,002,003,169,164
94 DATA 141,003,003,169,001,141,198,000
95 DATA 169,013,141,119,002,076,131,164
```

Bill Giel  
Yonkers, NY

**C-64 List freezer**—The following lines will Poke a machine language routine into empty memory locations at 679-688, then set the vector IQPLOP at 774-775 to point to the start of the routine. Once that has been done, you can temporarily halt a program listing by pressing the CTRL, Commodore, shift or shift-lock keys. The feature will stay active until you reset your computer.

```
10 FOR J=679 TO 688 : READ K : POKE J,K : NEXT
20 POKE 774,167 : POKE 775,2 : NEW
30 DATA 072,173,141,002,208,251,104,076,026,167
```

If you wish, you can add these lines to the Basic part of the C-64 wedge program. That way, this useful feature will be enabled along with the wedge.

John P. Valengavich  
New Britain, CT

**Compatible color RAM**—Different versions of the C-64 behave differently when you Poke characters to the screen, and often you must Poke the color as well as the character. Below is a Basic loader for a machine language subroutine. It clears the screen and instantly fills color RAM with the cursor color. It eliminates all those extra Pokes and makes your program usable on all versions of the C-64.

As an added bonus, it can be used to change the color of all characters without clearing the screen. You can make it a part of your main program or run it separately, then have the main program use it. The loader lines will put the machine language into memory, ready to use until the computer is turned off.

After running the loader lines, SYS 828 will clear the screen and set your color memory to the current cursor color. To change the colors of all characters on the screen without clearing the screen, use SYS 828 + 5. The commands work either in Direct mode or in a program.

The machine language can be relocated to any place you have 28 bytes of free memory. You need only change the value of AB in line 10 and replace the 828s, mentioned above, with the new value of AB.

```
10 AB = 828 : FOR J = AB TO AB + 27 : READ K : POKE J,K : NEXT
20 DATA 169,147,032,210,255,173,134,002,041,015,162,000,157,000
30 DATA 216,157,000,217,157,000,218,157,000,219,232,208,241,096
```

**C.J. Mohler**  
Walnut Creek, CA

## 2. Computers—C-128

**C-64 to C-128 conversions**—Many Basic programs written for the C-64 will work in C-128 mode as well. When evaluating a program's chances for success, you should pay particular attention to these keywords, which behave differently in the two modes. The 128 mode's special features are mentioned:

**FRE**—The argument is no longer a dummy. It determines the memory bank to be reported on.

**LIST**—A program-mode List does not terminate program execution.

**RESTORE**—This can reposition the Data pointer to the beginning of a specified line.

**SYS**—Registers can be loaded with values separated from SYS by commas.

**PEEK**—The Bank statement affects Peek. In addition, most C-128 memory locations have been changed.

**POKE**—Same considerations as Peek.

Also, since Basic 7.0 has many more keywords than the previous versions, there's a chance that some statements, previously perfectly legal, will now contain embedded keywords.

**Louis F. Sander**  
Pittsburgh, PA

**C-128 monochrome monitor**—The manual doesn't say so, but it's easy to use a monochrome monitor on the C-128's beautiful, 80-column output. The signal is available on the computer's rear-panel RGBI connector, which mates with any male DB-9 plug, such as the Radio Shack 276-1537. Connect the center wire of your monitor's video cable to pin 7 of the DB-9, and connect the shield to pin 1 or 2.

If you put the appropriate connectors on your monitor cables and cut them to the proper length, you can facilitate switching your monitor between the 80- and 40-column outputs on the 128.

**Margaret Ittel**  
Los Angeles, CA

**40/80 display switching**—Although it's not mentioned in the manual, the 40/80-display key is read whenever the stop and restore keys are pressed. So, to switch from one mode to the other, just set the display key, then tap the stop and restore keys.

**Louis F. Sander**  
Pittsburgh, PA

**C-128 display width Peek**—Location 215 decimal (\$D7 hex) is a display-width flag. When PEEK(215) = 0, your computer is in 40-column mode. When PEEK(215) = 128, it's in 80-column.

If you use a 1902, or other monitor that must be switched from 40- to 80-column mode, you can use the flag to help you set the switch. For example:

```
100 IF PEEK(215) = 128 THEN PRINT "SWITCH TO 40 COLUMNS"
      : GRAPHIC0
```

If you're in 40-column mode when this line is executed, nothing will happen. If, however, you're in 80-column mode, the message will print to your screen, and your computer will switch to 40-column text mode (Graphic0). Seeing the message, you'll manually switch the monitor.

**Kenneth Hottes**  
Danbury, CT

**Easy program load**—It's easy to load any program shown on a C-128 directory display. Just move your cursor to the line containing the program, then type DLOAD. Press the tab key three times to put your cursor on the PRG indicator, then hold down your space bar until the PRG is obliterated. When you press the return key, your program will be loaded from disk.

**Mary Martinez-Haver**  
Squirrel Hill, PA

**Safe and easy scratches**—When making multiple scratches on the C-128, the following technique can save you time and potential anguish. If you think you want to scratch all programs whose filenames start with "ABC," for example, do this:

```
DI {SHFT R} "ABC*" {RETURN}
```

This will give you a directory listing of every file whose name starts with ABC. Check the listing carefully to ensure it doesn't contain something you want to keep.

When you're satisfied, move your cursor up to the line you originally entered and change the DI to SC. Press the return key, and the files you examined will be immediately erased.

**Hashafisti Scratchi**  
Tokyo, Japan

**Non-destructive reset**—If, while pressing the C-128's reset button, you hold down the run/stop key and keep it depressed until the reset is finished, you'll get a reset that doesn't disrupt Basic's pointers or lose your Basic program. When this type of reset is finished, the computer comes up in its Machine Language Monitor mode. To return to Basic, just type X and press the return key, and your program will be awaiting you.

**Mary the Juggler**  
Pittsburgh, PA

**F-keys for data**—The accompanying program makes it easy to enter Data statements on the C-128. Run it, then execute the Auto command that appears on the screen. (If you want some other increment between your Data statements, substitute it for the 10 in the Auto command.) Type the line number of your first Data statement, then use the function keys for the following: f1 types the word

RUN SPECIAL ISSUE 1986 / 95

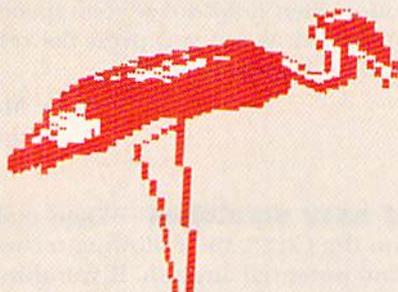
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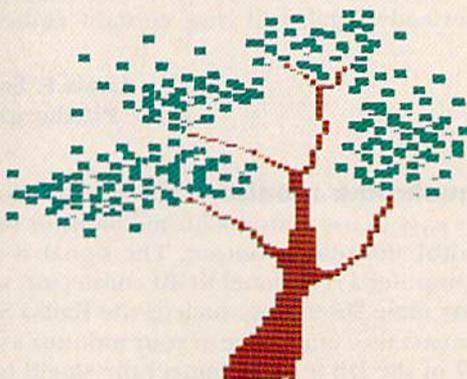
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DATA, f3 or f5 types a comma and f7 is equivalent to pressing the return key. The Auto command takes care of the line numbers on subsequent lines.

```
50000 REM F-KEYS FOR DATA - FRED HUNT
50010 FOR L=1 TO 8 : KEYL,"" : NEXT
50020 KEY1,"DATA"
50030 KEY3,""
50040 KEY5,""
50050 KEY7,CHR$(13)
50060 PRINT"{SHFT CLR}{3 CRSR DNs}AUTO10{HO
ME}"
```

Fred Hunt  
Albany, GA

**Hexadecimal keypad**—Most C-128 owners appreciate the 14-key numeric keypad. Many also enjoy using the built-in machine language monitor. Wouldn't it be nice to be able to enter hexadecimal numbers from the keypad?

Well, it's easy. Just redefine the function keys as the letters A through G. Since you have eight key values and only six letters, you can use the other values for common symbols such as \$ and #. The following little program makes everything automatic.

```
10 FOR A=1 TO 8 : READ A$: KEY A,A$: NEXT
20 DATA A,E,B,F,C,$,D,#
```

Tim Shea  
Burlington, VT

**Sprite shower**—This one-liner for the Commodore 128 gives a dazzling and animated depiction of sprites and how they move. Not only is it fun to watch, but it's also a useful tutorial on C-128 sprites and how they are controlled.

```
10 FOR J=3584 TO 4095 : POKE J,204 : NEXT : FOR K=1 TO 8 :
   SPRITE K,1,K : MOVSPR K,50*K#K : NEXT
```

Mary Lee McCafferty  
Butler, PA

**Sprite storm**—Here is an upgraded version of the above one-liner. This one features multicolor sprites that change as they move about. Some of the changes are a sight to behold.

```
10 FOR L=1 TO 255 : FOR J=3584 TO 4095 : POKE J,L : NEXT :
   FOR K=1 TO 8 : SPRITE K,1,K,1,1,1,1 : MOVSPR K,50*K#K :
   NEXT : NEXT
```

For another variation, add STEP2 after the 4095.

Mary Lee McCafferty  
Butler, PA

**Sprites and function keys**—Memory location 4096 (\$1000 hex) is used by the C-128's function key routines. One common way of loading sprites will inadvertently and unnecessarily overwrite this location, thus clobbering your function keys. Beware.

Although sprite definitions are only 63 bytes long, we're accustomed to saving them in 64-byte chunks. The extra byte is generally unused, but it's convenient to include it when Poking the sprite data. But for sprite #7, that 64th byte is memory location 4096. Be sure you don't Poke it there; you'll have no more function keys.

Bruce Jaeger  
St. Paul, MN

**Sprite insurance**—Sometimes your sprites will fly into never-never land, behaving erratically or refusing to obey your commands. A reliable way to return their feet to the ground is

```
FOR J=1 TO 8 : MOVSPR J,0#0 : NEXT
```

This immediately brings them to their senses.

P.W. Herman  
Hollywood, CA

**SPRDEF in Program mode**—It's not mentioned in the manual, but you can use the SPRDEF command within a program. When you exit the editor, your program will continue at the statement following the SPRDEF. (SPRDEF transfers control to the 128's built-in sprite editor. You exit the editor by pressing the return key in response to the Sprite Number prompt.)

Douglas Johnson  
Seminole, FL

**Exiting Quote mode**—The C-128's keyboard offers a handy way to escape from Quote mode—press the ESC key, then press C. To make this even easier, just redefine the f1 key:

```
KEY1,CHR$(27)+"C"
```

Bruce Jaeger  
St. Paul, MN

**More to print**—We're all familiar with embedding cursor controls and color changes inside Basic Print statements. As you use the 128, don't forget that now you can also print the bell sound (CTRL G), TAB (the tab key or CTRL I), and, in 80-column mode, Underline (CTRL B) and Flash (CTRL O). CHR\$(130) turns off underlining, while CHR\$(143) turns off flashing.

Sue Dohnim  
Otherna, ME

**PRINT@ in disguise**—While the main use described for the C-128's CHAR keyword is to print text on the graphics screens, the keyword can also be used to position the cursor in Text mode. Just make its first parameter a 0, and you have a ready-made PRINT@:

```
100 CHAR 0,10,20,"THIS IS AT POSITION 10,20"
```

Loura Grantham  
Bluegrass, KY

**Doodle and the 128**—If you have the popular Doodle program, it is extremely easy to load its pictures into the C-128. Just do this in Direct mode:

```
GRAPHIC 1 : BLOAD "doodlename", P7168
```

Bruce Jaeger  
St. Paul, MN

**C-128 sound box**—Here's an amazingly useful program for exercising the Play statement. After you run it, whatever key you press will be "played." If it's a note, you'll hear it. If it's something else, like the element for a half note or a sharp, you'll hear its effect when the next note is sounded. If you press an illegal key, you'll get an error message.

Since it works so quickly and simply, the program is ideal for exploring the differences between the various notes, lengths, octaves, tone envelopes and filter and volume settings. If you want to become a music expert, run it as you study pp. 276-277 of the *Commodore 128 System Guide*.

```
10 REM 128 SOUND BOX—LOUIS F. SANDER
20 TRAP30:GETKEYA$:PLAY"M"+A$:GOTO20
30 IFER = 30THENEND:ELSEPRINT"?:":RESUME20
```

Louis F. Sander  
Pittsburgh, PA

**Multi-voice bug avoidance**—Sometimes the second or third voice on the C-128 gets "lost," especially after other programs have used the voice registers. To ensure that your machine will make music or sound with all three voices, early in your program set each voice's volume and filter individually, like this:

```
10 PLAY "V1 U15 X0"
20 PLAY "V2 U15 X0"
30 PLAY "V3 U15 X0"
```

Jerry Kozak  
Kayell, MN

**Using C-64 utilities**—If you have some C-64 programmer's utility programs, many of their features may be usable on programs written for the C-128. Just save the C-128 program, then go to C-64 mode and activate your utility. Next, load the 128 program and operate on it in the usual way. Be careful, because the two computers handle some keywords differently, and the 64 list and screen editor routines don't know what to do with the new C-128 keywords.

Mary Haver  
Wood Islands, PEI  
Canada

**Renumber bug**—The Renumber command accurately handles all Goto statements and other references within program lines, except one. If your program contains a List command with line numbers after it, Renumber will miss it entirely. There's no error message and no renumbering, either.

Lucy S. Terrier  
Alton, IL

### 3. Computers—Plus/4 and C-16

**Plus/4 and C-16 organ**—Here's a rudimentary organ program for the new Basic 3.5.

```
10 VOL 8 : A = PEEK(198) : IF A = 64 THEN 10 : ELSE A = A*15 :
   SOUND 1,A,20 : SOUND 2,A,20 : GOTO 10
```

Jerry W. Jarvis  
Spokane, WA

**Plus/4 and C-16 Super Palette**—This program elegantly displays all the Basic 3.5 colors, at all luminance levels. Instructions appear in lines 3 and 4. When entering

C\$ in line 100, hold down the control (CTRL) key, then press each number key from 1-8. Release the control key and hold down the Commodore key, then press 1-8 again. You should end up with 16 reverse-field characters between the quotes.

```
1 REM SUPER PALETTE—LOUIS F. SANDER
2 REM
3 REM COLOR KEYS CHANGE BKGD COLOR
4 REM NUMBERS 0-7 CHANGE BKGD LUM
5 :
100 C$ = " - SEE TEXT - ":N$ = "01234567"
110 C = 2:GRAPHIC3,1:TRAP250
120 COLOR0,C:COLOR2,1:COLOR3,C:COLOR4,C
130 BOX3,0,0,10,23,0,1
140 CIRCLE2,4,10,3,8:PAINT2, + 0, + 1
150 SSHAPEA$,0,0,10,23
160 FORX = 0TO15:FORY = 0TO7:COLOR2,X + 1,7 - Y
170 GSHAPEA$(X*10),(Y*24),0
180 NEXT:PAINT3,159,199
190 GETKEYA$
200 FORJ = 1TO16
210 IFASC(A$) = ASC(MID$(C$,J))THENC = J
220 NEXT:FORJ = 1TO8
230 IFAS$ = MID$(N$,J,1)THENL = VAL(A$)
240 NEXT:COLOR3,C,L:COLOR4,C,L:GOTO190
250 COLOR0,2:COLOR1,1:GRAPHIC0
```

Louis F. Sander  
Pittsburgh, PA

**Plus/4 word processor tip**—I use a non-Commodore printer with my Plus/4, and I often want to use one of its special typefaces with the Plus/4's built-in word processor. Unfortunately, the word processor has only limited built-in means of accessing printer-special features, and my printer requires a complicated command string.

I solve the problem by executing the following simple program before entering the word processor.

```
10 OPEN 4,4 : CMD4
20 PRINT (Printer's code for accessing special typeface)
30 PRINT#4 : CLOSE4
```

The printer does not reset when the computer enters the word processor, so when I print out my document, it comes out in the typeface I selected above.

Chris Edgeworth  
Jasper, TX

**Plus/4 tab clear**—To clear a single tab in the Plus/4's built-in word processor, you put your cursor at the position in question, then simultaneously press the CTRL and = keys to clear only that tab. Because of an error in the manual, it took me six weeks of struggle to find this little secret.

Judy H. Maxwell  
Leawood, KS

**Plus/4 and C-16 easy saves**—Make your first program line

```
1 REM {SPACE} programname
```

Then you can save it by listing that line, putting the cursor on the 1 and pressing the f5 key. DSAVE" will overwrite the 1 REM {SPACE} and pressing the return key will save the program.

G. Bradford Tiffany  
Needham, MA

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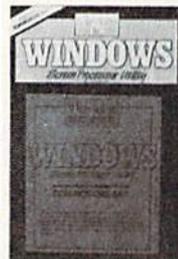
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**Plus/4 slow lister**—You can slow down all listing and printing on this machine by pressing ESC A before listing your program. This automatically puts the machine into Insert mode, which causes it to execute the Insert routine before it prints a line to the screen. Remember that ESC does not work like shift and CTRL—you press and release the escape key, then press A or whatever character follows it.

**Randy Thompson**  
Eugene, OR

**Plus/4 and C-16 tips**—To disable the stop key, enter POKE 806,103. Return to normal by entering POKE 806,101. Unlike the 64, all keys repeat on the new machines. To emulate the 64, with only cursor keys, insert/delete and space repeating, enter POKE 1344,0. Return to flying text by entering POKE 1344,128.

Empty the keyboard buffer with POKE 239,0. (The keyboard buffer is from 1319 to 1328.) Keypresses are detected at memory location 2038, much as they are in the C-64 and VIC in location 197. The values returned are generally the same as those for the 64. Run the following program and press some keys.

```
10 GETKEY A$ : PRINT A$
20 PRINT PEEK(2038) : GOTO 10
```

**Wayne Arnett**  
Chandler, AZ

**C-16 tips**—The Warm Start command is SYS 32768. This is similar to SYS 64738 on the C-64 and SYS 64802 on the VIC. When using the Else command, you must precede it with a colon. All in all, the Commodore 16 is a very nice little machine.

**Bob Underdown**  
Fayetteville, AR

**Plus/4 and C-16 graphics**—These machines have some wonderful graphics modes that have to be used to be believed. A minor inconvenience is that sometimes you get hung up in a non-text mode, with no obvious way out. I avoid the problem by using another wonderful Basic 3.5 feature—the easily programmable function keys. When I start to program with graphics, I just type KEY1, "GRAPHIC 0" + CHR\$(13) {return}. From then on, pressing the f1 key returns me to full Text mode.

**Scott Burg**  
Phoenix, AZ

**Plus/4 and C-16 screen titles**—With this trick, you can print your program title at the top of the screen and forget about it. It will stay there until you remove it with a SYS 55432 or by pressing the ESC key followed by the N key.

```
10 SYS 55432 : REM CLEAR SCREEN & SET NORMAL WINDOW
20 PRINT "Your title goes here"
30 SYS 56926 : REM SET SCREEN WINDOW BELOW TITLE
```

**Jerry W. Jarvis**  
Spokane, WA

**Plus/4 screen Pokes**—On the C-64, screen memory starts at 1024, and color memory starts at 55296. On the

new Plus/4, screen memory starts at 3072, and color memory starts at 2048. When converting C-64 programs to work on the Plus/4, just add 2048 to C-64 screen Poke locations and subtract 53248 from the C-64 color Poke locations. For example, on the C-64,

```
POKE 1524,1 (letter 'A' in center screen)
POKE 55796,2 (makes it red)
```

would convert to this on the Plus/4:

```
POKE 3572,1 (3572 = 1524 + 2048)
POKE 2548,2 (2548 = 55796 - 53248)
```

The screen map for the C-64 is on page 382 of the *Commodore 64 Programmer's Reference Guide*. The map for the Plus/4 is on page 199 of the user's manual that comes with the computer. [The Plus/4's luminance feature may make it necessary also to change the value Poked to color memory. Ed.]

**Kenneth H. Hottes**  
Danbury, CT

**Plus/4 calculated Goto**—Jump to any calculated line using this one-liner. To use it, set variable GL to the desired line number, then execute the following line. Please note that the routine changes the Data pointer.

```
1000 POKE 1281,105 : POKE 1282,141 : RESTORE GL :
      GL =USR(GL)
```

**Randy Thompson**  
Eugene, OR

## 4. Computers—SX-64

**SX-64 screen magnifier**—Stationery stores carry an 8 × 10-inch Fresnel magnifying lens that is a wonderful magnifier for the SX-64's tiny screen. I mount mine on the clips of a Radio Shack #64-2093 Helping Hands device, using a cardboard strip to protect the plastic. By adjusting the stand and clips, I obtain an enlarged screen to make computing with the SX-64 easier.

**Edward S. Wozniak**  
Oceanside, CA

**SX-64 video modulator**—You can modify a Texas Instruments modulator, available at many Radio Shack stores, to work with the SX-64 and your television set. Just open it up and replace R6 with a jumper. You may have to fine-tune it a little by adjusting the tuning capacitor. A little goes a long way when tuning it. To operate, the TI modulator requires +5 volts, which is available from several ports on the SX-64. See the printer-interface tricks for some suggestions.

**Normand Daoust**  
Address unknown

**SX-64 TV display**—The SX-64 lacks a built-in RF modulator. To display its video signal on a TV, you can avoid an external modulator if you have a video cassette recorder. Just plug the video output of the SX into the

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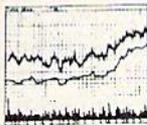
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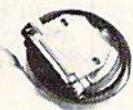
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D.L. Jassby  
Princeton, NJ

**SX-64 printer interface**—As most owners know, the SX-64 has no cassette port from which to pick up +5 volts for the popular Cardco +G printer interface. Not so many people know that on most printers with a Centronics interface, pin 18 of the printer connector is a source of +5 volts. That is the case on my Panasonic KX-P1091 printer, and I took advantage of it by making an easy modification to my Cardco.

I opened up the Cardco +G, cut the 5-volt power wire that went to the cassette connector and resoldered it to pin 18 of the printer connector. If you make this change, be careful. The power wire is white between the computer and the disk drive, but there it is often connected with a different colored wire to the interface. When you open the Cardco, the wire you want is connected to the + terminal of the capacitor. Mine was blue.

Also, be careful in locating pin 18. When you are facing the underside of the board, with the ribbon cable facing downward, pin 18 is the second one up on the second row from the left.

This arrangement has worked for over six months without any sort of problem. My Cardco warranty is probably void, but at least I'm able to use my printer.

T.V. Dinsmore  
Knoxville, TN

**SX-64 printer interface #2**—You can also pick up +5 volts from pin 7 of the joystick port, but that precludes using a dongle or joystick with your program. My ideal solution is to strip an old cartridge by cutting out everything except the connections to pins 2 and 3. Both these pins are connected to +5 volts inside the computer, and they make an ideal source of power for my interface.

Edward J. Pearce  
Peru, NY

**SX-64 disk tip**—Since a shifted run/stop on the SX-64 loads the first program on disk, I start each disk with the Menu program from Commodore's Disk Bonus Pack. That way, a single keypress gives me a complete list of programs on the disk.

Tony Grice  
Queensland, Australia

**SX-64 dual drives**—You can use an external 1541 or similar drive with your SX-64. The external drive must be configured as device #9, which can be done by making a simple internal hardware change. You can also change the device number through software, as described in the 1541 manual, but you must use a slightly magic technique.

First, connect the external drive and change the device numbers on both drives to 9. Then, without powering it down, disconnect the external drive from the serial bus and change the internal drive back to device 8. Reconnect the external drive, and you're all set for dual-drive operation.

David L. Hanna  
Winchester, KY

## 5. Computers—VIC-20

**VIC survival kit**—When Commodore discontinued the VIC-20, I stocked up on merchandise offered at low prices and ended up with a very useful, fully equipped system. Most of these items are still available new or used, and I'd encourage you to get them:

- A disk drive or a cassette deck with VIC Rabbit from Eastern House.
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Jim Goldfarb  
Poughkeepsie, NY

**New life for the VIC**—Here's a good way to use some of your VIC cartridges on your C-64, in a manner of speaking. The VIC-20 Programmer's Aid cartridge has some excellent utilities on it, the Renumber utility being one of the most useful. After writing a Basic program on the C-64, save it to disk or tape as you usually do. Now load the program into the VIC. (You may need extra memory if the program is a long one.) Next, activate the Programmer's Aid cartridge. You can use all its features, as long as you don't run the C-64 program on the VIC. When your editing is finished, resave the program and move it back to your C-64.

Try this trick with VICMON, too.

Murray Stockill  
Seattle, WA

**VIC extra memory**—The VIC has 512 extra nybbles of memory that you may not have noticed, and that may come in handy from time to time. There are enough color RAM locations (1024) for two text screens, even though few programs use more than one. There are 512 locations, from 37888 to 38399, that a program can use for storing information with Peeks and Pokes. But watch out, for they are only nybbles, not full bytes, and the four high-order bits contain ever-changing garbage.

You can only Poke numbers from 0-15, and, when you Peek them, you must add AND 15 to remove the garbage. You should also know that if you move the screen to a different place in memory or plug in an expansion cartridge, the computer may use these nybbles for character colors. In that case, the nybbles normally used for character colors will be free for you to use.

Brent Dubach  
Green Mountain Falls, CO

**VIC Super Expander disable**—Due to its many added commands, this popular plug-in restricts the variable names you can use in your programs. Moreover, programs that use the function keys will not run properly, if at all. You can deactivate the Super Expander's extra features, leaving its 3K of RAM expansion intact, by

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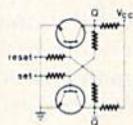
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entering SYS64818 after a reset or after turning on the computer. The technique also works if additional RAM expansion has been installed, but, of course, the 3K is not then available to Basic.

Daniel L. Scheftner  
Iwakuni, Japan

**VIC Super Expander disable #2**—A semi-permanent way to turn a Super Expander cartridge into a normal 3K memory cartridge is to use a piece of thin tape to insulate one of the connector pins. Hold the cartridge with the connector facing you, top side up, and tape over the 13th pin from the right. This disables block-five signals, which contain the Super Expander ROM.

Tim Shea  
Burlington, VT

## 6. Connectors and Cabling

**Connector overview**—When connecting external devices to your computer, you need special cables, which you can often make yourself if you have the right connectors. This trick describes the connectors used on Commodore machines and gives specific information on finding them in stores.

The round connectors used for power, video and disk/printer hookups are often called DIN connectors, after the German standards organization responsible for their design. Radio Shack carries most of the DIN connectors you will need for your Commodore. Other possible sources are audio stores and distributors of electronic parts.

Your control ports, used for joysticks and similar devices, and the C-128 RGBI video port require a standard connector known as the DB-9, made by many manufacturers. Radio Shack stocks the male and female versions of this connector, plus many associated accessories.

The television connector requires a very common plug known as a phono, or RCA plug, which is available in many variations at Radio Shack.

Your cassette and user ports require printed circuit-board edge connectors. Edge connectors are made in a huge variety of sizes and grades, so finding the right one is like looking for a needle in a haystack. The ones for your Commodore are for 1/16-inch-thick PC boards, with contacts on .156-inch centers. The user port takes a 12-position dual-sided connector, while the cassette port takes a 6-position single- or dual-sided one.

Neither of these are particularly common configurations, so they may be difficult to find. Any good parts house will be able to get them for you, however. They come in a variety of types, costing anywhere from \$2 to over \$10 (the cheaper ones are fine for your purposes). You'll probably want the kind with solder lugs rather than wire-wrap pins or other special terminals.

If possible, get polarizing keys for each connector to keep each one from being inserted upside down. The key fits into the slots cut between certain fingers on the PC board. If you can't find the exact connectors you need, you can often buy larger ones and cut them down with a hacksaw—messy, but it works!

Connectors for the expansion port are not readily

available in stores, and usually must be custom-made from PC-board stock. Many people get expansion port connectors by cannibalizing defunct cartridges.

Victor H. Pitre  
Pittsburgh, PA

**DIN defined**—Commodore's audio/video and serial ports use the well-known DIN connectors, but do you know what DIN stands for? Deutsches Institut für Normung is the German Institute for Standards, which sets industrial equipment specifications, some of which have been adopted by consumer electronics manufacturers.

Frank Biondi  
Mount Lebanon, PA

**DIN connectors**—There are two points of caution when making up cables with DIN connectors.

First, the standard DIN pin numbers are not what you might imagine. For example, depending on the number of pins in the connector, pin 1 may or may not be next to pin 2. The situation is so confusing that published diagrams are sometimes incorrect. (The ones in Commodore publications are all right. Look closely at them to see what we're talking about.)

The second confusing point is that published pinouts often don't say which end of which sex connector they are illustrating, so it's again unclear which pin is which. The Commodore manuals illustrate the solder terminal end of the male connector.

Tiny pin numbers are always molded into the insulator on the connector, so if your eyes are good and you're careful, you shouldn't have any trouble.

Louis F. Sander  
Pittsburgh, PA

**Power supply connector**—If you have a defective round power connector, it can easily be replaced. Switchcraft part #15GM7M will do the job for both the 4- and 7-pin connectors, and it's usually available through electronics distributors. Here are the proper connections:

Pin 2	Yellow Wire	- 5 volts dc
Pin 5	Red Wire	+ 5 volts dc
Pin 6	Black Wire	9 volts ac
Pin 7	White Wire	9 volts ac

Jerry Schauss  
Newburgh, IN

**Serial bus extenders**—Radio Shack sells all the parts needed to make extension cords for the Commodore serial bus. The cables you make can be male-male or male-female, depending on whether you want to use them by themselves or add length to existing cables. The male connector is #274-020, and the in-line female is #274-021. They sell for about \$1 each.

The wire for your cables can be cannibalized from the #276-1978 Joystick Extension Cord, available for under \$5. Remove the D-sub connectors from either end, and you're left with ten feet of thin, flexible nine-conductor cable.

When you make up your cables, be meticulously careful that you connect pin 1 to pin 1, pin 2 to pin 2, and so forth. It's easy to become confused, so I always double-check the tiny numbers molded into the body of the connector.

The joystick wire is not shielded, so your cables may increase the RF interference from your computer. There's also a chance that extra-long cables will cause timing problems on the bus. I've used two long, unshielded cables for several months, however, and I haven't had any problems.

Louis F. Sander  
Pittsburgh, PA

**User port connector**—Having trouble finding a 12/24-pin 0.156-inch spacing card-edge connector for your user port? This oddball size can be hard to find and expensive. A cheap substitute is to use a standard 22/44-pin connector, available for about \$1 from most surplus outlets.

Use a hacksaw to cut it in half after the 13th pin. (You need to leave an extra pin so the 12th one won't fall off.) Remove the redundant 13th pin, and you have a nice connector all ready to use. If you find it difficult to remove from the user port, glue some plastic handles onto the ends.

As an added bonus, you can cut a six-pin cassette port connector from the piece you sawed off the 22/44.

Rama Viswanathan  
Beloit, WI

**Connector protector**—If you make a cable for your user port, the 24 exposed pins on its edge connector can be easily shorted by metal objects sitting behind the computer. If you don't like to give disaster a chance to strike, cover the bare pins with the backshell from a 37-pin, D-style connector. Any backshell to which the connector attaches by screws, such as the Cannon DC 51214-1, should work. The cover not only protects the pins, but it provides a handle for inserting and removing the user-port connector.

Joel R. Robertson  
Bonaire, GA

**Edge connector protector**—If you don't use the cassette or user port connectors in the rear of your computer, there's the danger of something touching them and shorting them out. I protect mine with a piece of plastic spine from a clear report cover, readily available in stationery stores.

Cut the spine slightly narrower than the opening in the computer's case, so it won't slide sideways once in place. To remove the protective cover, press in on one end, and the other will pivot out.

Robert Lewis  
Decatur, IL

**Disaster prevention**—If you're charged with static electricity and touch one of the joystick ports, you can destroy an important chip inside. Since your video screen is powerfully charged with static, there's a disaster just waiting to happen.

If you put a piece of black electrical tape over the joystick ports, you will insulate them against all but the strongest static charges. The tape is undetectable, won't gum up the ports and can easily be removed when you need to plug in a joystick. It's an excellent safeguard for

your computer and your wallet, and I had to learn it the hard way.

Kenny Sumrall  
Sumrall, MS

**Making connections**—There are many sockets on the rear panel of any Commodore computer, and if you move your machine very often, you must continually match the cables with the proper sockets, while everything is out of sight behind the machine. The video and serial bus DIN connectors are very similar in appearance, which makes it difficult to distinguish between them.

I've used tape and a felt-tip marker to put connector identification labels on the top surface of my machine, just above the back panel. Now I can see where the cables belong, by just looking at the labels. With that information at hand, I can connect my cables by feel, without looking at the back panel, and with no fear of making a shocking mistake.

Kay Belle Joyner  
Fitz, IN

## 7. Datasette Recording

**Tape care tip**—When you get a new cassette, you should use the fast-forward and rewind keys to run it through your recorder from end to end. This will lessen the chance that your tape will jam and/or stretch when you are using it for something important.

Nicholas Ashworth  
Manchester, MI

**Timesaving saves**—You can make multiple copies of programs without having to babysit the computer. Just do something like this:

```
FOR J=1 TO 3 : SAVE "programname" : NEXT
```

You can use the same trick to verify the programs you have saved. If you'd like, you can put a simple sound routine after the NEXT, so your computer will tell you when it's finished.

Robert Korpowski  
Voorhees, NJ

**Loading from tape**—When your tape pauses after the Found message, you can end the pause by pressing the CTRL, Commodore or space keys. If you have a joystick plugged into port 1, you can do the same thing by pressing the fire-button.

Luis Daniel Martinez Calcano  
Caracas, Venezuela

**Selective load and run on tape**—To use the shifted run/stop key on a named program, type four spaces, then your program name in quotes. Move your cursor back to the start of the line, using cursor-lefts or a shifted return plus a cursor-up. When you press the shifted run/stop key, the selected program will automatically load and run.

Steve Hedemann  
Richfield, MN

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**Datassette audio**—If your C-64 or C-128 video monitor has sound capability, you can use it to listen to your Datassette tapes. Such listening is most informative and often helps diagnose difficulties with the tape system. To do the magic, enter POKE 54296,15 then turn your volume up to max. When you load, save or verify, you should hear the tape loud and clear.

Dan Kennedy  
Gearhart, OR

**Finding files on tape**—You can use an audio tape player to locate programs and datafiles on your cassettes. Just listen for the spaces between files and for the ten-second leader tone that signals the start of a new recording. If your player has the popular cue and review feature, you can use fast-forward and rewind to quickly locate these points.

Lon O'Bannon, III  
Address unknown

**Cassette directory**—You can get a printed directory of all the programs on your tape by doing this:

```
OPEN 4,4 : CMD 4  
LOAD"XXXXX"
```

If there is no file named XXXXX, the tape will run from end to end, with each file being listed to the printer as it is found.

Of course, you can use the same trick to get a listing on the screen—just eliminate the OPEN and CMD statements.

Danny Macpherson  
Medley, Alberta  
Canada

**Finding load addresses**—To find the start and end addresses of a program loaded from tape, print the following Peeks:

```
Start Address: PEEK (829) + 256*PEEK (830)  
End Address: PEEK (831) + 256*PEEK (832)
```

To find the program name, do this:

```
FOR J=833 TO J+15 : PRINT CHR$(PEEK(N)); : NEXT
```

For the C-128, use the same techniques, but instead of Peeking from 829 upward, start at 2817. For the C-16 and Plus/4, start at 821 [untested].

Stefan Linnenbank  
's-Hertogenbosch  
The Netherlands

**Direct tape reading**—When a program using cassette files is troubled with errors, it often helps to see what is recorded on the tape. This routine will display the data:

```
10 OPEN 1  
20 GET #1,A$  
30 PRINT A$ : GOTO20
```

To verify what is being written on the tape, use OPEN 1,3,1 instead of OPEN 1,1,1. This will output the data to the screen instead of the cassette. In either case, use the CTRL key to slow down the listing.

Max W. Kuypers  
Haugesund, Norway

**Tape counter trickery**—If your tape counter gets out of sync with your tape, you can easily locate your desired

program by first loading or verifying any program on the tape. That puts your tape at the start of the next program, whose normal starting number is the key to the trick. Let's call that number the current program's normal starting number, or CNSN. If your counter showed that number right now, you wouldn't have a problem. To get to the desired program, move your tape to the counter number determined by this formula, where DNSN is the desired program's normal starting number:

Desired Counter Reading = Present Reading + (DNSN - CNSN)

If the number happens to be negative, add 1000 to it. If it's over 1000, subtract 1000.

Norman K. Creter  
Cleveland, OH

**Controlling tape errors**—If you're working on a program and save it to tape several times with the same name, you could be asking for trouble. When you try to load it, the computer might find an old cut-off version under the same name and give you a Load error. You can usually find the "lost" beginning of your program, but it will take you several attempts. A better solution is to use a different name each time you save a version of the program.

Julie Rhodes  
Columbus, OH

**Bad cassette fix**—If you have a cassette that suddenly refuses to load, check the felt pressure pad inside the cassette that pushes the tape against the read head. As the adhesive ages, the pad can slip out of place, even while sitting in its box.

If your pressure pad is okay, you should clean and demagnetize your record/play head. Dirty or magnetized heads are by far the most common cause of unsatisfactory Datassette performance.

Ted Hering  
Redding, CA

**Tape jam cure**—If your tape gets jammed, there's a chance you can salvage it. Radio Shack sells cassette repair kits that include an empty cassette shell and instructions for loading it with your fouled tape. If the tape is not severely twisted, everything may be okay.

Charles Brogdon  
Dalton, GA

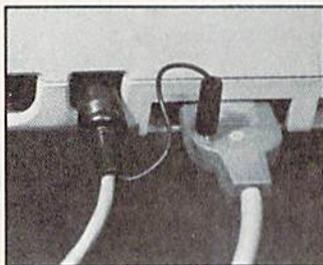
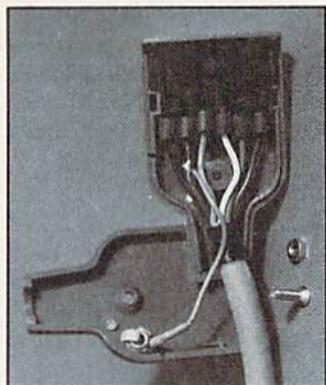
**Loading problem cassettes**—Sometimes a cassette program just won't load. Perhaps it was recorded commercially or on a friend's system, and the head alignments on the two recorders don't match.

When this happens to me, I patch two good-quality audio decks together and make a copy of the offending tape. While sometimes I have to experiment with volume levels, I've never yet failed to make a new tape that loads all right. Once it loads, of course, I make a new copy on my own Datassette.

Bruce Jaeger  
St. Paul, MN

**Better power takeoff**—To enhance your Datassette plug, open it up with a screwdriver and clip the ground

braided as short as possible. Use the space gained to install a trimmed-down submini phone jack (Radio Shack 274-292) in the upper shell. Connect the tip terminal of the jack to wire B-2 and leave the shaft terminal unconnected. You can then draw power for your printer interface with a submini plug such as Radio Shack's 274-291.



Albert W. Kuhfeld  
Minneapolis, MN

## 8. Disk Directories

**Selective directories**—If you want to get a directory of all files of a certain type, you can use one of the following commands.

LOAD"\$\* = P",8—loads PRG files only  
LOAD"\$\* = S",8—loads SEQ files only  
LOAD"\$\* = R",8—loads REL files only  
LOAD"\$\* = U",8—loads USR files only

David Lim  
Pasadena, CA

**Multi-selective directory**—It's well known that you can load a selective directory by using something like \$0:AB\*, which will load a directory of all disk files whose names begin with AB. It's less well-known that you can use \$0:AB\*,CD\* to get all those files whose names start with AB or CD.

You can make up to five selections at one time, and the trick works with or without the wedge. The entries for the different selections are not separated on your screen, but appear intermingled in the order in which they appear on the directory as a whole.

Lowell K. Unger  
Wynyard, Saskatchewan  
Canada

**Harmless disk directory**—Using the command Load"\$",8 loads the 1541 disk directory into memory, overwriting any program that may already be there. You can avoid the overwriting by using these Direct mode commands for the C-64 or VIC:

```
POKE 44,PEEK(46)+1
LOAD "$",8
LIST
```

When you want to return to your Basic program, just type:

```
POKE 46,PEEK(44)-1:POKE 44,8
```

Karen Guzowski  
South Burlington, VT

**Directory trouble**—I forgot to enter NEW after loading a disk directory, and after spending an hour typing in a program, I found I was in trouble. When the program was listed, the directory lines were interspersed with the program lines. Since the directory line "numbers," really the numbers of sectors, etc., were not in numerical sequence, they wouldn't erase in the usual way.

I solved the problem by renumbering the few program lines that were mixed in with the directory numbers and erasing the original program lines. When I relisted the program, all the directory lines appeared at the beginning, where they could easily be deleted by typing their numbers.

Richard L. Mitchell  
Lafayette, LA

**Directory printer**—This program loads and prints a disk directory, with no keyboard input from you.

