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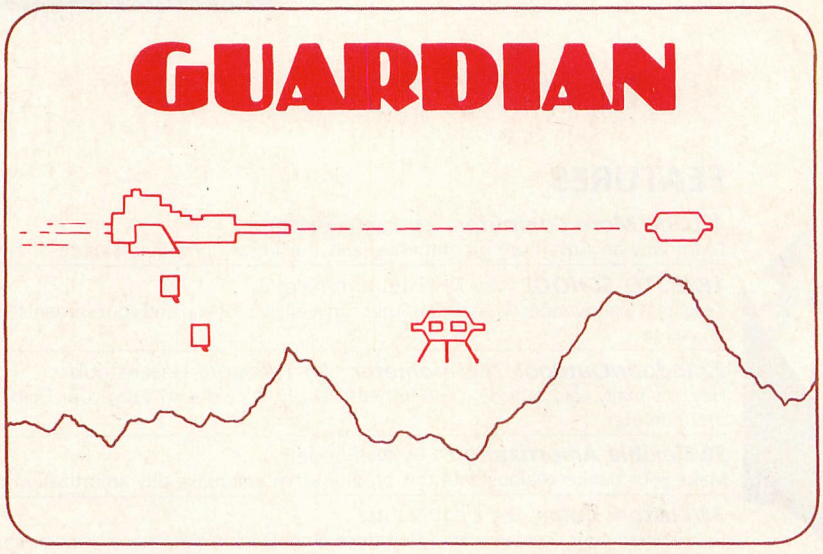

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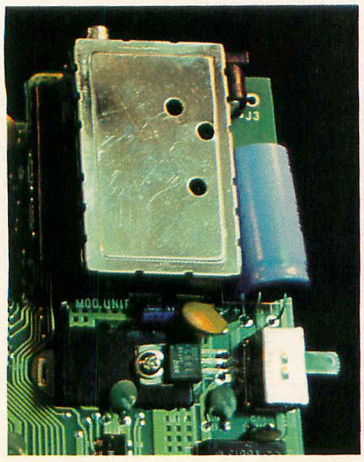

## FEATURES

***12/One More Computer*** by Jyym Pearson ***(General)***
Learn why an Adventure programmer feels the Color Computer is more of a Ferrari than a Pinto.

***18/GOTO SCHOOL*** by Dr. Paul Kimmelman ***(Education)***
Teachers! Ever wonder what a computer can really do for you and your students? Let a computer-literate educator fill you in.

***22/Indoor/Outdoor Thermometer*** by Theodore Hasenstaub ***(Construction)***
Hey, it's really cold outside—and in here! Just how cold is it? Turn your Color Computer into a fancy thermometer.

***30/Flexible Amortization*** by Mel Seder ***(Finance)***
Make your banker jealous with this program that will make any amortization program easier.

***33/Custom Color*** by Dennis Kitsz ***(Hardware)***
Ever wished your computer could produce characters in Kata Kana? Dennis shows us how—and doesn't stop there.

***48/GO SUB Destroy*** by Robert Toscani ***(Game)***
Sub Destroy for 4K machines—what more could a fleet captain want? Many difficulty levels—and this game has them.

***52/Learning Games*** by David Stevens ***(Education)***
These spelling and state capital teaching games are too much fun to restrict to kids.

***60/Wide Printing*** by Robert Lake ***(Utility)***
Color Scripsit takes on a new look with this w-i-d-e printing program!

***66/RECOVER!*** by Kenneth Van Camp ***(Utility)***
No...no! Don't hit that Reset button! Oh—too late. Or is it? This program can help you out of an otherwise tight situation.

***71/Dissecting Your ROM*** by Jake Commander ***(Tutorial)***
The second of a 12-part series examining the Color Computer ROM, bit by bit.

***78/Cliché*** by George Aftamonow ***(Game)***
Here's a game that will show off your computer at parties, and keep your guests laughing and guessing.

## DEPARTMENTS

***4/PEEK (08,83)***
Your guide to the issue.

***10/INKEY$***
Letters from our readers.

***84/REVIEW$***
A look at the MC-10, Game Writer, Armadillo Bug, and others.

***92/NEW:PRODUCT$***

***96/END OF FILE***
On software piracy and user groups.

***96/FOR...NEXT (09,83)***
Looking ahead to next month's issue.

**Cover**
*Dennis Kitsz* by Charley Freiberg

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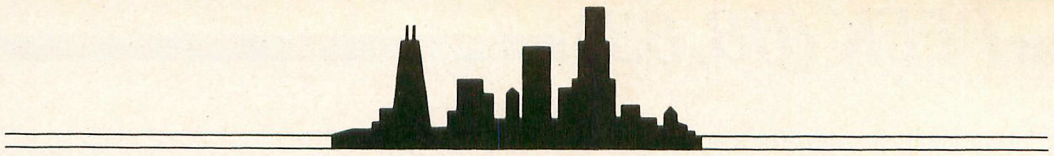

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# PEEK (08,83)

I'm writing this in May. The magazine and all our minds may be on August, but the calendar actually reads May. I moved here to Maine just a few short weeks ago, and it has done nothing but rain since I got here. I tell you this so you will better appreciate our cover shot of Dennis Kitsz: his arrival from Vermont brought the only bit of sunshine I've seen since I moved here, literally and figuratively. Maybe I've been spending too many late nights at the office, but Dennis' visit was a true joy.

Dennis has an air of controlled insanity that can brighten up even the gloomiest of overcast days. After executing a charming pratfall across the office carpet, and gobbling about two pounds of sweet goodies from the local bakery, Dennis showed me his latest modification for our machine—video screen type fonts is the best way to describe them (GOTO 33). You'll want to indulge in this hardware addition, and let your eyes feast on Kata Kana.

GOTO 12 to discover whether you bought a Ferrari or a Pinto computer model. Jyym Pearson, adventure programmer extraordinaire, has a definite opinion on this question.

On the line of opinions, computers and education have always been a combination that raises strong feelings in parents and teachers. Dr. Paul Kimmelman is a computer-literate educator; better than that, his school system is a test site for computer educational software. GOTO SCHOOL (GOTO 18) is the first in a continuing column about education. We think you'll find it *very* helpful.

Jake Commander's ROM Disassembly continues—GOTO 71. Kenneth Van Camp has a nice utility to help you recover programs when you accidentally hit the Reset button (GOTO 66). And Ted Hasenstaub can show you how to turn you computer into a thermometer (GOTO 22).

Amortization—a word we all learn to fear. Mel Seder has a program that will make *any* amortization program easier to use (GOTO 30). He swears it will make your banker jealous—so keep it hidden!

Don't you admire computer printouts that do nice things with spacing? They look, somehow, more professional, more sophisticated. Robert Lake (GOTO 60) has a program for us that will let you do wide printing with Color Scripsit.

August is the hot end of the summer. On hazy August days, all I want to do is sit back with a glass of cool lemonade and—play games! And then—play more games! The best games are those I can play on my Color Computer, of course.

Ever play Sub Destroy on someone else's computer? Here's a 4K version by Robert Toscani with enough difficulty levels to keep us all on our toes (GOTO 48). GOTO 80 for a party game designed specially by George Aftamonow to show off your computer and let an entire party full of guests play at once. For games that will also teach you and the kids something (school's right around the corner—rats!), GOTO 52. Just because these games were written for kids, don't sell them short. If you like Jumbles or Hang-Man, you'll love these games. I flunked every one of them.

Don't forget to check out our REVIEW$ section. An enterprising group of hard-bitten computerists in Ohio have spent all day and all night working hard to discover what the new MC-10 can do (GOTO 84). They believe it will do a lot more than first meets the eye—and here's a quick run-down of their first findings. But don't stop there—a lot more follows...