```
100 PRINT " {SHIFT CLR}{3 CRSR DNs} LOAD" CHR$(34) "$"
    CHR$(34) ",8"
110 PRINT " {4 CRSR DNs} OPEN4,4:CMD4:LIST"
120 PRINT "PRINT#4:CLOSE4 {HOME}"
130 POKE 198,5 : FOR J=1 TO 5 : POKE 630+J,13 : NEXT : END
```

The above is for the C-64 and VIC only. For the C-128, change line 130 to read

```
130 POKE208,5: FOR J=1 TO 5: POKE 841+J,13 : NEXT : END
```

For the Plus/4 and C-16, change line 130 to

```
130 POKE 239,5 : FOR J=1 TO 5 : POKE 1398+J,13 : NEXT : END
```

Alan Sperling, Esq.  
Mount Lebanon, PA

**Printed disk directories**—If you set your printer on condensed pitch with a small line feed, the printed directories will be physically compact. These small printouts can be taped to the disk sleeve or put into a binder. On my Gemini printer, I do this:

```
LOAD"$",8
OPEN 4,4 : CMD4
PRINT CHR$(15) CHR$(27) CHR$(48)
LIST
PRINT#4 : CLOSE4
```

On the Commodore 1526 or MPS-802, you can get a similar effect by entering:

```
OPEN 6,4,6 : PRINT#6,CHR$(22) : CLOSE6
LOAD"$",8
OPEN 4,4 : CMD4 : LIST
PRINT#4 : CLOSE4
```

The characters won't be any smaller than normal, but the line spacing will be very tight.

George Hu  
Renton, WA

**Directories on non-CBM printers**—Users of non-Commodore printers may have trouble printing directory listings, since the reverse-field characters in the first line can be interpreted as printer-control characters. The way around the problem is to remove the reverse-field characters.

Loading the directory, then pressing zero and the return key will delete the problem line. But your listing will have no disk name. Alternatively, leave line 0 in the directory, but replace both quotes with apostrophes or some

other character, and then hit the return key. Your printed directory should turn out all right. If problems persist, you can retype line 0 without the quotes or reverse field, and enter the corrected line by pressing the return key.

Gary Fields  
Asheville, NC

**Disk names**—When naming disks, include the current date in the disk name. It will help you tell, for example, when you last did a backup.

Michael D. Daniels  
Broomfield, CO

**Disk names #2**—Put your own name or initials in the disk name, and it will always be easy to tell who owns it.

Tom Hartwig  
Address unknown

**Disk names #3**—Photo stores sell small, numbered adhesive dots for marking 35mm slides. They make good ID number labels for your disks and also provide good insurance against duplicate numbers.

Charles A. Wood  
Kemah, TX

**Disk names #4**—One way to get unique disk IDs without having to remember titles or write them down is to code the ID to the date. Using numbers and letters, let the first letter be the month, from 1 for January to 0 for October to B for December. Let the second be the date, using a similar code from 1 through T. If you format any reasonable number of disks in a year, you won't be troubled with duplicate IDs.

Edward T. Tanton  
Marietta, GA

**Disk names #5**—Some very odd results can be achieved by using shifted or Commodore-key characters in disk IDs. Many of them translate into Basic keywords.

Dennis C. Davis  
Gray, TN

**Renaming disks**—The 1541 New command is capable of more than most people think. The command

`N0:diskname.id`

completely formats a disk, giving it the name *diskname* and the ID *id*. If you use the abbreviated command

`N0:diskname`

on a previously formatted disk named *diskname*, you erase all files in the directory without doing the time-consuming complete reformatting process. But if you use the command

`N0:anothername`

you'll also rename the disk *anothername*. It will still have its original ID, but it most surely will have a brand-new name.

Charles Lavin  
Coral Gables, FL

**Naming programs**—I use a standard method for naming programs that involve a loader program. (These tend to be machine language programs that have a Basic loader

or Basic programs where one part is loaded by another.)

If I have a two-part chess game, I name the first part "CHESS" and the second part " CHESS". Note the space before the C in the second program name.

This way, it's easy to see which programs go together when viewing the disk menu or copying programs. As an added benefit, the second program name doesn't list on the C-64.MENU program that is included on many Commodore disks.

Dave Brown  
Wandering River, Alberta  
Canada

**Shifted spaces in filenames**—Things would be easier if all disk files had short names—like M1 instead of MONITOR.49152, for example. But how do you remember the meaning of M1? If you save or rename a file using a shifted space inside the name, you can use its left portion (before that shifted space) as a normal name, while the rest of it may be treated as a comment. If you save a program as

`"M1{shift space}MONITOR.49152"`

the directory will list it as

`"M1"MONITOR.49152`

From then on, you will be able to load it as "M1", and to perform all other disk operations using that abbreviated name. If you forget, just list the directory and see the whole name. Incidentally, the DOS still considers the entire name, so these two files can coexist with no problems:

`"M1"MONITOR.49152`

`"M1"MONITOR.51111`

This is not any convenience, however, since any command aimed at "M1" will affect only the one that appears first in the directory.

Carlos A.G. de Figueiredo  
Sao Paulo, Brazil

**Easy load filenames**—If you load programs by typing on top of a directory listed to the screen, the easy part is typing the word LOAD on top of the number of blocks to the left of the filename. It's somewhat harder to move the cursor past the filename in order to type ,8,1 or ,8: (either the ,1 or the colon removes the need to erase the PRG).

It is generally known that messages may be embedded to the right of the filename, just past the second question mark, by renaming the file and using a shifted space to separate the filename from the message. If we could put a ,8,1 message in the filename like that, we'd make it a lot easier to load the program from its directory listing. Unfortunately, the drive will not accept a comma when it renames a file.

But there is a way to put a comma there. Instead of using a comma, use a Commodore-D, the little block character that the D key makes when pressed with the Commodore key. The disk drive will accept this character, and the new directory will print it out as a comma!

For example, to embed the phrase ,8,1 after the filename MERLIN, just type the following.

```
OPEN 15,8,15 , "R:MERLIN{shift space}{COMD D}8{COMD D}
1 = MERLIN" : CLOSE 15
```

To put a colon in the filename, use the shifted @.

Doug Ferguson  
Elida, OH

**Encrypted filenames**—You can make it difficult for others to load your secret programs by using unorthodox dummy characters to start their names. It doesn't matter which characters you use, and you don't even have to remember them, since your loading method will decrypt them automatically.

What's important is to use the same number of dummy characters each time—perhaps something in the range of 3–5. The best characters to use are those in the ranges CHR\$(0) to CHR\$(31) and CHR\$(128) to CHR\$(159). Also try CHR\$(20), the delete character, which really confuses directory listings. A good example is:

```
SAVE CHR$(143)+CHR$(20)+"REAL NAME",8
```

The secret to loading such programs is to use the question mark wild-card character. If you use four dummies in naming the file, use four question marks in loading it. If you used three, use three, and so on. In our example, you would use:

```
LOAD "??REAL NAME",8
```

Cornelius Vanderbilt  
New York, NY

**Program load lock**—If you save a program to disk using

```
SAVE "programname" + CHR$(34),8
```

it will appear in the directory like any other program named "programname." However, it can't be loaded unless you use the "programname" + CHR\$(34) format. The result—nobody but you can load it!

Gary Wilson  
Anthon, IA

**Comma files on disk**—When experimenting with disk files, simple program errors often cause difficulties with filenames. Sometimes, a file named "," pops up, which resists all efforts to be killed or renamed. When this happens, just search your directory for any other files with single-character names, then give them longer ones.

When the comma file is the only single-character name on the disk, it can be scratched or renamed by using the filename "?". The wild-card character (the ?) will match the comma and allow you to do as you wish. After the comma file has been disposed of, you can give the others their original one-character names.

Craig Brookes  
Joondanna, Western Australia

## 9. Disk Handling and Storage

**Disk-handling tip**—Everyone knows it's a bad idea to touch the surface of a floppy disk or to allow it to become contaminated in any way. But not everyone realizes that the *bottom* of the disk is the side that's actually written on.

So, if you spill coffee on a disk, you might not have any problems. But if you lay it on a wet or dirty desktop, you may be asking for trouble.

Louis F. Sander  
Pittsburgh, PA

**Magnetic fields**—We've all heard about the danger of storing your disks close to the monitor or TV. Possible magnetism could wipe out your whole library. If you worry about this sort of thing, place a small magnetic compass between the set and the proposed location of the disk box. If the magnetic field is dangerous to the disks, the needle will swing whenever it's in the field.

Jim Stephens  
Nashville, TN

**Dry disk storage**—High humidity can cause loading problems when the felt inside your disk becomes slightly damp. You can reduce the problem by storing your disks with a desiccant capsule, such as those packed with vitamin pills. If you don't use vitamins, ask your druggist to give you a desiccant capsule.

Judith C. Fiore  
Cleveland Heights, OH

**But not too dry**—Very low humidity can also be a problem, because it may promote static electricity, which can attract dust and even rearrange data on a disk. If low humidity is a problem, you can install a humidifier. [But see Beware of Humidifiers, in the Computer Room Hints section.—Ed.]

Ray Berg  
Calumet City, IL

**Disk carrier**—The Rubbermaid No. 3871 five-cup Square Servin' Saver, available in most discount stores, makes an excellent storage box for disks. It is water- and dust-tight and will hold up to 25 disks. I bought mine for 99 cents.

Marty Amarin  
Iowa City, IA

**Disk archives**—A compulsory part of anyone's disk library is the file of backup disks. For my own backup file, I used brand-new disks, appropriately named and write-protected and sealed in zip-lock sandwich bags to guard against dust and moisture. These are then put in a plastic disk box and stored in a linen cupboard, far away from magnetic fields of any sort.

Jim Lynch  
Antigua, West Indies

**Disk labels**—To give my disks individuality and character, I remove the manufacturer's label from the upper-left corner, then hunt through magazines and other literature for suitable material to cut out and paste in its place. It's amazing what can be found to make your disks distinctive and easy to find in a file.

Ken Williams  
Wahroonga, NSW  
Australia

**Disk labels #2**—For easy identification of disks, use colored strips of electrical tape. Use different colors for each type: blue = games, red = utilities, and so on.

David Barrowman  
St. John's, Newfoundland  
Canada

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**Disk labels #3**—Color-coded file-folder labels work well as disk labels, but are hard to remove. To make removal easier, apply a 4-inch length of Scotch Magic Mending Tape to the disk, then apply the file-folder label to the tape.

Stanley Beck  
Chalmette, LA

**Disk labels #4**—I use sticky-back shelf paper, available in a variety of colors. The shiny ones accept printing from my Okimate printer.

David F. Hiestad  
Seattle, WA

**Disk labels #5**—To label my disks, I use the silver or gold markers available in office supply stores for about \$2. The ink is like paint, and I write directly onto the disk jacket.

David J. Todeschini  
Richmond Hill, NY

**Disk labels #6**—To more readily identify different categories of disks, place the labels in different positions across the top of the disk. This helps you organize and find them.

If there's not enough room on the label, put another label on the back of the disk. That's where I record special instructions such as printer and interface settings.

Karl Thurber  
Millbrook, AL

**Inexpensive disk mailers**—To make my own disk mailers, I cut two squares of corrugated cardboard slightly larger than a disk and its envelope. Then I put the disk between them, making sure the corrugations on the two pieces run at right angles to each other. When I tape the four corners, the resulting sandwich is strong, light and compact, and can be mailed in any envelope large enough to hold it. Photographers have used this method for years, and their valuable prints are seldom damaged in the mails.

Alan Sperling, Esq.  
Mount Lebanon, PA

**Disk mailer**—Having trouble with disks getting bent in the mail? Get a six-inch square of styrofoam insulation about one inch thick, put your disk on top of it and wrap it in brown paper. The package is bend-resistant beyond belief, and the styrofoam is so light that it doesn't add to the cost of the postage.

Brian Gasperich  
Houghton, MI

run a program from disk with the fewest typing strokes. Just type:

```
{CLR}{4 SPACES} "filename",8: {HOME}{SHFT RUN/STOP}
```

The program comes up running.

John K. Newell  
San Antonio, TX

**Loading "\*"**—When you enter LOAD"\*",8 with your Commodore disk drive, you don't always get the first program on the disk. Usually, in fact, you get the last program you've accessed. To fix this, just insert a colon in front of the asterisk:

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

This gives you the first program every time.

Brian Kennedy  
Colorado Springs, CO

**Estimating program lines**—It's useful to be able to estimate the number of lines in a program when you have to print out a listing. Depending on a program's compactness, each disk block holds about 8-10 lines. Therefore, a program that occupies 30 disk blocks probably has 240-300 lines, or about five pages.

Peter T. Crosby  
Claremont, NH

**Disk copying tip**—When making a copy of disks, using the programs that require switching source and destination disks, it is a good idea to put a write-protect tab over the window of the source disk. It provides extra protection against accidental erasing of the source material.

Larry Thomas  
Hooks, TX

**Disk-save command quirks**—If you type

```
SAVE"PROGRAM",8
```

you will get "PROGRAM" PRG in the disk directory. If you type

```
SAVE"PROGRAM,S",8
```

the directory will show "PROGRAM" SEQ, and the program won't load unless you enter LOAD"PROGRAM,S". If you save it as "PROGRAM,U", it will similarly show up as "PROGRAM" USR in the directory, and must be loaded as "PROGRAM,U".

You can use these quirks in several ways. If, for instance, you save a program whose name ends in ".S", you give it a modest amount of security from being loaded by others. Only those in the know would think of trying to load what appears to be a SEQ file. Or, if you make it a habit to end machine language program names with ".U", the USR in the directory will be your clue that they must be loaded with ,8,1 or BLOAD on the C-128. The clue is a good one, since Radio Shack and some other computers reserve the USR designation for machine language files.

Eddie Lyons  
Bronxville, NY

## 10. Disk Operations

**Disk load and run**—If your shifted run/stop key loads and runs programs from tape, here's a way to load and

**Appending to files**—There is a command that can be used on the 1541 disk drive to add data onto an existing sequential file.

The A stands for append; for some reason, this command is not in the owner's manual for the 1541.

**Keith Marshall**  
San Juan, Trinidad

**Commodore 1571 caveat**—The new 1571 disk drive has many marvelous features, not the least of which is its ability to write on both sides of the disk. But if you've been notching your floppies for two-sided recording on a single-sided drive, be careful. When you use the 1571 to reformat those disks (or any others), it will automatically reformat both sides, even if you've write-protected your extra notch. If you aren't aware of that aspect of double-sided recording, you could unexpectedly wipe out a flip side.

**William W. Weaver**  
Saxton, PA

**2040/4040 disk drives**—If you use one of these units, you may have trouble loading software written for the 1541, even though the disk formats are compatible. It sometimes helps if you put the 1541 disk in drive 0 and put another formatted disk in drive 1. If the program still doesn't load, it's because the manufacturer used a protection scheme that depends on the frailties of the 1541 drive.

**Bruce Jaeger**  
St. Paul, MN

**Disk error light**—If your disk drive's red light starts blinking, some sort of disk error has occurred. If you have a C-128, Plus/4 or C-16, type PRINT DS\${return}. If you have the wedge in memory, type @ {return} to find out what type of error occurred. Otherwise, enter and run the following line.

```
10 OPEN 15,8,15 : INPUT#15,A$,B$,C$,D$ : PRINT A$,B$,C$,D$ :  
CLOSE 15 : END
```

You cannot enter this in Direct mode, because the Input# statement is only valid in a program. You can use any line number you want, and there's no reason to destroy any program you already have in memory. Merely enter the line with an unused number XXX, then type RUN XXX {return}. Delete XXX after it's done its work.

The message you get will consist of an error code, error name and the track and sector on which the error occurred. Often the error name is enough to tell what happened, but the error code can be helpful, too. Your 1541 operator's manual includes a most informative listing of error codes.

**Mark Blayney**  
Darwin, Northwest Territory  
Australia

**Disk hang-up fix**—Sometimes disk drives, especially the older ones, seem to disregard your commands from the keyboard. When this happens, try simultaneously pressing the run/stop and restore keys. Chances are, the hang-up will end immediately.

**Eric Haver**  
Pittsburgh, PA

**Disk doctor**—Do you have a disk that absolutely will not format properly? Try erasing it with a bulk eraser of the kind used to erase magnetic tapes. I have used this trick to reclaim several disks of the bargain variety.

During this process, be sure to keep the disk in its protective envelope to lessen the possibility of contaminating it. Don't worry—the magnetic field will go right through the protective envelope.

**Scott Bouslog**  
Muncie, IN

## 11. Hardware—General Hints & Tips

**Equipment turn-on sequence**—Much has been written about the proper order in which to turn your computer and peripherals on and off. All sorts of disk hangups and printer problems are involved, and it's difficult to find the best turn-on sequence for every situation.

I struggled with these problems for years before discovering that if a reset button is connected to the serial bus, turn-on sequence doesn't matter. If you turn everything on, then press your reset button, the problems magically disappear. Apparently, the reset button causes the serial bus to normalize all the peripherals, regardless of when they have been turned on. This interesting experience represents one more reason to install a reset button on your computer.

**Karl T. Thurber, Jr.**  
Millbrook, AL

**Travel tips**—When you travel with your computer, always take along a good extension cord and a three-prong adapter for the ac wall socket. It's not a bad idea to take a multi-socket power strip, either, just in case you run out of outlets.

**R.W.P. Patterson**  
Stone Mountain, GA

**Burning in**—A fact of life in modern electronics is that if a newly assembled piece of equipment is going to fail, it will likely do so very early in its operating life. A common practice to ensure future reliability is to "burn in" new equipment—that is, to leave it powered up for some period after initial assembly and testing and to check whether it continues to function normally.

Whenever you get a new piece of equipment, it's a good practice to burn it in yourself. Leave it energized around the clock for the first week or so that you own it. It doesn't have to be doing anything; it just needs to be turned on. Of course, you should use it from time to time, just to be sure it's still functioning correctly. If something is going to fail, it will likely fail during this burn-in period. Burning-in has three main advantages to you.

First, you will have put on enough hours during the warranty period to decrease the likelihood of later failure. Second, you will have done so soon enough after purchase that you can take your unit back to the retailer, rather than sending it to Commodore or a service center. Third, you will have a reasonable degree of confidence in the reliability of your computer.

**Greg Kundert**  
Detroit Lakes, MN

**Contact cleaning**—Have you ever had a train set where the train goes dead in the middle of a piece of track? Train hobbyists know that's an indication the track needs cleaning.

Similar problems occur with computers that use plug-in cartridges and other peripherals. Usually what needs cleaning is the brass fingers on the printed circuit board that plugs into the female edge connector. (The female edge connectors themselves are made to be self-cleaning and highly reliable. They are also very delicate, so you should keep your fingers out of them.)

A pencil eraser is a very good tool for cleaning these brass or solder-covered fingers.

**Tim Thompson**  
Boston, MA

**Keyboard maintenance**—I ended up with some orange juice in my C-64 keyboard, and the keys stuck down like they were glued. Since I had been playing adventure games (thereby building courage, character and other powerful attributes), I decided to clean it up myself. It was easy.

Three screws get you into the 64. To remove the top assembly, you must unplug two connectors—one to the LED power light and the other to the keyboard. Just pay attention to which end is which and work with a gentle touch, and you'll have no trouble taking them off or putting them back on.

Take out all the little screws, and the keyboard assembly will come off. You need to de-solder or cut one wire to the shift-lock key. You can solder it back on when you're done, or just live without shift lock in the future.

Use alcohol and a paper towel to gently wipe off the printed circuit board inside the keyboard. Be careful not to put too much pressure on the membrane that the keys touch. I put the keyboard in the sink and washed it with soap and water, then dried it with a hair drier set on low heat.

When you're finished cleaning your keyboard, reverse the disassembly process, and everything should be as good as new.

**James Roberts**  
Central Valley, CA

## 12. Joystick Port Peripherals

**Non-Commodore joysticks**—Atari or Coleco joysticks will work just fine with your Commodore computer, as will many other brands. If in doubt, try them out.

**William Saunoris**  
Mokena, IL

**Joystick identifiers**—The cords on my two joysticks are always getting tangled, so I don't know which one is which. I solved the problem by putting two pieces of masking tape on one of the joystick cables—one at the connector end and the other up near the joystick.

**Mick Barrowman**  
St. John's, Newfoundland  
Canada

**Fix stix**—When your joystick stops working, it's likely  
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you can fix it yourself. Just open it up and make sure all the connections are sound and that everything is lined up mechanically. It's surprising how often you can see and fix the problem.

**Joe Buckshaw**  
Holbrook, NY

**Cable repairs**—If your Atari 2600 joystick cable is defective, you can buy a replacement for less than the cost of a new joystick. You can replace it yourself if you keep careful notes on which colored wire goes where. Be careful not to lose the fire-button spring.

**Jim Smith**  
Bowling Green, KY

**Fire-button fix**—If your joystick's fire-button is ready for the big arcade in the sky, you might be able to give it a new lease on life. Try replacing the fire-button spring with a section of spring from an inexpensive ballpoint pen.

**Phil Dietz**  
Omaha, NE

**Left-handed joysticks**—The standard Atari joystick has its fire-button on the left side, making it inconvenient for left-handers to reach. By making some easy wiring changes, you can make the joystick suitable for lefties.

Remove the screws from the bottom of your joystick and observe the six wires attached to the unit by removable connectors. The original wiring follows the order: brown, white, black, blue, green, orange. To get the "lefty" modification, rearrange the order as follows: blue, brown, black, green, white, orange. Notice that the connectors are very easy to change and that you have to move only four wires.

When you've made the changes and screwed the joystick shut, just turn the lefty joystick so the fire-button is on the right side.

**Al Degutis**  
Chicago, IL

**Which port?**—By adding this subroutine to your C-64 programs, you will be able to use your joystick in either port. Pressing the fire-button will tell the computer which port the joystick is using.

```
10 PRINT "PRESS FIREBUTTON TO START..."
20 IF (PEEK (56320) AND 16) < > 16 THEN PO = 56320 : GOTO 50
30 IF (PEEK (56321) AND 16) < > 16 THEN PO = 56321 : GOTO 50
40 GOTO 20
50 Rest of program starts here
```

**Alexei Gilchrist**  
Rotorua, New Zealand

**Reading the joystick**—Some books do not give clear examples of how to read a joystick. They provide a long program to do a difficult job that you care nothing about for the time being. After a lot of frustration, I wrote this simple program for reading a joystick in port 2. To read port 1, set PO = 56321 instead of 56320.

```
100 PO = 56320
110 H = ((PEEK(PO)AND4) = 0) - ((PEEK(PO)AND8) = 0)
120 V = ((PEEK(PO)AND1) = 0) - ((PEEK(PO)AND2) = 0)
```



Listing continued.

```
130 B = ((PEEK(PO)AND16)=0)
140 IF H = 1 THEN PRINT "RIGHT"
150 IF H = -1 THEN PRINT "LEFT"
160 IF V = 1 THEN PRINT "DOWN"
170 IF V = -1 THEN PRINT "UP"
180 IF B THEN PRINT "BANG!"
190 GOTO 100
```

Terry Zembruski  
Address unknown

**Paddle improvements**—When using paddles from the Atari 2600 game system, it is possible to reduce jitter and optimize the range of the paddle by connecting a 1 megohm trimmer (Radio Shack #271-229) in parallel with the paddle potentiometer.

Using the program below, with the paddles in port 1, turn the paddle clockwise until it stops, then adjust the trimmer so the value on the screen is 254. Repeat for the second paddle.

```
10 PRINT "{SHFT CLR}";PEEK(54297),PEEK(54298) : GOTO 10
```

C.F.  
Throop, PA

**Better paddle Peeking**—There is a misconception that paddles cannot be reliably read from Basic on the C-64. But it's easy to do, if you disable the keyboard while you're reading them. This line will do the trick for paddles plugged into port 1. For port 2, change the 64 to 128.

```
10 POKE 56334,0 : POKE 56320,64 : X = PEEK(54297) :
Y = PEEK(54298) : POKE 56334,1
```

Andrew Bedno  
Chicago, IL

**KoalaPad tip**—If you have the KoalaPainter, you've probably discovered that you can't save both screens. However, you can load both screens. Here's how.

Load one screen normally, then use the Swap option. Load again using any other picture. Now both pictures are in place, and the push of a button will swap the screens back and forth. This is handy for comparisons and should work on any Koala cartridge that has the Swap command.

L.K. Simmons  
Riverside, CA

**KoalaPad programming**—Many people have the KoalaPad, but never use it except for drawing pictures. This fine peripheral can be used for many other purposes and looks like a game paddle when plugged into the computer. To read the X-Y coordinates of the stylus when your pad is in port 1, simply Peek locations 54297 and 54298.

Marvin Green  
Corvallis, OR

**KoalaPad buttons**—By Peeking memory location 197 on the C-64, you can tell if the KoalaPad's buttons have been pressed. The result will be 59 when the right button is down and 50 when the left button is down. Other numbers mean no Koala button is down.

Randy Batt  
Haysville, KS

**Lazy light pens**—Before you give up on your light pen, try cleaning your TV screen with an antistatic cloth. It keeps dust from collecting on the screen and keeps the screen from zapping your pen. My light pen improved dramatically after this treatment.

Unknown contributor

**Light pen checkout**—Some inexpensive light pens give inadequate resolution along the X-axis of the screen display. The program below Peeks the contents of the light pen registers. Even though the pen may be perfectly still on the screen, some pens show a variation of as many as five units in successive samples of the X position.

To test your own light pen, plug it into port 1. Run the program and try to read the Xs with your pen.

```
10 PRINT PEEK(53267),PEEK(53268), "X.X.X.X.X.X.X.X"
20 FOR J = 1 TO 500 : NEXT : GOTO 10
```

Fred Jestaedt  
Mitchellville, MD

## 13. Keyboards and Keyboarding

**Read the key labels**—The labels on your keys will tell you what they do. The so-called CLR/Home key moves the cursor home when unshifted, but clears the screen when shifted. The clue to that fact is that Home is below CLR on the keybutton label. Other keys work similarly, for example run/stop and INST/DEL. By the way, the proper name for that key is *Insert/Delete*, not *Instant/Delete*.

Louis F. Sander  
Pittsburgh, PA

**Special keys**—Everyone is familiar with the shift key on a typewriter—it shifts the mechanism only while it is depressed. The idea is to push shift before pressing any other keys, and to release it only when you're finished with it. On your computer, the SHIFT, CTRL (or Control) and Commodore Logo keys all work in just that way. Be sure they are pressed before and during your activity with the other keys involved.

If your computer has an ESC (or escape) key, you should be aware that it does *not* work in the same way. You must *press and release* ESC before pressing the other key or keys involved.

Louis F. Sander  
Pittsburgh, PA

**Touch assistance**—Touch-typists sometimes have difficulty placing the fingers on the home keys without looking at the keyboard. I have found that putting small pieces of cellophane tape on the F and J keys makes it very easy to find them. Others have used clear nail polish or Elmer's glue. The idea is to find something that makes the key feel slightly different, but that can be easily removed in the future.

Mark Bersalona  
Philadelphia, PA

**Keyboard overlays**—When using complex programs like Easy Script and Simons' Basic, the function keys, and usually others, have many hard-to-remember purposes. Cardboard overlays for your keyboard can make it easier to use these programs.

Get pieces of thin cardboard from a stationery store or shirt laundry, then measure the dimensions of your computer and its keyboard area. Cut the cardboard to fit your computer, then cut out places for the keyboard areas. When you put the overlay in place, your keys will be surrounded by cardboard on which you can write the instructions appropriate to your program. If you own several complex programs, it's easy to make an overlay for each.

Mary D. Brigito  
Old Forge, NY

**Better overlays**—I use Scotch Post-It notes to label my function keys. The 3½- × 5-inch size is best, but several sizes are available. If you prefer cardboard overlays with cutouts, try the omnipresent 3- × 5-inch index cards.

Jerry Rush  
Address unknown

**Basic abbreviations**—You can fit many statements onto one program line by using the abbreviations in the appendix to your user's manual. When the line is listed, the keywords are printed out in full, so your program line might take up more than the usual number of screen lines.

This is no problem, but if you try to edit the long line, your computer will cut it down to normal program line size. So use abbreviations to pack the statements into a line, but be very careful when editing it later.

And speaking of abbreviations, please remember that you cannot use a question mark in abbreviating the Print# command. The correct abbreviation for Print# is P{shift R}, which Basic stores as token number 152.

If you try to abbreviate PRINT# as ?#, it will be tokenized as 153 (the token for Print), followed by 35 (the token for #). That will give you a Syntax error instead of a Print#.

Debbie Billeter  
Phoenixville, PA

**Direct mode colons**—In Direct mode, colons can be used in entering several commands on one line. It saves time, as you don't have to wait for the execution of individual commands. For example:

```
OPEN15,8,15:PRINT#15:"S:TEST":CLOSE 15:LOAD "$,8:LIST
```

This one line tells the computer to open the disk command channel, scratch the file named "TEST", load the directory, then list it. You can save even more time by abbreviating the keywords.

Pat Fenceroy  
Dallas, TX

**Type it anywhere**—When using commands such as RUN, LIST and CONT in the Direct mode, it is not necessary to type them starting in the left-most margin. They can be entered anywhere on a line by themselves.

In fact, any line can be entered in that way. Not only that, but the cursor's position doesn't matter, either. As

long as it's on the same screen line as part of what you're entering, you can press the return key, and your line will be entered perfectly. Try it—it works!

R.V. Taylor  
Little Rock, AR

**Editing in color**—When editing a listing on the screen, it makes things easier if you change the color of your cursor before making your edits. If the listing is in blue on blue, for example, press CTRL 2 to change the cursor to white, then make your corrections. The changes will stand out on the screen, making it easy to see the results of your work.

Meredith Jones Frummer  
Riverdale, NY

**Quote mode**—Commodore computers go into the so-called Quote mode whenever an odd number of quotation marks have been typed. In Quote mode, cursor and color keys do not have their normal effect, but instead print reverse-field characters to the screen. When included in Print statements, those reverse-field characters translate back into the keystrokes that created them. It's all very useful; if you don't understand it too well, experiment until you do.

There's another way to get into Quote mode: When the insert key is used to open up spaces in a line, those spaces behave as though they are in Quote mode. That knowledge is useful if, for example, you need to insert a cursor control into an existing Print statement.

It's often desirable to get out of Quote mode, but the means to do so are not always obvious. You can try the following.

- Type another quotation mark. (You can then delete it, if you'd like.) This doesn't always work on inserted spaces.
- Press the return key. This, of course, enters your line into the computer, which may or may not be what you want.
- Press the shift and return keys together. This does not enter your line into the computer.
- Use an escape sequence. On the C-128, use ESC C. On the Plus/4 and C-16, use ESC O.
- For inserted spaces only, use your space bar to move over the inserted spaces.

Cindy de Roulhac  
Pittsburgh, PA

**Disaster relief**—Have you ever typed over a program line by mistake, then changed your mind before entering it? If so, you're familiar with the panic that sets in when you try to remember what the line looked like before you ruined it.

In this case, relief is spelled s-h-i-f-t-e-d r-e-t-u-r-n. Simultaneously press the shift and return keys, then list the line again. You'll see it in its original form.

Mike Whittingham  
Fanwood, NJ

**Reclaiming erased programs**—If you accidentally erase a program from memory when using the New command, there's an easy way to reenter it without retyping, if the program is still listed on the screen. Just move your cursor onto any part of the first line, then press the return key. Repeat the process for the other lines on the screen

(except for NEW), and your program will be reclaimed (prove the fact by listing the program). The trick works well for the short programs that beginners practice on, since many of them can be listed in less than a whole screen.

**Douglas Shepherd**  
Addis Ababa, Ethiopia

**Combining two lines**—It's easy to combine two program lines into one, if they're both short enough, and if you know the magic. Here it is:

1. List the higher-numbered line onto the screen.
2. Type spaces over its line number, then insert spaces until the text stops moving.
3. Press shifted return, then move the cursor up to your original List command.
4. Change the line number in the program listing to the number of the other line you're interested in (the lower-numbered of the two).
5. Press the return key to list the line. The two lines will now be together, with spaces between them.
6. Delete these extra spaces, and put a colon between the two former lines.
7. Press the return key to enter your new line.
8. Delete the former second line, which is, of course, still in memory.

This trick will only work if the total length of the two lines is less than the maximum length allowed by your computer's screen editor (80, 88 or 160, depending on your computer). Some space can be gained by abbreviating commands on the bottom line before listing the top line.

**Richard D. Stueven**  
Lincoln, NE

**Escape literature**—Many printers require the ASCII escape character, CHR\$(27), to be sent as part of various control sequences. Some Commodore computers don't have an escape key, and there's nothing in the documentation to show how one can be rigged. Fortunately, the matter is easily resolved, since pressing {CTRL : } generates an escape character.

If the computer is in Quote mode, a reverse-field left bracket will come up on the screen, and when that character is printed, the escape code will be sent. If your printer is open to file #4, an escape can be sent to it by entering:

```
PRINT #4,"{CTRL : }"
```

Of course, {CTRL : } means to hold down the control key, then hit the colon.

**Mrs. Deane Maddocks**  
Glenwood, IA

**Generating CTRL characters**—Sometimes, especially when working with printers or telecommunications, it is required to generate a CTRL S or other similar character. While the CTRL characters are very common in the computer world, Commodore computerists don't see them too often.

The CTRL characters are CHR\$(0) through CHR\$(31), and in the standard non-Commodore ASCII nomenclature, each one has a name, albeit a cryptic one. On non-

Commodore computers, these characters are generated by pressing CTRL and another key.

Many Commodore computers can generate these characters in the same way, as illustrated in the table below. Several of the characters have their own Commodore meanings; some can also be generated by other keys and some cannot be generated as shown, depending on which Commodore machine you're using. However, by and large, the table is accurate for Commodore use, and you should try it when you need to send a CTRL character.

NAME	KEY	CHR\$	HEX
NUL	= CTRL @	= 0	\$00
SOH	= CTRL A	= 1	\$01
STX	= CTRL B	= 2	\$02
ETX	= CTRL C	= 3	\$03
EOT	= CTRL D	= 4	\$04
ENQ	= CTRL E	= 5	\$05
ACK	= CTRL F	= 6	\$06
BEL	= CTRL G	= 7	\$07
BS	= CTRL H	= 8	\$08
HT	= CTRL I	= 9	\$09
LF	= CTRL J	= 10	\$0A
VT	= CTRL K	= 11	\$0B
FF	= CTRL L	= 12	\$0C
CR	= CTRL M	= 13	\$0D
SO	= CTRL N	= 14	\$0E
SI	= CTRL O	= 15	\$0F
DLE	= CTRL P	= 16	\$10
DC1	= CTRL Q	= 17	\$11
DC2	= CTRL R	= 18	\$12
DC3	= CTRL S	= 19	\$13
DC4	= CTRL T	= 20	\$14
NAK	= CTRL U	= 21	\$15
SYN	= CTRL V	= 22	\$16
ETB	= CTRL W	= 23	\$17
CAN	= CTRL X	= 24	\$18
EM	= CTRL Y	= 25	\$19
SUB	= CTRL Z	= 26	\$1A
ESC	= CTRL :	= 27	\$1B
FS	= CTRL 3	= 28	\$1C
GS	= CTRL ;	= 29	\$1D
RS	= CTRL 6	= 30	\$1E
US	= CTRL 7	= 31	\$1F

**Tim Johnson**  
Houston, TX

**CTRL character tips**—Sometimes when a program has finished, the shift/Commodore keys are still disabled, so you can't change character sets. The easy way to enable them again is to type CTRL I. This is a shorthand way of printing CHR\$(9), which enables character set changes.

Also, instead of using CTRL RVS, try using CTRL R. It has the same effect and is a lot easier to reach.

**Stephen Shapiro**  
Portland, ME

**Program indentation**—If you've ever tried to indent your program lines to clarify program structures like For...Next, you've seen that Basic removes all leading spaces. You can override this by entering POKE 129,1. That little Poke causes the C-64 or VIC to remove CHR\$(1)'s instead of spaces!

The trick works in Program mode, but it affects Direct mode, too, because it prevents you from using spaces inside your commands. If you use them, you'll get a Syntax error. To return things to normal, enter POKE 129,32.

You can have more fun with this by Poking other

character strings into 129. If N is the number Poked, the computer will delete any CHR\$(N) you try to enter in a program or Direct mode line.

Gustavo A. Tolosa A.  
Mexico City, Mexico

**Vanishing variables**—Shift your computer into Lowercase mode, then type in the following program (you'll have to shift to get the uppercase letters).

```
10 DATA XYZend
20 N=5
30 READ N$: PRINT N,N$
```

Now run the program and observe that the computer ignores it completely. List the program, and notice that not much of it remains. The moral is to be cautious when typing in Lowercase mode, since your computer ignores shifted letters unless they are in quotes. Use only unshifted letters for commands and variables, or some very strange bugs may appear.

Marion Maddocks  
Glenwood, IA

**Easy RUN**—When typing RUN to start a program, you need not move your cursor to a blank line, and you need not clear your screen. Just type a colon after the RUN, then press the return key.

Robert Train  
Patchogue, NY

**Easier RUN**—When there's a program in memory and the Ready prompt is on the screen, just put your cursor on the Ready and press shifted run/stop. It will automatically run your program. The technique works with any non-executable text line on the screen, so if you don't have a Ready prompt, just type some garbage, then press shifted run/stop.

John Schroeder  
Westville, NJ

**Easiest RUN**—You can run a program just by simultaneously pressing the shift key, space bar and question mark key. All three are clustered together and can easily be pressed with one hand.

Tim Harris  
Fox Point, WI

**RUNDY**—Have you ever typed in RUN over READY? If you have, the computer probably printed the familiar Undef'd Statement error. But, on many Commodore models, if your program starts with line number zero, it will run no matter what follows RUN on the screen.

Tim Brugman  
Fullerton, CA

**Reset curiosity**—When powering up or resetting, hitting the restore key will bring the system to a halt. The computer won't be able to continue, as evidenced by the shrunken border that persists until you reset the system again.

Craig Johnson  
Juneau, AK

## 14. Modems and Telecommunications

**Telecommunications library**—A world of information on this fascinating field is available at your local Radio Shack. Three excellent books cover the subject as well as you're likely to want.

*Understanding Telephone Electronics* explains all aspects of the telephone network, from telephones to transmission lines to central office equipment; *Understanding Data Communications* tells, in easy-to-read technical detail, how data is transmitted over that network; and *Installing Your Own Telephone* gives the nuts and bolts of residential telephone installation, including step-by-step instructions.

All three books are inexpensive and easy to understand. Buy them, read them, then donate them to your local public library.

Mary Lee McCafferty  
Butler, PA

**Reliability aid**—When a Commodore 1600 or similar modem is plugged into the user port, it doesn't rest solidly on the desk behind the computer. When pressure is applied under these conditions, the modem moves slightly, and connections are momentarily broken, leading to loss of communication. If you put a pencil or similar object under the modem, you'll eliminate the problem.

Leonard R. Faucett, Jr.  
Denver, CO

**Phoneless modem**—The manual for the Commodore 1650 modem implies that you need a modular telephone to use the 1650. But all you really need is access to a modular phone line—you can get by without the telephone!

Just use the 1650's auto-dial feature to make your calls, and be sure to move the T-D switch to T when the modem isn't in use. If you forget to move it to T, the phone will remain off the hook, tying up your line until you discover it.

Reginald E. Darby  
Buffalo, NY

**Easy modem upgrade**—I have an easy way to improve the operation of the 1600 or any other modem that connects to the handset cord. I get a two-way modular adapter plug and a \$5 electronic phone. (The cheap ones don't have modular handset cords.) The adapter plug plugs into the wall, and, in turn, the electronic phone and my desk phone (with modular handset cord) plug into it. The desk phone stays constantly plugged into the modem, with its handset (unconnected) on the hook-switch, keeping the line dead. The electronic phone, of course, also remains off-line.

When the time comes to telecommunicate, I pick up the electronic phone and use it to make the call. When I hear the carrier, I lift the handset from the desk phone and hang up the electronic one.

This low-cost system lets me get on-line with a minimum of hassle and without having to plug and unplug a handset cord.

Daniel R. Zoll  
Brookline, MA

**Multi-line modem**—Business users usually dedicate a special single line for telecommunications, because few business phones are equipped with modular jacks. But Radio Shack's 43-233 Modular Multi-Line Controller lets you connect your modem to most five- or ten-button telephones.

It provides a modular jack for your modem, plus buttons to switch it to any one of five lines. The unit connects between the halves of your telephone's Amphenol connector and can be installed in less than five minutes.

**James F. Ritterbusch**  
Mississauga, Ontario  
Canada

**Don't auto-dial**—If you have an auto-dial modem, the auto-dial feature is often more trouble than it's worth, since it takes so long to dial, then waits forever to hang up if the line is busy. To save time, dial with the phone plugged into the modem. If the line is busy when you call, you can hang up immediately. And if your telephone has the re-dial feature, you can use it when you place the call again.

**Tim McVeigh**  
Lockport, NY

**Modem intercom**—This little trick has helped solve many modem problems. If you have two computers and two modems, you can get them to talk to each other over two phones on one line in your home. With both ends of the link in one building, troubleshooting becomes a snap.

Simply pick up the phone and wait for the loud beeping to stop. It will take a minute or two, but it will eventually stop. Plug that phone into your modem (or switch from T to D if you have a 1650). Then pick up an extension phone and do the same for that. You should now be able to converse between two computers on a single line!

**Mike Mann**  
New Smyrna Beach, FL

**Modem intercom revisited**—If you tried the above trick, but the dial tone never went away, you have an older switchboard on your local telephone network. Dialing the first digit of your own telephone number should get rid of the dial tone for you.

These old systems also cause a lot of errors while telecommunicating. If you ask your operator to make your call for you, chances are good that you'll get a better connection.

**Mike Handy**  
Middletown, OH

**Dummy modem**—If you're trying to correct modem problems, learning to telecommunicate or debugging your own terminal software, there's an easy, low-cost way to go on-line. Get a friend to bring his computer and modem over, then connect your modems directly together, completely bypassing the telephone system. You can use any modular extension cord for this purpose, including the one that connects your own telephone to the wall.

You'll have to ensure originate/answer compatibility between the two modems, but that can be as simple as flipping a switch. (One modem must be in Originate

mode, and the other in Answer mode.) Once you are in communication, this system completely eliminates phone-line problems. And having both terminals in the same room gives wonderful feedback to the operator, since keyboard entries on one can be viewed immediately as they are received and displayed on the second.

**Chuck McGaffin**  
Ballston Lake, NY

**Call waiting**—If you have the call-waiting feature on your telephone, incoming calls can disrupt communications over your modem. Here's a simple way to disable this feature while you're computing. Prior to going on-line, just dial a 9 on your telephone, push the hang-up button once, as you would if answering a call-waiting signal, then dial the number for your computer call. Anyone trying to call you will simply get a busy signal until you complete your computing session, and the phone will resume its normal status when you log off your system.

**W.L. Cochran**  
Green Cove Springs, FL

**More on call-waiting**—Call-waiting is implemented differently by different telephone companies, and no one method will work in all parts of the country.

Here in southern Wisconsin, you dial \*70, wait for the dial tone, then dial your own number. Anyone trying to call you then gets a busy signal until you complete your call. As soon as you hang up, the \*70 is disabled, and you have the normal call-waiting feature available again.

If you need information on this subject, the best thing to do is call your local telephone company. If you ask to speak to a switching foreman or a repair foreman, the chances are you'll find somebody who can help you. But, if at first you don't succeed, try, try again.

**Walt Grosch**  
Milwaukee, WI

**Cheap terminal program**—The following one-liner will serve as a terminal program for any RS-232-compatible Commodore computer.