*—D.M., Managing Editor*


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*Quasar Animations regrets any inconvenience to Williams Electronics caused by its Guardian ad last month.*

*For those of you who were wondering who wrote the FORTH review in last month's issue; it was written by Gregg Williams—sorry Gregg!*

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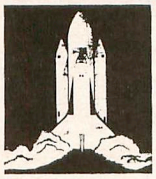

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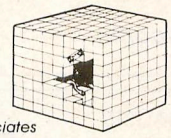

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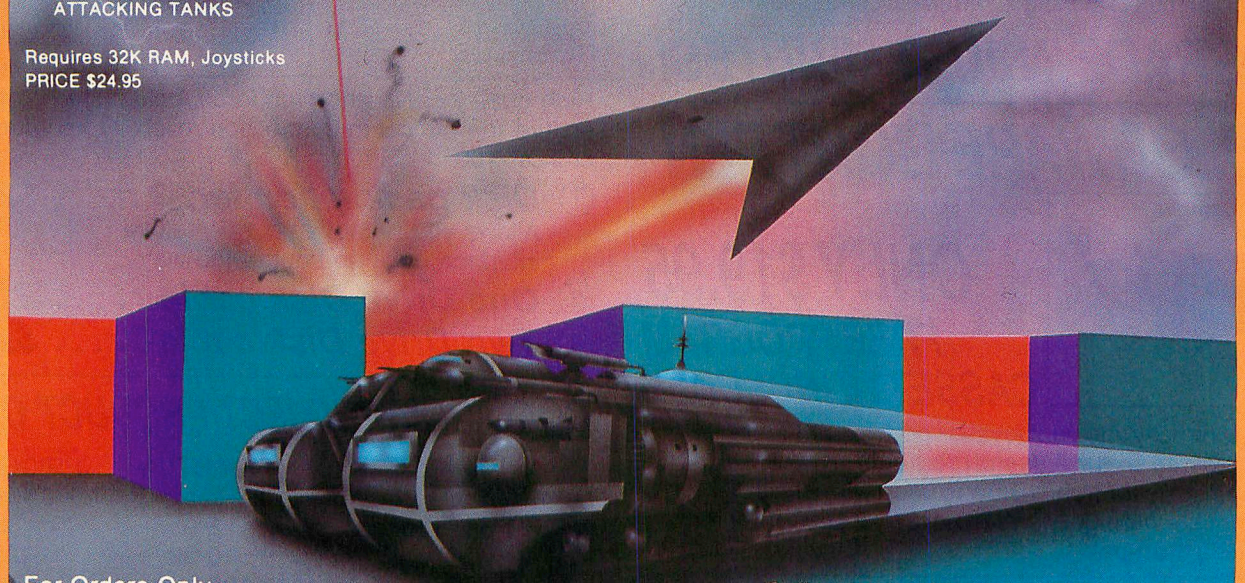

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Telewriter-64 is feature packed. Besides the standard features found in any word processor, Telewriter also includes: user-friendly full-screen editing, rapid cursor and scrolling control, page jump, right justification, menu-driven disk or cassette access, compatability with spelling checkers (such as Spell-and-Fix), and a clever double check that asks the user "Are you sure?" before executing any operation that would kill any sizeable amount of your text.

Telewriter-64 runs on any 16K, 32K, or 64K system (extended Basic not required) and works with any printer. It has all of the control codes necessary to take full advantage of all of the features in any printer. There is even a "typewriter" mode which sends typed lines directly to your printer.

With advanced word processing software such as this, your color computer becomes a truly powerful word processing system, with a price that makes sense for the personal user.

Beyond impressive capability, Telewriter-64 simply makes any kind of writing a pleasure. It is a truly sophisticated system that is marvelously easy to learn and enjoyable to use.

## TELEWRITER-64

**Disk .... $59.95**
**Cassette . $49.95**

## SUPER-PRO KEYBOARD

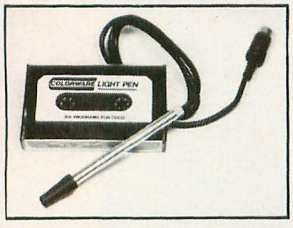
### REPLACEMENT PROFESSIONAL KEYBOARD KIT...ONLY $69.95

- Contour molded, full travel keys for fast smooth typing.
- Custom made to fit precisely. Has same key layout.
- Complete, easy instructions for any CoCo or TDP-100.
- Ideal for word processing and other serious CoCo use.

Note: For computers manufactured after Oct. 1982, add $4.95

### UPGRADE IN JUST MINUTES!

## COLORWARE LIGHT PEN

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### FREE PROGRAM CASSETTE INCLUDED

- Plugs directly into your joystick port.
- Comes with six fun & useful programs on tape.
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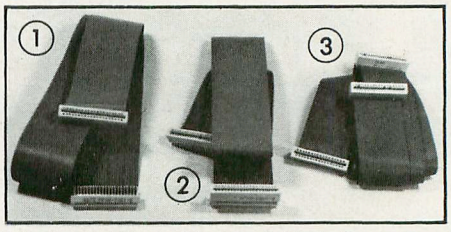
- Comptible with light pen software such as Computer Island's "Fun-pak."

## EXTENSION CABLE FOR YOUR MODEM/PRINTER

*Place your modem or printer where you want. 15 ft. cable with four-pin male and four-pin female DIN connectors.*

**$19.95**

## CABLES




### QUALITY DISK DRIV CABLES

High quality cable and high force, gold plated contacts ensure the utmost in connection reliability for your CoCo or TDP-100.

1. ***Disk pack extender, 3 ft. . . $29.95***
   Allows you to move your disk drive interface back and out of the way.
2. ***One Drive Disk cable . . . . . $19.95***
3. ***Two Drive Disk cable . . . . . $29.95***

## COCO ROM/PROJECT/PRODUCT CASE

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| 5-9 | 3.50 |
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| 100 & up | CALL |

***Give a Professional look to your project or product***

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- Same size and specifications as Radio Shack ROMpa

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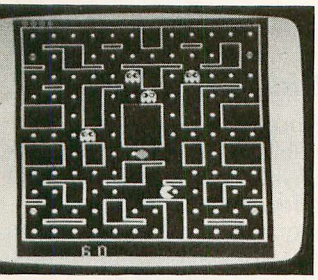
★ For the phone call. Use our convenient toll free watts line.

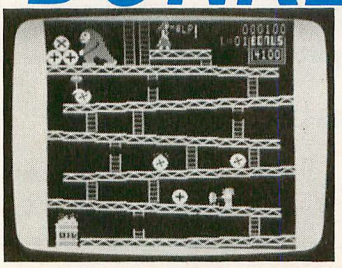


### GHOST GOBBLER

From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Requires 16K. Tape: $21.95, Disk: $25.95

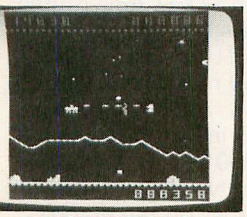
# GHOST GOBBLER

# DONKEY KING



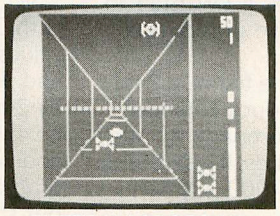
### DONKEY KING

You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: $24.95, Disk: $27.95



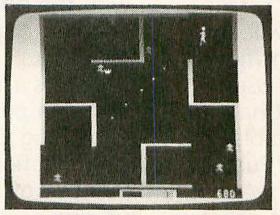
### PROTECTORS

ere are several good versons of the "Defender" theme ailable for the CoCo. None, wever, rival this one from m Mix. No other game atches the detailed graphics d sheer excitement of this top ller. Requires 32K. Tape: 4.95, Disk: $27.95



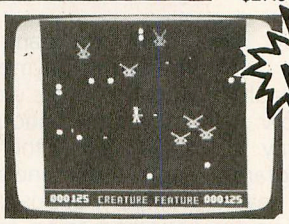
### INTERGALACTIC FORCE

Your space fighter roars into the Death Corridor. Lock-on and blast the enemy fighter from the sky. Now try dropping one into Death Star's narrow exhaust vent. It takes skill and guts. Good luck! With "Star Wars" theme song. From Anteco. Requires 16K. Tape: $24.95



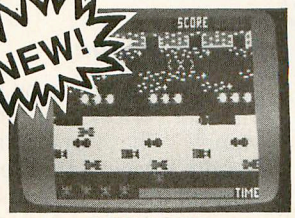
### ANDROID ATTACK

Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: $21.95



### CREATURE FEATURE

From Color Software, comes a lightening swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: $17.95. Disk: $19.95




### FROGGER

Just released by The Cornsoft Group, this is the officially licensed version from Sega, the arcade manufacturer. It has it all! 4 lane super highway, snakes, turtles, logs, alligators, etc. Lots of action and laughs! Requires 16K. Tape: $19.95

# THE COLORCADE

## SUPER JOYSTICK MODULE

## ONLY $19.95

### ★ It's a Joystick Interface

Now you can connect any Atari compatible joystick to your CoCo. These sticks are extremely rugged and provide very fast response and real arcade type action. They will improve the play of almost any game. The difference will amaze you!