```
10 OPEN 2,2,0,CHR$(6):FORT = 0TO1STEP0:GET#2,A$:PRINTA$:  
GETB$:PRINTB$::PRINT#2,A$::NEXT
```

CHR\$(6) sets the modem to 300 baud, eight-bit word length, one stop bit, no parity, and three-line handshake. Consult your *Commodore 64 Programmer's Reference Guide* for other settings.

The program will allow excellent communications between Commodore machines, but, since there is no ASCII conversion, you may have trouble with some characters on other systems. Also, there is no cursor to indicate where you will type next. If every key prints two characters instead of one, delete the PRINTB\$ statement. When you use the program, of course, one modem must be in Originate mode and one in Answer mode.

**Todd and Troy Andrews**  
Wilder, VT

**Better translation tables**—Terminal emulator users may want to make the following changes in their keyboard translation tables. They work with the Smart 64 Terminal

+ 2 and should work with most others unless the keys are assigned a special function by the program. In our table,  $C > A$  means that the Commodore ASCII value  $C$  is translated to the standard ASCII value  $A$  for transmission.  $C < A$  means that the received standard ASCII value  $A$  is translated to the Commodore ASCII value  $C$ .

29 > 19 makes the unshifted cursor-right key send a CTRL S to stop host transmission. (An unshifted cursor-down key already sends CTRL Q to cause the host to resume.)

147 < 12 converts the host's form-feed to a clear screen command.

141 < 10 converts incoming line feeds to shifted returns, giving double-spaced copy if the host sends line feeds.

20 > 127 makes the delete key send a true delete, rather than a CTRL H.

145 > 123 and 157 > 125 make the shifted cursor keys send left and right curly brackets.

123 > 123 and 125 > 125 cause left and right curly brackets to be displayed on screen as a cross and a vertical bar, respectively. Your computer can't display braces directly, but they will be printed normally if you use a standard ASCII printer.

Fred Burch  
Gainesville, FL

## 15. Power Supplies

**Hot power supplies**—Even when your computer is turned off, your power supply draws enough current to keep itself unnecessarily warm, which is a condition leading to early failure. Prevent the problem by plugging your computer and all its peripherals into a switched multiple outlet strip. Then use the outlet strip's switch to turn your system on and off.

Joseph Bober  
Brooklyn, NY

**Spike protection simplified**—Instead of buying spike protectors for each of your computer units or buying an expensive surge-protected power strip, plug a small voltage spike protector between your present outlet strip and its source of ac power. The widely available GE VSP-91D is rated at 15 amps, which is more than enough for a large Commodore installation and can be bought for about \$6.

R.E. Duderstadt  
Cincinnati, OH

**On overheating**—A common symptom of an overheated power supply is a screen full of crazy characters. This symptom often arises just before a power supply failure. If you experience this problem, temporarily substitute a borrowed power supply for your own. If the problem goes away, your power supply is probably defective.

Joseph H. Toy  
Jackson, TN

**Heat sinks**—My power supply got hot on the ends. To fix it, I used Duco liquid solder to glue two aluminum

heat sinks to each end. Radio Shack 276-1363 heat sinks are less than a dollar each, and they cured my overheating.

Garold R. Stone  
Annapolis Junction, MD

**Fuses**—There are two glass fuses in most Commodore computers, and if your power supply seems dead, you ought to check them out. The first one is inside the computer and can be easily seen when you open up the machine. The second is inside the power supply. To reach it, use a screwdriver and hammer to remove the bottom of the power supply itself. The fuse is soldered into place, so repairing it is best left to someone experienced in electronics. Make sure you unplug the unit before trying to open the case—high-voltage connections will be exposed inside.

Robert Crowell  
Trappe, MD

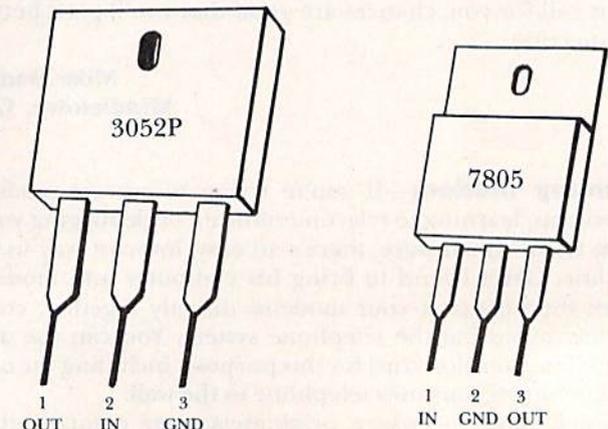
**Power supply repairs**—Commodore power supplies are subject to self-destruction, because of a weakness in the 3052P voltage regulator inside. Not only is it unreliable, but the 3052P isn't available in the United States. If your power supply fails, chances are that the problem is the 3052P. But you're in luck if your power supply is of the type that can be opened for servicing, because there's a widely available replacement regulator.

Many electronics dealers handle the ECG line of replacement ICs, and ECG makes an exact, pin-for-pin replacement for the 3052P. The part number is ECG-1934, and it costs about \$7. If your ECG dealer doesn't stock the part, he should be glad to order it for you.

Bob Wingerter  
Raceland, KY

**Power supply repairs #2**—If you can't locate an ECG-1934, you can try a lower-rated regulator, the more widely available ECG-7805. [Equivalent to the Radio Shack 276-1770. Ed.] It will be overloaded, but could work for you in a pinch.

The pin configurations of the two units are different, as illustrated below. I soldered a heavy wire onto pin 3 of the new regulator, then inserted the assembly into the 3052P socket, sliding the 7805 one hole to the right to line up the "in" and "gnd" pins with the original wiring. Then I soldered the 7805's new wire to the left hole of the 3052P socket.



Marty Irons  
Goshen, NY

**Dead Datasette**—If your Datasette suddenly stops operating, but everything else works fine, the chances are good that part of your power supply has blown. The power supply provides both 5 volts dc and 9 volts ac, with the latter used for the tape deck. You can use a Radio Shack 273-1515 transformer, 18 volts center-tapped, to bypass a defective 9-volt supply. Unless you're qualified in electronics, you should get a knowledgeable friend to help you.

Strip the round power supply cord and identify the red and blue wires, plus two black ones. Cut the black wires and connect them to the 9-volt ac from your new transformer, and you should be back in business. If you want, you can attach the new transformer to the top of the old power supply; it's not too fancy, but it's definitely functional.

John Long  
Clarkston, GA

## 16. Printer Paper and Ribbons

**Easier paper loading**—When loading fanfold paper into the printer, it's often difficult to force the flimsy sheets through the mechanism. I get around that by doubling the paper back on itself at the first fanfold crease, then feeding the double-thick piece into the printer.

Dan McCarthy  
Glendale, CA

**Easier paper loading #2**—Here's another way. As the printer is running out of paper, be sure to leave the last sheet in the machine. Carefully align the leading edge of the new sheet with the trailing edge of the old one, and tape the two together. The old sheet will pull the new one into place.

David G. Ennis  
Ridgecrest, CA

**Using plain paper**—If your printer doesn't have friction-feed capability, you can still use unperforated letterhead and other paper. If you're careful, you can tape the unperforated sheet to a perforated one, using the latter to carry the former through the machine.

A small piece of tape in each corner will hold the stationery in place, with perhaps another at the center top, to keep it from catching on the printer mechanism. The forms' thickness-control can be adjusted slightly if necessary.

Gwen Pelletier  
North Eastham, MA

**Thermal paper**—If you're not happy with the way your thermal transfer printer works with standard computer paper, be aware that Hammermill makes fanfold paper (item #19900-0) specifically for thermal transfer technology. The paper contains micro perforations and is very smooth on one side. The results are excellent, and the price is comparable to standard computer paper.

Doug Mlodzinski  
Canandaigua, NY

**Single-sheet printing tips**—Many printers have a paper alarm that discontinues printing when the paper runs out or breaks. The details of these alarm systems vary, but they work on the same general principles. On Commodore's 1526, for example, normal-feeding paper closes a microswitch placed inconspicuously in its path. When a paper outage opens the switch, the printer stops and the paper-advance button flashes as a warning.

The paper-alarm feature can be a nuisance when printing single sheets, especially when it activates partway down your printed page. Here are some ways to avoid this inconvenience.

- Tape a second sheet to the bottom of your page, avoiding the paper-out condition.

- If tape is too much trouble, wait until printing stops, then feed another sheet behind the first one. Just push it in until the printer mechanism stops it, and there's a good chance it will clear the alarm. Sometimes you must also press a switch to resume printing. On the 1526, you press the flashing paper-advance button.

- Use a DIP switch on the printer to deactivate the paper alarm. On the Gemini 10X, switch #1 on the back serves this purpose. If your printer has DIP switches, see if one of them does the same.

B. Franklin  
Philadelphia, PA

**Printing on envelopes**—I use my printer for addressing envelopes, but sometimes the envelope slides around as it moves out of the range of the friction-feed device. I solve the problem by inserting a full-size sheet of paper under the envelope's flap, then feeding the envelope-paper combination into the printer.

Also, if your printer has a thickness lever, it's a good idea to set it to "thick" while printing on envelopes.

Alfred Lusher III  
Cold Spring, KY

**Making envelopes**—In a pinch, you can make very serviceable envelopes from fanfold paper. Print the mailing address in the center of a fanfold sheet, then remove the sheet from the printer. Do not remove the perforated side strips. Fold the letter that is to go inside the envelope, then fold this sheet around it. Tape or glue the perforated sides and the flap, and there you have it.

Robert C. Lane  
Danville, VA

**Printing stencils**—Dot-matrix printers strike hard enough to cut a mimeograph stencil. I've used Double-strike mode to get the best copies and have been well-pleased with the results of my word processor/computer printer combination.

Ed Schutz  
Utica, MI

**Making spirit masters**—Spirit masters are used on the so-called "ditto" machines, found in countless schools, clubs and churches. Use your printer to make the master, and you've got a very low-cost, time-efficient duplicating system. You'll have to make a few trial runs to optimize reproduction quality, since the printer must strike the

paper with enough force to transfer the spirit ink onto the master.

Other printers may produce different results, but my Gemini 10X works best in Emphasize mode; Double-strike mode transfers too much ink, which results in filled-in letters. After printing, each of my masters makes about 75 copies. If I need more, I just print more masters!

Ed Schutz  
Utica, MI

**Two-up labels**—If your labels are two-up (two across the page), but your program will only print one-up, never fear. Run through the whole box of labels using only the ones on the left side. Then flip the stack right over left and insert it in the printer. The labels that were on the right will now be on the left, where you can use them to your heart's content.

Linda R. Lang  
Tucson, AZ

**Pin-feed prestidigitation**—To ease the repositioning of your pin-feed or tractor mechanisms, put an arrow-shaped piece of colored tape on each movable part, then put marks or other arrows where they can be lined up with the movable ones. Put these index marks at your chosen positions for standard paper, labels, narrow paper, and so on.

John W. Petty  
Augsburg, West Germany

**Paper saver**—You can save paper by saving your old program listings. When you need to print something for your own use, use the reverse side of these discarded listings. This has worked well for me, especially with the higher-quality paper.

Mary Brigito  
Old Forge, NY

**Tractor-feed fodder**—Some printers, like the 1525 and MPS-801, waste a sheet of paper every time they are set to top of form. Keep a clipboard handy, and, as you remove your printout from the printer, tear off that first blank sheet and add it to the clipboard. Clean, full-size sheets have plenty of uses around the house.

Phillip D. Deem  
Indianapolis, IN

**Visible perforations**—My printer's smoke-gray cover makes it hard to see the paper perforations, and, consequently, I found it difficult to align the printhead and the top of the sheet. I solved the problem by running a dark, felt-tip marking pen over the points of all four corners of the folded paper. The ink soaks through the paper and makes it easy to see the perforations. Since they appear only on the outer edge of the paper, which is torn off and discarded, the ink marks have no effect on my final documents.

John B. Boninger  
Rock Island, IL

**Paper alarm**—It's a good idea to ink a big cross on the third-to-last sheet of paper in the tray. This gives you a timely warning of imminent paper exhaustion.

Ian Haynes  
Westville, South Africa

**Ribbon replacements**—If you don't have a source of inexpensive ribbons for your printer, take a worn-out ribbon to Radio Shack. Some of their ribbons are exact replacements for the Commodore 1525/MPS-801 and for other printers as well. If Radio Shack doesn't have what you need, try other local sources of ribbons. The key to success is letting them see your sample ribbon—many printers use identical ribbons, and most published cross-reference lists are incomplete.

Steven J. Guenther  
Washington, DC

**Ribbon re-inking**—The 1525/MPS-801 and other printers have re-inkable cloth ribbons, and you can save money by re-inking them yourself. If your ribbon has a removable ink cartridge, the job isn't even very messy.

Be sure to use printer ribbon ink, since other inks may jam or abrade your print head. This ink is available from re-inker companies that advertise in *RUN*. Another possible source is the commercial ribbon re-inking companies that are found in most large cities. You may have to beg them to let you have some ink, but they're usually very understanding.

It's helpful to put a few drops of ink directly on the re-inking wick. The wick sometimes gets clogged with paper dust, in which case soaking it in solvent can help.

Bob Ingay  
Victor, NY

**Ribbon rejuvenation**—A simple way to extend the life of your fabric ribbon is to spray it with a little WD-40 oil, available at any hardware store. The oil thins the ink and lets it flow into the print area. Use the WD-40 sparingly, and you'll probably have very good results. Don't forget to wash your hands.

Alan Helfers  
Chatham, IL

## 17. Printers and Printing

**Printer stands**—Many common items can serve double-duty as printer stands, especially when you turn them upside down. Look through the housewares department in your local discount store, and you're certain to find something you can use.

Another source of printer stands is the office supply department. I use an inverted \$2 stacking file, which fits my MPS-801 perfectly. It's the #982 from Sterling Plastics, and it's found in discount stores everywhere.

Frank Knorowski  
Berwick, PA

**Space saver**—Unless you have a custom computer desk, it's always a problem finding room for your printer paper. I keep my paper in a cardboard tray made from the top of the carton it came in, but there's not much

room for it between my printer and the wall. Also, no matter where I put my paper, it tends to tear on the cables at the rear of the printer.

My solution is to prop the tray against the wall at a 45-75 degree angle. This lets me move the printer closer to the wall and out of my way on the desk. I put a large empty can or cardboard tube between the printer and the tray, and the paper never touches the cables.

Barry L. Cohen  
New York, NY

**1520 plotter supplies**—Commodore's 1520 plotter has the same mechanism as Radio Shack's CGP-115 and uses the same supplies, which are available at any Radio Shack store. The paper is #26-1428. Black pens are #26-1480, and colored ones are #26-1481. As always, the price is right, and if your store doesn't stock these items, the manager can order them for you.

Richard Fader  
Fort Lee, NJ

**Plotter as printer**—Commodore's slick little plotter can double as an 80-column word processing printer. Before loading your word processor, run the following driver program.

```
100 OPEN 6,6 : PRINT#6,1 : REM UPPER/LOWERCASE
200 OPEN 3,6,3 : PRINT#3,0 : REM 80 CHAR/LINE
300 OPEN 2,6,2 : PRINT#2,0 : REM BLACK INK
```

You must then set your word processor to send its text to device #6, rather than the usual 4 or 5. If you have PaperClip, run the MERGE PRTFIL-D program and merge PaperClip with the 1525-P-ALF printer file. Then run the PRINTER SETUP-D program and set the printer device to #6. Save this newly modified PaperClip program. When you run it, your printer device will automatically be set to 6.

We like to use the 1520 as a portable printer, and its small size more than makes up for its tiny little letters.

Thomas F. Trocco  
New York, NY

**1520 disk directories**—The 1520 plotter's smallest character set can be very valuable in making disk directories. First, select a color with the color-change button. Then do this:

```
OPEN 3,6,3 : PRINT#3,"0" : CLOSE 3
LOAD"$",8
OPEN 4,6,0 : CMD4 : LIST
PRINT#4 : CLOSE 4
```

You will get a readable directory that is small enough to be taped to the disk jacket.

Robert Gruskiewicz  
Wyoming, PA

**Servicing the 1520 plotter**—The Radio Shack CGP-115 printer-plotter is very similar to Commodore's own 1520. In fact, the paper transport, the pen transport and the electromechanical printing mechanism are identical on the two devices. Even though Radio Shack has discontinued the CGP-115, its operation and service manuals are still available, both under the same catalog number 1520. The operation manual doesn't

relate to the Commodore plotter, but the service manual is very useful. It costs about \$8, once you convince the store manager to order it from Texas.

By the way, don't forget that the pens and paper for the Radio Shack unit are directly compatible with the 1520.

Dave English  
Orange, CA

**1525/MPS-801 paper alignment**—Here's how to ensure that this popular printer doesn't print a line on the perforations between sheets. Advance a sheet of paper until the tear line is exactly even with the top of the print head. Then advance the paper three double clicks. This sets the paper so that, regardless of the number of pages printed, all of the print lines will be on either side of the tear line.

No name  
Address unknown

**1525/MPS-801 paper-jam fix**—I always had to watch my printer to make sure the paper exited properly, without jamming. Sometimes the perforated edge would get caught on the paper entering the printer from the rear. To fix the problem, I glued two pieces of stiff plastic to the plastic guide behind the carriage. They extend about two inches behind the printer and are completely effective.

John V. Gilmour III  
Florence, SC

**1525/MPS-801 carriage return**—The carriage mechanism on these printers has a tendency to slow down as the printer ages. The solution is to clean and lightly oil the two metal bars that guide the print head down and back. If that is not sufficient, try boosting the carriage return spring by shortening it or by paralleling it with a rubber band.

James F. Ryan  
Winthrop, MA

**1525/MPS-801 underlining**—You can underline with this printer by using a graphics line character on the line below the one you want to underline. Of course, no other characters can be printed in the same spaces as the graphic underlines, so when you underline, you should also double space. Here's the technique for underlining:

```
10 OPEN 4,4
20 PRINT#4,"UNDERLINING WITH THE MPS-801";CHR$(13);
   "{20 spaces}{7 CMTD}"
30 CLOSE 4
```

David Bushko  
Address unknown

**1525/MPS-801 and labels**—Some models of this printer can take a minimum of 4½-inch paper. Before buying labels to use with it, carefully check their width, since many are only 4¼ inches wide and cannot be used with the MPS-801.

James Llanos  
Ketchikan, AK

**1526/MPS-802 secrets**—The mechanism in this printer is the same as that in the Mannesmann Tally 185 Spirit-80; Spirit-80 ribbons work perfectly in the 1526. The lever at the right of the platen is to adjust for paper thickness. Normal position is toward the platen; if you are doing envelopes or three-part forms, or if your print is smudging, move it toward the front of the machine.

Quinze Vingtetsix  
West Chester, PA

**1526/MPS-802 underlining**—There's a rumor going around that the 1526 won't underline. But CHR\$(141) gives you a carriage return without a line feed, allowing you to overprint the line from the beginning. Try this for a demonstration:

```
10 OPEN 4,4
20 PRINT#4, "THIS IS A COMMODORE PRINTER"CHR$(141){10
    SPACES}{9 COMD @}"
30 CLOSE4
```

Marion Deland  
New York, NY

**1526/MPS-802 print sizes**—Since printer manuals are hard for beginners to understand, many owners of Commodore's 1526 may not be aware that there are actually four sizes of print available. There is the regular size, plus three horizontally expanded fonts. The program below illustrates them very nicely.

```
2 A$ = CHR$(14)
4 OPEN4,4
6 PRINT#4, "THIS IS REGULAR PRINT"
8 PRINT#4, CHR$(13)
10 PRINT#4, A$; "THIS IS ENHANCED PRINT"
12 PRINT#4, CHR$(13)
14 PRINT#4, A$; A$; "GETTING BIGGER"
16 PRINT#4, CHR$(13)
18 PRINT#4, A$; A$; A$; "LARGEST!"
20 PRINT#4, CHR$(13)
22 CLOSE4
```

Some MPS-802s, and possibly some 1526s, will print a fourth enlargement, giving five sizes of print. You can test your own unit by repeating line 18 as line 21.

Gregory L. Bues  
Milford, CT

**1526/MPS-802 listings**—This printer has a little-understood paging mode that allows it to skip over the perforations between sheets of paper. With very little effort, you can use this feature to get nice top and bottom margins on your multipage listings.

To try it out, put a long Basic program in memory—one that takes more than a page to list on the printer. Align the paper in your printer so the top of the sheet is just barely under the two black rollers on the movable paper bail, and enter the following line in Direct mode. The heading can be anything at all and, if you'd like, can be omitted.

```
OPEN4,4 : CMD4, "{SHIFT CLR}title" : LIST
```

Then watch as your printer makes a professional-quality listing. When the listing stops, don't advance the paper by hand. Instead, enter, in Direct mode:

```
PRINT#4 "HOME" : CLOSE4
```

You'll see the paper advance so the bottom perforation is right at the tear-off point on the silver bar that covers the platen.

You can add the following lines to any program, and a GOTO 10000 will get you a similar listing, but with a customized heading for the date or anything else you'd like. When the listing is finished, your cursor will be positioned so you can feed your sheet just by pressing the return key.

```
10000 REM ** LIST ON 1526 PRINTER · PERFS AT ROLLERS
10010 INPUT "HEADING"; A$
10020 PRINT "{SHIFT CLR}{CRSR DN}PRINTCHR$(19) ; :
    PRINT#4:CLOSE4{2 CRSR UPs}":OPEN4,
    4:CMD4:PRINT "{SHIFT CLR}"A$:LIST
```

Remember, a question mark *cannot* be used in abbreviating the Print# statement.

Louis F. Sander  
Pittsburgh, PA

**PaperClip and the DPS-1101**—Commodore's nice daisywheel printer can easily be used with the PaperClip word processor, if you know the secret. First, you *must* switch DIP switch #3 on the long bank of switches. Then use the 6400-A-NLF printer file. This will handle 5-pitch, 10-pitch, 12-pitch, 15-pitch, boldface, underline and sub/superscripts.

If you want to use shadow printing as well, you must run the printer setup program. When it asks you to load your previous file, load the 6400-A-NLF file. For "italics on," use codes 27, then 87. For "italics off," use 27, then 38. Please realize that you can't get italics with a daisy-wheel—you get shadow printing instead.

Thomas F. Trocco  
New York, NY

**Okimate programs**—If you use your Okimate 10 to print pictures made with the popular Doodle! program, the manual says you need a Learn to Print disk plus your Doodle! file. Since Learn to Print has only 21 blocks free, the Doodle! file has to be on a separate disk, and you waste a lot of time in swapping disks.

I've learned that you don't need all the Learn to Print files. The ones you need leave over 500 blocks free on the disk, and you can use those blocks to store picture data and printer routines. These are the files you need: COLOR, N, W, S, U, V, T and AA. Use a file copy program to put them onto a disk, then fill the remaining space with your artwork.

Colin Crawford  
Grafton, OH

**Paper for the Okimate 10**—This little printer will do wonderful black-on-white printing without a ribbon, if you use the right kind of thermal paper. The thermal paper for the IBM PC Junior is widely available and comes in rolls, fanfold and single sheets. It gives better print quality than you can get with a ribbon or with Okidata's special smooth paper.

William R. Alsing  
St. Louis, MO

**Paper for the Okimate 10 #2**—When you are using a ribbon with this printer, regular computer paper gives very unsatisfactory copy. The special paper is expensive and sometimes hard to obtain. Believe it or not, inexpensive newsprint-like paper gives wonderful results! I buy cheap scribbling paper at my school supply store, and I save my stock of the special paper for important letters and reports.

Dale Leibensperger  
Gang Mills, NY

**Easy Script Oki-magic**—If you have used the Okimate 10 with Easy Script, you may have been dismayed to find that the gaps for page-skipping are twice as wide as they should be and that the error increases with every printed page. The trouble is that both Okimate and Easy Script have an automatic page-skip feature. The solution is to disable the Okimate's automatic perf-skip by executing the following line before loading Easy Script.

```
OPEN 1,4,0 : PRINT#1,CHR$(27);"B"
```

Charles L. Baker  
Topeka, KS

**Olivetti PR2300 ink**—Thousands of Commodore owners also own this printer, and most of them have run out of dry ink ampules. I searched for ampules for almost a year and finally gave up trying to find them. Out of desperation, I tried refilling my old ones with various types of pencil lead. After much testing, I've learned that Staedtler/Mars Duralar K3 gives excellent results. A single 5-inch piece is enough to refill an ampule ten times, at a cost of five cents per filling.

Jim R. Williamson  
Carrollton, TX

**Olivetti PR2300 ink #2**—DAK Industries, the company that sold so many of these printers at closeout prices, still stocks the ampules. You can call them at 1-800-423-2866.

Gary Leonhardt  
Roscoe, IL

**Printer special features**—Many non-Commodore printers have wonderful special features that can be used with commercial programs. To enable these features, one must often send several commands to the printer prior to loading the program. A good way to handle this without having to remember the commands is to include them in a small loader program that sends them, then loads the main program using dynamic keyboard techniques, as described in the "Programming Tips-General" section.

For example, I use the following program to set my Epson to Double-strike mode with a five-line skip over perforations, after which it loads the PractiCalc program.

```
10 Q$ = CHR$(34) : OPEN 4,4
20 PRINT#4,CHR$(27)"G"
30 PRINT#4,CHR$(27)"N"CHR$(5)
40 PRINT
50 PRINT"LOAD" Q$ "PRACTICALC" Q$ ",,8,1{2 CRSR UPS}";
60 POKE 631,13 : POKE 198,1 : END
```

Donald D. Fick  
Muscatine, IA

**Printer cable hang-up**—Some sophisticated programs, especially those involving the disk drive, seem to be sensitive to the presence of other peripheral devices. I found several fast-copy programs that hung up the computer whenever a printer cable was connected. Disabling the printer didn't help—I had to physically remove the printer cable from the serial bus. If you have a similar problem, try removing the printer cable first, then look to the other ports for possible remedies: cassette port, user port, cartridge slot and, perhaps, even the joystick ports.

Karl Thurber  
Millbrook, AL

**Printer lockup fix**—If a program locks up while it is trying to communicate with the printer, don't panic. Turn the printer off, then back on, and you'll probably clear the lockup.

Michael P. Rogalski  
Monrovia, CA

## 18. Video Displays and Loudspeakers

**Eyesaver**—It's not so obvious to everybody: Use your TV's contrast, brightness and other controls to optimize your programs's display. Often the best setting for text is quite different from the best setting for games and other programs.

Mark Emilio  
Address unknown

**Glaring nerdhood**—Don't have a glare screen for your monitor? Just wear polarized sunglasses whenever you're computing. Your family may think you're withdrawing further into the tube, but you're really just saving money.

Mike Rogalski  
Monrovia, CA

**Soap opera computing**—Watching a blank screen during long cassette loads becomes very boring. If you are using a TV as a monitor, you can solve this problem by flipping the TV/computer switch and watching some television. Switch back when the cassette drive stops, and your computer program will be waiting.

Steven J. Walsh  
Seaford, NY

**Tip for teachers**—If your class is large, think about using a projection TV set for a monitor. Such equipment, though expensive, makes it a lot easier for the students to see the screen and react to what is on it.

Frank Piazza  
Address unknown

**Commodore and the VCR**—If you have a VCR and a 1702 or similar monitor, you can watch TV on your computer screen. Using the front panel connections on the 1702, patch the VCR's audio-out to the monitor's audio-in. Then connect the VCR's video-out to the mon-

itor's video-in. Make sure the 1702's rear-panel slide switch is set for the front connections, then lean back and relax.

Reed Huish  
Mesa, AZ

**Screen layout aids**—A 12-inch flexible steel ruler, of the type made by Bates and sold in office supply stores, makes a superb screen layout tool. Use the metric scale to measure CRT distances, and hi-res positioning will be easier than you've ever imagined.

To simplify the counting of text lines, draw a dot at the start of every fifth line on your screen, about 1 mm into the border. I use a Sharpie brand marker for permanence, and I make the dots as tiny as possible, to keep them from polluting the display.

Louis F. Sander  
Pittsburgh, PA

**Video audio**—Many TVs have an annoying speaker buzz even when the sound is turned to its lowest setting. If you're using such a TV for a monitor, just plug a headphone into its headphone jack, and the buzz should disappear. Sometimes you can use just a plug, with nothing connected, and achieve the same effect.

Fred Lacey  
Corvallis, OR

**Monitor cables**—If your 1702 cable has eight pins, but your computer's video jack has only five, then get out your needle-nose pliers. Use them to remove pins 6, 7 and 8 on the cable.

Reed Huish  
Mesa, AZ

**TV set switches**—If you have a computer and a video game machine, you know how frustrating it is to constantly be connecting and reconnecting the switch boxes. My suggestion is to connect all the switch boxes to the TV set, leaving each external device connected to its own box. When you want to use a component, just switch its box to the computer position, leaving all the others in the TV position. When you want to change components, just turn the first one to TV and the second one to computer.

Michael Peterman  
Lebanon, OR

**Video monitor tips**—My monitor is a green monochrome without a speaker, which is little help when a program involves color, sound, or both. But since the green monitor is plugged into the video connector on the back of my 64, the TV connector is vacant. I run a long cable from the TV connector to the switchbox on the back of my color TV. When a commercial comes on, I can do my color work without interrupting the family's viewing. The 64 can simultaneously drive both the monitor and the TV.

Of course, the cable connecting my green screen to the computer has a separate audio line. I patch it into my stereo receiver so I can play the 64's sound. I frequently

use this setup to record C-64 sound onto a cassette or reel-to-reel tape.

Stephen M. Zapytowski, Sr.  
Beaverton, OR

**Wavy video**—If your power supply is physically close to your monitor, it can cause a slow, side-to-side waving in the video display. If you see such interference, try moving your power supply.

Sechzig Hertz  
Storung, Germany

**Computer/TV interference**—If you use a slide switch on your TV antenna wire, it's possible that the video output from the computer can cause interference on other sets connected to the same antenna or cable. The problem is that the antenna lead coming into your switchbox is not terminated when the switch is in the computer position. Under that condition, the radio frequency from the computer can leak into the common antenna/cable system.

To solve this problem, install a TV-interference filter, as sold in most electronics stores. The proper place for it is at the connection between your antenna and switchbox. Putting it between the switchbox and TV won't help, because the interference arises inside the switchbox.

David J. Todeschini  
Queens, NY

**Ground your switchbox**—Connecting the TV/computer switchbox to a good ground can dramatically reduce interference. In houses with three-wire electrical sockets, the screw on an outlet cover is usually very well-grounded.

Carl R. Wilcox  
Dayton, OH

**Toroid love story**—Ferrite loops about two inches in diameter are very good interference traps. Wrap your computer-to-TV cable through one about three times, and you'll see what I mean.

John Cappuccilli  
Fairview, NJ

**Foiling interference**—Try putting a cookie sheet or a large piece of aluminum foil under your computer. It can do wonders in reducing television interference.

Jim Barzydlo  
Lincoln, NE

**For high-quality monitors only**—Some high-quality monochrome monitors have such good resolution that they show the individual dots that make up the characters. This can be visually annoying, and, if you have that trouble, there's a simple solution available. Connect a .0047 microfarad mylar capacitor between pins 1 and 4 of your video output cable. It dampens the sharp rise and fall of the video signal, smearing the dots and making them more continuous.

Jim Stephens  
Nashville, TN

## 19. Entering Programs

**Saving keystrokes**—If you aren't interested in the contents of the REM statements in your program, don't eliminate the REM line entirely—just type the line number and the word REM. This saves keystrokes and avoids potential problems if the line is the destination of a Goto or Gosub statement.

Sue Harder  
Chicago, IL

**Audiovisual typing**—Have a friend read the program line while you type it in or proofread it. If no suitable friend is available, use a tape recorder and read the lines to yourself.

Kathleen Mead  
Westerville, OH

**Typing in programs**—To lessen the wear and tear on my precious copies of *RUN*, I use a copy machine to reproduce any programs I intend to type into the computer. As I type, I can mark, cut, spindle or mutilate the copy to my heart's content, with no chance of mutilating my magazine.

If the program doesn't run properly, it is much easier to compare a listing with the copy than to work with the whole magazine.

Geneva Hamilton  
Fortuna, CA

**Blow it up**—If your copy machine has a setting that enlarges material, use that setting to copy your magazine listings. It makes them much easier to read as you type them in.

James Volk  
Bellmore, NY

**Musical stitchery typing tip**—As an aid in typing programs, my husband and I have combined equipment from two other hobbies, music and cross-stitch. A music stand allows us to easily adjust the height of our material. To keep our place while typing, we use the metal sheet and magnetized strips that are sold as place holders for cross-stitch patterns. With the metal sheet behind the page we're working on, we slide the magnetized strip under the lines being typed. One word of warning: The magnetized strips can be disastrous to disks and tapes, so keep them away from your magnetic media.

Barbara Eberly  
Cullowhee, NC

**Magazine magnifier**—I went to a store where needlepoint and embroidery notions are sold, and I bought a line magnifier, made for use with sewing instructions. It works quite nicely in magnifying the program lines as I type in goodies from *RUN*.

Mildred Carroll  
Rosedale, NY

**Placekeeping tip**—Before starting to type a long program, I use a marker to highlight every other line. It gives a definite reference point to which I may return after looking away from the page.

Chris Markiewicz  
Windsor, CT

**Placekeeping tip #2**—When typing in long programs, use a hi-liter marker to record your progress. These markers are available in transparent pastel colors in any stationery department. Every five lines or so, cross off the completed material with your marker. This is also a good method to use when checking for typing mistakes.

Ellen Pekar  
Florence, MA

**Placekeeping tip #3**—Ever lose your place while typing a program from a magazine? Try cutting a piece of colored cellophane (approximately 9 inches long and 2 inches wide). Rub it on the page with the program, to build up static electricity, and it will stick to the page anywhere you slide it! Now use your magic cellophane to keep track of your place on the page. If it starts to slide off, just give it another rub.

Wake Lankard  
Kenner, LA

**Placekeeping tip #4**—I use Scotch Post-It notes. These self-sticking sheets are easy to move around on the page, and they have many other uses around the computer room.

David Chang  
Millbrae, CA

**Placekeeping tip #5**—I made a place marker by gluing a narrow strip of light cardboard to a clothes pin. The strip is long enough to go completely across the page, since most programs are printed in two columns.

Bro. Joseph M. Walsh  
El Paso, TX

**Typing Data statements**—When typing a series of Data numbers, I place my fingers over the number keys, using them as the home row. Instead of inserting commas between the numbers, I use my thumb to enter spaces. Then, after entering the line, I go back to the beginning, this time proofreading my work and using the comma and cursor-right keys to put the commas where they belong.

I have found that I can enter data much faster this way, because of the modified touch system of typing and the accuracy that comes from the overall process.

K.W. McFall  
Connersville, IN

**Easydata**—This C-64 program makes it easier to type Data statements by assigning new values to the back-arrow, @ and asterisk keys. After you run it, the back-arrow prints the shorthand abbreviation of Data, the @ key prints a comma and the asterisk executes a carriage return. These reassignments mean that your fingers never

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leave the top row of keys when entering long listings of numerical Data statements. The run/stop/restore combination will restore the keys to their normal functions, while SYS900 will reactivate the Easydata feature.

As always with Magic's machine language programs, we have included a checksum routine to make sure you enter your data items correctly. The first time you run the program, you'll be informed if you made a typing error or that everything's all right. If all is well, delete lines 1-4, then save the program in the usual way.

```

1 FORY=1TO83:READZ:CS=CS+Z:NEXT
2 IFCS<>9260THENPRINT"DATA ERROR":STOP
3 PRINT"CHECKSUM OK. DELETE LINES 1-4,"
4 PRINT"THEN SAVE THE PROGRAM.":END
10 REM EASYDATA - MARK GRANZOW
11 DATA 120,162,145,160,003,142,020,003
12 DATA 140,021,003,088,096,072,165,215
13 DATA 201,095,208,021,169,157,141,119
14 DATA 002,169,068,141,120,002,169,097
15 DATA 141,121,002,169,003,133,198,240
16 DATA 038,201,064,208,016,169,157,141
17 DATA 119,002,169,044,141,120,002,169
18 DATA 002,133,198,240,018,201,042,208
19 DATA 014,169,020,141,119,002,169,013
20 DATA 141,120,002,169,002,133,198,104
21 DATA 076,191,234
30 M=PEEK(55)+256*PEEK(56):A$=CHR$(17)
40 PRINT"WORKING":FORJ=900TO982:READK
50 IFK=191ANDM>32768THENPOKEJ,49:NEXT
60 POKEJ,K:NEXT:PRINTCHR$(147)
70 PRINT"SYS900 REASSIGNS THESE KEYS:"
80 PRINTA$(LEFT ARROW)=DATA @=COMMA *=RETURN
90 PRINTA$"STOP/RESTORE KILLS THEM."
100 SYS900:NEW

```

Mark Granzow  
Carol Stream, IL

**Computer-assisted proofreading**—When proofreading a program, it's helpful to scroll the screen up until the line to be read is at the very top of the screen. When looking back and forth from page to screen, this makes it much easier to locate the correct line. Once the line has been checked, use the cursor-down key to move the next line into position.

Rob Landeros  
Olympia, WA

**Proofreading tip**—After you've typed in a program from a magazine, it's often necessary to proofread your work. This job can be made easier by listing your program onto the printer, then proofreading the printout against the original copy. Compared to reading the screen, reading the printout is easy on the eyes, and it's much easier to find errors. This method is also timesaving, since you don't have to keep listing to the screen.

Roberta Roberts  
Chesapeake, VA

## 20. Languages—Basic

**Keyword tokens**—All the commands, keywords and functions that we use in Basic are converted to so-called tokens before being stored in memory. That is, the com-

puter replaces each of these words with a single number between 128 and 202, then stores that number instead of the full word. The principle is the same on every Commodore machine. You can check this for yourself by entering this program:

```

100 PRINT:
110 PRINT "BYTES FREE=";FRE(0)+2116

```

(If you have something other than a C-64, delete the +2116.) Run the program to see how much free memory you have.

Then, after the colon in line 100, add another keyword of some sort (PRINT, RESTORE or REM will work fine). Run the program again and observe that your additional keyword used only one byte of memory. Welcome to the world of advanced computer science!

To see all the C-64's tokens and their associated keywords, run the following program. It prints the keywords directly from their locations in ROM memory.

```

10 REM C-64 TOKENS - DION HOUSTON
20 T=127:PRINT:FORI=41118TO41373:M=- (PEEK(I)-128):PRINTCHR$(PEEK(I)-M*128);
30 IFMTHEN=T+M:PRINTTAB(7);T
40 NEXT

```

Dion Houston  
Bellevue, WA

**CLR clarified**—The manuals tell you that CLR gets rid of all variables, arrays and user-defined functions. It closes all files and clears the stack, which wipes out any Gosub statements and For...Next loops presently in effect. What the manual doesn't say is that a Restore is also called, setting the data pointer back to the beginning.

Brad Leypold  
Colorado Springs, CO

**Data statement bug**—If you use shifted characters in a string in a Data statement, they will list improperly and disappear or give erratic results when read. The solution is to enclose the string in quotation marks.

David Martin  
Little Rock, AR

**DEF FN wizardry**—Commodore Basic only allows one argument in user-defined functions, but this limit should not be taken seriously. I use functions with no arguments or with multiple arguments.

For example, when using the Read statement, it's useful to know from which line on the C-64 the data are being read. The line can be found by entering:

```
PEEK(63)+256*PEEK(64)
```

If I'm using that specific Peek a lot, I add the following line early in my program.

```
100 DEF FNP(X)=PEEK(63)+256*PEEK(64)
```

Then, whenever I want this information, I just type

```
PRINT FNP(X)
```

where X is a dummy argument.

If I want to read bit B from memory location M, I use DEF FN with multiple arguments as follows.

```
200 DEF FNR(B)=(PEEK(M) AND 21B) / (21B)
```

To use it to read bit 3 of memory location 32768, enter:

```
290 M=32768:PRINT FNR(3)
```

Other examples are numerous. Just remember the key: Any complex, often-used arithmetic expression can be abbreviated in this fashion.

**Dan Reisberg**  
Brooklyn, NY

**Defining variables**—It is sometimes desirable to define Basic variables in a certain order, particularly where execution speed is critical, and we want frequently used variables to be at the top of the heap.

To accomplish this, it is not necessary to assign a value to each variable, as most programs do. Commodore Basic allows you to establish variables in order, each with a value of 0, by using the DIM statement:

```
DIM X,Y,Z,A,P1,P2
```

Although the manuals make no reference to this use, the DIM command is not restricted just to array variables.

**I. Adam**  
Vancouver, BC  
Canada

**For...Next statements**—These initialize the loop variable before they compute the loop's end. You can use this to your benefit, especially if you're working in Direct mode. Take, for instance, the clearing of C-64 color memory, where it's common to remember the start as 1024 + 54272:

```
FOR I= 1024 + 54272 TO 1024 + 54272 + 1024 : POKE I,PEEK(646)  
: NEXT
```

can be shortened to

```
FOR I= 1024 + 54272 TO I + 1024 : POKE I,PEEK(646) : NEXT
```

**Curtis Sieber**  
Somerville, AL

**Better For...Next delay loops**—The following line is often used to wait until a key is pressed or a certain time has passed.

```
100 FOR T=1 TO 2000 : GET A$: IF A$="" THEN NEXT  
110 Continuation of program
```

The above method usually works fine, but it includes a potentially fatal bug, since it can exit the For...Next loop without executing the Next. When such an exit is made, the computer's stack pointer is not restored to its proper value, and the chance of an Out of Memory error is greatly increased. It is better to use something like this:

```
100 FOR T=1 TO 500 : T=T+(500-T)*PEEK(198) : NEXT :  
POKE 198,0  
110 Continuation of program
```

Location 198 contains the number of entries in the keyboard buffer. When no key is pressed, the loop sets  $T = T$ , then increments  $T$ ; it finishes as soon as  $T = 500$ . As soon as a key is pressed,  $PEEK(198) = 1$ , setting  $T = 500$ . The loop is satisfied without corrupting the stack pointer.

If you begin line 100 with `POKE 198,0` you will clear any previous keypresses before starting the delay loop. If you want to have the loop exit only when a certain key is pressed, you can do this:

```
100 FOR T=1 TO 500 : T=T-(500-T)*(PEEK(197)=X) : NEXT :  
POKE 198,0  
110 Continuation of program
```

In this line, X would equal the value for the desired key as de-

termined by the keyboard matrix table. You can find the value for the key you want by running this:

```
1 PRINT PEEK(197) : GOTO 1
```

When you press the key of interest, its matrix value will appear on the screen. This is the value you should substitute for X.

**Katherine Myers**  
Fresno, CA

**GET this straight!**—Executing a Get statement will turn off any current CMD command in effect. This unsuspected effect can be the source of mysterious hexes in a program.

**Mr. Smouse**  
Address unknown

**Simple cursor for GET**—The various methods of establishing a flashing cursor to use with the Get statement are sometimes unsatisfactory for reasons of complexity or their tendency to leave white squares on the screen. This easy way uses a non-blinking cursor and is perfectly fine for my purposes. Perhaps you will like it, too.