### ★ It's a Rapid Fire Module

Press the fire button on your joystick and get a great burst of fire instead of just a single shot! Adds tremendously to the many shooting type games that do not have repeat fire. With variable burst speed.

### ★ It's a 6 ft. Extender Cord

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well proven joystick, the Atari is own for being rugged and reliable. It ves good response and is the standrd among home video players. Now a great price! Use with module above.

### ZIRCON VIDEO COMMAND

ONLY $14.95

A GREAT BUY!

This one has received outstanding reviews. Its unique design fits the hand beautifully and it has the truly fast and positive response needed for high speed play. Actually out-performs some joysticks that cost $50 or more.

### WICO FAMOUS "RED BALL"

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The high performance joystick from the people who make them for the arcade machines. Built to take the abuse of even the most enthusiastic player. This is the best! Wico #15-9730. Use with module above.

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# INKEY$

*All letters are subject to editing for space considerations.*

**INKEY$**
**The Color Computer Magazine**
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## Money, Money

I enjoyed the article by Paul Detwiler: "How to Borrow Money." That's one of my favorite subjects! His program is one of the better ones I have seen, and the shortest, too. When I saw the listing I was very surprised to see how few lines he used.

Unfortunately, the Color Computer has built-in rounding errors, that usually cause problems with math programs. (Maybe the 1.1 ROM has fixed that?) Also, mortgage amortization tables don't always agree from publisher to publisher, and a program writer has to decide which book to use as a guide for his testing.

Paul's program will agree in monthly payment figures with the tables we use in Arizona only about half the time. We use the tables put out by the Financial Publishing Company of Boston. Also, the rounding errors can cause Paul a problem as early as payment 2. Note that the principal and the interest ($404.29 and $30.66 — see Figure) don't add up to the monthly payment ($434.94). Also, the previous balance of $4598.39 (after payment 1) less payment 2's principal of $404.29 doesn't come out to the next balance ($4194.11) as shown.

Almost all the programs I have seen have these problems. Just a few cents off, but still — off. A sure tip-off that something is not right is when the final payment zeros out the loan. In real life, this just never happens. The final payment is almost always something a little less than a regular payment.

I did learn a few tricks from Paul's program, and was able to improve my program with the ideas. I use my program in my real estate business and had to work on it for many long hours until it was right. It had to agree 100 percent with the book if I wanted to be able to give printouts to my clients.

Here is a line to make Paul's program produce Financial Publishing Company monthly payment figures. It just rounds 999 out of 1,000 payments up one cent.

```
115 MP=INT(MP*100+.999)/100
```

Here is a one-liner that displays the rounding error (1.0 ROM):

```
10 X=X+.01:PRINT X:GOTO 10
```

Paul still has The Color Computer's built-in rounding problems to overcome in his program.

Tom Garcia
Tucson, AZ

***Garcia's Printout Comparison***

***Paul's Version***

```
PRINCIPAL AMOUNT $ 5000      RATE .08
MONTHLY PAYMENT   $434.94
    PRIN          INT        BAL
 1  401.61       33.33      4598.39
 2  404.29       30.66      4194.11
 3  406.98       27.96      3787.12
 4  409.69       25.25      3377.43
 5  412.43       22.52      2965.00
 6  415.18       19.77      2549.83
 7  417.94       17.00      2131.88
 8  420.73       14.21      1711.15
 9  423.53       11.41      1287.62
10  426.36        8.58       861.26
11  429.20        5.74       432.06
12  432.06        2.88         0.00

          TOTAL # OF PAYMENTS 12
TOTAL PAYBACK     $5219.31

  $ 5000     8 %    1 YEARS

 MONTHLY PAYMENT $ 434.95

 #     PRIN       INT        BAL
 1   $401.62    $33.33    $4598.38
 2   $404.29    $30.66    $4194.09
 3   $406.99    $27.96    $3787.10
 4   $409.70    $25.25    $3377.40
 5   $412.43    $22.52    $2964.97
 6   $415.18    $19.77    $2549.79
 7   $417.95    $17.00    $2131.84
 8   $420.74    $14.21    $1711.10
 9   $423.54    $11.41    $1287.56
10   $426.37     $8.58     $861.19
11   $429.21     $5.74     $431.98
12   $432.07     $2.88      -$0.09
OVERPAYMENT REFUND DUE YOU IS:
  $0.09
HAPPY MORTGAGE BURNING PARTY!!!
```

***My Version***

## RF Fix

I got rid of the RF problem in my Color Computer by inserting a Radio Shack TV interface filter in-series with the line between the TV and the switch; clearest picture I ever saw.

You should tell us that the Up Arrow in your programs is printed as a caret by the DWII. Also, shift Down Arrow gives you an open bracket [, and shift Right Arrow gives you a closed bracket ].

Seth Paul
Bristol, RI

*It's true; our printer produces carets in place of up arrows and left and right brackets [ ] for Shift-left arrow and Shift-right arrow respectively. Readers should be aware of this, in* ***The Color Computer Magazine*** *and other computer magazines that run program listings on a printer that makes this "rearrangement."* — Eds.

## Disk NOTECARD

Since NOTECARD was published, I've acquired a disk drive and have discovered that a few minor changes are required to make the program fully compatible with the disk. The changes and an explanation follow:

When NOTECARD is used with Disk Extended Basic, the values of LO in Lines 490, 540, and 550 must be increased by 2048. The values should be 4399 in Lines 490 and 540, and 4400 in Line 550. Any program which uses POKE to put shapes on the graphics screen will need similar changes. Disk Extended Basic moves the start of graphics screen memory up 2048 bytes to make room for additional system memory and the disk input/output buffers.

R.F. Miller, Jr.
Homewood, IL

## New Club

We are pleased to announce the Metropolitan Greenville (SC) Color Computer Club formed in January of this year, and already almost 50 members strong. The MGCCC serves the interests of present and prospective Color Computer owners in the entire western South Carolina region. As a group, we are totally committed to computer literacy among ourselves and within the community. Members enjoy a lively exchange of computing information, free language programming, and hardware tutorials as well as a biweekly club newsletter. Meetings are held every Tuesday night at 7:30 at the Plain Elementary School in Simpsonville, SC.

Anyone wanting more information about this dynamic organization may contact me any time at (803)876-3928 or 3812, or write to P.O. Box 6, Gray Court, SC 29645.

Ed Lowe
Gray Court, SC

# Telewriter-64™

## the Color Computer Word Processor

- **3 display formats: 51/64/85 columns × 24 lines**
- **True lower case characters**
- **User-friendly full-screen editor**
- **Right justification**
- **Easy hyphenation**
- **Drives any printer**
- **Embedded format and control codes**
- **Runs in 16K, 32K, or 64K**
- **Menu-driven disk and cassette I/O**
- **No hardware modifications required**

### THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

*...one of the best programs for the Color Computer I have seen...*
— Color Computer News, Jan. 1982

### TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

### 64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

### 64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.
The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

### RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.
Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

### FEATURES & SPECIFICATIONS:

**Printing and formatting:** Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

**File and I/O Features:** ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

**Editing features:** Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

*...truly a state of the art word processor... outstanding in every respect.*
— The RAINBOW, Jan. 1982

### PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.
Telewriter-64 costs $49.95 on cassette, $59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)
To order, send check or money order to:

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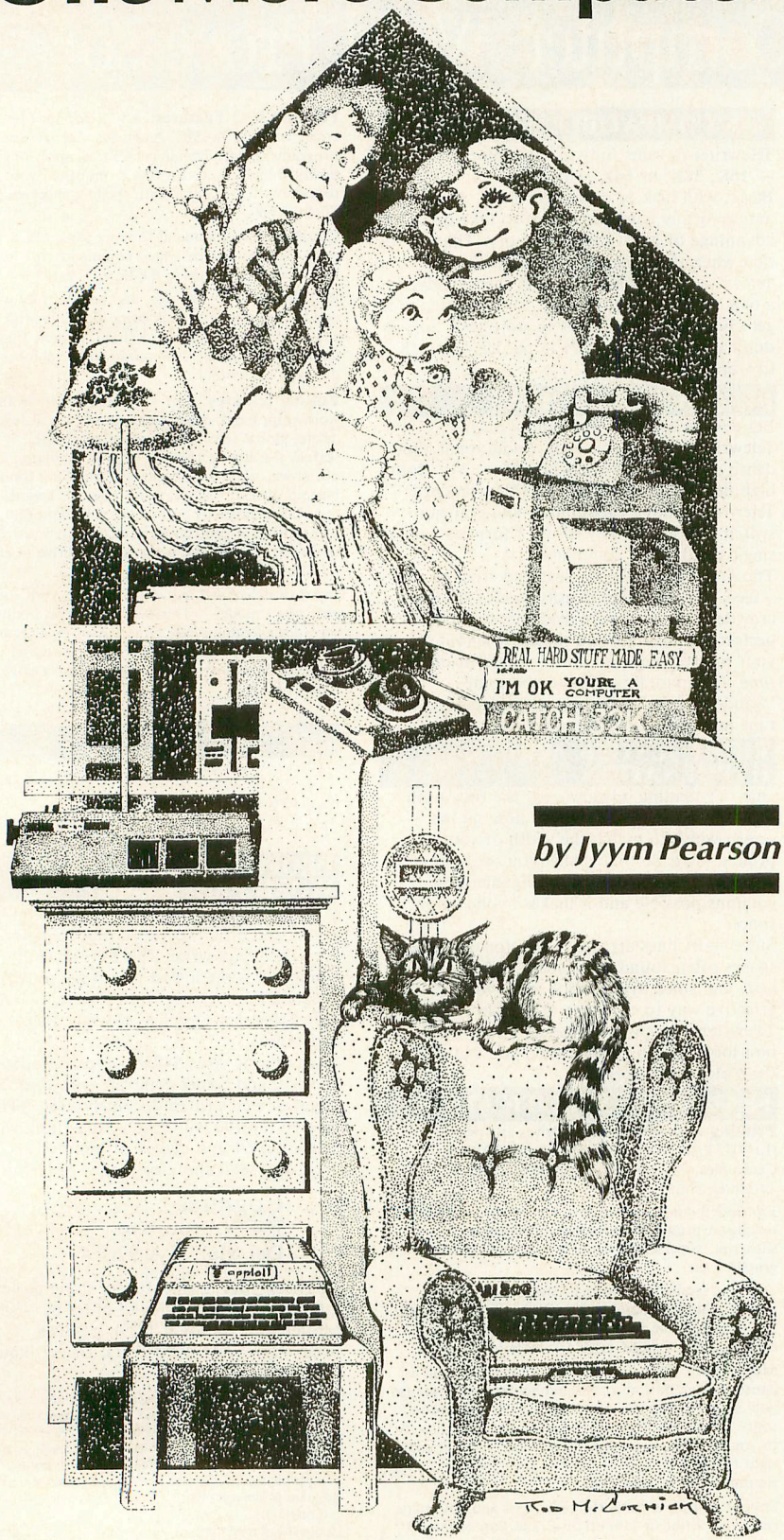
Del Mar, CA 92014

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

(Add $2 for shipping. Californians add 6% state tax. Allow 2 weeks for personal checks. Send self-addressed stamped envelope for Telewriter reviews from CCN, RAINBOW, 80-Micro, 80-U.S. Telewriter owners: send SASE or call for information on upgrading to Telewriter-64. Telewriter-compatible spelling checker (Spell 'n Fix) and Smart Terminal program (Colorcom/E) also available. Call or write for more information.)

Apple II is a trademark of Apple Computer, Inc.; Atari is a trademark of Atari, Inc.; TRS-80 is a trademark of Tandy Corp; MX-80 is a trademark of Epson America, Inc.

# One More Computer




*by Jyym Pearson*

BY THE FALL of 1982 the situation in my household was becoming critical: we had just been blessed with a new arrival to the family, bringing the total to nine. Our two-bedroom apartment was ridiculously crowded.

The circumstances are not quite as bad as they sound, however, since only three members of the family are human (myself, my wife Robyn, and our daughter Kristen). The rest of the family are all computers, and the new addition was a Radio Shack Color Computer.

I am a freelance adventure game software author using a number of publishers across the country. At this time I have 10 programs on the market or in the works. Since my wife and I do all our conversions, and since all the programs run on several machines, I've been accumulating computers for four years.

Included in my collection are a TRS-80 Model I, Atari 800, Commodore 64, Apple II, Timex/Sinclair, NEC 6000, and now a Radio Shack Color Computer has joined the brood.

My interest in the Color Computer goes back to its initial release. I cut my digital teeth, as it were, on a TRS-80 Model I, and when Radio Shack released a machine with color capability and hires graphics I was very interested. My initial reaction was negative, however, as soon as I saw the price. I thought, "How much computer can they sell for $499?" That was about the price I paid for my first Model I with 4K back in early 1978, and the Color Computer boasted color graphics and sound. What I had expected (and wanted) from Tandy was a color Model III, with built-in RGB monitor, drives, intelligent video with separate memory mapping and firmware, and all at a price to compete with the Apple II.

A closer scrutiny revealed that there was more to the Color Computer than the price suggested. Multiple graphic modes, 1500 baud cassette I/O, D/A and A/D conversion capability and built-in RS-232. But the clincher was the CPU. It seems that no matter how much we dislike *some* of Radio Shack's decisions, there's one thing you have to give them credit for — they can really pick a microprocessor. One of the drudgeries of programming the Apple, Atari and Commodore machines is the 6502 processor, which has two good points — it's cheap and it's fast. The speed advantage is largely offset by the fact that you have to write a large number of program lines that on any good processor would be

*Please turn the page*

# AARDVARK L.T.D.

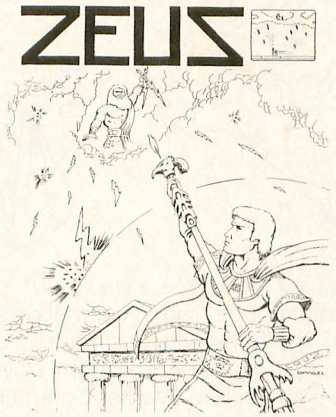
**TRS-80 COLOR  COMMODORE 64  VIC-20  SINCLAIR/TIMEX  TI99/4A**

**QUEST** – A NEW IDEA IN ADVENTURE GAMES! Different from all the others. Quest is played on a computer generated map of Alesia. Your job is to gather men and supplies by combat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time. TRS-80 Color, and Sinclair, 13K VIC-20. Extended BASIC required for TRS-80 Color and TI99/A. $14.95 each.

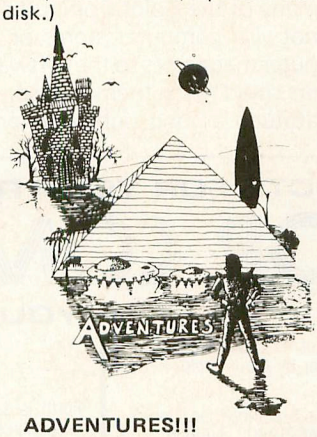
32K TRS 80 COLOR Version $24.95.
Adds a second level with dungeons and more Questing.

**WIZARDS TOWER** – This is very similar to Quest (see above). We added wizards, magic, dragons, and dungeons to come up with a Quest with a D&D flavor. It requires 16k extended color BASIC. 13k VIC, Commodore 64, TRS-80 16k Extended BASIC, TI99/A extended BASIC. $14.95 Tape, $19.95 Disk.