```
100 PRINT "{RVS ON}{SPACE}{RVS OFF}{CRSR LF}";  
110 GET A$: IF A$="" THEN 110  
120 IF A$=CHR$(13) THEN PRINT "{SPACE}"; CHR$(20) :  
GOTO 150  
130 PRINT A$;  
140 GOTO 100  
150 Rest of program goes here
```

**Osp Viggosdottir**  
Reykjavik, Iceland

**GET# improved**—Here's an incredible C-64 trick that works the same as the GET# statement, but is about five times faster. The editors tried it on a directory-reading program that contained a lot of GET# statements, and execution time was cut in half.

There's a routine in the operating system that works like CMD, but in the opposite direction—it defines a certain file as the input channel, rather than the output channel. To call the routine from Basic, Poke the file-number into location 781, then execute a `SYS 65478`. Once that's done, you can use the normal GET statement to read a character from the file. When you're through reading from the file, you must clear the input channel with `SYS 65484`.

Those procedures are for the C-64, and may have to be modified for other machines. 65478 is the kernal CHKIN routine, while 65484 is the kernal's CLRCHN. The Poke to 781 causes the filename to be placed in the X-register before CHKIN is called.

The trick speeds things up because Basic is relieved from constantly switching its input channel between the keyboard and the file. Although we've only tested it on disk, it should work with cassette files, too.

**Tim Gerchmez**  
Bellevue, WA

**Calculated GOTO**—This routine for the C-64 and VIC lets you go to a line number that is calculated within your program. To use it, just set variable GL equal to the line number to be executed, then enter `GOTO 63000`. The

routine can be put in any three consecutive lines, provided the third line is typed exactly as shown here, with no spaces between any of the characters.

```
63000 GL$=STR$(GL):LN=LEN(GL$)-
      1:GL$=RIGHT$("0000"+RIGHT$(GL$,LN),5)
63010 FOR DI=1TO5:BY(DI)=ASC(MID$(GL$,DI,1)):NEXT DI
63030 AD=PEEK(62)*256+PEEK(61):FORDI=
      ITO5:POKEAD+51+DI,BY(DI):NEXT:GOTO00000
```

The routine works by Poking memory to change the last characters of the third line. You can test the routine by setting GL, then executing it, then listing it. In the listing, the 00000 should be replaced by the value of GL.

Douglas Johnson  
Evesham, England

Thomas Henry  
N. Mankato, MN

**If...Then...Else**—Unfortunately, Commodore Basic doesn't have this useful construction, which allows you to redirect the program if the If statement fails. You can use the ON...GOTO statement to give a similar effect, as in this example:

```
400 GET A$:IF A$="" THEN 400
500 ON((A$="Y")+2) GOTO 600:ON ((A$="N")+2) GOTO 700:
      GOTO 400
600 PRINT "YES":END
700 PRINT "NO":END
```

Note how the two tests have been put on the same program line.

Mike Sokolewicz  
San Francisco, CA

**No-question-mark Input**—Here's an easy way to get it:

```
10 POKE 631,154:POKE 198,1:INPUT "PROMPT {CTRL 7}";IN$
```

The {CTRL 7} changes the print color to dark blue, so the question mark, though printed, is invisible. The two Pokes put a light-blue character into the keyboard buffer, so your response to the prompt will be visible. If you aren't using these screen and print colors, change the {CTRL 7} and the CHR\$(154) to the appropriate values, found in your user's manual.

The Pokes given here are for the C-64 and VIC. To use this technique with other machines, substitute the proper values in place of 631 and 198. You can find them in the Dynamic Keyboard trick in the "Programming Tips-General" section.

Steve Freedkin  
East Lansing, MI

**Input with default**—Input parameters are often known in advance, but sometimes you may want to make a change. If the Input statement itself contains the most-used parameter, you can select it just by pressing the return key. If another parameter is desired, you merely type it in the usual way. Here's a simple example:

```
INPUT "DEVICE NUMBER{2 spaces}8{3 CRSR LFs}";D
```

The number 8 will appear under the cursor and can be selected by hitting the return key.

E. Dam Ravn  
Olstykke, Denmark

**Easy Input filter**—Many real-world problems only make sense if the input data is made up of non-negative

integers. For example, when inputting the number of items in an inventory, you must make sure there are no negative numbers or fractions.

Of course, the programmer's sacred duty in these cases is to trap erroneous input responses before they can cause problems. Here's an elegant input filter that excludes both fractions and negative numbers. Notice how simple it is and how it does its job without resorting to Boolean operators.

```
10 INPUT "HOW MANY RABBITS IN THE HAT";N
20 IF INT(ABS(N))<>N THEN 10
30 Rest of program goes here.
```

**Improving on INT**—The Basic function INT(X) is very useful, but sometimes you want the integer closest to X. (INT works by a kind of truncation, not by rounding off.) The simplest way to get the rounded value is by the formula INT(X + 0.5).

This works for both positive and negative numbers, but a problem still remains, since

```
INT(+3.5+0.5)=4 and INT(-3.5+0.5)=-3
```

You can cure this by defining and using a function such as

```
DEF FNI(X) = SGN(X)*INT(SGN(X)*X+0.5)
```

Jerry Bridgman  
Madison, WI

**Loading overlays**—When the Load command is used in Program mode, the loaded program must be shorter than the one that loads it. As soon as it loads, the second program is automatically executed, and any variables set by the first program retain their values.

For string variables, however, things are not so simple. Their values will be lost unless the first program has concatenated them to something. If A\$ = "TEXT", just use A\$ = "TEXT" + "", and the necessary condition will have been met.

Reinhard Ruscher  
Szekesfehervar, Hungary

**Load in Program mode**—It is well-known that if you load one program from another, the variables from the first program remain intact and are immediately accessible to the second one. It's also well-known that the second program must be shorter than the first, or the computer will become confused.

It's not so well-known that similar problems arise when the second program, after being loaded from the first, is saved to disk or tape. What happens is that the Save routine thinks the second program is now as long as the first, so it saves much more than is required. At the time, this is usually unnoticed by the operator, but it can cause future problems and erratic operation.

So, if you need to make changes to your second program, you must execute a New statement, then load it from Direct mode. Make your changes, then resave it.

H.K. Hirashima  
Billerica, MA

**Loading machine language**—The common way to load a machine language program from disk is:

LOAD "filename",8,1

It isn't widely known that *any* odd number can be used instead of the 1. I find it easier to use:

LOAD "filename",8,9

since the 9 is right next to the 8 on the keyboard.

**Eric the Juggler**  
Squirrel Hill, PA

**MIDS documentation error**—The book erroneously says that MIDS's numeric parameters can range from 0–255. But if either one has a value of 0, an error immediately occurs. Forewarned is forearmed.

**J. Paul Keller**  
Springfield, VA

**Open command glitch**—Any time the Open command is used with device number 2, all variables and arrays are cleared. Device number 2 is reserved for RS-232 devices, and activating it makes some internal changes to prepare for RS-232. Whether or not you have an RS-232 device connected, OPENx,2,y will clear all your variables. Therefore, be very careful about using device number 2 at any time. If you're writing a program involving an RS-232 device, be sure to open your channel before setting any critical variables.

**Heather Albright**  
Ventura, CA

**Printing quotes**—If you want to print quotation marks, you'll soon discover that you can't put them inside a Print statement. The solution is to Print CHR\$(34).

**Andrew Apold**  
Panama Canal Zone

**Printing quotes #2**—When you print a quotation mark, your machine goes into Quote mode, which may be contrary to your wishes. You can avoid the problem by using:

```
PRINT CHR$(34) CHR$(20) CHR$(34)
```

THE CHR\$(20) is a Delete, which wipes out your first quote. The second quote then overwrites it and takes the machine out of Quote mode.

**Bruce Romney**  
Suffern, NY

**Printing the bottom line**—You've probably had the maddening experience of printing something on the bottom line of the screen, only to see everything scroll up a line. To prevent this, press the cursor-up key twice as the last characters of the line.

**William W. Braun**  
Arnold, MO

**Shifted REMs**—If you put a shifted letter inside a REM statement, the computer will interpret it as a Basic keyword when it is listed. (The same is true of the graphics characters created by the Commodore key.)

A shifted L in any REM statement will cause a Syntax error if the computer tries to list it. REM followed by an

alternating series of shifted Vs and unshifted spaces will commemorate nylon stockings, the Olympics and an equally famous fountain of knowledge. Replacing the shifted Vs with shifted Ss will show what you do with the latter.

When shifted or Commodore key characters follow a quotation mark, they list as themselves rather than as Basic keywords. So, if you *must* use shifted characters in your REM statements, precede them by a quotation mark.

**Ellen Pekar**  
Florence, MA

**Uses for REMs**—REM statements are much more helpful than just describing a subroutine or giving credit to the program originator. I use them at the beginning of each program to list the source and location of the program, plus any special instructions that may be required in using it. It saves me from having to dig through stacks of magazines trying to find the article. For example:

```
10 REM FILE HANDLER—RUN FEB 84 PAGE 48
20 REM USE SPACE BAR TO SKIM PAGES. USE RETURN TO SKIM
   CATALOG.
```

**Howard VanDover**  
Trenton, MI

**C-64 selective Restore**—Do you ever need to restore the data pointer to a specific line in your program? (Plus/4 and C-128 owners are lucky—their Restore command will accept a line number as an argument.)

On the C-64, you can use this strange-looking program to have the same effect. Just set variable RL to the number of the desired line, then enter GOSUB 1000.

```
1000 POKE 785,232:POKE 786,7:POKE 209,232:POKE 210,7:POKE
     211,0:POKE 213,39
1010 PRINT "{SPACE}S{CTRL 9}&${CTRL 0}{COMD *}{CTRL 9}
     HD{CTRL 0}{SHIFT A}{CTRL 9}${CTRL 0}
     {SHIFT SPACE}{CTRL 9}D{CTRL 0}{SHIFT B}
     {SHIFT SPACE}":POKE RL,PEEK(RL):RL =USR(RL):RETURN
```

I've said it before, and I'll say it again. It may not look like it, but it works!

**Randy Thompson**  
Eugene, OR

**Random numbers**—The general formula for producing a random number between A and B is:

$$N = \text{RND}(0) * (B - A) + A$$

If you wanted to choose Ns between 30 and 40, for example, you would use:

$$N = \text{RND}(0) * (40 - 30) + 30$$

You could combine the numbers inside the parentheses, of course, and if you wanted only integers as N, you could use the INT function to get it or use N% rather than N. To correct for the downward rounding in these cases, the quantity inside parentheses must be changed to (1 + B - A).

**Mary D. Brigito**  
Old Forge, NY

**STOP and CONT**—These two commands can be used as valuable debugging tools. CONT will restart a program that has been halted by the stop key, or by an End or Stop statement. Execution will continue from the statement following whatever caused the halt.

You can put STOP into your program at various test points. When the program encounters a Stop command, the number of the last line executed will be shown on the screen, proving that the program reached the line in question. While the program is halted, you can check the value of variables, and can even change them if you'd like. A Direct mode CONT will, of course, resume program execution.

Charles Brogdon  
Dalton, GA

**Tab magic**—The number used in a Tab statement can be as large as 255; this can be very helpful when formatting a screen. PRINT TAB(240) is much easier than five Print statements, yet both give the same result.

Randy Thompson  
Eugene, OR

**Verifying machine language**—The Verify command works with machine language as well as Basic. A program saved and loaded with the ,8,1 suffix can be verified using:

```
VERIFY "filename",8,1
```

Charles Lavin  
Coral Gables, FL

**WAIT for keypresses**—A good way to pause until a key has been pressed is this:

```
100 WAIT 198,1 : GETAS : REM C-64 AND VIC  
100 WAIT 239,1 : GETAS : REM PLUS/4 AND C-16  
100 WAIT 208,1 : GETAS : REM C-128
```

It's simpler than a loop using GET and can be put into a line with other statements.

Unknown contributor  
Unknown address

**WAIT for special keys**—You can use the Wait statement to pause until the shift, Commodore or Control keys are pressed. The command is of the form:

```
WAIT FL,N
```

where FL depends on your machine as

```
653 for the C-64 and VIC  
1347 for the Plus/4 and C-16  
211 for the C-128
```

and N depends on the key you're waiting for

```
1 for the shift key  
2 for the Commodore key  
4 for the control (CTRL) key
```

Kenneth H. Hottes  
Danbury, CT

## 21. Languages—Machine Language

**Machine language definitions**—The following may help you understand the mysteries of machine language.

Source code—word commands like LDA and JMP. Easy to program in and easy for knowledgeable humans to understand. For the microprocessor to understand it as

machine language, it must be translated by an assembler.

Source listing—a printout of a program's source code, usually including comments that make it easier for humans to follow.

Object code—fully numeric commands, usually expressed in hexadecimal format, which the microprocessor directly understands. Hard for humans to program in and to understand.

Assembler—A program that accepts written word commands (source code) and converts them to fully numeric form (object code).

Disassembler—A program that translates object code (numeric) back into source code (word commands). Such source code lacks the comments that make the original source listing so valuable.

Monitor—a program that lets you directly examine the contents of specified memory areas. Usually allows you to alter these contents as well. Many monitors also include simple assemblers and disassemblers.

Mary Brigito  
Old Forge, NY

**Machine language lesson**—Many readers are totally in the dark when it comes to machine language. It may shed a little light if we explain the various sections of an assembly listing.

This machine language program creates an unusual color display on the C-64's screen. We have provided a Basic program to Poke it into memory, beginning at 828 decimal (\$033C hex). Type it in, run it and observe some psychedelic magic.

```
1 FORX = 0TO9:READA:POKE828 + X,A:NEXT:DATA120,206,33,  
208,206,33,208,76,61,3:SYS828
```

You can regain control of your machine by simultaneously pressing the run/stop and restore keys. Here's an assembly listing of the program, along with an explanation.

```
033C 78          SEI  
033D CE 21 D0   DEC $D021  
0340 CE 21 D0   DEC $D021  
0343 4C 3D 03   JMP $033D
```

● Each line in the listing describes a single machine language instruction.

● The first column indicates the memory location, in hexadecimal format, of the first byte in the instruction.

● The next three columns show, in hex, the byte or bytes that make up the instruction. A complete instruction can be one, two or three bytes in length.

● The final columns show the mnemonic representation of the instruction.

In the first line of the sample program, you can see that memory location \$033C holds a \$78, and that the \$78 is the hex form of a SEI instruction. (SEI sets the interrupt mask. You don't have to know any machine language to see the value of the mnemonic.)

Louis F. Sander  
Pittsburgh, PA

**Machine language memory locations**—For programmers, Basic automatically allocates memory as needed, so you never have to concern yourself with memory matters. Machine language, however, requires you to choose every memory location used by your program. Locations from 0-255 are particularly useful, since machine language's zero-page instructions can access them

in miraculous ways. They are also particularly scarce, since the computer and its operating system make heavy use of them. In the C-64, the following zero-page locations are available for user programs.

182 and 247-254—Available if the RS-232 channel is not being used.

251-254—Always available for user programs.

If you are not using the Datassette recorder, several other zero-page locations may be safely available. For clues as to where they are, consult the memory map in your *Commodore 64 Programmer's Reference Guide*.

Many other locations in C-64 memory are also available for machine language programs, and they may or may not be interfered with by Basic or the Datassette. Following are some commonly used ones.

679-767—Unused by C-64

820-827—Unused by C-64

828-1019—Cassette buffer. Used if you use the Datassette. Otherwise, untouched.

1020-1023—Unused by C-64. (Notice that locations on either side of the cassette buffer are available for machine language use.)

2048-40959—Basic program space. This area is used by Basic programs. If you know how to adjust the Basic pointers in locations 43-56, you can protect parts of this area from alteration by Basic's activities.

49152-53247—Unused by C-64. This is the largest and most commonly used area in which to load machine language programs.

On other computers, similar locations will be available for your use. To find them, study your memory map.

**Many contributors  
All across the land**

**Machine language in tape buffer**—On the C-64, it's easy to keep any machine language routine in the cassette buffer, even while loading or saving; just type POKE 179,4 before your tape activity. The computer will then use screen memory for its tape activities, leaving your machine language intact in 828-1019. If you don't like the resulting screen disruption, choose another location and Poke it into 178 and 179.

**Michael L. Smith  
Pacific, MO**

**Magic ML poker**—Machine language programs are usually (and conveniently) listed as hexadecimal memory dumps, with an address and eight hex bytes on each line. In many cases, we convert those bytes to decimal form, then type them into Data statements, where a Basic program can read them and Poke them into memory. Unfortunately, this process often introduces errors, and since the Data statements bear little resemblance to the original ML listing, the errors can be *very* hard to find.

The accompanying C-64 program avoids these troubles, letting the original hex dump be used verbatim in the Data statements. It eliminates the use of commas and allows proofreading of Data statements against the original ML dump. Lines 100-170 are the program itself; the others are a test routine that Pokes some letters onto a C-64 screen.

To use the main program on your own ML, just delete the extra lines, then do this:

● In line 110, set variable BA to the decimal value of the ML's beginning address.

● Add your Data statements, each consisting of a line number, the word DATA and the data item as described below.

● Each Data item must consist of a four-hex-digit address, followed by any number of hex bytes (usually eight or fewer), all separated by single spaces. There must be no punctuation marks or other characters on the line. (Most hex listings are very close to this form already.)

● Add a final Data statement, of fewer than six characters, to mark the end of your ML. The number 999 works fine.

● Run the program. As it reads each Data statement, it ignores the four-character address, then checks that each other item is a valid hex byte. (If you type an I for a one, the poker will catch it, showing you the defective entry and the number of the line it's in. Hallelujah!) Finally, it converts the bytes to decimal and Pokes them into the proper locations.

```
10 REM{2 SPACES}MAGIC ML POKER
20 POKE53281,1:PRINT"{SHFT CLR}":POKE53281,
  6
30 :
100 REM{2 SPACES}MAGIC ML POKER
105 REM{2 SPACES}CREATED BY LOUIS F. SANDER
110 BA=1024:READHD$:HD$=MID$(HD$,6):IFHD$="
  "THEN170
120 FORP=1TOLEN(HD$)STEP3:BY$=MID$(HD$,P,2)
130 HN=ASC(BY$)-48:HN=HN+7*(HN>9):IFHN<0ORH
  N>15THEN160
140 LN=ASC(RIGHT$(BY$,1))-48:LN=LN+7*(LN>9)
  :IFLN<0ORLN>15THEN160
150 POKEBA+Q,LN+16*HN:Q=Q+1:NEXT:GOTO110
160 PRINT"ERROR IN"PEEK(63)+256*PEEK(64)":
  "BY$:END
170 PRINT"DONE!":END
1000 :
1001 DATA 0400 01 02 03 04 05 06 07 08
1002 DATA 0408 09 0A 0B 0C
1003 DATA 999
```

**Louis F. Sander  
Pittsburgh, PA**

**Machine language saves**—This short sequence will save a machine language program to disk without upsetting any Basic pointers. SA is the starting address of the material to be saved, and EA is its ending address + 1.

```
POKE 175,EA/256
POKE 174,EA-256*PEEK(175)
POKE 194,SA
POKE 193,SA-256*PEEK(194)
OPEN 15,8,15,"filename"
SYS 62957
CLOSE 15
```

**Wallace Fini  
San Diego, CA**

**Loading the registers**—On the C-64 and VIC-20, memory locations 780-783 are used to save and reload registers between SYS calls. Values placed in these locations are placed in the corresponding registers before the SYS is executed. When the program returns to Basic, the then-current register values will be put in these locations.

You may examine them from Basic to determine the results of the called routine. The locations and their contents are:

780—accumulator  
781—X register  
782—Y register  
783—status register

G.R. Davies  
Los Altos, CA

**Waiting for shift**—You can use this routine to pause your program if the C-64's shift key is depressed. (It also works with the CTRL and Commodore keys.) The shift-lock key will hold the pause indefinitely.

```
C100 LDA $028D
C103 BNE $C100
```

Roy B. Graff  
Sheridan, WY

## 22. Languages—Other

**Comal sprites**—Comal is a great language that makes programming sprites especially easy. The only problem is that since the VIC-II chip can only “see” 16K at a time, the Comal sprite commands put the sprites on the graphics screen. As it turns out, however, we only need to replace two of the commands to put sprites on the text screen. Try substituting these two procedures for the Comal commands Define and Identify. (Notice that FUNC BITOR is called by IDENTIFY\*TX PROC. Comal 2.0 has BITOR built-in.)

```
PROC DEFINE*TX(IMAGE#,DEFINITIONS) CLOSED
FOR I:=0 TO 63 DO
  POKE I+IMAGE#*64,ORD(DEFINITIONS$(I+1))
ENDFOR I
ENDPROC DEFINE*TX

PROC IDENTIFY*TX(SPRITE#,IMAGE#) CLOSED
POKE SPRITE#+2040,IMAGE#
POKE 53269,BITOR(PEEK(53269),21*SPRITE#)
ENDPROC IDENTIFY*TX

FUNC BITOR(NUM,MASK) CLOSED
POKE 2024,169 // LDA# NUM
POKE 2025,NUM //
POKE 2026,9 // ORA# MASK
POKE 2027,MASK //
POKE 2028,141 // STA 2032
POKE 2029,240 //
POKE 2030,7 //
POKE 2031,96 // RTS
SYS 2024
RETURN PEEK(2032)
ENDFUNC BITOR
```

The syntax is the same: The sprite number, image number and definition string are used the same way. The only difference is that *only* image numbers 13, 14, 15 and 189 are safe to use, and SETGRAPHIC is not needed!

A. Hanson Kappelman  
Pittsburgh, PA

**Logo tips**—When using the Logo language on the C-64, you can use the run/stop key to get out of the Editor. Outside the Editor, you can repeat a line continuously by pressing the up-arrow key. If you find that your lines or colors overlap, simply use the Doublecolor mode rather than the Singlecolor mode. And finally, in words and lists

Logo, you can get multiple blank spaces by putting them inside apostrophes.

Valerie Ann Brown  
Brownsburg, Quebec  
Canada

**Logo program**—This will print a decorated tree. Type CTREE 40 for the best result or CTREE 10 to check your typing.

```
TO CTREE :L
  TREE :L
  TEE
END
TO TEE
  PC 9
  RT 180 FD 40 RT 90 FD 20 BK 40
END
TO TREE
  HT FULLSCREEN
  BG 0
  PC 1+RANDOM 15
  IF :L<5 STOP
  RT 45
  FD :L
  TREE :L*.75
  BK :L
  LT 90
  FD :L
  TREE :L*.75
  BK :L
  RT 45
  TREE :L/2
END
```

D.A. Barrows  
Centerville, MA

**Logo tool**—In Commodore Logo, typing GOODBYE will erase all your work from memory. To ensure that you've saved it to external storage, add this procedure:

```
TO GB
PR [HAVE YOU SAVED YOUR WORK?]
MAKE "ANSWER REQUEST
IF :ANSWER=[Y] THEN GOODBYE
END
```

Now, instead of typing GOODBYE, always type GB. If you answer the prompt with anything other than Y, you'll have a second chance to save your work.

Alan L. Brown  
Islington, Ontario  
Canada

**Logo autostart**—To make your Logo program run automatically after you've read it in, add this to the program before you save it:

```
MAKE "STARTUP {starting procedure}
```

In place of the words “starting procedure,” substitute the name of the procedure you want to start with.

Alan L. Brown  
Islington, Ontario  
Canada

## 23. Programming Tips—Debugging

**Tips for beginners**—I've learned that most novice programmers have similar problems in figuring out what to do when an error message presents itself. I always give them the following checklist, which should expose the majority of problems:

1. Read the error message and make sure you understand it. If necessary, consult your user's guide.
2. List the line mentioned in the error message and read it over for obvious errors. You should be able to spot most Syntax errors if you read carefully, remembering that Basic often chokes on anything that looks like a keyword.
3. Print out the value of each variable on the offending line and write down its value. This will help you find errors like a bad array index or a bad argument to a string function.
4. If possible, execute in succession each separate Basic statement on the line. You might be able to tell which statement killed the program.
5. If these steps fail or expose a problem that you don't know how to fix, then you probably don't understand how your program works. In this case, you should read over it, tracing out how it executes until you understand the problem.
6. As a last resort, seek help. This is last because you need to learn how to solve your own problems if you ever really want to know what you're doing.

Andrew M. Fregly  
Greenbelt, MD

**Error finder**—If you're having trouble debugging a program, wait until just before the error is executed, then press the stop key. You should get a Break error in a certain line number, which usually gives you a good idea of the location of your bug.

Steve Myers  
Monroe, MI

**Test it**—To test small parts of a program without disturbing anything already in memory, give your program fragment a high line number and run with that number. For example, if you're not certain whether the square root function is called by SQR or SQRT, do this:

```
50000 PRINT SQR(25) {RETURN}
      RUN 50000 {RETURN}
```

R.P. Mayor  
Swampscott, MA

**Follow the cursor**—When debugging a program, list the lines of interest, then use your cursor to follow the line while you read or review the program. It works great when someone else reads to you, and you can both celebrate when the offending bug is killed. It works even better if you change cursor color.

R. Ferdman  
Riviera, AZ

**Use Stop**—To help in debugging, I list the offending line and insert Stop commands between two of the line's statements. Then whenever the program stops, I get a Break error. If the break happens before the bug asserts itself, I know the error is somewhere after the Stop. If the bug comes up first, I know the opposite. I can continue the program after it has stopped by executing CONT in Direct mode.

Paul L. Biggs  
Ogalalla, NE

**Crowder probe**—This debugging tool is named after its inventor, my friend Kevin Crowder. It has saved us days of debugging time, at very little cost. To use it, insert this subroutine at the end of your program:

```
30000 POKE 53280,PROBE : FOR J=1 TO 1000 : NEXT :
      PROBE=PROBE+1 : RETURN
```

Each time it is called, it changes the border color and pauses briefly so you can see where you are.

Now put Gosub statements to access the Probe subroutine at important points in your program. When the program executes them, the border color will change.

Jim Von Ehr  
Plano, TX

**Data debugging**—Sometimes when using a checksum program to assist in the correct entry of Data statements, you continue to get checksum errors even though the data items seem to be correct. In those cases, you probably have a punctuation error in your Data statements, such as a period instead of a comma, or an extra comma that adds a spurious zero to your data.

Marie E. Coon  
Bothell, WA

**Check the checksum**—Much can be learned by examining the value of the checksum number. If it has a decimal point in it, there's an unwanted period in your Data statements.

Also, by comparing its value with the known "good" value, you can learn something about the size of the discrepancy in your program. If it's off by a lot, you're reading too few or too many Data statements. If it's off by just a little, maybe you've mistyped a number. If it's off by 34, you know to look for some sort of error that involves that number.

Larry W. Self  
Shelby, NC

**Debugging tip**—Debugging a routine that follows several Input statements can be the ultimate in tedium, since you must make all the inputs each time you run the program. Avoid this useless repetition by temporarily changing the Input statements to Read statements, and providing data for them to read. For example, instead of

```
100 INPUT A,B,C
110 Rest of program
```

you can temporarily use

```
100 REM INPUT A,B,C
102 READ A,B,C : DATA 12,34,56
110 Rest of program
```

This will quickly get you into the more troublesome parts of your program.

Peter L. Rasco, Jr.  
Address unknown

**Examining arrays**—Every now and then you have to find a bug in a large array. You could wear out your fingers doing it one element at a time. Yet, if you write a routine to examine the elements, typing the line numbers will destroy them. The solution? The following Direct mode command lets you look at a new element every time you press a key. Use a repeating key to zip through them quickly.

```
FOR J = 0 TO 9999 : PRINT J, A$(J) : WAIT 198,1 : POKE 198,0 :  
NEXT
```

If your array is something other than A\$( ), of course, you'll use the proper name in this line. Each screen line will contain a subscript number and the contents of that element in the array. As soon as you exceed the size of the array, a Bad Subscript error will get you out of your loop.

Alan P. Davenport  
Salem, OR

**Debugging hint**—When debugging a program with a lot of variables, I find it helpful to "echo print" the variables. This is done by putting a Print statement in the program each time a variable is defined or updated. For example, to echo print the variable A, I enter:

```
160 A = INT(RND(0)*10) : PRINT A
```

When debugging a program like this, it's easy to find where a variable is going astray, since each value is printed as the program is run.

James Ryan  
Winthrop, MA

**Line tack**—When you're debugging a program and get a Syntax error in a line that appears correct, try listing the line by itself. (Example: LIST 120.) If you get two lines instead of one, you have what I call *line tack*. It's caused when you type a line exactly 40 characters long, then type another line below it, without first pressing the return key.

The computer interprets this as one long line and executes it correctly until it encounters the second line number, which causes the error. The cure is to type both lines again, being careful to press the return key at the end of the first one. If you're skillful with the screen editor, you can list the offending line twice, then edit both listings to achieve the desired effect.

Rickey Bartlett  
Plumerville, AR

**Line feed fix**—Commodore computers are subject to an occasional but maddening malady, where the cursor refuses to line feed when the return key is pressed. It will jump to the end of the current line, but will refuse to go any further. The problem usually arises when hard-copy printing is aborted by the stop key or some other non-standard means.

Pressing the shift key along with the return key will move the cursor to the start of the next screen line. Then, typing a letter or two and pressing the return key will cause a Syntax error, which will end the line feed problem.

At this point, there is probably some garbage in your

printer's buffer. Give it something unimportant to print, and the buffer will clear itself.

Beldare Lecone  
Remulac, France

**Tough to see**—When using PRINT TAB(x), you may get a Bad Subscript error. For example:

```
100 PRINTAB (25); "HEMIPTERA"  
RUN  
? BAD SUBSCRIPT ERROR IN 100
```

Since there are no subscripts in line 100, you might think something has gone haywire. But the real reason is that a "T" was left out, making the computer print the value of AB(25)! This error is hard to find, because you'd normally expect a Syntax error. Of course, if the number in parentheses is less than 11, you won't get any error message at all. Instead, you'll get a 0 on the screen.

Charles Brogdon  
Dalton, GA

## 24. Programming Tips—General

**Automatic line numbering**—This Direct mode line puts ten line numbers on the screen. By moving your cursor to the proper position on the screen line, then typing a program line, you can use them as line numbers.

```
FOR A = 10 TO 100 STEP 10 : PRINT A : NEXT
```

The number values, of course, can be changed to anything you'd like. If you're typing in Data statements, change the line to read:

```
FOR A = 10 TO 100 STEP 10 : PRINT A;"DATA" : NEXT
```

You then only have to enter the data items themselves.

Lum Kin Leon  
Kuala Lumpur, Malaysia

**Program subsets**—If you want to extract a few lines from a program (for example, a sound or scoring subroutine), there's an easier way than by deleting all the unwanted lines. The method is to load the program, list the desired lines on the screen, then enter NEW. Move your cursor onto each of the lines you want to save, and press the return key. This will put the lines into memory as a new program, which can easily be saved. The method can be used to save lines that are not contiguous, as well.

If you want to extract more lines than can be listed on the screen at one time, just go through the procedure more than once, saving each segment with a different name. Then merge all the segments together, using the following procedure.

- Load and List segment #1.
- Load segment #2.
- Put your cursor on each of the listed lines from segment #1, pressing the return key on each line.
- Save the combined segments, and repeat as necessary.

Ian Hayes  
Westville, South Africa

**Programming trick**—While programming, if you are not sure whether a line must be deleted, just insert a REM statement at the beginning of that line. This way, the line

will not be executed if you run your program, and you'll be able to know if you have to keep it in. If you do have to retain the original line, just delete the REM statement and press the return key.

**Alain Niquet**  
Alma, Quebec  
Canada

**Easy GO testing**—When testing a program that uses On...Go commands, or perhaps computed Goto's, it's useful to establish dummy lines as the targets for those commands, so you can get easy proof that the program is going where you want it to. Once you have that proof, you can replace the dummies with more interesting sections of code.

The ideal dummy line would be easy to type in, easy to replicate with various line numbers and would be self-documenting when executed. After years of looking, I finally found it:

```
1200 STOP:RETURN
```

When executed, this line will cause a Break in XXX message, where XXX is whatever line number you've given it. When you then enter CONT, the program will return from the subroutine. Of course, if you've used a Goto rather than a Gosub command, you don't need the Return command in your dummy line.

**Louis F. Sander**  
Pittsburgh, PA

**Programming tip**—When developing a program, you can save time by making the last step a List rather than an End. Then when the program is run, you can see the results and easily make any needed changes. When the program is right, just change List to End, then save it.

**John P. Oprea**  
Kirkland, WA

**Dynamic keyboard explained**—It's easy to make a program simulate keypresses, with truly magical effect. The technique has been around at least since 1978 and is commonly called *dynamic keyboard*. The basic idea is to have your program Poke the CHR\$(13) values of one or more characters into the *keyboard buffer* area of memory. When the program is finished, the computer will print the Ready prompt, then act like you've typed the Poked characters.

The keyboard buffer occupies the ten memory locations from 631-640 decimal. It works in conjunction with location 198, which must always hold a count of the characters Poked into the buffer. For the Plus/4 and C-16, the buffer runs from 1319-1328, and the counter is in 239. For the C-128, these locations are 842-851 and 208.

Run this little program to see the principle in action:

```
10 FOR I=1 TO 10 : POKE 630+I,65 : NEXT : POKE 198,10 : END
```

The Plus/4 version is:

```
10 FOR I=1 TO 10:POKE 1398+I,65:NEXT:POKE 239,10:END
```

The C-128 version is:

```
10 FOR I=1 TO 10:POKE841+I,65:NEXT:POKE208,10:END
```

You should get the Ready prompt, followed by a series of ten A's (CHR\$(65) is A). Change the 65 to 64+I, and you'll get the first ten characters of the alphabet. Change the 10s to smaller numbers, and you'll get fewer letters.

Dynamic keyboard's *real* magic comes when your pro-

gram prints an executable statement on the screen, then makes the Ready prompt appear on the line above it. If the buffer holds a 13, it's just like putting the cursor on that statement and hitting the return key; your computer will do whatever the statement tells it to.

Clever programmers can print up to ten Direct mode lines, with proper spacing between them, then put CHR\$(13)s into the buffer, causing all those lines to be executed. The key to success is careful placement of the screen commands and careful positioning of the cursor at the moment the program ends.

**R.E. Peat**  
Pittsburgh, PA

**Programmable Run key**—CHR\$(131) is equivalent to the shifted run/stop key. That is, it automatically loads and runs a program. Unfortunately, you cannot print CHR\$(131) and expect this result, but you can Poke it into the keyboard buffer as follows:

```
10 POKE 631,131 : POKE 198,1 : END : REM C-64 and VIC  
10 POKE 1319,131 : POKE 239,1 : END : REM PLUS 4 and C-16  
10 POKE 842,131 : POKE 208,1 : END : REM C-128
```

When the line is executed, it will print the combination described above. If you're reasonably skilled at positioning on the screen, you can combine this and the previous trick to make a programmable load and run. Unlike a load executed from Program mode, this has no restrictions on program size.

**Mark DuRussel**  
Midland, MI

**Using illegal direct keywords**—C-64 and VIC memory locations 57 and 58 hold the line number of the Basic statement currently being executed. When no numbered statement is being executed, location 58 contains a 255.

In Direct mode, if the start of your line Pokes 58 with anything less than 255, you can use a Basic keyword in the rest of your line. Some keywords are otherwise illegal in Direct mode: Input, Input#, Get, Get# and DEF FN.

One practical use for this is determining the result of a defined formula before placing it in the program. Another is reading the disk error channel with Input#.

**Richard Shackelton**  
Chatham, NY

**Why disable run/stop?**—There are several ways to disable the run/stop key, but few explanations of why you would want to do it. One such circumstance arises when writing files to disk. Any interruption at that time could result in data being lost or the file being improperly closed.

**Devaun Ferguson**  
Aniwa, WI

**Timekeeper**—For an easy way to keep track of time while programming, try this: As soon as you turn on your computer, type the following in Direct mode:

```
TI$="hhmmss"
```

where hhmmss is the correct time in hours, minutes and seconds. Then, whenever you want to know the time, just type PRINT TI\$, and your built-in clock will tell you. You should note that the clock isn't extremely accurate and

will be slowed down by tape operations, but it's good enough for most purposes.

**Darren Atwater**  
Delta, British Columbia  
Canada

**Time format**—The TI\$ variable is somewhat confusing, since it includes hours, minutes and seconds with no separators. Since TI\$ is a string variable, the string manipulation commands can be used to add a colon and drop off the seconds.

```
100 PRINT LEFT$(TI$,2) ":" MID$(TI$,3,2)
```

**Mark Doble**  
Mons, Belgium

**Program delays**—To halt your program until a key is pressed, try this:

```
10 PRINT "PRESS ANY KEY TO CONTINUE"  
20 POKE 198,0 : WAIT 198,1:POKE 198,0  
30 Program continues here
```

On the C-16 and Plus/4, use 239 instead of 198. On the C-128, use 208.

**Andres Rios**  
Montevideo, Uruguay

**Named subroutines**—They are easy. Just do this:

```
100 GOSUB 1000,SUBROUTINE NAME : Rest of line goes here
```

It works because, when Basic returns from the subroutine, it looks for the next colon or line number, ignoring the subroutine name. It's useful because it lets you put a remark inside a program line, while eliminating the need for the REM statement.

**Richard Murray**  
Red Deer, Alberta  
Canada

**Deek**—Commodore machines store addresses in a low-byte, high-byte format, which means that to convert the address to decimal form, you must enter a statement similar to

```
20 SV = PEEK(45) + 256 * PEEK(46)
```

to get the value of the low byte plus the high byte multiplied by 256.

If your program does many such conversions, it may be convenient to set up a user-defined function to do them. Often the function is named DEEK (a mnemonic for Double pEEK). Here it is:

```
10 DEF FN DEEK(A) = PEEK(A) + 256 * PEEK(A+1)
```

When you want to find a two-byte address whose low byte is at NN, you enter

```
20 SV = FN DEEK (NN)
```

Notice that the dummy variable name used in the DEF FN statement need not be used when you call the function itself.

**William Keith Prusaczyk**  
Athens, GA

**Lost variables**—Ever wonder why you lost all your variables without typing CLR or RUN? They all go into

never-never land when you type in a new line or make any changes to an existing one. Even deleting a non-existent line will wipe out all your variables.

On the C-128, this situation has been changed. You can do anything at all with your program lines, and your variables stay just as they were. Only CLR and RUN can change them. It's a wonderful aid in debugging.

**Robert Spandau**  
Palm Desert, CA

**Protected variables**—Did you ever need a variable whose value is unchanged by CLR or other variable-destroying activities? A good technique is to Poke the number into an unused memory location, then Peek it later when you need it. If your number is greater than 255, you'll have to use more than one location.

I also use this technique when I need a new variable and can't remember what names have already been used.

**Mike Maynard**  
Bossier City, LA

**Redimensioning arrays**—Here's a technique you can use to free up memory space and redimension arrays without getting a fatal Redim'd Array error. On all machines but the C-128, it resets the array pointer, clearing the array space without clearing other variables. To use it, simply insert the following line before the computer encounters another DIM statement.

```
POKE 49,PEEK(47) : POKE 50,PEEK(48)
```

The C-128 version is:

```
BANK5 : POKE51, PEEK(49) : POKE52, PEEK(50) : BANK 15
```

**Jim Knarr**  
N. Manchester, IN

**Detecting peripherals**—When a program is running, you can determine whether a specific device is on-line by executing the following, where DN is the device number in question.

```
40 OPEN15,DN,15:CLOSE15  
50 DI$ = "OK":IFST <> 0 THEN DI$ = "OFF LINE"  
60 PRINTDN :DI$
```

The key is to access the peripheral through channel 15, then read the status variable ST. If it has a non-zero value, the peripheral is off-line.

**Fred Roberts**  
Charlotte, NC

**Terminating games**—Many computer games end with the player's man, android or spaceship being blasted or otherwise put to death. Unlike the real-world variety, this death is generally reversible, often by pressing a key. Vigorous pursuers of realism will appreciate the routine below, which is a *real* android killer. Executing the appropriate version blacks out the screen, disables all keys and sounds, and thoroughly corrupts any Basic program in memory. There is *no* way to recover. The first routine is for the C-64, the second is for the VIC-20. For the 128, it's simple—just GO64!

```
6400 REM ** KILLER FOR C-64 **  
6410 POKE808,225:POKE53280,0:POKE53265,11:POKE649,0  
6420 FORN = 54272 TO 54296:POKEX,0:NEXT
```

Listing continued.

```
6430 FORX = 2048TOPEEK(61) + 256*PEEK(62)
STEP7:POKEX,PEEK(56324) :NEXT:WAITX,0
20000 REM ** KILLER FOR VIC:20 **
20010 PRINTCHR$(147):POKE808,127:POKE36879,8:POKE649,0
20020 FORX = 36874TO36878:POKEX,0:NEXT
20030 FORX = 4096TOPEEK(61) + 256*PEEK(62)STEP7:
POKEX,PEEK(162):NEXT:WAITX,0
```

Louis F. Sander  
Pittsburgh, PA

## 25. Programming Tips—Mathematical

**Normal distribution**—The bell-shaped normal distribution curve is a useful tool in statistics and quality control. If ME is the mean of the distribution, and SD is the standard deviation, this line will produce Xs that are randomly distributed.

```
100 X = ME + SD*((-2*LOG(RND(0))){UP ARROW}.5*COS(2*{PI}
*RND(0)))
```

Put the line in a For...Next loop, and it will generate as many numbers as you'd like. INT(X) could be used to generate integers, if that's your pleasure.

Frank Biondi  
Pittsburgh, PA

**Speedy execution**—There are two ways of putting polynomial calculations into a Basic program. One closely duplicates the normal algebraic notation, while the other uses parentheses and looks somewhat unusual. The unusual-looking method is illustrated below, along with proof that it is much more rapidly executed than the standard method.