**Authors** – Aardvark pays the highest commissions in the industry and gives programs the widest possible advertising coverage. Send a Self Addressed Stamped Envelope for our Authors Information Package.




**ZEUS** – It's fast and furious as you become the WIZARD fighting off the Thurderbolts of an angry ZEUS. Your Cone of Cold will destroy a thunderbolt and your shield will protect you – for a while. This is the best and highest speed arcade action we have ever done. Difficulty increases in wave after wave, providing hours of challenging fun and a game that you may never completely master. Commodore 64, Vic20 (16k expander), and 16k TRS-80 Color Computer. (ALL MACHINE CODE!)
$19.95 tape  $24.95 disk. (Tape will not transfer to disk.)




**ADVENTURES!!!**

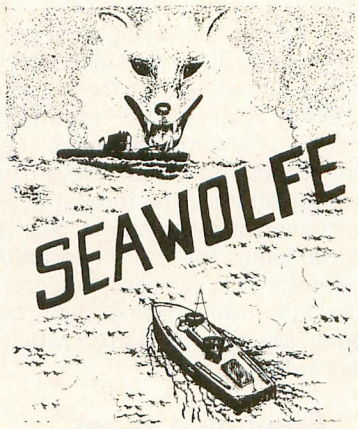
The Adventures below are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer, commands like "Look in the Coffin" and "Light the torch.")

Adventuring requires 16k on Sinclair, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Now available for TI99. Any Commodore 64.

$14.95 Tape – $19.95 Disk.

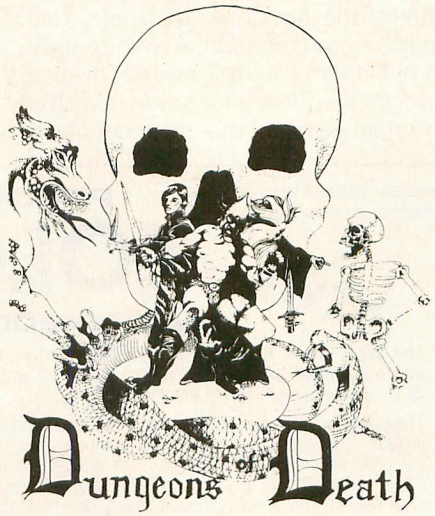
**ESCAPE FROM MARS**
(by Rodger Olsen)
This ADVENTURE takes place on the RED PLANET. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

**PYRAMID** (by Rodger Olsen)
This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!




**SEAWOLFE** – ALL MACHINE CODE In this high speed arcade game, you lay out patterns of torpedoes ahead of the attacking PT boats. Requires Joysticks, at least 13k RAM, and fast reflexes. Lots of Color and Sound. A fun game. Tape or Disk for Vic20, Commodore 64, and TRS-80 Color. NOTE: tape will not transfer to disk!

$19.95 Tape – $24.95 Disk.




**Dungeons of Death** – This is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. 16k Extended TRS-80 Color, 13k VIC, Commodore 64. At the normal price for an Adventure (14.95 tape, $19.95 disk), this is a giveaway.

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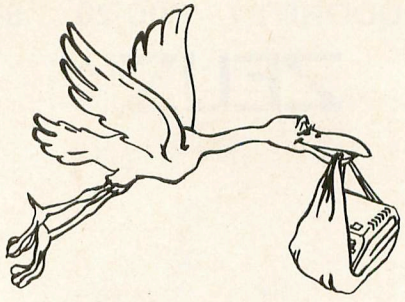
*Continued from page 12*

found in the micro-code inside the chip.

When I heard the Color Computer contained the 6809 I was excited. The 6809 is a state-of-the-art eight-bit processor. It contains all the register power of the 8080/Z-80 family, *plus* the indexing and memory manipulation advantages of the 6800/6502 family. It's a true "best of both worlds" machine. It even has mini and mainframe tricks thrown in, like auto-increment and decrement, plus 16-bit relative jumps for totally relocatable code. Despite its capabilities, however, I still couldn't justify buying the Color Computer. My reason had to do with the software industry itself.

## Freelance Woes

Any freelance author or publisher has to answer one key question concerning each computer system: Have enough units sold to support a market? The greatest hardware package in the world does not guarantee a successful computer system. As we're finding out in today's market, the bottom line is units sold. Until there are enough machines in use no publisher or author can risk his time developing software for a system with an uncertain future. The next couple of



years is going to see a shake-out in the home computer field as the market saturates. The home video game market is entering a similar stage right now, as anyone who owns Warner Communications stock will tell you. Some computers are going to bite the dust: it's inevitable.

For the first year after the release of the Color Computer I got the same feedback from all my publishers: "We know a market must be there, but we can't get a handle on it!" Tandy didn't help matters by their policy towards second-source software and making available accurate sales figures. It seemed that many of the Color Computer buyers did not visit computer stores or read computer magazines so the software marketers could reach them. Consequently, the attitude among publishers and authors through 1981 was, "Let's wait and see what happens." That wait *could* have killed the Color Computer. Many of you Model I converts will remember the 1981 period when even major magazine publishers were asking the question, "Is the Color Computer dead?"

Things remained at a stalemate until the summer of 1982. At that time I received a phone call from Mark Sprague at Adventure International, one of my publishers. "Listen Jyym," he said, "It really looks like the Color Computer is taking off, we'd like you to consider it." Mark started the ball rolling for me, and when I began getting the same positive views about the Color Computer from other publishers, including Med System/Intelligent Statements, I stopped by Radio Shack and picked up a 32K Color Computer with Extended Basic.

## Up and Running

Three weeks later my first converted adventure was running on the 6809. Now, with five games down and three to go, I've really come to appreciate the capabilities of the Color Computer (and keep in mind that I haven't programmed a single line in Extended Basic). I work with Editor-Assembler, so Basic fans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The powerful 2-pass macro assembler features conditional assembly, local labels, include files and cross referenced symbol tables. MACRO-80C supports the complete Motorola 6809 instruction set in standard source format. There are no changes, constraints or shortcuts in the source language definition. Incorporating all of the features of our Rompack-based assembler (SDS80C), MACRO-80C contains many more useful instructions and pseudo-ops which aid the programmer and add power and flexibility.

The screen-oriented text editor is designed for efficient and easy editing of assembly language programs. The "Help Key" feature makes it simple and fun to learn to use the editor. As the editor requires no line numbers, you can use the arrow keys to position the cursor anywhere in the file. MACRO-80C allows global changes and moving/copying blocks of text. You can edit lines of assembly source which are longer than 32 characters.

DCBUG is a machine language monitor which allows examining and altering of memory, setting break points, etc.

The editor, assembler and monitor — as well as sample programs — come on one Radio Shack compatible disk. Extensive documentation included. MACRO-80C **Price: $99.95**

**SDS80C** — Our famous editor, assembler and monitor in Rompack. Complete manual included. **Price: $89.95**

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Color Forth consists of the standard FORTH Interest Group (FIG) implementation of the language plus most of FORTH-79. It has a super screen editor with split screen display. Mass storage is on cassette. Color Forth also contains a decompiler and other aids for learning the inner workings of this fascinating language. It will run on 4K, 16K, and 32K computers. Color Forth contains 10K of ROM, leaving *your* RAM for *your* programs! There are simple words to effectively use the Hi-Res Color Computer graphics, joysticks, and sound. The 112-page manual includes a glossary of the system-specific words, a full standard FIG glossary and complete source listing. COLOR FORTH ... THE BEST! From the leader in Forth, Talbot Microsystems. **Price: $109.95**

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have experienced pleasures with the powerful Extended Basic ROM I haven't yet reached.

The current industry view is that the Color Computer is not just *going* but *hot*. You Color Computer owners are going to be seeing a lot of software for your machine in the next year, so get your charge cards ready. And now, with Tandy licensing good outside software through Radio Shack stores, the Color Computer's future is bright indeed!

A question I'm often asked is, "With all those computers you have, which do you like best?" I pass on that one, it's something each person must answer himself, according to his needs. I can answer this question though: "How does the Color Computer stack up with the bunch?" The answer is, "Damn well!"

Sure, the Color Computer doesn't have the hi-res color power of the Apple II, but then, neither does the Atari 800, as anyone will tell you who has seen the same hi-res adventure on both machines. The Color Computer doesn't have the graphic animation hardware of the Atari 800, but then neither does the Apple II, as any programmer will tell you who has programmed arcade games on both machines. The Color Computer doesn't have the memory or sound flexibility of the Commodore 64, but then neither do the Atari or Apple, as anyone will tell you who has stuck $600 worth of ALF boards into his Apple to get the same sound synthesis power that a $500 Commodore 64 has. There is one thing the Color Computer has over Atari 800, Apple II and Commodore 64. It comes in a 40-pin integrated circuit, sitting quietly on the circuit board of your Color Computer: The 6809 microprocessor.

Moving from Apple, Atari or Commodore to the Color Computer is like climbing out of a Pinto into a Ferrari for the machine language programmer. If you think by that I'm saying you can't totally appreciate the Color Computer's capabilities unless you get into machine language, you're right. The 6809 is a beautiful machine, and I invite anyone who is serious about computing to investigate the world of machine language. You'll find the horizons are unlimited compared with working with an interpreter like Basic ROM. (It will also give you something to bring up when talking with the local Apple, Commodore or Atari expert. You'd be surprised at how fast you can lose those guys when you start talking about autoincrementing, 16-bit indirection, 5-bit or register offsets, unrestricted base page, dual stacks, 16-bit relative jumps and hardware multiplies.)

As for the Vic 20, Sinclair/Timex, T.I. and Atari 400, they really don't stack up to the Color Computer. The 400 comes closest and it has severe hardware limitations unless you are willing to modify it.

I've enjoyed programming the Color Computer very much. It's a beautiful machine that can hold its own with the best of them. It is also one of the greatest computer values, cost versus performance, on the market today. Remember; if Basic starts to limit you, get a copy of a 6809 machine language book (I used *6809 Assembly Language Programming* by Lance Leventhal), a good Editor Assembler (EDTASM from Radio Shack is a good cartridge-based utility), and take the Ferrari out of the garage and leave the Pintos behind.

By the way, we've now moved into a three bedroom home with one large room just for the computers. Only one problem so far: if I leave all the machines on at night, in the morning I find the CRT's are full of text. It seems that the machines sit up all night hurling insults at each other with self-generated Print statements. I guess as long as there are computers there will be rivalry between the machines and their owners. Right? I wouldn't have it any other way. ■■■


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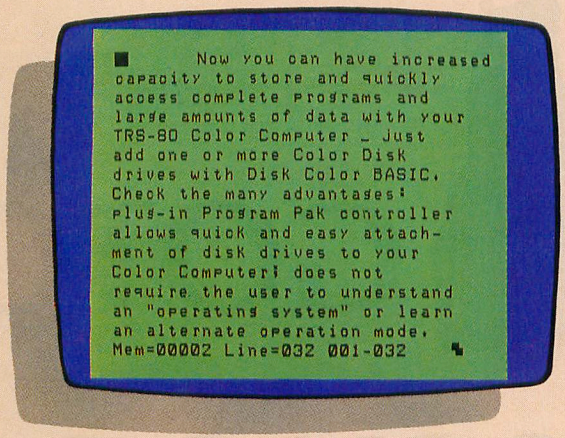


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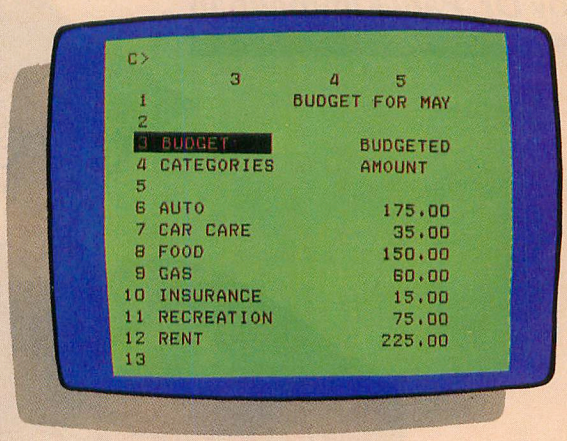


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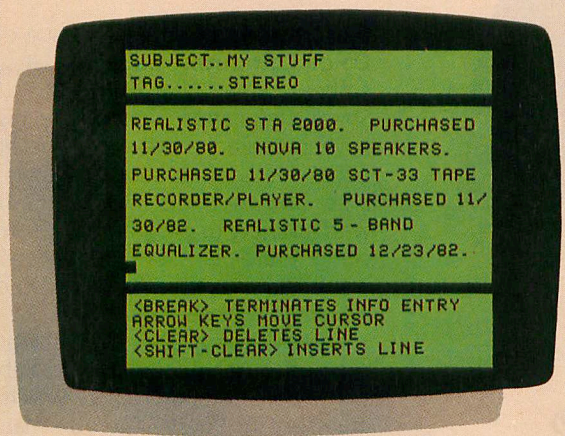


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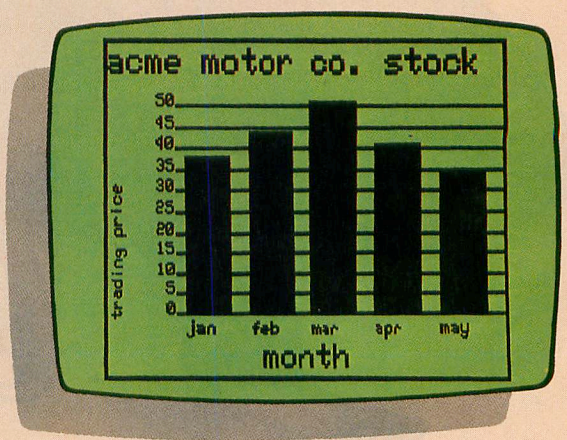


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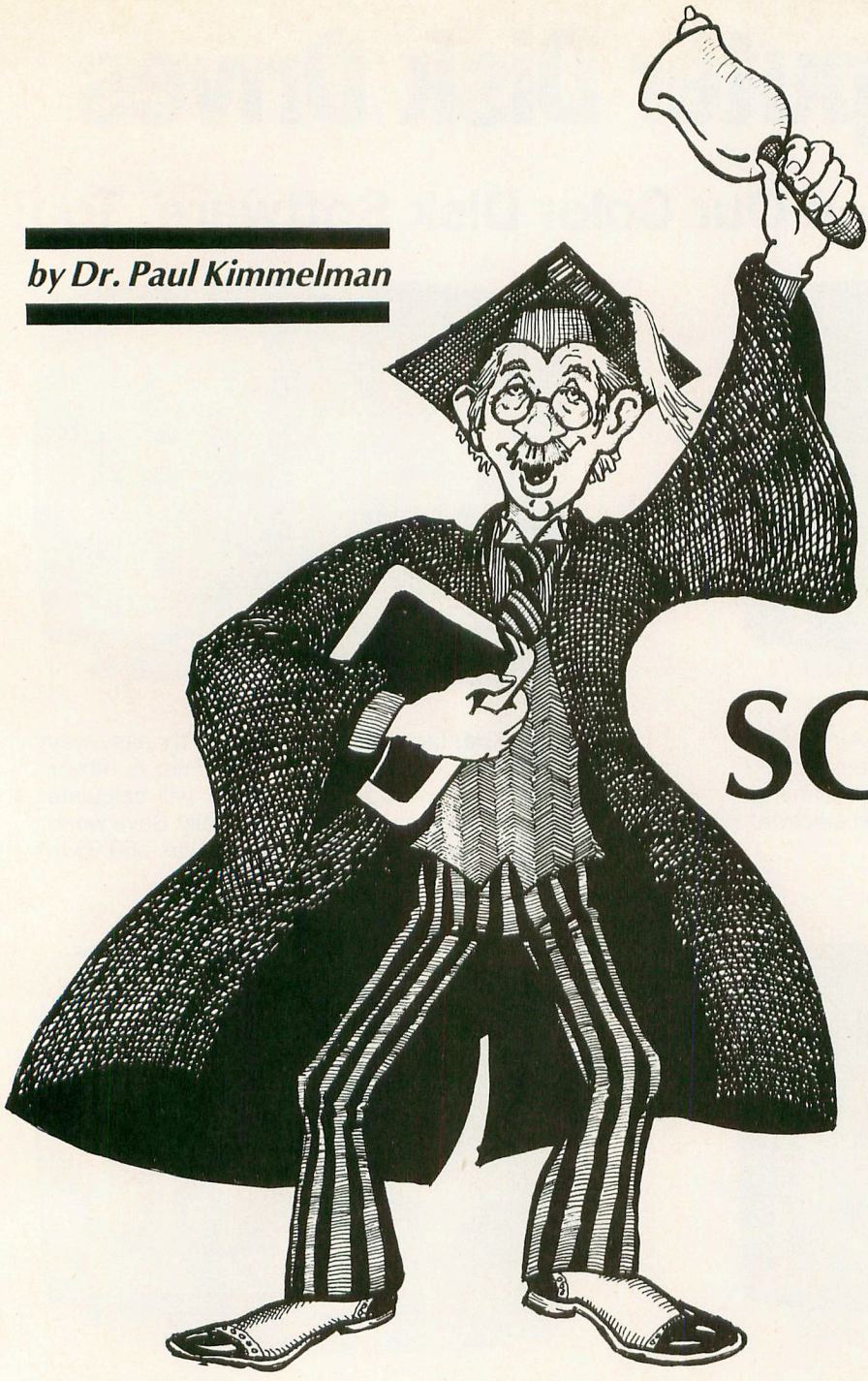
*by Dr. Paul Kimmelman*