```
10 A = 2 : B = 3 : C = 4 : D = 5 : X = 2.5 : T = TI
20 FOR I = 1 TO 100
30 Y = A*X + B*X12 + C*X13 + D*X14
40 NEXT
50 PRINT "TIME = "TI - T;"ANSWER = "Y
60 T = TI : FOR I = 1 TO 100
70 Y = (((D*X + C)*X + B)*X + A)*X
80 NEXT
90 PRINT "TIME = "TI - T;"ANSWER = "Y
```

Dennis P. Dykstra  
Vienna, Austria

**Toggling**—If you need to toggle between two values in a program, set the toggle variable to one of the values, then use:

TG = [sum of the two values] - TG

For instance, if the two values were 3 and 7, you'd execute TG = 10 - TG each time you needed to toggle the value.

There's also a quick way of toggling between three or more values, as long as there's a regular relationship between them. Without going into the details, the formula for values of 1, 2 and 3 is:

TG = TG + 1 + (TG = 3)\*3

With a little effort, the formula can be adapted to work with any regular sequence of values.

Clay Carr  
Westerville, OH

**To float or not to float**—Does a floating-point variable or integer variable use less memory? Each side has its advocates, but the real answer asks another question first—how is the number used? As a single variable, such as a simple counter, using I is shorter than I% by the one byte needed to type the %. Otherwise, they use exactly the same amount of memory. However, if you use an integer array, then I%(J) will use much less memory than storing the same numbers in array I(J) because the computer stores integer arrays more compactly.

Marilyn Sallee  
Alliance, NE

**Random numbers, all different**—This routine generates a series of random numbers, of which no two are the same. It is perfect for programs involving decks of cards or for lottery-type programs where the restrictions do not allow for duplication. The number of elements to be selected from is A; to choose numbers ranging from 1 to 40, set A = 40. The number of selections to make is B; to draw six numbers, set B = 6.

```
20 N = 1 : DIM P(A)
25 X = INT(RND(0)*A + 1) : IF N > 1 THEN 200
30 P(N) = X : PRINT P(N) : N = N + 1
35 IF N = B + 1 THEN END
200 FOR M = 1 TO N : IF X = P(M) THEN 25
210 NEXT M : GOTO 30
```

Gene Majewski  
Schiller Park, IL

**Decimal flags**—Here's an easy way to put six flags in one integer variable. It uses the first six prime numbers (2, 3, 5, 7, 11 and 13) as flags for six conditions. Multiply together the prime numbers corresponding to each "ON" condition, and put the result in an integer variable. For example, if conditions 3, 4 and 6 are ON, the number is  $5 \times 7 \times 13 = 455$ . Set X% = 455, and you can use statements like

```
101 IF X%/2 = INT(X%/2) THEN PRINT "CONDITION 1 IS ON"
102 IF X%/3 = INT(X%/3) THEN PRINT "CONDITION 2 IS ON"
103 IF X%/5 = INT(X%/5) THEN PRINT "CONDITION 3 IS ON"
104 Etc.
```

to determine which conditions are ON. This works because X% is evenly divisible by each of the prime numbers that were multiplied together to get X% in the first place, but is not evenly divisible by any other prime. The technique fails if X% = 0.

David Hall  
Saskatoon, Saskatchewan  
Canada

**Binary flags**—Often when reading about programming, you see references to setting or clearing a certain bit (turning it on or off). Doing this is not difficult at all, once you know the magic. If the eight bits in a byte are numbered from 0 (low-order bit) through 7 (high-order bit), you can clear a single bit in memory location X by entering:

POKE X,PEEK(X) AND (255 - 21 bitnumber)

You can set a bit in location X by entering:

POKE X,PEEK(X) OR (21 bitnumber)

Robert Rovinsky  
Duluth, MN

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## 26. Programming Tips—Screen Display

**Improved reverse characters**—After typing CTRL 9, type in some words and look closely at them. The uppercase characters are not completely surrounded by reverse video, so they look cut off at the top. They will take on a more professional look if you put a row of unreversed COMD@ characters, CHR\$(164), just above the reverse characters needing the improvement.

Perfectly Clear  
Honolulu, HI

**Quote mode tip**—When a quotation mark is printed to the screen, the value of memory location 212 (C-64 and VIC) is changed from its normal 0, and the computer goes into Quote mode. In Quote mode, of course, cursor controls and other control characters print as reverse-field graphics symbols. If you print the quote mark from within a program, but want to avoid going into Quote mode, just enter POKE 212,0 after printing the quotation mark.

For the C-128, execute POKE 244,0. For the Plus/4 and C-16, the proper version is POKE 203,0.

Joseph R. Charnetski  
Dallas, PA

**Tricky screen formatting**—If you use horizontal lines to divide your screen, this routine will let you print them in most unusual ways. Use GOSUB 1210 to print a line that starts in the center and moves simultaneously toward both ends. Use GOSUB 1220 to print a line from both ends converging toward the center. You can shorten the lines by adding to X in line 1220 or Y in line 1210. Each number added will shorten the line by two spaces.

```
1200 REM**JOSEPH R. CHARNETSKI**
1210 X = 19 : Y = 1 : Z = -1 : GOTO 1230 : REM FROM CENTER
1220 X = 1 : Y = 19 : Z = 1 : REM FROM BOTH ENDS
1230 FOR J = X TO Y STEP Z : PRINT TAB(J){SHIFT C}";
1240 PRINT TAB(39-J){SHIFT C}{CRSR UP}"
1250 NEXT : PRINT : RETURN
```

Joseph R. Charnetski  
Dallas, PA

**Centered printing**—You can center A\$ on the screen as follows.

```
100 DEF FNC(X) = 20 - (LEN(A$)/2)
110 More program lines, if desired
120 Etc.
700 A$ = "PRESTIDIGITATION" : PRINT TAB(FNC(X));A$
710 A$ = "IS" : PRINT TAB(FNC(X));A$
720 A$ = "PLEASURABLE!" : PRINT TAB(FNC(X));A$
```

The X is a dummy argument, not used, but required to avoid a Syntax error. For the VIC, use 11 rather than 20 in line 100.

Carol A. Sowle  
Fort Wayne, IN

**Vertical tabbing**—You can easily have a vertical tab function, similar to Commodore's horizontal TAB, by using:

```
100 DIM VTAB$(25) : A$ = "{HOME}" : VTAB$(0) = A$
```

```
110 FOR J = 1 TO 25 : A$ = A$ + "{CRSR DN}" :
VTAB$(J) = A$ : NEXT
```

Then, if you enter PRINT VTAB\$(n), the cursor will move to the start of screen line n, in the same way that PRINT TAB(n) moves it to column n. As usual, the first line and column are numbered 0, rather than 1.

Louis F. Sander  
Pittsburgh, PA

**PRINT# to the screen**—By using variables for device number and secondary address in your Open statement, you can easily send your output to the printer or to the screen. You need only change the values of the variables. Printer device numbers are usually 4 or 5, with various secondary addresses. The screen uses device number 3 and secondary address 1. (The C-64 *User's Guide* mistakenly shows it as device number 0.) Here is an example for the MPS-801 printer in Upper/Lowercase mode:

```
100 INPUT "WANT PRINTED COPY (Y/N)";A$
110 DV = 4 : SA = 7 : IF A$ = "N" THEN DV = 3 : SA = 1
120 OPEN 1,DV,SA
130 PRINT#1,"THIS IS THE OUTPUT"
140 CLOSE 1
```

C.G. Sperling  
Greenville, SC

**Screen layout aid**—When I design a hi-res screen, I take an overhead projector transparency pen and draw on my video monitor a picture of how I want the screen to look. Then I take my graphics program and plot dots underneath my pen lines. If I make a mistake or want to change something, I simply take a wet tissue and wipe off the lines on the screen. If you adopt this method of layout, be sure you use transparency pens, not permanent markers. A popular transparency pen made by Vis-a-Vis can be found in most bookstores.

Scott Eldridge  
Lima, OH

**Graphics memory map**—Here's a listing of all the memory locations used with the VIC-II chip. In the style of many memory maps, the lower memory locations are lower on the page. The Label column contains the names often given to these locations in Commodore literature. For ease in finding the locations that control the sprites, we've printed them in all capital letters. To gain an in-depth understanding of the function of each memory location, consult the *Commodore 64 Programmer's Reference Guide* or any good book on Commodore graphics.

Hex	Offset	Dec	Label	Function
\$D02E	V + 46	53294	SP7COL	SPRITE 7 COLOR
\$D02D	V + 45	53293	SP6COL	SPRITE 6 COLOR
\$D02C	V + 44	53292	SP5COL	SPRITE 5 COLOR
\$D02B	V + 43	53291	SP4COL	SPRITE 4 COLOR
\$D02A	V + 42	53290	SP3COL	SPRITE 3 COLOR
\$D029	V + 41	53289	SP2COL	SPRITE 2 COLOR
\$D028	V + 40	53288	SP1COL	SPRITE 1 COLOR
\$D027	V + 39	53287	SP0COL	SPRITE 0 COLOR
\$D026	V + 38	53286	SPMC1	2ND MULTI-COLOR SPRITE COLOR
\$D025	V + 37	53285	SPMC0	1ST MULTI-COLOR SPRITE COLOR
\$D024	V + 36	53284	BGCOL3	Background Color 3
\$D023	V + 35	53283	BGCOL2	Background Color 2
\$D022	V + 34	53282	BGCOL1	Background Color 1

\$D021	V + 33	53281	BGCOL0	Background Color 0
\$D020	V + 32	53280	EXTCOL	Border Color
\$D01F	V + 31	53279	SPBGCL	BITS FOR SPRITE-BACKGROUND COLLISION DETECT
\$D01E	V + 30	53278	SPSPCL	BITS FOR SPRITE-SPRITE COLLISION DETECT
\$D01D	V + 29	53277	XXPAND	BITS FOR SPRITE HORIZONTAL EXPANSION
\$D01C	V + 28	53276	SPMC	BITS FOR SPRITE MULTICOLOR ENABLE
\$D01B	V + 27	53275	SPBGPR	BITS FOR SPRITE-BACKGROUND PRIORITY
\$D01A	V + 26	53274	IRQMSK	Interrupt Mask Register
\$D019	V + 25	53273	VICIRQ	Interrupt Status Register
\$D018	V + 24	53272	VMCSB	Memory Control Register
\$D017	V + 23	53271	YXPAND	BITS FOR SPRITE VERTICAL EXPANSION
\$D016	V + 22	53270	SCROLX	Control Register
\$D015	V + 21	53269	SPENA	BITS FOR SPRITE DISPLAY ENABLE
\$D014	V + 20	53268	LPENY	Light Pen Y Position
\$D013	V + 19	53267	LPENX	Light Pen X Position
\$D012	V + 18	53266	RASTER	Raster Register
\$D011	V + 17	53265	SCROLY	Control Register
\$D010	V + 16	53264	MSIGX	BITS FOR SPRITE X POSITION MOST SIGNIFICANT BIT
\$D00F	V + 15	53263	SP7Y	SPRITE 7 Y POSITION
\$D00E	V + 14	53262	SP7X	SPRITE 7 X POSITION
\$D00D	V + 13	53261	SP6Y	SPRITE 6 Y POSITION
\$D00C	V + 12	53260	SP6X	SPRITE 6 X POSITION
\$D00B	V + 11	53259	SP5Y	SPRITE 5 Y POSITION
\$D00A	V + 10	53258	SP5X	SPRITE 5 X POSITION
\$D009	V + 9	53257	SP4Y	SPRITE 4 Y POSITION
\$D008	V + 8	53256	SP4X	SPRITE 4 X POSITION
\$D007	V + 7	53255	SP3Y	SPRITE 3 Y POSITION
\$D006	V + 6	53254	SP3X	SPRITE 3 X POSITION
\$D005	V + 5	53253	SP2Y	SPRITE 2 Y POSITION
\$D004	V + 4	53252	SP2X	SPRITE 2 X POSITION
\$D003	V + 3	53251	SP1Y	SPRITE 1 Y POSITION
\$D002	V + 2	53250	SP1X	SPRITE 1 X POSITION
\$D001	V + 1	53249	SP0Y	SPRITE 0 Y POSITION
\$D000	V	53248	SP0X	SPRITE 0 X POSITION

Louis F. Sander  
Pittsburgh, PA

**Sprite troubles**—When checking for sprite collisions on some machines, you find a colliding sprite that suddenly disappears. These are called sparkles, and the best way to avoid them is to check each location twice. If you detect a collision on the first check but not on the second, your collision was really a sparkle.

Steven Davis  
Address unknown

**Magic flasher**—This subroutine can make all or part of your screen prompt flash on and off. It adds a little class and pizzazz, with very little effort.

```
500 REM ** MAGIC FLASHER **
510 PRINT "PRESS RETURN {CTRL RVS OFF} TO
CONTINUE"
520 PRINT "{2 CRSR UPs}": IF PEEK(162)AND32 THEN PRINT
"{CTRL RVS}";
530 GET AS$: IF AS$="" THEN 510
540 PRINT "{CTRL RVS OFF}": RETURN
```

A Gosub 500 will put the prompt on the screen, with the first two words flashing. The rate of flash is set by Peeking a bit in the real-time clock. For a faster rate, replace the

32 in line 520 with a 1, 2, 4, 8 or 16. For a slower rate, use 64 or 128. Moving the RVS OFF character in line 510 will change the amount of the prompt that flashes. Once any key is pressed, the subroutine returns with AS\$ equal to the character that was entered.

Frank C. Gutowski  
Cheswick, PA

**Fade in, fade out**—Have you ever thought of having the title of your program fade in, then out, on a black screen? It's a nice effect, and it's actually quite simple. Commodore machines have 16 colors, three of which are different shades of gray, with black and white at either end, and you can use them in your fading process. The following program summarizes it. Have fun!

```
10 POKE 53280,0 : POKE 53281,0
20 AS$(1)="{CTRL 2}": AS$(2)="{COMD 8}": AS$(3)="{COMD 5}":
AS$(4)="{COMD 4}": AS$(5)="{CTRL 1}"
30 INPUT "{SHIFT CLR} MESSAGE":MES$
40 PRINT "{SHIFT CLR}": FOR J=5 TO 1 STEP -1 : PRINT
"{HOME}";AS$(J);MES$: FOR K=1 TO 95 : NEXT : NEXT
50 FOR J=1 TO 5 : PRINT "{HOME}";AS$(J);MES$: FOR K=1 TO 95
: NEXT : NEXT : PRINT AS$(1)
```

Line 10 sets the C-64 and C-128 screen and border colors to black. If you have a different machine, replace that line with one of your own.

Greg Burns  
Address unknown

**Answer screen**—You can use the following line to acknowledge correct responses in educational programs. (To squeeze it into one line, you must abbreviate every Basic keyword.) It flashes the word "RIGHT!" in the center of a blank screen.

```
500 PRINT "{SHFT CLR}":FORX=1TO12:PRINTTAB(17)
"{10 CRSR DNs}RIGHT!":FORY=1TO80:NEXT:PRINT
"{SHFT CLR}":FORZ=1TO80:NEXT:NEXT
```

It would be easy to use the line in a subroutine or to change the word it prints.

Marlene Dunn  
Miami, FL

**Customized Ready prompt**—We have changed the C-64 operating system, so that instead of the Ready prompt, a customized message will appear. To do this, lines 10-20 transfer the basic operating system to RAM. Line 30 causes the Ready prompt to be looked for at memory location 828 rather than its usual place. Lines 40-60 put the new prompt into locations 828 on up.

```
10 FOR J=40960 TO 49151 : POKEJ,PEEK(J) : NEXT
20 POKE 1,PEEK(1)AND254
30 POKE 42101,60 : POKE 42103,3
40 FOR J=0 TO 33 : READ K : POKE J+828,K : NEXT
50 DATA 013,010,087,072,065,084,032,083
60 DATA 072,079,085,076,068,032,073,032
70 DATA 068,079,032,078,079,087,044,032
80 DATA 077,065,083,084,069,082,063,013
90 DATA 010,000
```

If you put this routine at the beginning of some of your programs, you can have a lot of fun. Line 10 takes some time to do its work, but the results are worth it.

Those who know about CHR\$ codes can construct their own message by changing the Data statements shown here. The first two and the last three must always be as shown, but you can put any reasonable number of char-

acters in between. The possibilities are limitless, and a lot of action can be had from very little work.

**Brian Axford**  
Petawawa, Ontario  
Canada

**Customized and optimized**—You can modify the above program to let you pick your own prompt message. Just delete lines 40–90, then replace them with these:

```
40 INPUT "PROMPT TEXT";P$
50 POKE 828,13 : POKE 829,10
60 FOR J=1 TO LEN(P$) : POKE 829+J,ASC(MID$(P$,J,1)) : NEXT
70 POKE J,13 : POKE J+1,10 : POKE J+2,0
```

Since the Pokes in line 10 take quite a while to complete, you might want to use machine language to speed them up. Check out the ROMwriter trick in this issue's C-64 section.

**K.M. Bridwell**  
Address unknown

## 27. Programming Tips—Sound

**Froggy**—This is one of those accidents that makes a realistic sound effect that couldn't be predicted. Give it a try, and remember that frogs eat bugs.

```
100 REM FROGGY - JAMES A. LISOWSKI
110 D=16:A=54272:POKEA+24,15:POKEA+6,0:POKE
    A+1,100:POKEA+5,2
120 IF(PEEK(162)ANDD)=DTHENPOKEA+4,33
130 POKEA+4,0:GOTO120
```

**James A. Lisowski**  
S. Milwaukee, WI

**Drum sounds**—The SID chip's noise waveform can be used for more than gunshots. By varying the pitch, filter and ADSR, you can create some useful percussion sounds. This program gives you a sample of some of them. The first group can be used as drum sounds, while the next 50 simulate cymbals. As numbers are Poked into the coarse-frequency register, they are also displayed on the screen.

Once you've chosen a sound, you can fine-tune it by adding the filter and varying the filter type, cutoff frequency and resonance. For a basic rock beat, set up two click sounds followed by a cymbal crash with twice each click's duration.

```
100 REM DRUM SOUNDS - TOM JEFFRIES
110 S=54272:FORL=STOS+24:POKEL,0:NEXT:POKES
    +24,15:POKES+5,17:REM SET SID
120 FORF=0TO50:POKES+1,F:PRINTF:POKES+4,129
    :FORT=1TO30:NEXT:POKES+4,128
130 FORT=1TO300:NEXT:NEXT:IFA=0THENA=1:POKE
    S+5,37:POKES+6,136:GOTO120
```

**Tom Jeffries**  
Oakland, CA

**Easier ADSR**—To get good ADSR settings, you don't need to go to the manual and spend all afternoon adding numbers until you get a sound you like. Instead of that, you can do this (for voice #1):

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100 POKE 54277,16\*A+D : POKE 54278,16\*S+R

where A = attack, D = decay, S = sustain and R = release. The values must be between 0 and 15.

**Sergio Daniel Freue**  
Buenos Aires, Argentina

**Instrument Pokes**—In the chart below are some settings to simulate musical instruments.

Instrument	Waveform	Attack/ Decay	Sustain/ Release	Pulse Rate
Flute	17	96	0	N/A
Trumpet	33	96	0	N/A
Piano	65	9	0	Lo 255, Hi 0
Harpichord	33	9	0	N/A
Accordion	17	102	0	N/A
Organ	17	0	240	N/A
Xylophone	17	9	0	N/A
Calliope	17	0	240	N/A

**Chris Brogdon**  
Dalton, GA

**Speech synthesis**—If you have a speech synthesizer, it can make Data statement debugging much easier. For example, here's how your program might read data:

```
10 FOR T=0 TO 62 : READ Q : POKE 832+T,Q : NEXT
```

The speech synthesizer will pronounce the numbers in your Data statements if you change this statement to:

```
10 FOR T=0 TO 62 : READ QS : FOR D=1 TO 500 : NEXT :
    SPEAK=QS : NEXT
```

All you have to do is follow along in the program listing, noting errors when they appear. When you've finished debugging, of course, change your program line back to its original form.

**Bryan Jacques**  
Lyn, Ontario  
Canada

## 28. Programs—Amusements and Delights

**Special effect**—This one-liner for the C-64 and C-128 will blow your socks off. Watch it run for a while, then press and hold down the space bar. You need a color display to see the full effect.

```
1 FOR X=0 TO 1 STEP 0 : POKE 53280,3 : POKE 53280,6 : NEXT
```

After replacing your socks, you can try replacing the 3 and the 6 with different numbers.

**Mark Mankins**  
Malvern, OH

**Special effect improved**—The only problem with the above trick is that you can't use it in a program because it's an infinite loop. To use it in a program, change it to look like this:

```
10 FOR X=1 TO 500 : POKE 53280,3 : POKE 53280,6 : NEXT
```

**Unknown contributor**  
Unknown location

**Magic color change**—The following short subroutine will display what you type in green, except for letters of

the alphabet, which will appear in red. Commodore 64 users might want to enter POKE 53281,1 first, to get a white screen. (128 users execute COLOR 0,2.)

```
10 GET A$: IF A$="" THEN 10
20 PRINT CHR$(28-2*(ASC(A$)<65) OR (ASC(A$)>90))A$:GOTO 10
```

Marilyn Sallee  
Alliance, NE

**Character codes**—To get some experience with character codes on the C-64 or C-128, try this recipe for Feminist's Delight:

```
5 POKE 53281,14:PRINT CHR$(19)CHR$(5)
10 X=X+1:PRINT CHR$(18)CHR$(69)CHR$(82)CHR$(65)
   CHR$(146)CHR$(32):IF X<240 GOTO 10
20 GOTO 20
```

Elizabeth Oman  
Lindsborg, KS

**Klawretaw**—We don't know who sent this, but it's well worth keying in. Can you tell what it does before running it?

```
10 REM KLAWRETAW - UNKNOWN MAGICIAN
20 A$="KLAWRETAW":FORA=9TO5STEP-1:B$=B$+MID
   $(A$,A,1):NEXT B$:B$=B$+B$+B$+B$
30 FORA=4TO1STEP-1:C$=C$+MID$(A$,A,1):NEXT
40 PRINTCHR$(147)CHR$(17)B$B$:FORJ=1TO35:PR
   INTCHR$(19)TAB(J)C$:;FORK=1TO5
50 PRINTCHR$(157):NEXT:PRINTTAB(J-1)CHR$(14
   5)"":FORL=1TO100:NEXT:NEXT:GOTO40
```

Mystery Magician  
Secret City

**Scintillating screenwork**—This gives an especially interesting pattern on 40-column screens:

```
10 GET A$: PRINT A$" see text ": GOTO10
```

Between the quotes, type the *shifted* letters DDCCFRF CCDDEE. Notice their nice grouping on the keyboard. Put your machine in Graphics mode, then run the program. You can change colors by pressing the Commodore key with one of the number keys.

Other interesting patterns can be made with these shifted letters, and {COMD Y} and {COMD P} can add to the fun. My best results came from strings 13, 14 or 19 characters long.

Eric Haver  
Squirrel Hill, PA

**Summertime sounds**—This will produce the sound of rolling waves on your computer.

```
10 REM SUMMERTIME SOUNDS - DANIEL WOODIE
20 V=54272:POKEV+6,240:POKEV+4,129:POKEV+1,34:POKEV,75
30 FORA=1TO15:POKEV+24,A:FORD=1TO50:NEXTD:NEXTA
40 FORB=15TO1STEP-1:POKEV+24,B:FORD=1TO200:
   NEXTD:NEXTB
50 FORD=1TO600+1200*RND(0):NEXTD:GOTO20
```

Here are versions for the newer machines.

```
10 REM PLUS/4 & C-16 SUMMERTIME SOUNDS—LFS
20 S=720+20*RND(1):FORV=1TO8:VOLV:SOUND3,S,V+2:
   NEXTV
30 FORV=8TO1STEP-1:VOLV:SOUND3,S,7*(8-V):NEXTV
40 SOUND3,S,250:FORD=1TO1500*RND(1):NEXTD:SOUND3,S,0:
   GOTO20
```

```
10 REM128 SUMMERTIME SOUNDS—LFS
20 ENVELOPE3,10,13,5,12,3:VOL15:TEMPO3*RND(0)+4
30 PLAY"T3W"+CHR$(65+7*RND(0))+ "M":SLEEP3*RND(0):RUN
```

Daniel Woodie  
Annapolis, MD

**Rick-rack**—Do you need something to dress up a dull screen in a program? This routine will give you a colorful rick-rack trim. After running it, you can erase the Ready prompt, then fit your printing onto the screen without using the return key. This will help you plan an aesthetic format.

```
10 REM{2 SPACES}RICK-RACK BY ELIZABETH OMAN
20 GOTO40
30 FORX=1TO20:PRINT"{CTRL 8}{CTRL 9}{COMD *
   }{SHFT LB.}{CTRL 0}";NEXT:FORX=1TO20:PR
   INT"{COMD *}{SHFT LB.}";NEXT:PRINT"{COM
   D 7}{HOME}":RETURN
40 PRINT"{SHFT CLR}":GOSUB30:FORX=1TO20:PRI
   NT:NEXT:GOSUB30
```

Elizabeth Oman  
Lindsborg, KS

**Flagrant chauvinism**—The accompanying C-64 program shows the colors on your video display. Vexillologists will love the picture, in spite of the flaw in the canton.

```
10 REM ** FLAGRANT CHAUVINISM **
15 A$="{4 SPACES}"+CHR$(18)
20 B$=CHR$(146)
25 C$="{16 SHFT SPACES}":C$=C$+C$
30 D$=" * * * * * "
35 E$="{HOME}{3 CRSR DNs}"
40 F$=A$+C$
45 G$=A$+B$+C$
50 H$=A$+RIGHT$(D$,13)+B$
55 J$=A$+LEFT$(D$,13)+B$
60 POKE53265,91:POKE53280,0:POKE53281,0
65 POKE53282,1:POKE53283,6:POKE53284,2
70 PRINT"{SHFT CLR}{CTRL 2}"E$
75 FORX=1TO6:PRINTF$CHR$(141)G$:NEXT
80 PRINTF$E$
85 PRINTH$,,,J$,,,H$,,,J$,,,H$,,,J$,,,H$
90 GOTO90
```

Kevin D. Skorupa  
Biloxi, MS

**Designs!**—Here are two short programs that will give you a swatch of fabric, wallpaper, gift-wrapping paper or a rack of Christmas neckties. They work on the C-64 or C-128. Run program #1, and you'll get an interesting repetitive pattern, chosen at random. Press any key except S, and you'll get a totally different one. Press S, and you'll get a table of numbers that are characteristic of that design. Run program #2 and enter those numbers, and you'll see the design repeated.

The possibilities in this are endless, and some of the designs are striking to behold. The odds are 2,519,040 to 1 against seeing the same one twice.

```
100 REM DESIGNS! #1 - ELIZABETH OMAN
110 REM PRESS 'S' TO SEE SPECS
120 REM PRESS OTHER KEY TO SEE DESIGNS
130 B=INT(RND(0)*16):S=INT(RND(0)*39)+2
140 CH=INT(RND(0)*256)
150 CC=INT(RND(0)*16):IF CC=B THEN130
```

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Listing continued.

```
160 POKE53280,B:POKE53281,B:PRINT"(SHIFT CLR
)"
170 FOR L=-1 TO 1000 STEP 5
180 POKE1024+L,CH:POKE55296+L,CC
190 NEXT
200 GETA$:IF A$="" THEN 200
210 IF A$="S" THEN 230
220 GOTO 130
230 PRINT"{CTRL 1}";:IFB=0THENPRINT"{CTRL 2
}";
240 PRINT"BACKGROUND="B
250 PRINT"STEP="S:PRINT"CHARACTER="CH
260 PRINT"CHARACTER COLOR="CC:GOTO200
300 REM DESIGNS! #2 - ELIZABETH OMAN
310 INPUT"BACKGROUND (0-15)";B
320 INPUT"{6 SPACES}STEP (1-41)";S
330 INPUT"CHARACTER (0-255)";CH
340 INPUT"CHAR COLOR (0-15)";CC
350 POKE53280,B:POKE53281,B:PRINT"(SHIFT CLR
)"
360 FOR L=-1 TO 1000 STEP 5
370 POKE1024+L,CH : POKE55296+L,CC
380 NEXT
390 GETA$:IFA$=""THEN390
400 POKE53281,6:PRINT"{SHIFT CLR}{CTRL 2}":E
ND
```

Elizabeth Oman  
Lindsborg, KS

**PET Emulator**—Once upon a time, most Commodore software was written for the famous PET computer. In those fond and bygone days, a powerful program called PET Emulator made the software-poor C-64 compatible with the extensive library of PET-based programs. The emulation idea was a dog, but it gave you something to do until better software appeared.

The amusing program below is much less powerful, but much more friendly. It *does* faithfully emulate a plug-compatible Commodore PET, and it works on all Commodore machines, including the C-128. Type it in right now and stand by for a pleasant surprise. Don't overlook the numerous spaces that are imbedded in the graphics strings; they appear as extra wide gaps adjacent to the curly brackets.

```
100 REM PET EMULATOR - LOUIS F. SANDER
110 DIMA$(20):A$="" {CTRL 9}:A$(15)="{CTRL
3}{CTRL 0} ."
120 A$(16)="{SHIFT LB.} {CMD *}:A$(17)="{C
OMD G} {CMD M}:PRINT CHR$(142)
130 A$(18)="{CTRL 0}{CRSR LF}{CMD C}{CTRL
9}{CMD G}{SHIFT W}{CMD M}{CTRL 0}{CMD
V}":A$(19)=A$(17)
140 A$(20)="{3 CMD Is}{CTRL 1}:A$(0)="{SH
FT CLR}":B$="{SHIFT J}"
150 C$=B$+"{2 CMD Is}{SHIFT Q}{CRSR DN}{4 C
RSR LFs} {CMD V}{CMD C} {CRSR UP}":D$
="{CRSR DN}{CRSR LF} {CRSR UP}"
160 E$="{HOME}{19 CRSR DNs}"
170 F$=E$+"{13 CRSR RTs}":G$="{SHIFT U}"
180 POKE53280,1:POKE53281,1:FORJ=0TO20
190 PRINTSPC(16)A$A$(J):NEXT:PRINTESC$
200 FORJ=1TO13:FORK=1TO200:NEXT
210 C$=D$+C$:PRINTE$C$:NEXT:FORJ=1TO10
220 FORK=1TO72:NEXT:PRINTF$G$
230 FORK=1TO68:NEXTK:PRINTF$;B$:NEXT
```

Louis F. Sander  
Pittsburgh, PA

You tell your friends that your computer "knows" you and will not cooperate with anyone else. Then you load ESP, type RUN and press the return key. The program runs fine. (It also disables List, to protect our little joke.)

The first listing is for the C-64, and the second is for the C-128. The C-128 version does not disable List.

The fun starts when you ask someone to run the program. Your friend types RUN and presses the return key, but the computer refuses to obey and instead disables the keyboard! You miraculously enable it again and run the program effortlessly; anyone else who tries it will fail. The computer appears to respond only to your mystical presence.

Here's how it works. After typing RUN, you hold your finger on the return key a little longer than normal (line 30 checks for this). When your friends fail to do this, lines 80-110 cause an apparent crash. To enable the keyboard, you discreetly press the back-arrow key, which gets you out of the loop.

If your friends suspect your slow action with the return key, mislead them by pressing it normally and immediately holding down the N key. This is easy, because you just had your finger on it from typing the word RUN. When they have been mystified long enough, you press the back-arrow key while the program is running, and List is re-enabled.

This ESP trick is easy to perform, and, with a little practice and showmanship, you can baffle even the most knowledgeable computerists.

```
10 REM ESP - DON THORPE
20 POKE808,234:FORJ=1TO250:NEXT
30 IFPEEK(197)<>1ANDPEEK(197)<>39THEN80
40 POKE808,237:POKE775,200
50 PRINT"HELLO, FRIEND.{2 SPACES}SEE ME RUN
!"
60 IFPEEK(197)=57THENPOKE775,167
70 GOTO50
80 PRINT:PRINT
90 PRINT"BEGONE! I DO NOT KNOW YOU."
100 PRINT:PRINT"READY.":POKE204,0
110 IFPEEK(197)<>57THEN110
120 WAIT207,1,1:PRINT"{3 CRSR UPs}"
130 POKE808,237:POKE198,0
```

```
10 REM ESP FOR C-128 - LOUIS F. SANDER
20 TRAP30:POKE2594,0:FORJ=1TO250:NEXT
30 IFPEEK(213)<>1ANDPEEK(213)<>39THEN80
40 TRAP
50 PRINT"HELLO, FRIEND.{2 SPACES}SEE ME RUN
!"
60 REM
70 GOTO50
80 PRINT:PRINT
90 PRINT"BEGONE! I DO NOT KNOW YOU."
100 PRINT:PRINT"READY.":POKE2599,0
110 IFPEEK(213)<>57THEN110
120 WAIT2598,1,1:PRINT"{3 CRSR UPs}"
130 TRAP:POKE208,0
```

Don Thorpe  
Glenunga, South Australia

**Fortune cookie**—This generates some interesting messages, which *may* be useful in predicting the future. In tests against tea leaves and an out-of-round crystal ball, its output was consistently equivocal. Anyway, it's a highly amusing program. For nonstop entertainment, put a delay at the end, then skip a line and loop back to 730.

**ESP program**—This little program gives the impression that your computer has ESP, or extrasensory perception.

```

700 REM FORTUNE COOKIE - MARCO BALAGUER
710 FORN=1TO10:READA$(N),B$(N),C$(N),D$(N):
NEXT:S$=CHR$(32)
720 DEFFNA(X)=INT(RND(0)*10+1)
730 A=FNA(X):B=FNA(X):C=FNA(X):D=FNA(X)
740 PRINTS$A$(A)S$B$(B)S$C$(C)S$D$(D)
750 DATA THEY,WILL,FIND,HER,HE,WON'T,EXPOSE
,PLANS
760 DATA RIVAL,DID,IGNORE,CONSEQUENCES,STRA
NGER,MIGHT,LOVE,YOU
770 DATA SHE,MIGHTN'T,ADMIRE,ANOTHER,YOU,DI
DN'T,KNOW,THEM
780 DATA FAMILY,CAN'T,PROTECT,US,WE,CAN,DEN
Y,IT
790 DATA CHILD,MAY,DESPISE,MONEY,SUPERIOR,C
OULD,ACCEPT,HIM

```

Marco Balaguer  
Brooklyn, NY

**Sui generis**—(These words are Latin for “in a class by itself”; they do describe this trick.) Trick \$EE (RUN, October 1984) purports to translate English into Pig Latin. In true translation, words beginning with vowels do *not* have the initial letter transposed to the end; instead, the syllable “-way” is appended. Also, pure porcine philology moves initial consonant clusters to the end of the word as a group. The English “speak,” therefore, is properly translated “eak-spay,” rather than “peak-say,” as translated by trick \$EE. The accompanying program will perfectly translate any English word into Swine. Quod erat demonstrandum.

```

100 REM {2 SPACES} PIG LATIN - ANNE ABBATE
110 PRINT
120 INPUT "ENGLISH";A$
130 L$=LEFT$(A$,1)
140 IFL$="A"ORL$="E"ORL$="I"ORL$="O"ORL$="U
"THENB$=A$:A$="-WAY":GOTO210
150 N=2:IFL$="Q"THEN N=3:GOTO200
160 M$=MID$(A$,N,1)
170 IFM$="A"ORM$="E"ORM$="I"ORM$="O"ORM$="U
"THEN200
180 N=N+1:IFN>LEN(A$)THEN110
190 GOTO160
200 B$=RIGHT$(A$,LEN(A$)-(N-1)):A$="-"+LEFT
$(A$,N-1)+"AY"
210 PRINT:PRINT "{2 SPACES} SWINE: ";B$;A$
220 GOTO110

```

Anne Abbate  
Northport, NY

Editor's note: The phrase “sui generis” could also be used in the barnyard, to summon a hog named Generis. That makes it, then, in the truest sense of the word, Pig Latin.

**My valentine**—Listed, these lines lack logic. Run, they're redolent with sentiment. Together, they make a valentine that must be seen to be believed. So type them in for your sweetheart—you won't be disappointed.

As listed, the program works on a VIC or C-64. If you have a C-128, substitute the special line 202.

The valentine is best experienced on a well-adjusted color display with the sound turned up to max. The more you know about exponential notation, the better you'll get the message.

If you get a Typing Error message, double-check your typing on line 204. If you get an Overflow Error message,

the program is working perfectly. See the Error Messages section in your user's manual.

```

100 REM MAGIC VALENTINE WITH SOUND
110 REM CREATED BY LOUIS F. SANDER
200 PRINT "{SHFT CLR}":S=54296:IFPEEK(213)=2
1THENS=36878
202 POKE53281,1:POKE198,4:POKE631,28:POKE63
2,211:POKE633,157:POKE634,5
204 A$="MFU!NF!DPVOU!UIF!XBZT;IPX!EP!J!MPWF
!UIFF@":P$="{HOME}{2 SPACES}{6 CRSR DNs
}"
206 FORI=1TO41:J=(-1+ASC(MID$(A$,I))):K=K+J
:B$=B$+CHR$(J):NEXT
208 IFK<>2756THENPRINT "TYPING ERROR IN A$":
STOP
210 A$=MID$(B$,23):B$=LEFT$(B$,22):PRINT "{C
RSR DN} "A$:PRINT "{CRSR DN}"B$
212 FORI=1TO33:GOSUB216:FORJ=1TO300-I{UP AR
ROW}1.8:NEXT:NEXT
214 I=2.1*I:GOSUB216:GOTO214
216 POKES,15:POKES,0:PRINTP$I:RETURN

202 POKE53281,1:POKE208,4:POKE842,28:POKE84
3,211:POKE844,157:POKE845,5:REM C-128

```

Louis F. Sander  
Pittsburgh, PA

**April Fool's program**—When he's not looking, run this on a friend's VIC or C-64. Then get him to type a line or two, and watch the fun as he scrambles for his warranty.

```

10 POKE207,0:POKE204,0:WAIT198,1:GETA$.PRINT
"{CTRL RVS OFF}"CHR$(ASC(A$)+1.1*RND(0)):GOTO 10

```

Don't forget the semicolon after the Print statement. Add to the fun by entering POKE808,225 (for the VIC, POKE808,100) before you run the program. (It disables the Stop, Restore and List commands.)

School have become famous by running this program at school or on machines displayed in stores.

Here is a version for the C-128.

```

10 TRAP10:POKE2599,0:POKE2598,0:WAIT208,1:GETA$.PRINT
"{CTRL RVS OFF}"CHR$(ASC(A$)+1.1*RND(0))

```

Larson E. Rapp  
Newington, CT

**Halloween disk devilment**—For a real trick or treat, prepare a disk with a number of interesting programs on it, and tell a friend you're going to give it to him as a Halloween treat. Make sure it contains the following one-line program, named “DO NOT RUN ME.”

```

10 OPEN 15,8,15,"N0:I WARNED YOU!TS":CLOSE15

```

The trick comes when he runs the forbidden program, which erases everything on the disk!

Bertram Schulman  
Valley Stream, NY

**Magic sprite demonstrator**—This program, in versions for the C-64 and C-128, allows you to see sprites in motion on the screen. If you like a sprite it demonstrates, you can include that sprite in more sophisticated programs of your own.

To be used with the demo program, sprites are presented as Data statements. The following tricks present

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some interesting sprites, which you can evaluate by using this program.

Try sending your own best sprite to Magic. Put it in our standard form—as Data statements numbered from 91–99, with line 91 containing a REM describing the sprite. In your Data items, please use leading zeroes to make each entry three characters long. (They are easier to type that way). Include a description of your sprite, but don't include Poking or animation routines.

```
10 REM SPRITEDEMO C-64 - LOUIS F. SANDER
20 POKE53281,6:PRINT"{SHFT CLR}{COMD 7}{4 C
   RSR DNs}"
30 FORS=832TO894:READT:POKES,T:NEXT
40 V=53248:POKE2040,13:REM SPRITE AREA
50 POKEV+21,1:REM DISPLAY SPRITE
60 POKEV+39,1:REM COLOR IT WHITE
70 POKEV+1,60:REM Y POSITION
80 FORJ=1TO255:POKEV,J:NEXTJ:REM X POS
90 LIST
```

```
10 REM SPRITEDEMO 128 - LOUIS F. SANDER
20 PRINT"{SHFT CLR}{4 CRSR DNs}"
30 COLOR0,12:COLOR4,14:PRINTCHR$(153)
40 FORS=3584TO3647:READT:POKES,T:NEXT
50 SPRITE1,1,2:REM DISPLAY WHITE SPRITE
60 MOVSPR1,0#0:REM STOP ALL MOVEMENT
70 FORJ=1TO255:MOVSPR1,J,60:NEXT
80 LIST
90 REM SPRITE DATA FOLLOWS:
```

Louis F. Sander  
Pittsburgh, PA

**That which flies**—These Data statements contain a sprite that can be demonstrated by the program above. It has a lot to do with Magic, and with my own personal interests.

```
91 REM THAT WHICH FLIES - SAMUEL SEWALL
92 DATA 000,000,000,000,064,000,000,064
93 DATA 000,000,096,000,000,096,000,003
94 DATA 252,000,000,240,000,000,096,001
95 DATA 255,225,204,063,255,112,124,240
96 DATA 192,248,251,000,112,252,000,225
97 DATA 248,000,001,252,000,003,102,000
98 DATA 028,099,000,120,097,192,248,096
99 DATA 000,176,112,000,032,000,000,000
```

Samuel Sewall  
Salem, MA

**That which flies not**—If you liked Judge Sewall's flying sprite, you're sure to like this one, which is often seen in the same season.

```
91 REM THAT WHICH FLIES NOT - L. SANDER
92 DATA 000,000,000,005,000,000,042,160
93 DATA 000,085,080,000,042,168,000,085
94 DATA 080,000,170,168,000,085,240,000
95 DATA 175,252,014,095,255,223,047,255
96 DATA 253,095,255,249,039,255,248,003
97 DATA 255,248,001,255,224,003,127,128
98 DATA 001,130,000,000,227,192,000,000
99 DATA 000,000,000,000,000,000,000,000
```

Louis F. Sander  
Pittsburgh, PA

**Season's sprittings**—These sprites add festive finery to all your Christmas greenery. Though brilliant in their way, their strong points are form and symmetry. Plug

them into our display programs or put them on the screen yourself.

```
81 REM CHRISTMAS SPRITE #1 - L. SANDER
82 DATA 000,126,000,003,255,192,015,255
83 DATA 240,031,255,248,063,255,252,063
84 DATA 255,252,127,255,254,127,255,254
85 DATA 127,255,254,127,255,254,127,255
86 DATA 254,063,255,252,063,255,252,031
87 DATA 255,248,015,255,240,003,255,192
88 DATA 000,126,000,000,000,000,000,000
89 DATA 000,000,000,000,000,000,000,013
```

```
91 REM CHRISTMAS SPRITE #2 - L. SANDER
92 DATA 000,000,000,000,000,000,000,000
93 DATA 000,000,024,000,000,024,000,000
94 DATA 060,000,000,060,000,000,126,000
95 DATA 063,255,252,015,255,240,003,255
96 DATA 192,000,255,000,001,255,128,001
97 DATA 231,128,003,195,192,003,000,192
98 DATA 006,000,096,000,000,000,000,000
99 DATA 000,000,000,000,000,000,000,099
```

Louis F. Sander  
Pittsburgh, PA

**12-day calculator**—This totals the number of gifts in the famous Christmas song. By following its logic, you can learn about nested loops.