# GOTO SCHOOL

I JOIN THE STAFF of **The Color Computer Magazine** with extreme pleasure. As a school administrator whose schools have implemented the use of Color Computers, I have witnessed the rapid growth of computer use for education. It must also be emphasized that using the computer for educational purposes has not been restricted to schools. How many of you are working with programs in your home to teach yourself or your children? There is really no longer any question about the value of computers in education. The claim that computers are a fad is shallow and lacks evidence. A more important consideration is how the computer is used for education, and with what types of programs.

There is little doubt that many teachers have used the computer only as an "electronic flash card," not its most appropriate use, but still an important aspect of computer education. Unfortunately, the rapid growth of computer use, declining prices, and the information explosion have surpassed many educators' ability to keep pace in this technological age. Fortunately, Radio Shack has recognized this problem and made a substantial investment with "America's Educational Challenge," a topic I will discuss later in this article and in the next issue of **The Color Computer Magazine.** It should suffice to say that Bill Gattis (Radio Shack's Education Director) and his staff have prepared us to meet the educational needs of students, teachers, parents, and even our children at home, with a variety of programs and some exciting future plans. Even more important is the fact that the Color Computer has a big part in those plans.

I receive many questions asking what color educational software is available for the Color Computer, and which programs are the "best." There are many fine programs available for educational use; my colleague, Dave Macali, and I will be reviewing programs for you in future issues. Dave and I spend considerable time working with these programs and constantly receive teacher and student reactions to them. Just be comfortable at this time knowing there are currently many excellent educational programs available for the Color Computer and many more coming in the near future. Also, don't forget games: Who said the computer was only for learning and not for fun?

Some final thoughts about this column. I would like to have a monthly question/answer and suggestion section. Bear in mind that this column is not intended to describe the technical operation of the computer. We want to help

teachers, parents, and individual computer users with questions about how to use the computer for educational purposes. I will also be telling you about many fine books and home instructional materials available about computers in general and the Color Computer specifically. These materials will help the home computer user become computer literate. Some of the materials include cassettes which are helpful for the daily commuter or someone who prefers to listen to instructions. Who knows, we may even devote a column to "learning styles and the computer?"

Finally, a few words on LOGO, an easy to learn programming language. Some people consider LOGO a "children's programming language," yet George Gerhold, the co-author of Color LOGO (Radio Shack's version), has used it in his college classroom with some very interesting results.

I believe Color LOGO is the most important software available for Color Computers used in schools. This opinion is not intended to diminish the importance of other fine educational software, only to emphasize the importance of children being able to creatively explore LOGO. Because of my strong feelings on this matter, each month a portion of this column will deal with LOGO. Send me your programs, ideas, ways it is being used, or criticisms. I intend to develop a forum for LOGO as a regular part of the magazine. Naturally, creative programs will be published, with your permission. Please enclose a cassette or disk with your documentation.

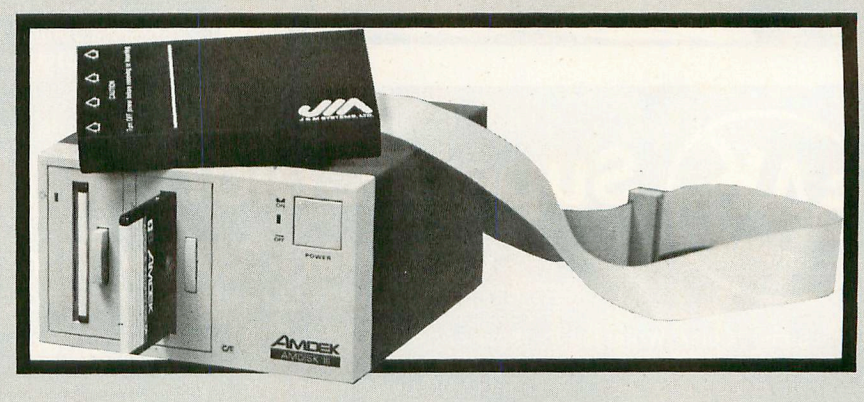
## America's Educational Challenge

By now, most of you have read or heard about Radio Shack's program to help all elementary and secondary teachers in the United States achieve a basic understanding of computers and their applications. Because of the magnitude of this endeavor, I have decided to review the program in two parts. The first part appears in this issue and will include a description of the program and a summary of Part I, *Educational Applications of Microcomputers.* Next month I will review Part II, *Introduction to Microcomputers.*

Last April Radio Shack mailed to every school in the United States a package that included: an educator's handbook describing how microcomputers are used in schools; a basic computer literacy package designed to teach elementary computer concepts; a secondary-level textbook designed to illustrate programming concepts; examples of what several school districts are doing with computers; a certificate for three free classes on Basic programming and educational uses of computers; an order form for a full staff-development program.

The staff-development program includes two audio-visual presentations, *Educational Applications of Microcomputers* and *Introduction to Microcomputers* for use in teacher workshops (both of these programs will be reviewed in this column); information describing available educational software; five certificates entitling teachers to two free classes in Basic programming and a workshop on educational computer applications, and a sample comic book from the series that has been distributed to schools on a regular basis.

Obviously, this was a massive undertaking. Radio Shack is to be commended for its efforts to help our teachers become more knowledgeable about how computers are used. Further, it is extremely important that our nation's youth be *properly* educated about computers. Radio Shack's contribution will be a major step toward helping educators assume this responsibility. ■■■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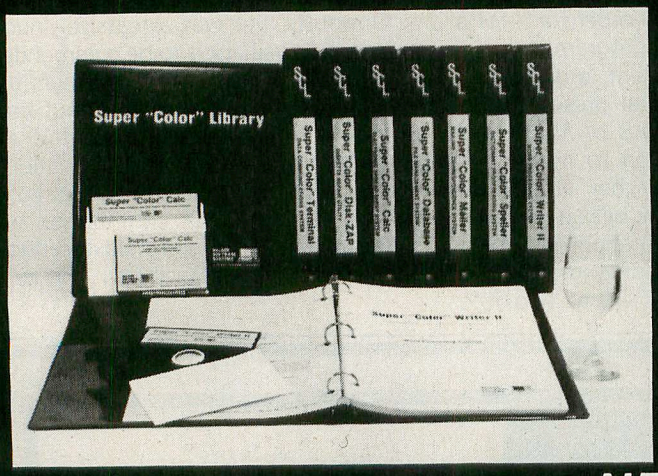


No matter what kind of problem you are trying to solve with the Color Computer, there is a program in the ever-expanding integrated, **Super "Color" Library** that will give you the solution; Faster, Better, Smarter!