```
100 REM 12 DAYS OF CHRISTMAS - KRINGLE
110 FOR DAY=1 TO 12
120 FOR PRESENT=DAY TO 1 STEP -1
130 PRINT PRESENT:
140 NUMBER=NUMBER + PRESENT
150 NEXT PRESENT
160 PRINT
170 NEXT DAY
180 PRINT "TOTAL PRESENTS=" NUMBER
```

Kris Kringle  
Santa Claus, IN

**Word tricks**—It's well-known that shifted characters in REM statements can List in unusual ways. Having considered this quirk at length, we've created a brand-new literary form. If you run the programs below, you'll see just what we mean.

When typing them, be extremely careful with the characters in the answers; a single error can ruin the entire line. In the answer lines, we've spelled out every character following the colons, since that is the most critical area. As you type, don't put spaces where they're not called for, and carefully watch your shift and Commodore keys. In the answers, all the spaces and a few of the letters are unshifted.

After typing a program, you should save it first, then run it and follow the instructions. The quotes to be deleted are those at the beginning of the answer lines.

```
100 LIST
110 REM ** COMPUTER MAGIC & TRIVIA **
120 REM
130 REM THINK OF YOUR ANSWERS.
140 REM THEN DELETE THE QUOTES
150 REM AND RE-LIST THE PROGRAM.
160 REM
170 REM Q: WHY DID THE COWARDLY LION
180 REM VISIT THE WIZARD OF OZ?
190 REM " A: {2 SPACES}{COMD @}{SPACE}{SHIFT X}{SPACE}
   {SHIFT E}{COMD A}
200 REM
210 REM Q: WHO EXPOSED THE WIZARD?
```

Listing continued.

```

220 REM " A: {2 SPACES}{COMD @}{COMD @}
230 REM
240 REM Q: WHAT DID THE WIZ SAY THEN?
250 REM " A: {2 SPACES}{COMD LB.}{SPACE}{COMD @}
      {SPACE}{SHIFT B}
260 REM
270 REM Q: WHAT CAN A GOOD WITCH DO
280 REM WITH A SPORTS BROOM?
290 REM " A: {2 SPACES}{COMD -}{SPACE}{SHIFT -}
      {SPACE}A{SPACE}{SHIFT R} E.

```

Louis F. Sander  
Pittsburgh, PA

### Word tricks #2—

```

10 REM Q: WHAT DID MRS. FLINTSTONE
20 REM SAY WHEN THE FIRE WENT OUT?
30 REM " A: {2 SPACES}{COMD U}D, {SPACE}{SHIFT K}
      {SPACE}{COMD K}{SPACE} A {SPACE}{COMD C}
40 REM
50 REM Q: WHY DO LEONARD AND VALERIE
60 REM GET A'S IN COMPUTER CLASS?
70 REM " A: {2 SPACES}{SHIFT C}{SPACE}{COMD P}{SPACE}
      {SHIFT E}{SPACE}{SHIFT S}{SPACE}{SHIFT V}

```

Scott Shepard  
Holly Hill, PA

### Word tricks #3—

```

10 LIST
20 REM Q: HOW FAR IS IT FROM THE TOP
21 REM OF THE EMPIRE STATE
22 REM BUILDING TO THE BOTTOM?
30 REM " A: {2 SPACES}{SHIFT -}{E}{SPACE}{SHIFT
      LB.}{SHIFT I}
40 REM Q: WHAT TAKES TWO (10 BINARY)?
50 REM " A: {2 SPACES}{COMD @}{SPACE}{SHIFT *}{SHIFT K}
60 REM Q: WHAT DID THE BROKEN GUITAR
61 REM SAY TO ITS DISTRAUGHT OWNER?
70 REM " A: {2 SPACES}{COMD LB.}{SPACE}{COMD @}
      {SPACE}{COMD U}{T}

```

Gary Forney  
Oelwein, IA

**Word tricks #4**—This is printed here as a tribute to programming ingenuity, no matter how misdirected.

```

10 LIST
20 REM Q: WHAT'S AN APPLE COSTA?
30 REM " A: {2 SPACES}{COMD V}
      {T}{SPACE}{A}{SPACE}{SHIFT R}{E}

```

Mike Leherr  
Startzen University  
Puget Sound, WV

### Bad spelling—

```

300 REM Q: NAME DOROTHY'S CAPITAL
310 REM " A: {2 SPACES}{COMD @}{SHIFT B} A

```

Leonard Pinth-Garnell  
New York, NY

**Word trick game**—Here's a different approach to using shifted characters in REM statements. The object is to guess a number between 1 and 10. The answer and some clues are hidden in the REM statements. First, type in the program and save it for future use. Then, to guess

a number, remove the quotes from the line having the number you've guessed. When you list the program, you'll see whether you've guessed correctly. If not, you'll get a clue or some moral support.

```

0 LIST 1 -
1 REM "H {COMD J}{SPACE}{COMD Q}{SPACE}{SHIFT Q}
      {SPACE} A {SPACE}{SHIFT E} UE {SPACE}{COMD E}
      {SHIFT -} E
2 REM "{COMD L}{SPACE}{SHIFT I}
3 REM "{COMD L}{SPACE}{COMD @} O {SPACE}{SHIFT
      SPACE}
4 REM "WR {SHIFT -} G
5 REM "{COMD L}{SPACE}{COMD @}{SPACE}{COMD U} T
6 REM "{COMD K} TING {SPACE}{SHIFT SPACE}
7 REM "{COMD D}{COMD D} $ {SHIFT I}{COMD D}{COMD D}
8 REM "H {COMD J}{SPACE}{COMD Q}{SPACE}{SHIFT B}
      {SPACE}{COMD S}
9 REM "DO {SPACE}{COMD L}{SPACE}{COMD -}{SPACE}
      {COMD Q}{SPACE}{SHIFT K}{SPACE}{SHIFT M}{SPACE} IT
10 REM "H {COMD J}{SPACE}{COMD Q}{SPACE}{SHIFT Q}
      {SPACE} A {SPACE}{SHIFT E} UE {SPACE}{COMD W}
      {SHIFT R} E

```

Randy Thompson  
Eugene, OR

## 29. Programs—Commercial Software

**Making tables**—If you need a table for a term paper or business report and are having trouble using a word processor to set it up, try using a spreadsheet program. The spreadsheet's features will greatly simplify the mechanics of spacing and tabulation.

Elizabeth Oman  
Lindsborg, KS

**Address books**—If you wish to have a neat, up-to-date and correctable address and telephone book, there's an available framework in Practicalc or any similar spreadsheet.

Using the spreadsheet columns, you can enter, in any order, names, phone numbers and personal details. The columns can then be sorted alphabetically or numerically by Practicalc, and changes or corrections can be handled with ease.

Ian Haynes  
Westville, South Africa

**Database Deluxe improved**—If you love the Database Deluxe program printed in *RUN* (February 1984) and ReRUN, but wish the printout were single spaced rather than double, make the following changes in the VIC version (C-64 owners should make the same changes to lines 740 and 790):

Line 74—Delete the CHR\$(10) and change LL = LL + 2 to LL = LL + 1

Line 79—Alter the paging statement to read IF LL > 55 THEN FOR NL = LL TO 67: (rest of line is okay)

The last line printed on page 1 is 55, and 67 is the first line printed on page 2. The difference between these two numbers determines the depth of the top and bottom margins. Twelve gives a nice one-inch margin.

Lorraine Richards-May  
Leesburg, IN

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**Doodle files from Print Shop**—If you own these excellent programs, you might like to put some Print Shop lettering on the screen, then decorate the display with Doodle's superior drawing options. If you have a machine language monitor, you can do it with ease. Let's say you wrote something with Print Shop and saved it as TEXT. Just enter your monitor and do this:

```
.L "TEXT",08 (load from monitor)
.T 4000 5F3F 6000 (transfer Print Shop screen to Doodle area)
.F 5C00 5FE7 01 (add color: black)
.S "DDTEXT",08,5C00,7F3F (save, adding "DD")
```

Then, from Doodle, load TEXT and doodle to your heart's content. Of course, you can substitute any name for TEXT, as long as you add the DD when saving it as a Doodle file.

**Erik Francois**  
Vienne, France

**Print Shop files from Doodle**—If you understood the trick above, you can also convert in the opposite direction. To convert a Doodle file named DDFILE into a Print Shop file named PSFILE, just:

```
.L "DDFILE",08
.T 6000 7F3F 4000
.S "PSFILE",08,4000,5F3F
```

Now you can create custom backgrounds for your Print Shop text.

**Emilio Jose Espinosa III**  
Baldwin Park, CA

**Koala files from Print Shop**—Let's say you have a Print Shop Screen Magic file called PSFILE. To change it to a file you can load and embellish on your KoalaPainter, enter your machine language monitor and do this:

```
.L "PSFILE",08
.T 4000 5F3F 6000
.F 7F40 870F 01
.S "{COMD1}PICltrfilename",08,6000,8711
```

In the last line, ltr stands for any letter between A and O, and filename stands for any name you choose. The total number of characters between the quotes, including the COMD1 character, must equal 15. If your chosen filename doesn't do this, you must pad it out with spaces.

The resulting file can be loaded into KoalaPainter. There may be some superfluous dots of color, but you can easily change them to the background color by using the Color Exchange feature.

Why not save the entire character set of your favorite typeface? Then you can use KoalaPainter's Swap and Copy features to put them into your pictures.

**Steven Sellors**  
Saint John, New Brunswick  
Canada

**Disabling Epyx Fast Load**—This popular cartridge sometimes interferes with the loading or running of other programs. You can disable it by entering:

```
POKE 770,131 : POKE 771,164
```

This will re-enable it:

```
POKE 770,106 : POKE 771,223
```

**Greg B. LaPorte**  
Blacksburg, VA

**Fast Load re-enable**—Documentation for the popular Epyx Fast Load cartridge says that once it is disabled, the only way to re-enable the cartridge is to reset the computer. I've found a second way to re-enable it. Just enter SYS 57194.

**Bryan K. Davidson**  
Clovis, NM

**Ghostbusters buster**—If you like the Ghostbusters game for the C-64, but don't think \$10,000 is enough to get started with, I've got some good news.

When you're asked for your name at the beginning of the game, type OWEN. When the computer asks if you have an account, answer Yes. When asked for your account number, simply type LIST. The vehicle selection screen will appear, and you'll start the game with \$720,000.

**Russel Swift**  
Address unknown

**Ghostfreezers**—In Activision's Ghostbusters game, one screen requires you to maneuver a ghost into a trap using laser beams. A simpler way is to align your men so they totally overlap one another, appearing to be only one man. When the ghost flies over you, press the fire-button, and the ghost will stop. Press it again and he's history.

**Maurice Arkinstall**  
Houston, British Columbia  
Canada

**Jumpman jiminy**—Jumpman is one of the C-64's best commercial games, with great sound and challenging multi-level screens. Unfortunately, a lot of us never get to see the higher level screens because we always run out of jumpmen. Here's a way to avoid running out.

Load the game boot and run it. Exactly 95 seconds after hitting the return key, simultaneously press the run/stop and restore keys, which will reset your machine. Your screen will be blue, and the cursor will be flashing. Now enter:

```
POKE 24015,173 : POKE 54296,15 : SYS 9*4096
```

If all is well, the Options screen should come on. Proceed normally, playing the game as usual but with one exciting difference: You'll never run out of jumpmen! When one of your men is killed, a new one appears, while the number you have left remains at seven.

**Tim Tan**  
Winnipeg, Manitoba  
Canada

**Jumpman jiminy revisited**—Another way to never run out of jumpmen is to insert your disk, then:

```
LOAD "INTRO*",8,1
POKE 24015,173 : POKE 54296,15 : SYS 36864
```

If you want to practice a particular screen, take a backup copy of Jumpman and rename file PLF01 to something easy to remember (PLF01 is the first screen, PLF02 is the second, and so on). Then rename your selected screen, say PLF17, as PLF01. When you load and run Jumpman, the first screen will say "Easy Does It," but, trust me, you'll get those awful

chickens to deal with. When you finally get past them, the game will go to screen 18, rather than to 2.

**Marty and Dave White**  
Colorado Springs, CO

**Making Simon simpler**—If you have Simons' Basic, using the Key function can save much time while developing a program. Saving the key setup routine onto tape or disk can provide additional savings. Just define your keys, enter DISPLAY and insert a line number before each key definition. After each line number is inserted, press the return key to add your new line to the program in memory. Then save this key-definition subroutine for future use. I have several such routines—one for program development, another for running programs, and so on. Here are a few key lines to illustrate the principle:

```
58000 KEY1,"LIST" + CHR$(13)
58010 KEY2,"PAUSE 30" + CHR$(13)
58020 KEY3,"RENUMBER" + CHR$(13)
```

**Susan Morrell**  
Lancaster, CA

**Disk backup improvement**—The Commodore program Single Disk Backup V1.0, by Michael Schaff, is great, but slow. If you add a sound subroutine, the program can notify you each time you need to intervene, and you can do other things while your disk is being copied. Add the following lines.

```
1000 FOR L=54272 TO 54296 : POKE L,0 : NEXT
1010 POKE 54296,15 : POKE 54277,128 : POKE 54278,128 : POKE
      54276,33
1020 POKE 54273,50 : POKE 54272,60
1030 FOR T=1 TO 1500 : NEXT : POKE 54276,16 : FOR T=1 TO
      100 : NEXT
1040 FOR L=54272 TO 54296 : POKE L,0 : NEXT
1050 RETURN
```

If you insert GOSUB 1000s in lines 465, 540, 700, 720, 725, 865, 890 and 980, the program will signal you at the appropriate times. Start the program, turn up the volume and go about your business.

The preceding changes give you only one beep as a reminder. If you prefer something that continues until you press a key, add this:

```
1035 GET A$: IF A$="" THEN 1010
```

**Ginger Scalet**  
Brookings, SD

**Star Trek tip**—This Sega game for the C-64 has a small bug that you can use to your advantage. The M key puts you into warp drive, which speeds you up and protects you from all enemies. When you lose warp drive energy, of course, you can no longer move faster, but that's where the bug comes in. As long as you hold down the M key, your invincibility persists. You can still use your phasers, photon torpedoes and non-warp engine power. Death to the treacherous Klingons!

**David Bloyd**  
Reedley, CA

**Star Wars trickery**—If you own Star Wars the Arcade Game for the C-64, and would like a fast way to the death star, try this: Start the game and press the restore key and

the space bar simultaneously. This should stop most of the fighters in their tracks and cause the rest to move in a straight line. Repeat the procedure, and all fighters should stop. Now, with the enemy disabled, kill his forces off and you should appear at the trench.

**Jared Groth**  
Detroit, MI

**Wolfenzauberei**—When your Beyond Castle Wolfenstein man is killed, the computer asks you to press the space bar to restart the game. If you remove the disk before pressing the space bar, what follows is sheer magic (in German, *Zauber*); the game will restart in the position right before you died or got caught. After restarting, reinsert the disk and resume where you left off.

**Darius Hatami**  
Mystic Islands, NJ

## 30. Programs—Useful Applications

**Loan payments**—This simple program will calculate monthly payments for various sorts of loans. Everything is lined up and rounded off, so the effect is very polished. Before counting your money, though, get confirming figures from your banker.

```
100 REM LOAN PAYMENTS - LEE MCEWEN
105 PRINT
110 INPUT "{4 SPACES}AMOUNT OF THE LOAN";P
120 INPUT "{4 SPACES}# MONTHLY PAYMENTS";N
130 INPUT "ANNUAL PERCENTAGE RATE";R
140 R=R/12/100
150 P=INT(100*P*R/(1-1/(1+R){UP ARROW}N)+.5
      )/100
155 P=P+.0001:P=INT(P/.01+.5)*.01
160 PRINT"YOUR MONTHLY PAYMENT IS";P
```

**Lee McEwen**  
Pensacola, FL

**Day of week routine**—This routine has its origins in home computer antiquity, since a similar program appeared in *PET User Notes*, way back in 1978. It will print the day of the week for any date from March 1, 1900 through February 28, 2000. It does not destroy the date and may be used as a subroutine after the WD\$ array is initialized. When you input the date, please use the numeric form of the month, day and year, using two digits for each and separating them with commas.

```
10 REM DAY OF WEEK ROUTINE
20 DATA SUN,MON,TUE,WED,THU,FRI,SAT
30 FORJ=0TO6:READWD$(J):NEXT
40 INPUT"MONTH,DAY,YEAR";MN,DY,YR
50 CY=YR:M=MN-2:IFM<1THENM=M+12:CY=CY-1
60 Y=CY-INT(CY/100)*100
70 WD=Y+INT(Y/4)+1+DY+INT(2.6*M-.1999)
80 WD=WD-INT(WD/7)*7:PRINTWD$(WD)
```

**R.E. Peat**  
Pittsburgh, PA

**Days between dates**—Sometimes, such as when daily interest rates are quoted, it is useful to know the number of days between two dates. This little program can cal-

culate it for you, and we've never seen it make an error. Give it a try.

```
100 REM DAYS BETWEEN DATES - W. DRISCOLL
110 INPUT "{CRSR DN}1ST DATE (MM,DD,YYYY)";M
    ,D,Y
120 GOSUB170:C1=C
130 INPUT "{CRSR DN}2ND DATE (MM,DD,YYYY)";M
    ,D,Y
140 GOSUB170:C2=C
150 PRINT:PRINT"THERE ARE";C2-C1;"DAYS BETW
    EEN THEM."
160 END
170 IFM>2THENN=0:GOTO230
180 Y1=INT(Y/100)
190 Y2=Y-Y1*100
200 IFY2<>0ANDY2/4=INT(Y2/4)THENN=1:GOTO230
210 IFY2=0ANDINT(Y1/4)=Y1/4THENN=1:GOTO230
220 N=2
230 C=INT(365.25*Y)+INT(30.56*M)+D+N
240 RETURN
```

William A. Driscoll  
St. Paul, MN

**Jumbles**—This program will help you unscramble the Jumbles anagrams that are published in many papers. It's also handy for other anagrammatical tasks.

```
100 REM JUMBLES - FRANK PANTALEO
110 INPUT "{SHFT CLR}{CRSR DN}WHAT'S THE JUM
    BLE";J$
120 LJ=LEN(J$):DIMB(LJ),J$(LJ)
130 PRINT "{CRSR DN}HOLD DOWN THE SPACE BAR.
    ..{CRSR DN}"
140 GETA$:IFA$=""THEN140
150 FORA=1TOLJ
160 J$(A)=MID$(J$,A,1):B(A)=A
170 NEXT
180 C=LJ
190 D=INT(RND(0)*C+1)
200 E=B(D):B(D)=B(C)
210 C=C-1
220 PRINTJ$(E);
230 IFCTHEN190
240 PRINT, :IF(POS(0)<1)ORLJ>15THENPRINT
250 GETA$:IFA$=""THEN250
260 GOTO150
```

Frank Pantaleo  
Elmwood Park, IL

**Pushup timer**—Here's a short C-64 and C-128 program that sets the tempo for doing pushups. It also makes useful calculations and offers moral support.

```
100 REM PUSHUP TIMER - ROBERT MUFFLY
110 INPUT "{SHFT CLR}{CRSR DN} HOW MANY PUSH
    UPS TODAY {2 SPACES} 10 {4 CRSR LFs}";N
120 INPUT "{CRSR DN} SPEED (1-9) {2 SPACES} 5 {
    3 CRSR LFs}";S
130 T=TI:PRINT "{CRSR DN} YOU HAVE 5 SECONDS
    TO GET READY...{CRSR DN}"
140 IF(TI-T)<300THEN140
150 GOSUB210:P=P+1:PRINTP;
160 FORDE=1TO400*(11-S):NEXT
170 IFP<NTHEN150
180 ET=INT((TI-T)/60)-5:X=ET/N:SP=INT(X/0.1
    +0.5)*0.1
190 PRINT:PRINT "{CRSR DN} YOU MADE IT IN";E
    T;"SECONDS, TIGER!"
200 PRINT "{CRSR DN} THAT'S";SP;"SECONDS PER
    PUSHUP. {2 CRSR DNs}":PRINT"YOU":PRINT"
    ARE{CRSR UP}":END
210 POKE54272,50:POKE54273,60
220 POKE54276,17:POKE54278,245
```

```
230 POKE54296,15
240 FORK=1TO100:NEXT:POKE54276,0
250 RETURN
```

Robert Muffly  
Wenatchee, WA

**Thermometer**—This is for those who have spent so much money on their computers that they can't afford a thermometer. It relies on the folklore that crickets chirp at a rate closely determined by the temperature. Although the folklore may not be science, it is a scientific fact that crickets are *not* bugs. Give the program a try.

```
100 REM THERMOMETER - CHARLES HOTCHKISS
110 PRINT "{SHFT CLR}{CRSR DN}THIS TELLS THE
    OUTSIDE TEMPERATURE"
120 PRINT "{CRSR DN}FROM THE NUMBER OF CHIRP
    S A CRICKET"
130 PRINT "{CRSR DN}MAKES IN 15 SECONDS."
140 PRINT "{2 CRSR DNs}YOU DO THE COUNTING,
    I DO THE COMPUTING."
150 PRINT "{CRSR DN}PRESS ANY KEY WHEN YOU H
    EAR THE"
160 PRINT "{CRSR DN}FIRST CHIRP..."
170 GETA$:IFA$=""THEN170
180 PRINT "{CRSR DN}{CTRL 9} START COUNTING.
    .."
190 T=TI
200 IF(TI-T)>899THEN220
210 GOTO200
220 PRINT "{CRSR DN}{CTRL 9} STOP!!! "
230 FORJ=1TO15:POKE54296,15:FORK=1TO3:NEXT:
    POKE54296,0:FORL=1TO3:NEXT:NEXT
240 INPUT "{CRSR DN}HOW MANY CHIRPS";C
250 C=C*4:F=((C-40)/4)+60:PRINT "{CRSR DN}IT
    IS";F;"DEGREES FAHRENHEIT."
```

Charles Hotchkiss  
Cincinnati, OH

**Printing practice**—I have a five-year-old son who is just learning to form his alphabet on special lined paper. You may remember it from your own school days, with its widely spaced lines for the tops and bottoms of the capitals and its dotted line in between for the tops of the lowercase letters.

Instead of buying this paper, I wrote a short program to have my printer form the lines, just like the practice sheets, and to print my son's name at the top of the page. The listing below shows a version for Commodore printers, where CHR\$(195) is the horizontal line corresponding to shifted C, and CHR\$(45) is the minus sign, or dash.

If you have a different printer, it shouldn't be hard to make it print similar characters with the line spacing appropriate to your needs.

```
100 REM PRINTING PRACTICE - D. BORKIN
110 T$="PRACTICE FOR MATTHEW"
120 FORJ=1TO79:SL$=SL$+CHR$(195):NEXT
130 FORK=1TO79:DL$=DL$+CHR$(45):NEXT
140 OPEN4,4
150 PRINT#4,SPC(40-LEN(T$)/2);T$
160 FORJ=1TO9
170 PRINT#4:PRINT#4,SL$
180 PRINT#4:PRINT#4,DL$
190 PRINT#4:PRINT#4,SL$
200 NEXT
210 CLOSE4
```

David Borkin, Jr.  
Dearborn, MI

## 31. Programs—Utilities

**Automatic UNNEW**—After a Basic program has been killed by a New or a Reset, you can use a machine language Unnew program to resurrect it. The Basic program below creates a most unusual Unnew—one that does its magic without being run. If you have a C-64 or VIC-20, plus a Commodore disk drive, you can use it to put the Unnew program on any disk you choose.

The first time you run the printed program, verify that CS = 8620; if it doesn't, you've made a mistake. Once CS = 8620, delete lines 1 and 2, then save the result, naming it Automatic UNNEW. When you run Automatic UNNEW, it will generate and save a program named UNNEW.AUTO. Once that program is on your disk, you can resurrect any NEWed program by entering:

```
LOAD"UNNEW.AUTO",8,1
```

As soon as the load is finished, your lost program will reappear, intact; there's no need to type RUN or SYS.

```
1 FORJ=1TO68:READX:CS=CS+X:NEXT
2 PRINT"CS="CS"(SHOULD BE 8620)":STOP
10 REM AUTOMATIC UNNEW - ERIC HAVER
20 OPEN2,8,2,"UNNEW.AUTO,P,W"
30 PRINT#2,CHR$(128);CHR$(1);
40 READA
50 IFA<>234THEN PRINT#2,CHR$(A);:GOTO40
60 FOR J=1 TO 70:PRINT#2,CHR$(2);:NEXT
70 PRINT#2,CHR$(A);:READ A:IFA>0THEN 70
80 CLOSE 2
91 DATA 160,003,200,177,043,208,251,200
92 DATA 200,152,160,000,145,043,165,044
93 DATA 200,145,043,133,060,160,000,132
94 DATA 059,162,000,200,208,002,230,060
95 DATA 177,059,208,245,232,224,003,208
96 DATA 242,200,208,002,230,060,132,045
97 DATA 164,060,132,046,032,089,166,032
98 DATA 051,165,076,116,164,234,234,234
99 DATA 076,128,001,000
```

Eric Haver  
Pittsburgh, PA

**Load address finder**—This short program finds the load address for any program saved on disk and is useful for investigating machine language files. It gives the load address plus the low byte and high byte of that address—all in decimal form. Since many machine language programs are executed by a SYS command to their first byte, knowing the load address is often the same as knowing the enabling SYS.

```
10 REM LOAD ADDR - M. TRANCHEMONTAIGNE
20 INPUT "(7 SPACES)FILENAME";F$
30 OPEN2,8,2,F$+"P,R"
40 GET#2,LO$: LO$=LO$+CHR$(0)
50 GET#2,HI$: HI$=HI$+CHR$(0)
60 CLOSE2 : LA=ASC(LO$)+256*ASC(HI$)
70 PRINT"LOAD ADDRESS IS:" LA
80 PRINT"{4 SPACES}LOW BYTE IS:" ASC(LO$)
90 PRINT"{3 SPACES}HIGH BYTE IS:" ASC(HI$)
```

Mike Tranchemontaigne  
Nashua, NH

**End address finder**—You can find the ending address of a C-64 or VIC program on disk or tape by using Verify, then

Peeking the pointer at 174–175. To find the highest address into which the program loads, verify it, then enter:

```
EA = PEEK(174) + 256*PEEK(175) - 1:PRINT EA
```

If you also know the load address, you can find the length of the program by:

```
Length = 1 + End Address - Load Address
```

Douglas Marshall  
Bell, CA

**Automatic appender**—Use this program to append other ones, with no Direct mode Pokes to fool around with. Here is a version for the C-64 and VIC, and another for the C-128.

Make sure your disk has a copy of your main program and the programs you wish to append. Run this program, entering the name of your main program in response to the first prompt. (The first line number in the main program must be higher than 6.) Then enter the device number of the drive your disk is in.

To append to the main program, run the automatic appender again, this time answering the first prompt with the name of the next program to append. Its line numbers must all be higher than the last line number in the main program. You may continue to append as many programs as you wish, provided their line numbers are all higher than those in the program currently in memory.

When you've finished, remove lines 1–6, then save your combined programs.

```
1 INPUT"PROGRAM TO APPEND";A$:INPUT"{5 SPAC
Es}DRIVE 8 OR 9";U: REM C-64 & VIC-20
2 A=PEEK(44):PRINT"{SHFT CLR}{3 CRSR DNs}LO
AD";CHR$(34);A$:CHR$(34);CHR$(44);U
3 PRINT"{4 CRSR DNs}POKE43,1:POKE44,";A;"{H
OME}"
4 POKE632,13:POKE633,13:POKE634,13:POKE198,
3
5 IFPEEK(45)<2THENPOKE43,PEEK(45)-2+255:POK
E44,PEEK(46)-1:END
6 POKE43,PEEK(45)-2:POKE44,PEEK(46):END
```

```
1 INPUT"PROGRAM TO APPEND";A$:INPUT"{5 SPAC
Es}DRIVE 8 OR 9";U: REM C-128 VERSION
2 A=PEEK(46):PRINT"{SHFT CLR}{3 CRSR DNs}LO
AD";CHR$(34);A$:CHR$(34);CHR$(44);U
3 PRINT"{4 CRSR DNs}POKE45,1:POKE46,";A;"{H
OME}"
4 POKE842,13:POKE843,13:POKE844,13:POKE208,
3
5 IFPEEK(4624)<2THENPOKE45,PEEK(4624)-2+255
:POKE46,PEEK(4625)-1:END
6 POKE45,PEEK(4624)-2:POKE46,PEEK(4625):END
```

Alan Leish  
Address unknown

**Trace utility**—The accompanying program traces the execution of any Basic program, a procedure that can dramatically ease debugging. As printed, Trace is for the C-64. For the VIC, change 189 to 221 in line 840. After you've typed in the program, enter in Direct mode:

```
FOR X=1 TO 54: READ Y: Z=Z+Y: NEXT: PRINT Z
```

The computer should print 6341 for the C-64 version; 6373 for the VIC. Any other number means there's an error in your Data statements. Once the proper number is printed, save Trace on disk or tape.

Running Trace puts a machine language program into memory, and displays its controlling SYS commands on

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the screen. You should record these commands for future reference. Type SYSxxx{return}, where xxx is the appropriate number from the screen display, to either enable or disable the tracing function. While enabled, Trace will print the line number of each Basic statement as it is executed. To trace a program, first load and run Trace. Then load a Basic program, enable Trace, and run the Basic. Tracing the following test program will give you a good understanding of Trace's workings.

```
10 PRINT "A" : PRINT "B" : X=5 : Y=6
20 PRINT "C" : PRINT "D" : Z=7
```

Notice how four statements are traced in line 10, plus three in line 20.

To get a hard copy of what you're tracing, add this line at the start of the program being traced:

```
5 OPEN 4,4 : CMD4
```

You can make Trace's SYS calls a part of the traced program, to limit tracing to those parts where it is needed. Try enabling/disabling Trace before/after one of the Print statements in the test program, and you'll see how this feature can be used.

As printed, Trace's machine language resides in the cassette buffer, where any tape activity will overwrite it. But the machine language is completely relocatable; to put it in a protected area at the top of memory, add:

```
115 POKE 56,PEEK(56) - 1 : CLR : S = 5 + PEEK(56)*256
125 A = INT(S/256):B = S - (A*256):POKE S + 38,A:POKE S + 33,B
100 PRINT "{SHFT CLR}TRACE UTILITY - MAGIC{CRSR DN}"
110 S=828: REM RELOCATABLE START ADDR
120 FORX=S TO S+53:READ Y:POKEY,Y:NEXT
125 A=INT(S/256):B=S-(A*256):POKES+38,A:POKES+33,B
130 PRINT"SYS";S+22;"ENABLES,"
140 PRINT"SYS";S+43;"KILLS."
828 DATA 165,058,201,255,240,013
834 DATA 169,060,032,210,255,032
840 DATA 201,189,169,062,032,210
846 DATA 255,108,251,000,173,008
852 DATA 003,133,251,173,009,003
858 DATA 133,252,169,060,141,008
864 DATA 003,169,003,141,009,003
870 DATA 096,165,251,141,008,003
876 DATA 165,252,141,009,003,096
```

Stanley Tobojka  
New Bedford, MA

**Memory Scope**—The accompanying program will display one page of memory at the top of your computer's screen. Unlike a machine language monitor, the Memory Scope display changes along with the contents of memory, letting you see what happens as keys are pressed or Basic statements are executed.

The main listing below is a Memory Scope for the C-64. If you use a Plus/4, C-16 or VIC-20, you should type in the C-64 version, then add the changed lines as shown. If you have a C-128, type in the entire C-128 version.

A memory page is a 256-byte block of memory, and pages start at integral multiples of 256. The pages with low numbers and those with high numbers are the most interesting to explore; there are no pages numbered greater than 255. To find the page number of any address, divide it by 256 and drop everything after the decimal point.

In the display, the characters have their screen Poke values: @ = 0, A = 1, B = 2, and so on. A complete listing appears under Screen Display Codes in the back of your

user's manual. If your cursor disappears while using Memory Scope, it's probably hiding behind the display. Cursoring down will bring it back into view.

Memory Scope is a simple but powerful tool for understanding your computer's operation.

```
1 REM MEMORY SCOPE - LOUIS F. SANDER
2 REM C-64 VERSION
3 DATA 120,169,145,141,020,003,169,003
4 DATA 141,021,003,088,096,173,136,002
5 DATA 141,158,003,162,000,189,000,000
6 DATA 157,000,004,202,208,247,162,000
7 DATA 173,134,002,157,000,216,202,208
8 DATA 250,076,049,234,4764
10 FORJ=1TO44:READK:CS=CS+K:NEXT:READCK
20 RESTORE:IFCS<>CK'THENPRINT"BAD!":STOP
30 FORJ=90TO943:READK:POKEJ,K:NEXT
40 V$="{SHFT CLR}{6 CRSR DNs}":W$="{CRSR DN}"
   :X$="RESTORE"
50 PRINTV$TAB(18)"POKE923,N - SYS900"W$
60 PRINT"POKE923,N TO SEE MEMORY PAGE N
70 PRINT"{CRSR DN}TO KILL THE DISPLAY, PRES
   S
80 PRINTX$" WHILE PRESSING {CTRL 9}STOP{CTR
   L 0}
90 PRINT
100 PRINT"TO REACTIVATE, DO A SYS900
110 SYS900:PRINT:PRINT

2 REM PLUS/4 & C-16 CHANGES
4 DATA 141,021,003,088,096,173,062,005
7 DATA 173,059,005,157,000,008,202,208
8 DATA 250,076,014,206,4350
40 V$="{SHFT CLR}{6 CRSR DNs}":W$=CHR$(141
   +CHR$(27)+"T"+CHR$(19):X$="RESET"
90 PRINT"THEN TYPE X <RETURN>":PRINT
```

```
2 REM VIC-20 CHANGES
40 POKE937,PEEK(244)-1:POKE942,191
50 PRINT"{SHFT CLR}{12 CRSR DNs}"
60 PRINT"POKE923,N SHOWS PAGE N"
70 PRINT"STOP/RESTORE KILLS"
80 PRINT"{CRSR DN}SYS900 REACTIVATES"
90 SYS900:END
```

```
1 REM MEMORY SCOPE - LOUIS F. SANDER
2 REM C-128 VERSION
3 DATA 78,A9,19,8D,14,03,A9,0B
4 DATA 8D,15,03,58,60,A2,00,BD
5 DATA 00,00,9D,00,04,CA,D0,F7
6 DATA A2,00,AD,F1,00,9D,00,D8
7 DATA CA,D0,FA,4C,9B,F9,00,00
10 FORJ=1TO40:READK$:L=DEC(K$):CS=CS+L:NEXT
   :RESTORE:IFCS<>4265'THENSTOP
20 FORJ=2828TO2867:READK$:POKEJ,DEC(K$):NEX
   T
30 PRINT"{SHFT CLR}{6 CRSR DNs}"TAB(18)"POK
   E2845,N - SYS2828"CHR$(141)+CHR$(27)+"T"
   +CHR$(19)
40 PRINT"POKE2845,N TO SEE MEMORY PAGE N
50 PRINT"{CRSR DN}TO KILL THE DISPLAY, PRES
   S
60 PRINT"RESTORE WHILE PRESSING {CTRL 9}STO
   P{CTRL 0}
70 PRINT"{CRSR DN}TO REACTIVATE, DO A SYS28
   28
80 SYS2828:PRINT:PRINT
```

Louis F. Sander  
Pittsburgh, PA

**Screen Poke finder**—When you're Poking characters to the C-64 or C-128 screen, determining the Poke addresses is *not* part of the fun. That's why I created the Poke Finder program. Type the appropriate listing in

and run it, and if your Data statements are perfect, you'll see the instructions. Otherwise, find your typing error and correct it.

Note the instructions. Then NEW the program. Then you're free to program or to cursor around the screen, leaving, if you're skillful, a trail of truth and beauty. To find the memory locations for any screen position, just move your cursor there and press the f1 key. Like magic, the numbers will materialize on screen! And since Poke Finder doesn't interfere with Basic, you can use its services while writing other programs. Simultaneously pressing the run/stop and restore keys kills Poke Finder, while entering the proper SYS resurrects it.

```

10 REM 64 SCREEN POKE FINDER - C.CONLEE
11 PRINT"{SHFT CLR}{2 CRSR DNs} WORKING..."
12 FORJ=1TO180:READK:CS=CS+K:NEXT
13 IFCS<>25844THENPRINT"DATA ERROR":STOP
14 RESTORE:FORJ=49152TO49331:READK:POKEJ,K:
NEXT
15 PRINT"{SHFT CLR}{2 CRSR DNs}USE THE F1 K
EY TO FIND THE SCREEN AND"
16 PRINT"COLOR POKE LOCATIONS FOR THE CURRE
NT"
17 PRINT"CURSOR POSITION."
18 PRINT"{CRSR DN}STOP/RESTORE KILLS THE FE
ATURE,"
19 PRINT"SYS49152 RESURRECTS IT.{CRSR DN}"
20 SYS49152
21 DATA 120,169,013,141,020,003,169,192
22 DATA 141,021,003,088,096,072,138,072
23 DATA 152,072,165,215,201,133,240,003
24 DATA 076,172,192,056,032,240,255,140
25 DATA 180,192,142,181,192,169,000,141
26 DATA 182,192,169,004,141,183,192,224
27 DATA 000,240,020,024,169,040,109,182
28 DATA 192,141,182,192,169,000,109,183
29 DATA 192,141,183,192,202,208,236,024
30 DATA 173,180,192,109,182,192,141,182
31 DATA 192,169,000,109,183,192,141,183
32 DATA 192,024,173,182,192,105,000,141
33 DATA 184,192,173,183,192,105,212,141
34 DATA 185,192,024,162,000,160,024,032
35 DATA 240,255,169,083,032,210,255,169
36 DATA 061,032,210,255,174,182,192,173
37 DATA 183,192,032,205,189,169,044,032
38 DATA 210,255,169,032,032,210,255,169
39 DATA 067,032,210,255,169,061,032,210
40 DATA 255,174,184,192,173,185,192,032
41 DATA 205,189,024,174,181,192,172,180
42 DATA 192,032,240,255,104,168,104,170
43 DATA 104,076,049,234

```

```

50 REM 128 SCREEN POKE FINDER - L.SANDER
60 PRINT"{SHFT CLR}{2 CRSR DNs} WORKING..."
70 FORJ=1TO184:READK:L=DEC(K):CS=CS+L:NEX
T:RESTORE:IFCS<>21451THENSTOP
80 FORJ=2816TO2999:READK:POKEJ,DEC(K):NEX
T
90 PRINT"{SHFT CLR}{2 CRSR DNs}USE THE F1 K
EY TO FIND THE SCREEN AND"
100 PRINT"COLOR POKE LOCATIONS FOR THE CURR
ENT"
110 PRINT"CURSOR POSITION."
120 PRINT"{CRSR DN}STOP/RESTORE KILLS THE F
EATURE,"
130 PRINT"SYS2816 RE-ENABLES IT.{CRSR DN}"
140 KEY1,CHRS(133):SYS2816
150 DATA 78,A9,0D,8D,14,03,A9,0B
160 DATA 8D,15,03,58,60,48,8A,48
170 DATA 98,48,A5,F0,C9,85,F0,03
180 DATA 4C,AC,0B,38,20,F0,FF,8C
190 DATA B4,0B,8E,B5,0B,A9,00,8D

```

```

200 DATA B6,0B,A9,04,8D,B7,0B,E0
210 DATA 00,F0,14,18,A9,28,6D,B6
220 DATA 0B,8D,B6,0B,A9,00,6D,B7
230 DATA 0B,8D,B7,0B,CA,D0,EC,18
240 DATA AD,B4,0B,6D,B6,0B,8D,B6
250 DATA 0B,A9,00,6D,B7,0B,8D,B7
260 DATA 0B,18,AD,B6,0B,69,00,8D
270 DATA B8,0B,AD,B7,0B,69,D4,8D
280 DATA B9,0B,18,A2,00,A0,18,20
290 DATA F0,FF,A9,53,20,D2,FF,A9
300 DATA 3D,20,D2,FF,AE,B6,0B,AD
310 DATA B7,0B,20,F6,8D,A9,2C,20
320 DATA D2,FF,A9,20,20,D2,FF,A9
330 DATA 43,20,D2,FF,A9,3D,20,D2
340 DATA FF,AE,B8,0B,AD,B9,0B,20
350 DATA F6,8D,18,AE,B5,0B,AC,B4
360 DATA 0B,20,F0,FF,68,A8,68,AA
370 DATA 68,4C,9B,F9,00,00,00,00

```

Chris Conlee  
Moro, OR

**Sort subroutine**—You can use the accompanying subroutine to sort the items in any one-dimensional array. When called, it will sort string array S0\$( ) into ascending order. Before calling it, you must make entries into S0\$( ), then set variable S1 equal to the highest subscript of the entries you've made. S0\$( ) can be dimensioned to any size, but only items S0\$(1) through S0\$(S1) will be sorted. S0\$(0) is not sorted, nor is it counted in S1.

```

39999 REM ** MAGIC SORT SUBROUTINE **
40000 S2=S1
40001 S2=INT(S2/2):IF S2=0 THEN 40009
40002 S3=1:S4=S1-S2
40003 S5=S3
40004 S6=S5+S2:IF S0$(S5)<S0$(S6) THEN 40007
40005 S7$=S0$(S5):S0$(S5)=S0$(S6):S0$(S6)=S7$:S5=S5-
S2:IF S5<1 THEN 40007
40006 GOTO 40004
40007 S3=S3+1:IF S3>S4 THEN 40001
40008 GOTO 40003
40009 RETURN

```

For your protection, the subroutine uses variables with unusual names; avoid using them in the rest of your program, and you'll avoid interference with the sort.

To sort into descending order, change the "less than" symbol in line 40004 to a "greater than" symbol. To sort an array other than S0\$( ), change all the S0s in 40004 and 40005 to the name of the new array. To sort a numeric array S0( ), delete all the dollar signs in lines 40004 and 40005.

You can use the following program to test your subroutine.

```

10 FOR I=0TO9:READS0(I):PRINTI,S0(I):NEXT:PRINT
20 S1=9:GOSUB40000:FORI=0TO9:PRINTI,S0(I):NEXT:END
30 DATA ZERO,HA,I,G,D,B,C,FE

```

Titania Queen  
Staten Island, NY

**Disk de-banger**—When using copy-protected programs, the copy-protection scheme can create a lot of disk-head bumping, as evidenced by the 1541's machine-gun sound effects. The banging tends to knock drives out of alignment or to kill them before their time.

If you run the following program before loading any DOS-protected software, most of the banging will stop.

```

10 OPEN 15,8,15
20 PRINT#15,"M-W":CHRS(106)CHRS(0)CHRS(1)CHRS(133)
30 CLOSE 15

```

The de-banger will stay in effect until the drive is powered down.

Gilbert D. Helland  
Scott AFB, IL

**Disk ID changers**—A disk's two-character ID is recorded once in the directory and once on each disk sector. If you have inadvertently given two disks the same ID, you can use the following routine to change the directory, which will avoid most of the problems of duplicate IDs. Use spaces where they are shown in the Print# statements, and don't forget the semicolon at the end of line 50.

```
10 OPEN 15,8,15,"10" : OPEN 2,8,2,"#"
20 INPUT "NEW ID";ID$
30 PRINT#15,"U1:2 0 18 0"
40 PRINT#15,"B-P:2 162"
50 PRINT#2,ID$;
60 PRINT#15,"B-P:2 0"
70 PRINT#15,"U2:2 0 18 0"
80 PRINT#15,"10"
90 CLOSE2 : CLOSE15
```

By adding these lines, the program can be changed to restore the disk's original ID. Note the new line 20.

```
20 PRINT#15,"M-R"CHR$(18)CHR$(0)CHR$(2)
25 GET#15,A$,B$ : ID$ = A$ + B$
```

Mark Niggemann  
Ames, IA

**Write-protect detector**—This routine detects if your disk has its write-protect notch covered. It reads bit 4 of a port at \$1C00 on the disk controller; if the bit is set, the write-protect notch is open.

```
10 OPEN 15,8,15
20 PRINT#15, "M-R"CHR$(0)CHR$(28)
30 GET#15,A$ : A = ASC(A$ + CHR$(0)) AND 16
40 IF A = 0 THEN PRINT "WRITE PROTECTED"
50 CLOSE 15
```

Mark Niggemann  
Ames, IA

**Sequential file reader**—The following program lets you examine the contents of sequential files on disk, making it very useful in debugging. Before entering the name of the file you want to inspect, be sure that that file is on the disk in your drive. Then enter its name and watch the screen as the program steps through your file.

Use the space bar to advance through the file. Press any other key to terminate the program. When you reach the end of the file, the program terminates automatically.

```
100 REM SEQ FILE READER-LOUIS F. SANDER
110 OPEN15,8,15
120 PRINT:INPUT"{SHFT CLR}FILENAME TO READ"
;F$
130 OPEN2,8,2,F$+" ,S,R":PRINT:GOSUB280
140 PRINT"{CRSR DN}HIT SPACE TO SEE NEXT BY
TE,"
150 PRINT"HIT ANY OTHER KEY TO QUIT."
160 PRINT"{CRSR DN}{CTRL 9}BYTE#{2 CRSR RTS
}CHR${CRSR RT}ASCII"
170 J=J+1
180 GET#2,A$:A$=LEFT$(A$+CHR$(0),1)
190 A=ASC(A$):B$=A$
200 IFA$<CHR$(32)THENB$="{CRSR LF}N/A"
210 IFA$>CHR$(127)THENIFA$<CHR$(160)THENB$=
"{CRSR LF}N/A"
```

```
220 PRINTTAB(3);J;TAB(7);A;TAB(14);B$
230 IFST>19THEN260
240 GETC$:IFC$=""THEN240
250 IFC$=CHR$(32)THEN170
260 CLOSE2:CLOSE15:END
270 REM ** DISK ERROR CHECK
280 INPUT#15,EN,EM$,ET,ES
290 IFEN=0THENRETURN
300 PRINTEN;EM$;ET;ES:GOTO260
```

Louis F. Sander  
Pittsburgh, PA

## 32. Word Processing

**Magic word processor**—Here's a rudimentary but elegant word processor for any Commodore machine. It loads in a flash and lets you type and edit single lines, which then list to the printer whenever you press the return key. This ultra-convenient program works well with my 1526 printer, even reproducing the Commodore key graphics symbols.

To use this mini word processor, you first customize it for your own machine by adding the proper line 20 (see lines 100-420). When you run the program and select your margin settings, you'll see an 80-column print line, with margin areas highlighted by crosshatching. Type whatever you want, using the delete key to make corrections. You can type past the right margin at any time, and you can use the delete key as a left-margin release.

Notice that all keys repeat, and that cursor controls and other non-printing keys are disabled. To print your line of text, press the return key, then begin typing the next line. To skip a line, press the return key again. To exit the program, press the stop key. If you exit by mistake, type CONT <return>, and continue where you left off.

Here are some fine points on working with the program: Line 15 sets the colors, which you can easily change to suit your taste. P\$ is the prompt color, while C\$ is the character color. Screen and border colors are set in the usual way.

If you don't have a Commodore printer, you may have to customize line 95. Set it up so your printer prints T\$ in upper- and lowercase. If you have a C-128, Plus/4 or C-16, your function keys can be used to type words or phrases. Use the Key command to set them up.

Finally, a few cautions. Avoid asking for margins outside the 0-80 range, or for left margins higher than right ones, because doing so will confuse the program. Also be careful if you save the program from one computer model and load it into another, since the process may change some keywords, especially the Color in line 420.

```
10 PRINT"{SHFT CLR}MAGIC WP - LOUIS F. SAND
ER"
15 POKE36879,104:POKE53280,14:POKE53281,6:C
$="{CTRL 2}":P$="{CTRL 5}":S$="{CRSR UP}
":PRINTCHR$(14)
20 REM***{2 SPACES}SEE LINES 100-{2 SPACES}
***
25 IFPEEK(0)=76THENS$=CHR$(141)+"{4 CRSR UP
s}"
30 INPUT" LEFT MARGIN{3 SPACES}5{3 CRSR LF
s}";LM
35 INPUT"RIGHT MARGIN{3 SPACES}75{4 CRSR LF
s}";RM
40 T$="":PRINTP$:IFRM>80THEN30
45 FORJ=1TOLM:T$=T$+" ":PRINT"{COMD LB.}";:
NEXT
```

Listing continued.

```
50 FORJ=JTORM-1:PRINT"{COMD @}";:NEXT:FORJ=
  JTO80:PRINT"{COMD LB.}";:NEXT:PRINTC$"{C
  RSR UP}";S$;TAB(LM)
55 POKEQF,0:PRINTC$;"{COMD @}{CRSR LF}";
60 GETA$:IFAS$=""THEN60
65 IFAS$=CHR$(13)THENPRINTP$;"{COMD @}";:GOT
  O95
70 IFAS$=CHR$(20)ANDLEN(T$)THEN90
75 IFAS$<CHR$(32)THEN55
80 IFAS$>CHR$(127)ANDAS$<CHR$(160)THEN55
85 T$=T$+A$:PRINTA$;:GOTO55
90 T$=LEFT$(T$,LEN(T$)-1):PRINTP$;"{COMD @}
  {2 CRSR LFs}";:GOTO55
95 OPEN4,4,7:PRINT#4,T$:CLOSE4:GOTO40
100 :
110 REM LINE 20 FOR VARIOUS MACHINES:
120 QF=212:POKE650,128:REM C-64 & VIC
220 QF=244{12 SPACES}:REM C-128 40 COL
320 QF=244:S$=""{6 SPACES}:REM C-128 80 COL
420 QF=203:COLOR0,7,0:REM PLUS4 & C-16
```

Louis F. Sander  
Pittsburgh, PA

**Automatic setups**—Often there are setup steps you need to take before loading your word processor. Typical are locking the interface and executing a no-head-knock routine. If your word processor is one of the large number that use a short Basic loader program to boot in the main machine language code, take heart. You can usually change the boot program to include these initial setup activities.

If your word processor doesn't use a boot, just make one up yourself. Have it do your setups before it loads and runs the main program.

Karl D. Laun  
Wichita, KS

**Printer setup tip**—Most word processors have setup routines to configure themselves for the type of printer being used. If you're using a Cardco or other parallel printer interface, be very careful in answering the setup questions. If your interface plugs into the computer's serial interface, tell the word processor that you have a serial printer.

Even though the printer itself is a parallel printer, the computer is communicating with the interface, which is a serial device.

Bruce Sides  
Florence, AL

**DIP switch tip**—Most DIP switches select the printer features that will be enabled at power-up. If your word processor requires different features than you usually have enabled, there's no need to change the switches when you run it. Almost invariably, software commands are available to change the settings away from their power-up values. Reading your printer manual will generally reveal them, and reading your software manual will generally tell how to send them.

Bertram Schulman  
Valley Stream, NY

**Setup files**—Most word processors have features by which you can pick out certain print formats, display modes, special keys, etc. After you've been using your

word processor for a while, you'll find yourself repeatedly using the same group of features, usually with identical settings. Make up a file that includes only these commands, then save it with a descriptive filename such as Setup. Then, when beginning a new document, just load Setup and append your new material.

Andrew Rogosin  
Queens Village, NY

**Text centering tip**—When using a word processor, it's sometimes desirable to center a block of text as a unit, rather than line by line. For instance, if you wanted to center:

```
From: J. Lee
      Riverside, CA
To:   Alexander Papatheophilus
      Greece
```

you'd want to do it as shown, with "From" directly above "To" and the first letters of the names and addresses lined up.

But with most word processors, each line would be individually centered, and the results would be chaotic. A solution is at hand if your word processor recognizes what is called a hard space. (In PaperClip and others, you get a hard space by typing a shifted space.)

If you turn on centering, but use hard spaces for the leading and trailing spaces, the whole block will be centered as a unit. In the above example, when typing the last line, you'd use hard spaces from under the T in To to the G in Greece and from the last letter in Greece until you were under the last letter of Al's last name.

Jerry W. Lee  
Riverside, CA

**Indenting outlines**—When typing an outline or other document with several levels of indentation, keeping the indentation straight is mentally and visually confusing. Hence, a trick to help.

Instead of indenting as you type, use unusual character strings. When you're finished typing, use your Search and Replace option to replace these strings with the proper number of spaces. For the unusual characters, I use symbols like ##, %, @, and so on.

G. Scott Wright  
Albany, NY

**Word processor glossary**—Dedicated office word processors often provide a glossary function that allows frequently used words and phrases to be recalled by a two-letter code. This function can be approximated on any word processor that offers the Search and Replace feature. As the document is typed, use a two- or three-letter acronym. Then go back and search and replace every acronym with the desired phrases. For example, I used MRC in a report where I needed to use the phrase "Microcomputer Resource Center" numerous times.

Jo Ann Strohn  
Dublin, OH

**Wordpro parentheses**—With many printers, you get more readable copy if you use spaces to separate parentheses from the material they enclose. But sometimes that

leaves you with a dangling parenthesis (one that sits by itself at the beginning or end of a printed line). To avoid the problem, try using shifted spaces to separate your parentheses. With Wordpro, and perhaps with other word processors, the computer treats the shifted space as an invisible letter and will not break a line on it.

You can also use this trick to make the line break occur where you want it in the printout. Just be sure you don't type too long a line of words and shifted spaces. If the combination won't fit on a single line, you'll abort printing and get an error signal.

**Sarah Knutti**  
Bethesda, MD

**Address files**—I keep a disk filled with address files in the format of my word processor. Each time I type a letter, I start by trying to load the file for my addressee. If it's there, it loads. If it isn't, I type the address, then save it using the save-range feature.

By keeping all the addresses on one disk, I can use the disk as an address book that's compatible with my word processor. When I want to make printouts of selected addresses, I append them one by one, then save and print the resulting file.

**Mike Randell**  
Vernon, British Columbia  
Canada

**Easy Script tip**—Since this program uses the left-arrow key for cursor control, it's not readily apparent what to do if you want to put a left-arrow character in your text. Control 7 will do the job.

**Michael A. Packer**  
Washington, WV

**Easy Script directories**—To get hard copies of a group of disk directories, load Easy Script, then go to Disk mode by pressing f4. Put the first disk in the drive and type + \$0, which will put its directory into the text section. For the next disk, move the cursor to the bottom of the first listing, then repeat the above steps. Continue until all directories have been added to the text section, then print them out just as you would any document.

With this method, all of Easy Script's editing and formatting commands are available for your use. Also, for the benefit of those whose printers can't handle that mode, the disk headers are not printed in reverse field.

**R.S. Michaelis**  
Marietta, OH

**Easy Script and interfaces**—Many printer interfaces require setup commands to be sent to special secondary addresses. Easy Script has a feature that does this with ease. Just execute a Format command of the form

```
{f3}sa,N,D,D,D... <return>
```

{f3} means to press the f3 key, which prints on the screen as a reverse field asterisk. The letters "sa" are the command, and N is the number of the secondary address in question. The Ds, of which there may be as many as 20, represent the CHR\$ values of characters to be sent to the secondary address.

To send the string "ABC" to secondary address 23, for example, you would execute

```
{f3}sa,23,65,66,67 <return>
```

**Ronald J. Keating, Jr.**  
Laplace, LA

**Easy Script and printer codes**—The f1 and numeric keys can be used to send special codes to the printer. For example, you can make f1/1 send a CHR\$(14) by executing the Format command f3/1 = 14. (Don't type the slashes—they're only used as separators.) For details, see the Special Characters section of your manual.

I keep a special-codes file on disk, which contains the Format commands to set up keys 1-0 to control my printer's special features. Each command includes a comment that defines the key's function in English. For easy remembering, the keyboard is set up so that the keys enabling and disabling a feature are next to each other.

**Glenn Foster**  
Murray, KY

**Easy Script and daisywheels**—Commodore's DPS-1101, like most daisywheel printers, responds to different control characters than the dot-matrix printers. Because of this, Easy Script's printer-control codes don't work as published, and the printed character set differs slightly from that on the keyboard.

After reading the printer's instruction manual, I discovered how to control its special features from Easy Script. Most require escape sequences to turn them on and off. An escape sequence consists of the escape character, CHR\$(27), followed by one or more other characters. To send Escape from Easy Script, press f1, then the up-arrow key. (It will appear on screen as a reverse-field E.) Then just type the character or characters required by the feature with which you're working. Sometimes they must be shifted—read your manual carefully, then do some creative experimentation.

The DPS-1101 cannot print the left-arrow symbol; it prints a backslash instead. Also, to print left and right curly brackets, use the shifted plus and minus keys, respectively.

**Jacob M. Chacko**  
Staten Island, NY

**Easy Script and SEQ files**—Easy Script saves its files as uncomplicated SEQ files. This feature makes it easy for you to read non-Easy Script sequential files of many types. Just load the desired file as though it were an Easy Script document, and chances are good you'll be able to read it.

**J.T. Todd**  
Suffolk, VA

**Easy Script and listings**—If you haven't read the back pages of the Easy Script manual, you are missing out on this otherwise undocumented gem. Basic programs can be saved in Easy Script-readable form with just these commands:

```
LOAD "filename",8  
OPEN 8,8,8,"0:newfilename,S,W" : CMD8 : LIST  
PRINT#8 : CLOSE 8
```

Of course, you must assign a new name to the file when

it is saved in this way. When you load this file into Easy Script, everything will be in lowercase. To convert it to uppercase, use the {f1}U command, which flips the case of all text characters following the cursor.

This technique introduces some spurious Ready prompts into the file, and it doesn't handle reverse-field characters, such as those used for cursor control. You can fix these flaws by using Easy Script to edit the file.

**James A. Lisowski**  
S. Milwaukee, WI

**Easy Script music**—On my husband's version of Easy Script, pressing f1 and CTRL 3 causes the computer to play Pomp and Circumstance through the monitor's speaker. My own version of the program, an older one, doesn't have this feature at all. So, if you've heard of the Easy Script/Pomp and Circumstance connection, but can't make it work on your own machine, maybe you have an older version of the program.

**Karen Rhodes**  
Orange Park, FL

**PaperClip tip**—In the PaperClip word processor, embedded commands are preceded by the check-mark symbol, which is made by pressing the pound-sign key (£). If you want to edit these symbols for purposes of using the files with non-PaperClip activities, you have a problem: In the Search and Replace mode, the pound-sign key produces pound signs, not check marks.

The solution is simple. When searching and replacing, use the shifted @ key to get your check mark.

**Thomas F. Trocco**  
New York, NY

**Quick Brown Fox colors**—It's not documented, but you can easily change the colors on your screen. From initial startup, press the space bar to get the QBF menu. Before making a selection, press the shifted less-than, greater-than or question-mark keys to get, respectively, red, green and blue characters.

**F.A. Frost**  
Altamonte Springs, FL

### 33. Computer Room Hints

**Cheap desk**—When my computer system outgrew my desk, I moved everything (temporarily) to our large diningroom table. There, I could see exactly how much desktop space was needed (in my case, about 36×48 inches). I called lumber yards until I found one that would cut a piece of ¾-inch plywood to that size; then I bought the piece for \$12.

I varnish-stained the plywood, taped its edges with ¾-inch decorative plastic tape and set it on my formerly too-small desk. Now I have a classy looking desk with ample room for every piece of equipment.

**Joseph P. Green**  
Gays Mills, WI

**Junkyard computing**—Every GM car contains lengths of plastic wire tubing, split lengthwise and used for harnessing cables. This material is excellent for wrapping the many loose wires coming out of your computer and is readily available in any automobile junkyard. There are two sizes of tubing in most cars; the larger one is best for most applications. I bought 50 cents worth, and the area behind my computer is cleaner and better looking than I thought it ever would be.

**Patrick Kiser**  
Silver Lake, IN

**Neater wiring**—A solution to your computer room's rat's nest of wires and cables can be found in your local garden shop. Double-sided strips of Velcro intended for use as plant ties can be cut to any length to bundle up those runaway wires. The strips can be easily moved, unwound, loosened, tightened and reused, giving greater flexibility than electrical ties provide.

**Donna A. Trefry**  
Scarborough, ME

**Cord control**—My computer cords and cables no longer are a mess. I fold them inside discarded toilet tissue rolls.

**John Wedding**  
Corning, NY

**Cable dressing**—Radio Shack sells several varieties of inexpensive cable ties and hold-downs, which can be used to keep your computer area from looking like a wiring rat's nest. I use the self-sticking, quick-release type, which allows me to remove all my cables when I need to transport my computer. They're much better than the permanent wire staples I formerly used.

**Darin Benart**  
Alta Loma, CA

**Ponytail computing**—Little girls, and some big ones, use a simple device to hold their ponytails. It's an elastic band with a plastic marble at each end, and it's available wherever barrettes and other such items are sold. I use these devices to bundle my cables and cords, and I find them the ideal solution to the rat's nest problem.

**Ken Schultz**  
Vermilion, OH

**Get a watch**—Buy a \$2 stick-on clock-calendar at your local discount store, and stick it to your computer or monitor. That way, you'll be aware of how much time you spend computing.

**Mike H.**  
Paramount, CA

**Disk holder**—Office supply stores sell an inexpensive item that is perfect for temporary working storage of computer disks and cartridges. Designed for sorting envelopes or holding telephone messages, it has a plastic base with eight vertical separators, dividing it into seven open-ended compartments. The one I use is a Mighty Sorter, made by W.T. Rogers Company, and it fits very nicely on top of my disk drive.

Using this sorter, I can keep about ten disks and cartridges organized on top of my desk, with no immediate need to return them to their envelopes or storage boxes. It really comes in handy when I'm copying disks or otherwise swapping them in and out of the drive.

Margot Poloka  
Sewickley, PA

**Cartridge labels**—Use embossed tape to label your cartridges for easy visibility when plugged into a cartridge-port extension unit. I tape the top edge with the cartridge name, the block or address it occupies, the bytes free or bytes used and the SYS call, if applicable.

Gary L. Rezeau  
Address unknown

**Marking your manuals**—Have you ever searched through a manual looking for a certain item, only to end up looking through every page in the book? Well, here's a little tip for you.

Go to an office supply store and buy some colored paper clips. Put the blue clips on the pages dealing with sound, red for graphics, yellow for memory maps, and so on. You'll find this to be very helpful.

Brian Cross  
Coral Springs, FL

**Flip files**—If you keep your reference data on 3x5 cards, try keeping your cards in a replacement leaf—the kind used in flip-type picture albums. These pages cost about \$1.50 and can hold 20 cards. The cards fit into transparent sleeves that are staggered from top to bottom. This arrangement allows you to label the bottom of each card for easy reference.

Doug Curtis  
Waukesha, WI

**Recordkeeping hint**—I keep track of all my machine language programs in a pocket-sized looseleaf notebook available at most department stores. The pages are 3 3/4" x 6 3/4", which is large enough to hold what I need, yet small enough to fit in a corner of my desk drawer. The program name goes on the top line of each sheet, followed by loading information, SYS calls, and so forth. I use both sides of the lined sheets, so I never run out of room. I use masking-tape tabs to divide the book into meaningful sections, and the looseleaf system keeps everything safely together, while enabling me to move pages when necessary.

Since Basic programs can be listed on the screen, with numerous REMs to explain them, I seldom enter one in my book. But for all those unlistable machine language programs, with all their versions, SYS calls and options, I wouldn't be without my little book.

Louis F. Sander  
Pittsburgh, PA

**Beware of humidifiers**—The new ultrasonic humidifiers can be hazardous to your computer's health. Some of the manufacturers are including a small warning that they may deposit harmful mineral films on disks and computer equipment. Unlike other humidifiers, which

depend on evaporation and leave the minerals behind in the tank, these new ones physically spray the water—minerals and all—into the air. Distilled or specially filtered water is one solution to the problem.

Tom Grayczyk  
Chicago, IL

**Hex conversion aid**—Radio Shack's #65-990 Programmer's Hexadecimal Calculator has been a wonderful addition to my computer room. It converts hex to decimal and vice versa, more smoothly and with less effort than any unit I've seen. It includes a clock and calendar, so it's useful even when sitting on the desk. At \$21.95, it's a worthwhile tool for any programmer.

Oberon King  
Staten Island, NY

**Batteries excluded**—If you're tempted to buy rechargeable ni-cads for all those battery-powered items around the computer room, you might want to think again. While they're great for powering toys, and so on, ni-cads don't hold a charge very long, which makes them a liability in seldom-used items like flashlights. And they have a disturbing tendency to fail completely after a year or so, leaving you with an incomplete set of batteries. Did you ever try to buy *one* AA-size ni-cad?

Louis F. Sander  
Pittsburgh, PA

**Short-wave computing**—Hams and SWLs can find a Commodore User's Net on Saturdays at 1500 Eastern Time on 7.228 MHz, lower sideband. All licensed hams are invited to participate.

Warren Flynn, WB4ZQJ  
Temple, GA

**School days**—Have you tried to teach your parents how to use the computer, only to have them walk away furious? Well, here are some of the do's and don'ts of teaching them.

Don't tell them they're dumb or slow or how fast you learned to use the computer.

Don't expect them to remember long commands. Give them one command at a time.

Don't hog the controls, trying to show off. They know you can use the computer or they wouldn't be there.

Do show them applications they're interested in, like word processing.

Do keep them going if they seem interested in a specific program or concept.

Do be patient with them. You weren't a computer whiz in ten minutes, either.

Use your knowledge wisely.

Nick Lugerio  
Kingwood, TX

## 34. Magazines and Books

**Magazine indexes**—Some of the most useful information in the computer field is found in the back issues

of magazines. A wonderful tool for finding it is the Microcomputer Index (2464 El Camino Real, Santa Clara, CA 95051; 408-984-1097). It's also available on-line through the Dialog information service (800-227-1927). Many libraries subscribe to this treasure trove of computeriana, and some will search Dialog for you.

The index categorizes articles, programs and reviews from dozens of computer publications, and a typical issue contains over 700 entries.

Once you've determined where a piece was published, ask for it at the library or order the back issue from the publisher. If all else fails, try to get a microfilm, from which a hard copy can easily be made. University Microfilms (300 N. Zeeb Road, Ann Arbor, MI 48106; 800-521-0600) provides this type of service.

**Frank Biondi**  
Pittsburgh, PA

**Outside reading**—*IEEE Spectrum*, the monthly publication of the Institute of Electrical and Electronics Engineers, is a semi-technical journal of interest to all sorts of electrical engineers. Its March 1985 issue contained a superb ten-page article on the design history of the Commodore 64. It includes, among other things, the real explanation of "sparkle" on the early 64s and tells why the 1541 disk drive is so slow. If you know an IEEE member, ask to see that copy.

**Louis F. Sander**  
Pittsburgh, PA

**Page tabs**—The write-protect tabs that come in each box of disks make dandy markers for important pages in your reference books. Just fold them in half on the desired pages, letting them stick out a bit, and information will be much easier to find.

**Jack Ryan**  
El Dorado, AR

**Magazine work**—Every computer magazine has its own system of listing programs, and there's little standardization in the symbols they use for cursor and other special characters. You can make your life easier by copying the "how to type in listings" sections from each of your favorite magazines, then pasting them all onto an 8½ × 11-inch card. If you keep the card close by, you can use it as a handy reference when typing in programs.

**Deb Sullivan**  
Pittsfield, MA

**Computerese**—In some computer publications, the space character is signified by **b**—a lowercase b with a slash through it. It's easier to see and count than an empty space, and the b is a mnemonic for blank.

**Rula Lenska**  
New York, NY

**Magazine hacking**—Whenever my magazines arrive, I go through each with a colored marker in hand, usually a translucent yellow one. I circle small items of special

interest to me, such as interesting Magic tricks. I scan each article briefly, and if it appears to be of interest, I circle its listing in the Table of Contents. For advertising, I circle items I'm interested in, then put a line through their listings on the advertiser's page in the back. I also circle the number on the page of the ad itself so it stands out when I flip through. Later, I make up a card file on articles, and so on. When my disk drive operates properly, I will set up disk files to replace the cards.

**D.G. Munoz**  
Dania, FL

**Saving valuable articles**—Like most people, I have a large collection of photocopied magazine articles on various computer subjects. One day I arranged them in the order I desired and had them bound at a local print shop. It cost me \$2 to have them placed in a plastic ring binder like that on the Programmer's Reference Guide.

**Craig Gibleon**  
Waterloo, IA

**Bookwork**—After working with my system for several months, I found myself returning again and again to the same few pages and tables in my computer's reference guide. To make things easier, I copied my most frequently used pages and glued them to different colored sheets of construction paper. Now I have a series of easy-to-find color-coded reference cards with all the sprite information, ASCII codes and other functional charts as needed. What a time saver it has been for me!

**Mrs. Ruth A. Hicks**  
Oak Run, CA

**Take notes**—Whenever I see an article that mentions a new Poke or Peek, I write it in my memory map book for future reference.

Also, whenever I use a memory location listed in the memory map, I highlight that location in the book. It's surprising how often I need that location again, and the highlighting makes it easy to find.

**Don Griffin**  
Los Angeles, CA

**C-64 User's Manual error**—In Appendix F (ASCII and CHR\$ codes), codes 149–155 are wrong. They should be: brown (149), lt. red (150), grey 1 (151), grey 2 (152), lt. green (153), lt. blue (154) and grey 3 (155).

**Ernesto Andrade**  
San Diego, CA

**C-64 User's Manual error #2**—If you couldn't get Michael to row the boat ashore when you tried to run the sound program on p. 88, it might be due to a typo that appeared in some versions. Line 60 should read as follows:

```
60 POKE HF.H : POKE LFL : POKE W.65
```

**Wally Morris**  
Science Hill, KY

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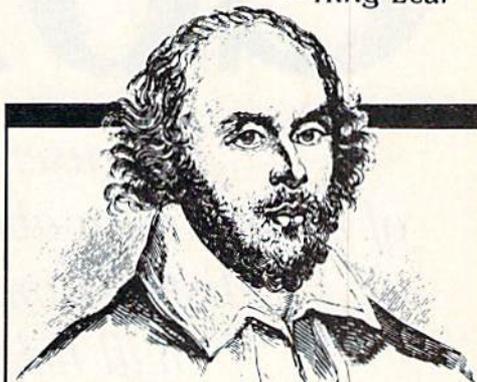
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At Christmas I no more  
desire a rose

Than wish a snow in May's  
new fangled mirth

But like of each thing  
that in season grows

—King Lear

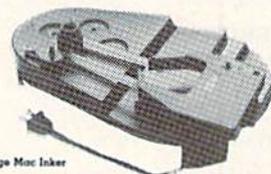


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904-799-5292

**BRANDON USER'S GROUP**

813 VALLEY HILL DRIVE  
BRANDON, FL 33511

**BROWARD COMMODORE USER'S GROUP**

PO BOX 25794  
TAMARAC, FL 33320

**CITRUS COMMODORE USER'S GROUP**

PO BOX 1494  
INVERNESS, FL 32651  
904-344-2793

**THE COMMODORE ADVANTAGE**

PO BOX 18490  
PENSACOLA, FL 32523  
904-456-6554  
DEANNA OWENS

**RAM ROM 84 COMPUTER USER'S GROUP**

PO BOX 1369  
ENGLEWOOD, FL 34295

**LAKE SUMTER COMMODORE USER'S GROUP**

PO BOX 416  
LEESBURG, FL 32748

**64 SOCIETY**

4071 EDGEWATER DRIVE  
ORLANDO, FL 32804

**CHIPS**

UMR BOX 3063  
AVON PARK, FL 33825

**VIC/64 HEARTLAND USER'S GROUP**

1220 BARROW ROAD #23  
LAKELAND, FL 33801  
813-666-2132

**COMMODORE COMPUTER CLUB**

PO BOX 21138  
ST. PETERSBURG, FL 33742  
813-522-2547

**TAMPA BAY COMMODORE COMPUTER CLUB**

10208 N. 30TH ST.  
TAMPA, FL 33612  
813-977-0877

**CLEARWATER COMMODORE CLUB**

PO BOX 11211  
CLEARWATER, FL 33518

**FT. WALTON BEACH COMMODORE USER GROUP**

PO BOX 3  
SHALIMAR, FL 32579  
904-651-3737  
JAMES MOORE

**COMMODORE USER'S GROUP OF PENSACOLA**

PO BOX 3533  
PENSACOLA, FL 32516  
904-455-5804  
DEBBIE JOHNSTON

**PUBLIC DOMAIN USER'S GROUP**

PO BOX 1442  
ORANGE PARK, FL 32067  
WILLIAM ROGERS

**COMMODORE USER'S GROUP AT TALLAHASSEE**

PO BOX 14015  
TALLAHASSEE, FL 32316  
DAVE LANG

**COMMODORE STUFF**

2260 17TH ST.  
VERO BEACH, FL 32920  
305-562-1645  
WADE GUGGINS

*Georgia*

**COMMODORE CRAZE INTERNATIONAL**

1284 LYNN DRIVE  
WAYCROSS, GA 31501

**ATHENS COMMODORE ENTHUSIASTS**

130 ST. JAMES DRIVE  
ATHENS, GA 30606  
404-543-5541  
STANTON ROBERTSON

**SAVANNAH COMMODORE USER'S GROUP**

103 VIRGINIA AVE.  
SAVANNAH, GA 31404  
912-236-1686  
DALE REAGAN

**COMMODORE COMPUTER CLUB OF COLUMBUS**

6618 FOXDALE DRIVE  
COLUMBUS, GA 31907  
404-563-0828  
NOSH SETHNA

**VIC EDUCATOR'S USER'S GROUP**

110 ACADEMY ST.  
CANTON, GA 30114  
CHEROKEE COUNTY SCHOOLS

**COMMODORE USER'S GROUP OF ATLANTA**

633 CLAIRMONT CIRCLE  
DECATUR, GA 30033  
404-634-8863

*Hawaii*

**20/64 HAWAII**

PO BOX 23260  
KAILUA, HI 96822

**MAKAI COMMODORE USER GROUP**

PO BOX 6381  
HONOLULU, HI 96818  
808-423-1504

**COMMODORE HAWAII USER'S GROUP**

PO BOX 61598  
HONOLULU, HI 96822

*Idaho*

**POCATELLO COMMODORE USER'S GROUP**

82 MOUNTAIN DRIVE  
POCATELLO, ID 83204

**COMMODORE USER'S GROUP**

310 EMERALD DRIVE  
KELLOGG, ID 83837  
208-784-8751

**64 BUG**

PO BOX 276  
BOISE, ID 83701  
208-344-6302

**SRHS COMPUTER CLUB**

SALMON RIVER HIGH SCHOOL  
RIGGINS, ID 83549

**GHS COMPUTER CLUB**

910 SOUTH D ST.  
GRANGEVILLE, ID 83530  
GRANGEVILLE HIGH SCHOOL

**EAGLE ROCK COMMODORE USER'S GROUP**

900 S. EMERSON  
IDAHO FALLS, ID 83401

**COMMODORE USERS**

548 E. CENTER  
POCATELLO, ID 83201

**COMMODORE-COEUR D'ALENE COMPUTER CLUB**

506 LUNCEFORD LANE  
COEUR D'ALENE, ID 83814  
208-765-3803

**USER'S GROUP OF LOWER IDAHO**

RT. 4, BOX 67  
RUPERT, ID 83350  
208-436-4283

**COMMODORE CORPS OF COEUR D'ALENE**

PO BOX 007  
HARRISON, ID 83833  
208-689-3919  
TOM NELSON

**CARIBOU COMMODORE CLUB**

PO BOX 535  
SODA SPRINGS, ID 83276  
208-547-4143

**BLACKFOOT USER'S GROUP**

417 SOUTH 1200 WEST  
PINGREE, ID 83262  
CURTIS SMITH

## Illinois

### SPRINGFIELD PET USER GROUP

3116 CONCORD  
SPRINGFIELD, IL 62704  
217-753-8500

### TRI COUNTY COMMODORE USER'S GROUP

PO BOX 564  
ERIE, IL 61250

### COMM EDISON EMPLOYEES COMMODORE USER GROUP

6536 W. TERRACE DRIVE  
TINLEY PARK, IL 60477  
312-429-1169  
JOHN MCDOWELL

### JACKSONVILLE AREA COMMODORE USER GROUP

PO BOX 135  
MURRAYVILLE, IL 62668  
217-882-5481  
GREG SIMPSON

### SO. ILLINOIS COMMODORE USER GROUP

508 WEST COLLINS  
GOREVILLE, IL 62939

### KANKAKEE HACKERS

RR #1, BOX 279  
ST. ANNE, IL 60964  
815-933-4407

### COMMODORE 64 USER'S CLUB

104 SUSAN LANE  
CARTERVILLE, IL 62918  
618-985-4710

### MT. VERNON COMMODORE USERS

PO BOX 512  
MT. VERNON, IL 62864

### WIPUG

RT. 5, BOX 75  
QUINCY, IL 62301  
217-656-3671

### PEORIA AREA PET USER'S GROUP

6 APPLE TREE LANE  
EAST PEORIA, IL 61611  
309-673-6635

### ILLINOIS VALLEY COMMODORE USER GROUP

2330 12TH ST.  
PERU, IL 61354  
815-223-5141

### COMCOE

2108 SHERMAN AVE.  
EVANSTON, IL 60201

### VIC/64 USER'S SUPPORT

114 S. CLARK ST.  
PANA, IL 62557  
217-562-4568

### CENTRAL ILLINOIS PET USERS

635 MAPLE  
MT. ZION, IL 62549  
217-864-5320

### COMMODORE USER'S CLUB

1707 EAST MAIN ST.  
OLNEY, IL 62450

### ASM/TED USER GROUP

200 S. CENTURY  
RANTOUL, IL 61866

### WESTERN ILLINOIS COMMODORE USER GROUP

906 WEST 6TH AVE.  
MONMOUTH, IL 61462  
ROBERT COKEL

### PEORIA AREA PET USER'S GROUP

800 SW JEFFERSON ST.  
PEORIA, IL 61605  
309-674-5998

### C-64 USER'S GROUP

PO BOX 46464  
LINCOLNWOOD, IL 60646  
312-588-0334

### SCOTT COMMODORE USER'S GROUP

PO BOX 397  
SCOTT AFB, IL 62225  
618-746-2732  
GILBERT HELLAND

### FOX VALLEY 64 USER'S GROUP

PO BOX 28  
N. AURORA, IL 60542  
312-898-2779  
FRANK CHRISTENSEN

### COMMODORE SIG CACHE

BOX C-176, 323 S. FRANKLIN #804  
CHICAGO, IL 60606  
312-685-0994  
HERB SWANSON

### SPRINGFIELD AREA VIC ENTHUSIASTS

PO BOX 2961  
SPRINGFIELD, IL 62708  
217-522-2706  
MIKE STOUT

### SURVIVORS OF 64 USER'S GROUP

WESTERN IL. UNIV. WESL.  
INSTITUTE  
MACOMB, IL 61455  
309-837-5378  
MACEY MCKEE

### MCHENRY COUNTY COMMODORE CLUB

227 EAST TERRA COTTA AVE.  
CRYSTAL LAKE, IL 60014  
815-455-3942  
JOHN KATKUS

### ALTON COMMODORE USER'S GROUP

3103 CLAY ST.  
ALTON, IL 62002  
618-462-7136

### SAUK VALLEY COMPUTER CLUB

BOX 702  
STERLING, IL 61081

### MIDWEST C-64 USER'S GROUP

PO BOX 421  
WESTMONT, IL 60559  
312-895-4026  
PIERRE CALLEROS

### GATEWAY COMPUTER CLUB

PO BOX 207  
BELLEVILLE, IL 62222  
RICH FISHER

### CANTON AREA COMMODORE USER'S GROUP

RR #1, SPOON RIVER COLLEGE  
CANTON, IL 61520  
309-647-4645

### ROCKFORD AREA COMMODORE COMPUTER CLUB

2507 PELLERHAM ROAD  
ROCKFORD, IL 61107  
KATHE HEYER

### SHELLY WERNIKOFF

2731 N. MILWAUKEE AVE.  
CHICAGO, IL 60647

### VIC CHICAGO CLUB

3822 N. BELL AVE.  
CHICAGO, IL 60618

### CHICAGO COMMODORE 64 USERS

PO BOX 14233  
CHICAGO, IL 60614

### OAK LAWN COMMODORE USERS

11004 S. CICERO AVE.  
OAK LAWN, IL 60453  
C/O COMPUTER STORE

### EAST SIDE COMPUTER CLUB

3103 CLAY ST.  
ALTON, IL 62002  
618-462-7136

### CHAMPAIGN-URBANA COMMODORE USER GROUP

2006 CRESCENT DRIVE  
CHAMPAIGN, IL 61821  
217-352-9681

### DECATUR COMMODORE COMPUTER CLUB

1368 W. RIVERVIEW  
DECATUR, IL 62521  
JIM TONIS

## Indiana

### COMPUTER USERS OF EVANSVILLE

PO BOX 2305  
EVANSVILLE, IN 47714  
812-476-9107  
BRAD CALLAHAN

### WESTERN INDIANA COMMODORE USERS

PO BOX 1898  
TERRE HAUTE, IN 47808

### COMMODORE OWNERS OF LAFAYETTE

PO BOX 5763  
LAFAYETTE, IN 47903

### COMMODORE 64 USER'S GROUP

912 SOUTH BROWN AVE.  
TERRE HAUTE, IN 47803  
812-234-5099

### SEYMOUR PEEKERS

108 N. CHESTNUT  
SEYMOUR, IN 47474  
C/O D&L CAMERA SHOP

### VIC/64 USER'S GROUP

2401 COLUMBUS AVE.  
ANDERSON, IN 46014  
317-378-3016

### NATIONAL VIC PROGRAM EXCHANGE

102 HICKORY COURT  
PORTLAND, IN 47371  
219-726-4202

### EAST CENTRAL INDIANA VIC USERS

RR #2  
PORTLAND, IN 47371

### COMMODORE USER'S GROUP

1020 MICHIGAN AVE.  
LOGANSPOUT, IN 46947

### CHUG

12104 MEADOW LANE  
OAKLANDON, IN 46236

### NO. INDIANA COMMODORE ENTHUSIASTS

927 S. 26TH ST.  
SOUTH BEND, IN 46615

### NATIONAL SCIENCE CLUBS COMMODORE USERS

PO BOX 10621  
MERRILLVILLE, IN 46411

### COMPUTER WORKSHOP VIC/64

282 SOUTH 600 WEST  
HEBRON, IN 46341  
219-988-4535

### CARDINAL SALES

6225 COFFMAN ROAD  
INDIANAPOLIS, IN 46286  
317-298-9650

### PET/64 USERS

10136 E. 96TH ST.  
INDIANAPOLIS, IN 46256

### VIC INDY CLUB

PO BOX 11543  
INDIANAPOLIS, IN 46201  
317-357-6906

**TRI-STATE COMMODORE USERS**

6500 CENTER RIDGE ROAD  
NEWBURGH, IN 47630  
812-853-2334  
JERRY SCHAUSS

**THE COLUMBUS COMMODORE CLUB**

2676 LAFAYETTE AVE.  
COLUMBUS, IN 47201  
WALT HUTTON

**COMMODORE COMPUTER CLUB**

PO BOX 2332  
EVANSVILLE, IN 47714  
812-985-9707  
JACK MARTIN

**Iowa****COMMO-HAWK COMMODORE USER'S GROUP**

PO BOX 2724  
CEDAR RAPIDS, IA 52406

**COMMODORE USER'S GROUP OF CLINTON**

PO BOX 743  
CLINTON, IA 52732  
319-243-2182  
TERRY VOSS

**COMMODORE COMPUTER USERS OF IOWA**

BOX 3140  
DES MOINES, IA 50702  
515-287-1378

**NEWTON COMMODORE USER'S GROUP**

320 W. 9TH ST. SOUTH  
NEWTON, IA 50208  
515-792-0814

**PEC COMMODORE USER'S GROUP**

333 JOY DRIVE  
WATERLOO, IA 50701  
AL SORENSEN

**COMMODORE USER'S GROUP**

965 SECOND ST.  
MARION, IA 52302

**SIOUXLAND COMMODORE CLUB**

2700 SHERIDAN ST.  
SIOUX CITY, IA 51104  
712-258-7903

**COMMODORE USER GROUP**

114 8TH ST.  
AMES, IA 50010

**QUAD CITIES COMMODORE CLUB**

PO BOX 3994  
DAVENPORT, IA 52808  
319-391-3197

**CRAWFORD COUNTY COMMODORE USER GROUP**

519 N. 19TH ST.  
DENISON, IA 51442  
712-263-6274

**Kansas****TOPEKA COMMODORE USER'S GROUP**

7939 S. TOPEKA BLVD. #39  
WAKARUSA, KS 66546  
ROBERT WAYMAN

**WALNUT VALLEY COMMODORE USER GROUP**

1003 S. SECOND ST.  
ARKANSAS CITY, KS 67005

**LAWRENCE COMMODORE USER'S GROUP**

PO BOX 2204  
LAWRENCE, KS 66045

**DODGE CITY COMMODORE USER GROUP**

14TH & BY PASS 50  
DODGE CITY, KS 67801  
IRWIN NOYES

**WICHITA AREA PET USERS**

2231 BULLINNGER  
WICHITA, KS 67204  
316-838-0518

**COMMODORE USER'S GROUP**

6050 SOUTH 183RD ST. WEST  
VIOLA, KS 67149

**KANSAS COMMODORE COMPUTER CLUB**

101 S. BURCH  
OLATHE, KS 66061

**SALT CITY COMMODORE CLUB**

PO BOX 2644  
HUTCHINSON, KS 67501  
JOHN BLEAZARD

**Kentucky****LOUISVILLE USERS OF COMMODORE KY**

2830 DESHLER DRIVE  
LOUISVILLE, KY 40213  
502-964-2696  
LARRY HIBBS

**BOWLING GREEN COMMODORE USER'S GROUP**

RT. 11, CREEKSIDE, APT. 6  
BOWLING GREEN, KY 42101  
502-781-9098

**GOLD CITY USER'S GROUP**

129 CECILIANNA DRIVE  
ELIZABETHTOWN, KY 42701  
502-737-9067  
PAT WATTERSON

**COMMODORE USER'S GROUP OF CENTRAL KY**

173 FOREST AVE.  
LEXINGTON, KY 40508  
JOHN REA

**LOGAN COUNTY COMMODORE USER'S CLUB**

PO BOX 302  
LEWISBURG, KY 42256  
502-755-2903  
LARRY MCDOWELL

**VIC CONNECTION**

1010 S. ELM  
HENDERSON, KY 42420

**C\*BUG**

PO BOX 165  
BARDSTOWN, KY 40004  
502-348-6380

**Louisiana****LAKE CHARLES 64 USER'S GROUP**

PO BOX 226  
LAKE CHARLES, LA 70602  
MARK BILLODEAUX

**COMMODORE 64 USER'S GROUP OF BATON ROUGE**

PO BOX 1422  
BATON ROUGE, LA 70821

**COMMODORE USER'S GROUP OF OACHITA**

PO BOX 175  
SWARIC, LA 71281  
318-343-8044

**ARK-LA-TEX COMMODORE 64 CLUB**

198 INDIA DRIVE  
SHREVEPORT, LA 71115  
318-797-9702

**VIC USER'S GROUP**

5064 BODOWN ST.  
MARRERO, LA 70072  
504-341-5305

**FRANKLIN PARISH COMPUTER CLUB**

#3 FAIR AVE.  
WINNISBORO, LA 71295

**64 CLUB**

PO BOX 1422  
BATON ROUGE, LA 70821  
504-925-5870

**SOUTHWEST LOUISIANA USER'S GROUP**

RT. 1, BOX 155JA  
DEQUINCY, LA 70633  
STEVE BEESON

**COMMODORE PET USER GROUP**

616 NIAGARA CIRCLE  
GREINA, LA 70053  
504-394-4928  
STAN PAPE

**Maine****SOUTHERN MAINE COMMODORE**

PO BOX 416  
SCARBOUROUGH, ME 04074  
207-761-1626  
STEVE SHAPIRO

**COMPUMANIA**

81 NORTH ST.  
SACO, ME 04072  
207-282-7418

**SO. AROOSTOOK COMMODORE USER'S GROUP**

PO BOX 451  
HOULTON, ME 04730  
207-532-6287  
ROBERT REECE

**COASTAL COMMODORE CLUB**

WALDOBORO VILLAGE, APT. 9  
WALDOBORO, ME 04572

**NORTHWOODS COMMODORE USER'S GROUP**

740 MAIN ST.  
VAN BUREN, ME 04785

**COM-VICS**

RFD #1, BOX 2086  
HEBRON, ME 04238  
207-966-3641

**YOUR COMMODORE USER'S GROUP**

BOX 611  
WESTBROOK, ME 04092  
207-854-4579

**Maryland****CUM-BACC**

PO BOX 479  
REISTERSTOWN, MD 21136

**ANNAPOLIS COMMODORE USER'S GROUP**

PO BOX 3358  
ANNAPOLIS, MD 21403  
301-956-3458

**COMPUCATS COMMODORE COMPUTER CLUB**

680 W. BEL AIR AVE.  
ABERDEEN, MD 21001  
301-272-0472

**COMMODORE 64 USER'S GROUP**

11209 TACK HOUSE COURT  
POTOMAC, MD 20854  
301-983-8199

**HAGERSTOWN USER'S GROUP**

23 COVENTRY LANE  
HAGERSTOWN, MD 21740  
301-979-9728

**HOUSE OF COMMODORE**

8835 SAIYR ROAD  
BALTIMORE, MD 21234

**BLUE TUSK**

700 EAST JOPPA ROAD  
BALTIMORE, MD 21204

**LONG LINES COMPUTER CLUB**

323 N. CHARLES ST.  
ROOM 201  
BALTIMORE, MD 21201

**FREDERICK  
FUNCTIONEERS**  
8512 YELLOW SPRINGS ROAD  
FREDERICK, MD 21701  
301-695-6561  
SCOT GARDNER

**ASSN. OF PERSONAL  
COMPUTER USERS**  
5014 RODMAN ROAD  
BETHESDA, MD 20016

**VICLIQUE**  
105A CONDUIT ST.  
ANNAPOLIS, MD 21401  
301-263-8568

**MONTGOMERY COUNTY  
COMMODORE COMPUTER  
SOCIETY**  
PO BOX 2689  
SILVER SPRING, MD 20902  
301-770-6778  
DAVE MENAKER

**GAITHERSBURGH C-64  
USER'S GROUP**  
12937 PICKERING DRIVE  
GERMANTOWN, MD 20874  
301-428-3328

**ROCKVILLE VIC/64 USER'S  
GROUP**  
5112 PARKLAWN TERRACE #103  
ROCKVILLE, MD 20852  
301-231-7823

**THE BOYDS CONNECTION**  
21000 CLARKSBURG ROAD  
BOYDS, MD 20841  
301-428-3174

**EDISON COMMODORE  
USER'S GROUP**  
4314 OXFORD DRIVE  
SUTTLAND, MD 20746  
301-423-7155

**HYATTSVILLE C-64 USER'S  
GROUP**  
7209 DARTMOUTH AVE.  
COLLEGE PARK, MD 20740  
301-779-8369

**SO. MARYLAND  
COMMODORE USER'S  
GROUP**  
6800 KILLARNEY ST.  
CLINTON, MD 20735  
301-868-6536

**WICOMICO C-64 CLUB**  
1306 HAMILTON ST.  
SALISBURY, MD 21801  
SAM SULLIVAN

**JUMPERS '64  
COMMODORE USER'S  
GROUP**  
712 SNOWDON LANE  
GLEN BURNIE, MD 21061  
301-969-6088  
ALAN KNEPPER

**BAY CUG**  
4605 VOGT AVE.  
BALTIMORE, MD 21206  
301-325-2156

**WESTINGHOUSE BWI  
COMMODORE USER  
GROUP**  
PO BOX 1693  
BALTIMORE, MD 21203

*Massachusetts*  
**MIT LINCOLN  
LABORATORY COMPUTER  
CLUB**  
244 WOOD ST.  
LEXINGTON, MA 02173

**BOSTON COMPUTER  
SOCIETY**  
THREE CENTER PLAZA  
BOSTON, MA 02108

**THE COMMODORE  
CONNECTION**  
132 NORTH RIDGE ROAD  
WESTFIELD, MA 01085  
413-568-2228  
PAUL JENNEY

**FOXBORO AREA  
COMMODORE USER'S  
GROUP**  
PO BOX 494  
MANSFIELD, MA 02048

**CAPE COD 64 USER'S  
GROUP**  
358 FORREST ROAD  
S. YARMOUTH, MA 02664  
800-225-7136

**EM 20/64 USER'S GROUP**  
24 COTTAGE ST.  
STONEHAM, MA 02180  
617-438-7133

**COMMODORE USER'S  
GROUP**  
269 LINCOLN ST.  
WORCESTER, MA 01605  
BEST BUSINESS EQUIP.

**BERKSHIRE HOME FOR  
LITTLE PET USERS**  
401 POMEROY AVE.  
PITTSFIELD, MA 01201

**PIONEER VALLEY  
COMMODORE CLUB**  
6 LAUREL TERRACE  
WESTFIELD, MA 01085  
413-562-1027

**MASSPET COMMODORE  
USER'S GROUP**  
PO BOX 307  
EAST TAUNTON, MA 02718

**VIC USER'S GROUP**  
193 GARDEN ST.  
NEEDHAM, MA 02192

**EASTERN  
MASSACHUSETTS VIC  
USER GROUP**  
7 FLAGG ROAD  
MARLBORO, MA 02173

**RAYTHEON COMMODORE  
USER'S GROUP**  
HARTWELL ROAD  
GRA-6  
BEDFORD, MA 01730

**COMMODORE 64 USER'S  
GROUP  
OF THE BERKSHIRES**  
184 HIGHLAND AVE.  
PITTSFIELD, MA 01201

**COMMODORE USER'S  
CLUB**  
STOUGHTON HIGH SCHOOL  
STOUGHTON, MA 02072  
**VIC INTERFACE CLUB**  
48 VAN CLIFF AVE.  
BROCKTON, MA 02401

*Michigan*  
**KALAMAZOO VALLEY  
HOME USER'S GROUP**  
PO BOX 3085  
KALAMAZOO, MI 49003

**COMMODORE USER'S  
GROUP OF DURAND**  
PO BOX 188  
LENNON, MI 48449  
MARLA ROMINE

**VAN BUREN USER'S  
GROUP**  
50984 35 1/2 ST.  
MAPLE LAKE  
PAW PAW, MI 49079  
ROBERT TOMPSETT

**DELTON AREA USER  
GROUP**  
11386 LETCHES LANE  
DELTON, MI 49046  
AL PILUKAS

**COMMODORE COMPUTER  
CLUB OF MONROE**  
PO BOX 586  
MONROE, MI 48161  
313-369-2291  
BOB TRIMBLE

**DOWNRIVER  
COMMODORE GROUP**  
17029 KEPPEL  
ALLEN PARK, MI 48101  
313-274-2589  
RON MARSHALL

**QUORUM OF 64**  
214 W. STATE ST.  
CLARE, MI 48617  
517-386-2251  
DAVID JENSEN

**EDWARDSBURG  
COMMODORE USER'S  
GROUP**  
406 BRUSH ROAD  
NILES, MI 49120  
616-663-2792  
DOUG STRINGFELLOW

**W. MICHIGAN  
COMMODORES**  
1952 CLEVELAND AVE. SW  
WYOMING, MI 49509  
616-458-9724

**DEBUG**  
PO BOX 196  
BERRIEN SPRINGS, MI 49103  
616-471-1882

**DAB COMPUTER CLUB**  
PO BOX 542  
WATERVLIET, MI 49098  
616-463-5457

**SEM 64**  
2501 FIVE MILE #3  
REDFORD, MI 48239  
313-537-4163

**ANN ARBOR  
COMMODORE USER'S  
GROUP**  
ANN ARBOR, MI 48103  
313-994-4751

**COMP**  
486 MICHIGAN AVE.  
MARYSVILLE, MI 48040  
313-364-6804

**MICHIGAN'S  
COMMODORE 64 USER'S  
GROUP**  
PO BOX 539  
E. DETROIT, MI 48021  
313-773-6302

**JACKSON COMMODORE  
COMPUTER CLUB**  
201 S. GRINNELL ST.  
JACKSON, MI 49203

**TRI-CITIES USER'S GROUP**  
PO BOX 45  
BAY CITY, MI 48706  
517-893-6999

**W. MICHIGAN VIC/64  
USERS**  
1311 PORTLAND NE  
GRAND RAPIDS, MI 49505

**VIC FOR BUSINESS**  
6027 ORCHARD COURT  
LANSING, MI 48910

**COMMODORE USER'S  
GROUP**  
1010 SPICERVILLE HIGHWAY  
EATON RAPIDS, MI 48827

**COMMODORE COMPUTER  
CLUB**  
H. DOW HIGH SCHOOL, ROOM  
#226  
MIDLAND, MI 48640  
517-835-5130

**DAVID LIEM**  
14361 WARWICK ST.  
DETROIT, MI 48223

**SOUTH COMPUTER CLUB**  
45201 OWEN  
BELLEVILLE, MI 48111  
SOUTH JR. HIGH SCHOOL

**VIC USER'S CLUB**  
UNIV. MICHIGAN SCHOOL  
OF PUBLIC HEALTH  
ANN ARBOR, MI 48109

**COMMODORE USER CLUB**  
32303 COLUMBUS DRIVE  
WARREN, MI 48093

**VIC/64/PET USER'S GROUP**  
8439 ARLIS ROAD  
UNION LAKE, MI 48085

**COMMODORE USER'S GROUP**

3947 W. TWELVE MILE ROAD  
BERKLEY, MI 48072

**SOUTHEAST MICHIGAN PET USERS**

BOX 214  
FARMINGTON, MI 48024

**TRI-COUNTY COMPUTER CLUB**

501 E. LOOMIS  
LUDINGTON, MI 49431

**Minnesota****METRO AREA COMMODORE COMPUTER CLUB**

BOX M  
MENDOTA, MN 55150  
612-729-0232

**CENTRAL MN COMPUTER USER'S GROUP**

217 RIVERSIDE AVE. SOUTH  
SARTELL, MN 56377  
DAVID HUNT

**BRAINERD AREA COMMODORE USER'S GROUP**

1219 SE 11TH ST.  
BRAINERD, MN 56401

**SMCUG**

1002 PFAU ST.  
MANKATO, MN 56001  
507-625-6942

**HEARTLAND AREA COMPUTER COOPERATIVE**

RT. 4, BOX 204  
LITTLE FALLS, MN 56345  
612-632-5511

**LAKE SUPERIOR COMMODORE**

1936 LAWN ST.  
DULUTH, MN 55812  
218-728-3224

**MINNESOTA COMMODORE USER'S ASSOCIATION**

PO BOX 32219  
FRIDLEY, MN 55432

**TWIN CITIES COMMODORE CLUB**

6623 IVES LANE  
MAPLE GROVE, MN 55369  
612-424-2425

**MINNECOMM 64**

PO BOX 24751  
MINNEAPOLIS, MN 55424  
612-423-2293  
GEORGE AUGHEY

**CLUB 64**

256 16TH ST. NE  
OWATONNA, MN 55060  
507-451-0128  
STEPHEN KNUDIEN

**MUPET**

PO BOX 179  
ANNANDALE, MN 55302

**Mississippi****COMMODORE BILOXI USER GROUP**

3002 HIGHWAY 90 EAST  
OCEAN SPRINGS, MS 39564  
601-875-1173

**COMMODORE COMPUTER CLUB**

SO. STATION BOX 10076  
HATTIESBURG, MS 38401  
601-268-7585

**Missouri****HEARTLAND USER'S GROUP**

PO BOX 1251  
CAPE GIRARDEAU, MO 63701  
314-335-8134  
HYMAN TANNER

**CARTHAGE COMMODORE COMPUTER CLUB**

PO BOX 842  
CARTHAGE, MO 64836  
417-358-5567  
GARY BAIRD

**SALEM COMMODORE USER'S CLUB**

PO BOX 73  
SALEM, MO 65560  
KARL DITTMAN

**KCPUG**

5214 BLUE RIDGE BLVD.  
KANSAS CITY, MO 65133

**PET SET CLUB OF ST. LOUIS**

633 BENT OAK DRIVE  
LAKE ST. LOUIS, MO 63367

**COMMODORE USER CLUB OF THE OZARKS**

211 N. AURORA  
ELDON, MO 65026  
314-392-4248

**COMMODORE USER'S GROUP OF ST. LOUIS**

BOX 6653  
ST. LOUIS, MO 63125

**COMMODORE USER'S GROUP OF WARRENSBURG**

PO BOX 893  
WARRENSBURG, MO 64093  
816-747-2406  
BUCK SOMMERKAMP

**MID MISSOURI COMMODORE CLUB**

1804 VANDIVER DRIVE  
COLUMBIA, MO 65201

**COMPUTERS OF THE BOOTHEEL USER GROUP**

1925 TREASURE DRIVE  
KENNETT, MO 63857  
MICHAEL JETT

**Montana****POWDER RIVER COMPUTER CLUB**

POWDER RIVER HIGH SCHOOL  
BROADUS, MT 59317

**MISSOULA COMMODORE USERS**

310 8TH ST.  
STEVENSVILLE, MT 59870  
406-777-3879  
JOHN VERBURG

**CASCADE COUNTY USER'S GROUP**

PO BOX 739  
GREAT FALLS, MT 59403  
406-459-1016  
JERRY SPURBECK

**COMMODORE USER CLUB**

1109 WEST BROADWAY  
BUTTE, MT 59701

**Nebraska****LINCOLN COMMODORE USER'S GROUP**

PO BOX 30655  
LINCOLN, NE 68503  
SECRETARY

**GREATER OMAHA COMMODORE 64 USER GROUP**

805 GINNY AVE., APT. 21  
BELLEVUE, NE 68005  
RICHARD MEYER

**PATHFINDERS 64**

2133 CLARMAR ST.  
FREMONT, NE 68025  
402-721-4346  
KENT TEGELS

**THE COMPUTER POWER UNLIMITED**

416 N. 27TH  
LINCOLN, NE 68503  
402-475-8081  
ROBERT HOWARD

**ALLIANCE COMMODORE COMPUTER CLUB**

1629 BOISE  
ALLIANCE, NE 69301

**Nevada****COMMODORE RENO USER'S NETWORK**

PO BOX 8566  
RENO, NV 89507  
702-972-3801  
RICK COOKE

**SILVER STATE COMPUTER USER'S GROUP**

PO BOX 81075  
LAS VEGAS, NV 89180  
KAREN DOUGLAS

**SOG COMMODORE USER'S GROUP**

4011 W. CHARLESTON BLVD.  
LAS VEGAS, NV 89201  
702-646-5656  
LEE SCHRAM

**CATFUN USER'S CLUB**

PO BOX 2155  
FALLON, NV 89406

**COMPU CLUB 64**

4220 S. MARYLAND PARKWAY  
BLDG. B  
LAS VEGAS, NV 89109  
702-369-7354

**LAS VEGAS PET USERS**

5130 E. CHARLESTON BLVD.  
SUITE 5-315  
LAS VEGAS, NV 89122

**New Hampshire****MONADNOCK USER GROUP FOR COMMODORE OWNERS**

135 LIBERTY LANE  
KEENE, NH 03431  
603-352-5948  
P. KIRKPATRICK

**AMOSKEAG C-64 USER GROUP**

61 PROSPECT ST.  
MANCHESTER, NH 03104  
603-669-6277  
BRAD & NANCY MAYER

**NORTHERN NEW ENGLAND COMPUTER SOCIETY**

PO BOX 69  
BERLIN, NH 03570

**64 USERS**

PO BOX 878  
ROCHESTER, NH 03867

**New Jersey****INFO-64**

16 RIDGEWOOD AVE.  
VIDEO DYNAMICS  
RIDGEWOOD, NJ 07450  
201-447-4422

**PLASMA PHYSICS LAB USER GROUP**

PRINCETON UNIV.  
PO BOX 451  
PRINCETON, NJ 08544

**CUMBERLAND COUNTY COMMODORE USER GROUP**

1976 NORTH EAST AVE.  
VINELAND, NJ 08360  
609-692-9366

**JERSEY SHORE COMMODORE USER'S GROUP**

89 STRATFORD ROAD  
TINTON FALLS, NJ 07724  
201-542-2113  
BOB MCKINLEY, JR.

**BORDENTOWN AREA C-64 USER'S GROUP**

PO BOX 381  
BORDENTOWN, NJ 08505  
JOE GRINER

**RANCOCAS VALLEY USER GROUP**

PO BOX 234  
MT. LAUREL, NJ 08054  
609-267-1912

**PARSIPPANY COMPUTER GROUP**

51 FERNCLIFF ROAD  
MORRIS PLAINS, NJ 07950  
201-267-5231

**SO. JERSEY COMMODORE USER'S CLUB**

46-B MONROE PATH  
MAPLE SHADE, NJ 08052  
609-667-9758

**COMMODORE FRIENDLY USER GROUP**

49 HERSHEY ROAD  
WAYNE, NJ 07470  
201-696-8043

**SOMERSET USER'S CLUB**

49 MARCY ST.  
SOMERSET, NJ 08873

**VIC-TIMES**

46 WAYNE ST.  
EDISON, NJ 08817

**ACGNJ PET/VIC/CBM**

30 RIVERVIEW TERRACE  
BELLE MEAD, NJ 08502  
201-359-3862

**VIC SOFTWARE DEVELOPMENT CLUB**

7 FOMALHAUT AVE.  
SEWELL, NJ 08080

**EDUCATOR'S ADVISORY**

PO BOX 186  
MEDFORD, NJ 08055  
609-935-1200

**VIC USER GROUP**

67 DISTLER AVE.  
W. CALDWELL, NJ 07006  
201-284-2281

**TBH VIC-NICS**

PO BOX 981  
SALEM, NJ 08079

**AMATEUR COMPUTER GROUP**

18 ALPINE DRIVE  
WAYNE, NJ 07470

**MORRIS AREA COMMODORE USER'S GROUP**

61 EARLY ST.  
MORRISTOWN, NJ 07960  
201-267-5088

**HUDSON COUNTY COMMODORE USER'S GROUP**

308 PALISADE AVE.  
UNION CITY, NJ 07083  
201-330-8317

**New Mexico****ALAMOGORDO COMMODORE USER'S GROUP**

PO BOX 231

**TAOS AREA COMMODORE USER'S GROUP**

PO BOX 5089  
TAOS, NM 87571  
505-758-4458  
DAVID HULL

**NEW MEXICO COMMODORE USER'S GROUP**

PO BOX 37127  
ALBUQUERQUE, NM 87176  
505-884-3778  
SUSAN PALMER

**COMMODORE USER'S GROUP OF ROSWELL**

304 E. COUNTRY CLUB ROAD  
ROSWELL, NM 88201  
505-623-4376  
GEORGE BARRY

**SO. NEW MEXICO COMMODORE USER GROUP**

PO BOX 4437, UNIV. PARK  
BRANCH  
LAS CRUCES, NM 88001  
505-522-7622  
DAVID SELWYN

**New York****SCUG**

CANAL SQUARE  
SCHENECTADY, NY 12305

**COMMODORE USER'S GROUP OF MASSENA**

MASSENA COMPUTER CENTER  
HARTE HAVEN PLAZA  
MASSENA, NY 13662

**MICRO-HUT USER'S GROUP**

62 EAST MAIN ST.  
BAY SHORE, NY 11706  
516-666-7805  
JOSEPH MOON III

**CAVE**

PO BOX 10  
HOLCOMB, NY 14469  
716-657-6575

**RAINBOW INTERNATIONAL C-64 USER GROUP**

947 HARRISON AVE.  
NIAGARA FALLS, NY 14305  
ROBERT HEMMINGS

**BRONX-64 USER'S GROUP**

PO BOX 47, CORNELL STATION  
BRONX, NY 10473  
DAVE RIVERA

**FOLKLIFE TERMINAL CLUB**

BOX 555/JW CO-OP CITY STATION  
BRONX, NY 10475

**BROOKLYN COMMODORE USER'S GROUP**

1735 EAST 13TH ST., APT. 7N  
BROOKLYN, NY 11229  
718-375-5278  
MALCOM GOTTESMAN

**SIMONS' BASIC USER GROUP**

6 BETHLEHEM PLACE  
POUGHKEEPSIE, NY 12603  
ROBERT WEGLINSKI

**CLUB-64**

1579 COATES AVE.  
HOLBROOK, NY 11741  
516-289-9271  
CHRIS THEODORE

**CENTRAL NEW YORK COMMODORE USER GROUP**

8037 MORGAN ROAD  
LIVERPOOL, NY 13088  
315-622-2913  
CARL BITTEL

**PLATTSBURGH COMMODORE USER'S GROUP**

61 EAST MAIN ST.  
MORRISONVILLE, NY 12962  
518-563-5764  
STEVE NOLAN

**COMMODORE USER'S GROUP OF ROCHESTER**

PO BOX 26514  
ROCHESTER, NY 14626  
716-544-5251

**CHAUTAUQUA COUNTY COMMODORE USER GROUP**

19-21 EAST MAIN ST.  
WESTFIELD, NY 14787  
716-326-2222  
MARK DUNLAP

**ELITE GROUP**

3207 TENBROECK AVE.  
BRONX, NY 10469  
RICHARD BAILEY

**VIC USER GROUP**

KODAK PARK, PAPER DIVISION  
ROCHESTER, NY 14617

**OSWEGO 64 USERS**

208 PARK HALL, DEPT.  
INDUSTRIAL ARTS  
OSWEGO, NY 13126  
315-341-3010

**POUGHKEEPSIE VIC USER GROUP**

2 BROOKLANDS FARM ROAD  
POUGHKEEPSIE, NY 12601  
914-462-4518

**COMMODORE COMPUTER CLUB**

1111 STEWART AVE.  
BETHPAGE, NY 11714  
516-575-9558

**HELLO CENTRAL**

76-12 35TH AVE.  
JACKSON HEIGHTS, NY 11372

**MANHATTAN 64**

1440 FREEPORT LOOP  
BROOKLYN, NY 11239  
212-647-4266

**ROCKLAND COUNTY COMMODORE USER GROUP**

PO BOX 573  
NANUET, NY 10965

**NEW YORK 64 USER'S GROUP**

222 THOMPSON ST.  
NEW YORK, NY 10012  
212-673-7241

**VIC/64 USER'S GROUP**

WAVERLY PLACE  
NEW YORK, NY 10003  
212-358-5155

**ADIRONDACK C-64 USER'S GROUP**

205 WOODLAWN AVE.  
SARATOGA SPRINGS, NY 12866  
518-584-8960

**L&M COMPUTER CLUB**

4 CLINTON ST.  
TULLY, NY 13159  
315-696-8904

**CAPITAL DISTRICT 64/VIC USER'S GROUP**

363 HAMILTON ST.  
ALBANY, NY 12210  
518-436-1190

**VIC USER'S CLUB**

339 PARK AVE.  
BABYLON, NY 11702  
516-669-9126

**CHENANGO COUNTY COMMODORE HELPERS AND USERS GROUP**

PO BOX 487  
NORWICH, NY 13815  
607-336-3903

**VIC USER GROUP**

1250 OCEAN AVE.  
BROOKLYN, NY 11239  
212-859-3030

**LIVE**

17 PICADELLO ROAD  
GREAT NECK, NY 11023

**ROCKLAND COUNTY COMMODORE**

14 HILLSIDE COURT  
SUFFERN, NY 10901

**SPUG**

4782 BOSTON POST ROAD  
PELHAM, NY 10803

**PET USER CLUB**

PO BOX 1280  
WHITE PLAINS, NY 10602

**WESTCHESTER COUNTY VIC USER'S GROUP**

PO BOX 146  
PELHAM, NY 10552

**VIC USER'S CLUB**

76 RADFORD ST.  
STATEN ISLAND, NY 10314

**COMMODORE MASTERS**

25 CROTON AVE.  
STATEN ISLAND, NY 10301

**SECTOR ONE COMPUTER**

19-21 EAST MAIN ST.  
WESTFIELD, NY 14787  
716-326-4479

**COMMODORE BUFFALO USER'S GROUP**

199 DALE DRIVE  
TONAWANDA, NY 14150  
716-631-3932

**MOHAWK VALLEY COMMODORE USER GROUP**

PO BOX 343  
TRIBES HILL, NY 12177  
518-829-7576

**COMMODORE 64 USER'S GROUP**

67-42 HARROW ST.  
FOREST HILLS, NY 11375

**STATEN ISLAND COMMODORE USER GROUP**

3770 RICHMOND AVE.  
STATEN ISLAND, NY 10312  
212-984-4256

**NEW YORK CITY VIC/C64 USER GROUP**

436 EAST 69TH ST.  
NEW YORK, NY 10021

*North Carolina***UNIFOUR COMMODORE USER'S GROUP**

PO BOX 9324  
HICKORY, NC 28603  
JANET MORRIS

**COMMODORE USER'S GROUP**

RT. 1, BOX 349-B  
SALISBURY, NC 28144  
CHARLES HUFFMAN

**TRYON COMMODORE 64 CLUB**

PO BOX 1016  
TRYON, NC 28782  
704-859-6340

**DOWN EAST COMMODORES**

302 BELLTOWN ROAD  
HAVELOCK, NC 28532  
919-447-4536

**RALEIGH VIC/64 USER'S GROUP**

410-D DELTA COURT  
CARY, NC 27511  
919-469-3862

**WILMINGTON COMMODORE USER'S GROUP**

409 RL HONEYCUTT DRIVE  
WILMINGTON, NC 28403  
919-799-5041

*Ohio***HAROLD WINKLE**

3337 GLENWAY AVE.  
CINCINNATI, OH 45205

**CAM AREA USER'S GROUP**

334 FAIRVIEW SE  
NORTH CANTON, OH 44720  
216-499-7990  
LOREN HINES

**SOUTHWESTERN OHIO COMMODORE USER GROUP**

PO BOX 46644  
CINCINNATI, OH 45246

**YOUNGSTOWN C-64 USER'S GROUP**

209 NORTH PEARL  
COLUMBIANA, OH 44408  
216-482-4758  
CHARLES LONGBOTTOM

**UCOM-64**

340 TANGEMAN U CENTER  
MAIL LOC 136  
CINCINNATI, OH 45221

**NORTHEAST OHIO COMMODORE USER GROUP**

PO BOX 718  
MENTOR, OH 44061

**COMMODORE COMPUTER CLUB OF TOLEDO**

PO BOX 8909  
TOLEDO, OH 43623  
419-475-9160  
JIM CYCHLER

**COMMODORE USERS IN AKRON**

PO BOX 9243  
AKRON, OH 44305

**COMMODORE CLUB OF CENTRAL OHIO**

PO BOX 292392  
COLUMBUS, OH 43229

**AKRON AREA C-64 USER'S GROUP**

2453 SECOND ST.  
CUYAHOGA FALLS, OH 44221  
216-923-4396  
PAUL HARDY

**COMMODORE 64 USER'S GROUP**

702 PARK AVE. NW  
NEW PHILADELPHIA, OH 44663

**COMMODORE USERS OF BLUE CHIP**

816 BEECHER ST.  
CINCINNATI, OH 45206  
513-961-6582

**CPU CONNECTION**

PO BOX 42032  
BROOK PARK, OH 44124

**CINCINNATI COMMODORE COMPUTER CLUB**

PO BOX 450  
OWENSVILLE, OH 45160  
513-732-6572  
WALLY JONES

**SE CLEVELAND COMMODORE CRAZIES**

18813 HARLAN DRIVE  
MAPLE HEIGHTS, OH 44137  
216-581-3099

*Oklahoma***GREATER OKLAHOMA COMMODORE CLUB**

PO BOX 96751  
OKLAHOMA CITY, OK 73143

**STILLWATER C-64 USER'S GROUP**

3124 N. LINCOLN  
STILLWATER, OK 74075  
405-372-1308

**TULSA AREA COMMODORE USER'S GROUP**

7804 N. 117TH AVE.  
OWASSO, OK 74055  
918-272-9755

**COMMODORE USER'S GROUP**

202 S. 12TH ST.  
MUSKOGEE, OK 74401  
MUSKOGEE COMPUTER SOCIETY

**COMMODORE OKLAHOMA USER'S CLUB**

4000 NW 14TH ST.  
OKLAHOMA CITY, OK 73107  
405-943-1370

**COMMODORE USERS**

BOX 268  
OKLAHOMA CITY, OK 73101

**COMMODORE USERS OF NORMAN**

209 BROOKWOOD  
NOBLE, OK 73068

**COMMODORE USERS OF BARTLESVILLE**

1704 S. OSAAGE  
BARTLESVILLE, OK 74003  
918-336-0233  
FRED MAYES

*Oregon***SOUTHERN OREGON VIC/64 USER'S GROUP**

3600 MADRONA LANE  
MEDFORD, OR 97501  
503-779-7631

**SPRINGFIELD COMMODORE USER'S GROUP**

4400 FRANKLIN AVE., STE. #1443  
EUGENE, OR 97403  
503-741-2522

**LANE COUNTY C-64 USER'S GROUP**

PO BOX 11316  
EUGENE, OR 97440  
503-726-2131

**JEFFERSON STATE COMPUTER USER'S GROUP**

PO BOX 4335  
MEDFORD, OR 97501

**SPRINGFIELD COMMODORE USER'S GROUP**

5324 B ST.  
SPRINGFIELD, OR 97478  
503-741-2522  
MARK JOERGER

**COMPUTER USERS**

86313 FRANKLIN BLVD.  
EUGENE, OR 97405  
503-726-8500

**US COMMODORE USER'S GROUP**

PO BOX 2310  
ROSEBURG, OR 97470  
503-672-7591

**CAVEMAN COMMODORE COMPUTER CLUB**

5836 LOWER RIVER ROAD  
GRANTS PASS, OR 97526  
503-479-7409  
KEN CROUSE

*Pennsylvania***NORTH COAST COMMODORE USER'S GROUP**

PO BOX 6117  
ERIE, PA 16512

**BEAVER COUNTY AREA COMMODORE USER'S GROUP**

112 SPRUCE DRIVE  
MONACA, PA 15061  
412-774-9080  
H.J. HEMER

**BLUE JUNIATA COMMODORE USER'S GROUP**

107 WASHINGTON AVE.  
LEWISTOWN, PA 17044  
CLIFTON BELL, JR.

**ABC C-64 CHIPS COMMODORE USER GROUP**

3159 MIDDLETOWN ROAD  
BETHLEHEM, PA 18017  
THOMAS DIFF

**LOWERBUCKS USER'S GROUP**

252 MAKEFIELD ROAD  
MORRISVILLE, PA 19067  
DON MOYER

**MAIN LINE COMMODORE USER'S GROUP**

1046 GENERAL ALLEN LANE  
WEST CHESTER, PA 19382  
215-388-1581  
EMIL VOLCHECK

**CENTRAL PA USER GROUP FOR COMMODORE**

BOX 102  
SALONA, PA 17767  
717-726-4564  
JOSEPH COFFMAN

**WEST BRANCH  
COMMODORE USER'S  
GROUP**

PO BOX 995  
WILLIAMSPORT, PA 17703  
717-323-7901  
GENE LOVELAND

**COMPUSTARS**

440 MANTAWNY ST.  
POTTSDOWN, PA 19464

**VIC PROGRAMMERS, INC.**

115 OLD SPRING ROAD  
COATESVILLE, PA 19320

**PACS COMMODORE  
USER'S CLUB**

20TH AND OLNEY STS.  
PHILADELPHIA, PA 19141  
215-951-1258

**NADC COMMODORE  
USER'S CLUB**

248 OAKDALE AVE.  
HORSHAM, PA 19044

**PET USER GROUP**

PO BOX 371  
MONTGOMERYVILLE, PA 18936

**WESTMORELAND  
COMMODORE USER'S  
CLUB**

PO BOX 3051  
GREENSBURG, PA 15601

**PPG**

2015 GARRICK DRIVE  
PITTSBURGH, PA 15235  
412-371-2882

**GRC USER CLUB**

300 WHITTEN HOLLOW ROAD  
NEW KENSINGTON, PA 15068

**G/C COMPUTER OWNER'S  
GROUP**

PO BOX 1498  
READING, PA 19607  
215-775-2600

**COMPSTARS**

130 BLUE TEAL CIRCLE  
AUDUBON, PA 19403

**BOEING EMPLOYEES  
PERSONAL COMPUTER  
CLUB**

PO BOX 16858  
PHILADELPHIA, PA 19142  
215-522-2257

**VIC SOFTWARE  
DEVELOPMENT CLUB**

440 W. SEDGWICK, APT. A-1  
PHILADELPHIA, PA 19119  
215-844-4328

**BITS & BYTES**

1015 DALE ROAD  
SECANE, PA 19018  
215-544-5875

**CLIFTON HEIGHTS USER'S  
GROUP**

PO BOX 235  
CLIFTON HEIGHTS, PA 19018

**COMMODORE USER'S  
GROUP**

781 DICK AVE.  
WARMINSTER, PA 18974

**SOUTH CENTRAL PENN  
COMMODORE CLUB**

21009 CEDAR RUN DRIVE  
CAMP HILL, PA 17011  
717-763-4219

**CACC CENTER AREA  
COMMODORE COMPUTER  
CLUB**

214 COMPUTER BUILDING  
UNIVERSITY PARK, PA 16802  
814-237-5912

**COMMODORE USER'S  
CLUB OF SE PENN**

2407 PENNSYLVANIA AVE.  
WEST MIFFLIN, PA 15122

**WORLDWIDE  
COMMODORE USER'S  
GROUP**

PO BOX 337  
BLUE BELL, PA 19422

**WYOMING VALLEY  
COMMODORE USER  
GROUP**

304 EAST ORIOLE DRIVE  
LARKSVILLE, PA 18704  
717-288-7949

**SCRANTON COMMODORE  
USER'S GROUP**

PO BOX 211  
CLARK'S SUMMIT, PA 18411

**MID-ATLANTIC REGIONAL  
COMMODORE  
ASSOCIATION**

PO BOX 76  
MT. HOLLY SPRINGS, PA 17065  
717-486-3274

**BELLWOOD-ALTOONA  
SWAPPERS IN  
COMMODORE**

515 E. 26TH AVE.  
ALTOONA, PA 16601  
814-942-9565

**CASTLE COMMODORE  
COMPUTER CLUB**

RD #1, BOX 210A  
EDINBURG, PA 16116  
412-652-3352

**EPA COMMODORE USER'S  
GROUP**

1712 AIDEN LAIR ROAD  
DRESLER, PA 19025  
EDWARD COHEN

*Rhode Island*

**NEWPORT COMPUTER  
CLUB**

PO BOX 1439  
NEWPORT, RI 02840  
DENNIS RITTER

**NARRAGANSETT  
COMMODORE USER'S  
GROUP**

PO BOX 8707  
CRANSTON, RI 02920  
401-942-5509  
KENNETH GASPAR

**NEWPORT VIC/64 USERS**

10 MAITLAND COURT  
NEWPORT, RI 02840  
401-849-2684

**IRVING SILVERMAN, CPA**

160 TAUNTON AVE.  
E. PROVIDENCE, RI 02914

**COMMODORE USER'S  
GROUP**

978 TIOGUE AVE.  
COVENTRY, RI 02816  
401-828-7385

**RHODE ISLAND  
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JOHNSTON, RI 02919  
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SOCIETY**

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CLUB**

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ODESSA, TX 79768  
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IRVING, TX 75016  
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801-785-5467  
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**PENTAF**

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703-523-1995

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**CUSSH**

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CANADA T0A 0L0  
403-826-3992

### HINTON COMPUTER CLUB

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CANADA T3H 1E1

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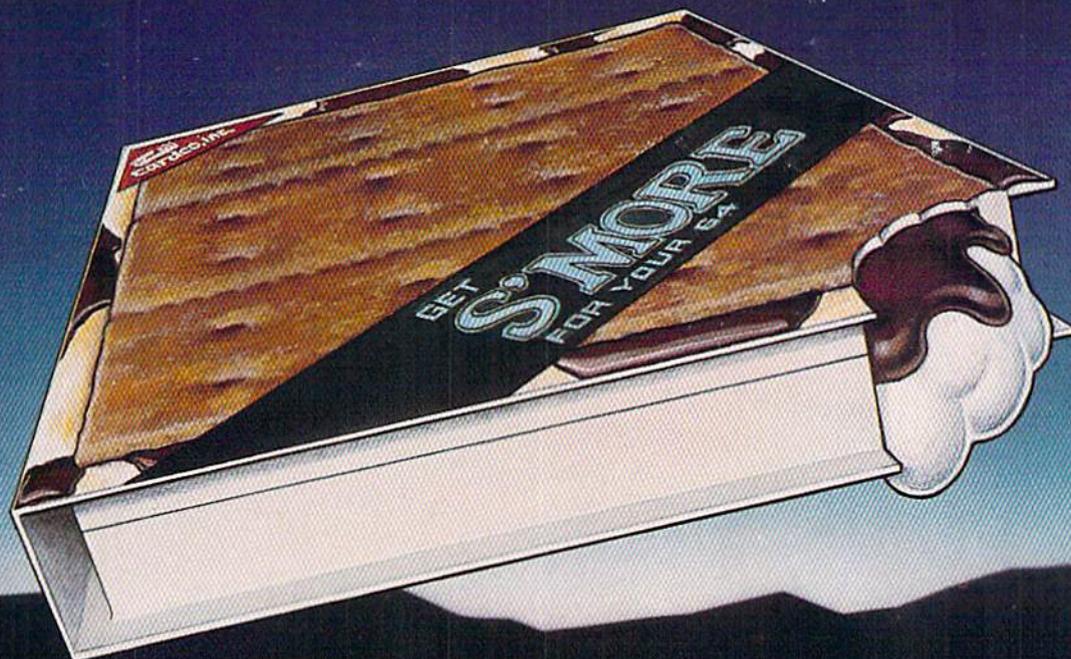
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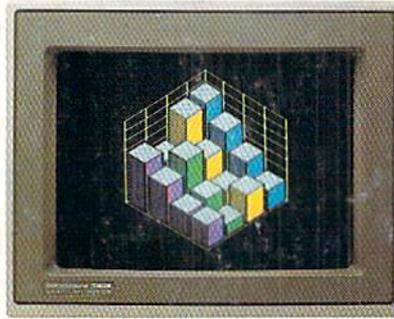


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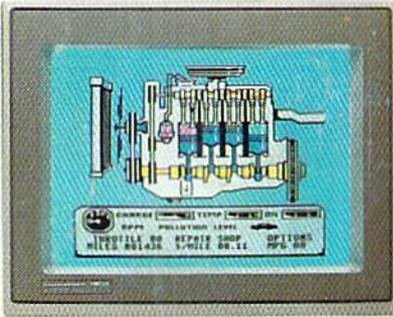
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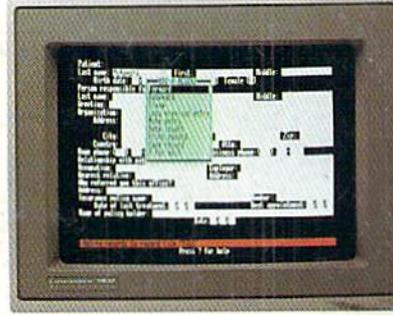
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