Every Library program features **MEMORY-SENSE** to determine your computer's memory, from 16 to 64K, and adjusts automatically to maximize work space. All programs, except the **Super "Color" Speller** and **Super "Color" Disk-ZAP**, feature a true lowercase display with below line descenders. Each program has been written specifically for the Color Computer in fast machine code to be totally compatible for optimum performance — Something a motley assortment of programs from diverse sources or a passel of overpriced, wallet-FLEXing software from a bygone era simply can not achieve.

The **Super "Color" Library** has all the power, speed, dependability and compatibility you will ever need so build your library a volume at a time or put the full power of the complete library of problem solvers to work right away.

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## Super "Color" Writer II™

32x16 & 51-64-85x21&24 WITH REAL LOWERCASE DISPLAY

### VERSION 3.0 By Tim Nelson

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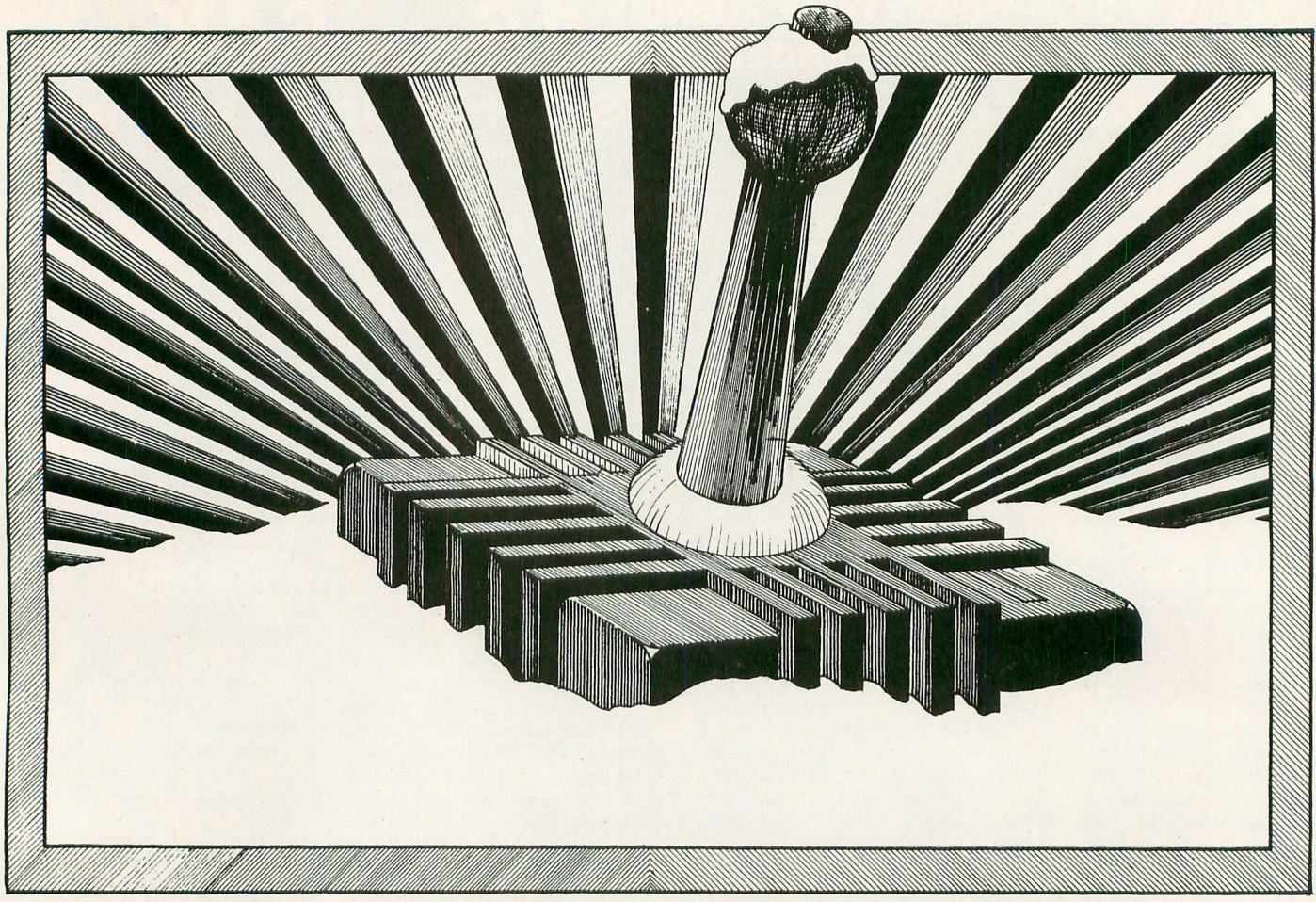

# Indoor/Outdoor Thermometer

**by Theodore Hasenstaub**

AFTER WEEKS OF BATTLE and endless hours, you finally succeeded in defeating Zorac and his Leithium Forces. Your score tops the 1,000,000 mark, and you still have four Star Cruisers left; now what will fill your leisure time? Let's give this a moment's thought. Remember — you own a full-fledged computer, not just a glorified game machine. So, why not unleash a little of its power?? Unplug those joysticks and let's get started.

Remember I said a full-fledged computer. Let's look a little closer: your Color Computer has a fantastic Basic language incorporated into its ROM (even more powerful if you have Extended Basic). It also has its own RS-232 serial port built in, enabling it to communicate with the outside world (an option on many computers). Not enough yet? How about digital to analog circuitry? You guessed it, the Color Computer has its own built right into it. This is the area we will use for this application.

Basically, digital to analog circuitry lets you convert electrical analogs into the digital information your Color Computer understands. A simple design lets you attach a variety of devices to the joystick ports, which will set up these electrical analogs (comparisons). Thermistors, photo cells, transducers and solar cells are a few of the devices you might plug in.

## How Does An Analog?

I won't go deeply into how the Color Computer accomplishes analog comparisons, but here is a general, easier to understand approach. On page 85 of *Getting Started With Color Basic*, you will see diagrams of the joysticks. Notice that you have four rotational axes, two on each joystick. The axes positions are designated as follows: the right joystick horizontal axis position as JOYSTK(0); the vertical axis position as JOYSTK(1); the left joystick horizontal axis position as JOYSTK(2); the vertical axis position as JOYSTK(3). These four values designate from which input channel the Color Computer reads information. This information is provided from potentiometers (pots), which are just variable resistors that are enclosed inside the joystick cases. When you change the joystick position you also change the position of the pots. Depending on which way you move them, you are either increasing or decreasing resistance.

A 5-pin DIN plug is used to plug devices into the joystick ports (see Figure 1). A voltage of about 5 Vdc is supplied on pin 5. Pin 5 is wired to one side of each pot. Pins 1 and 2 are the input lines (to the Color Computer), connected to the center lugs of the pots. One side of each pot is then connected to ground (pin 3). The pots are connected together me-

*Please turn to page 24*

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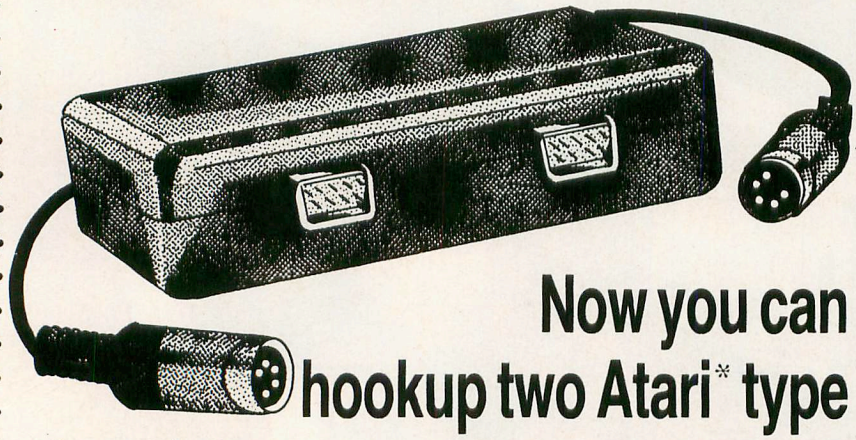

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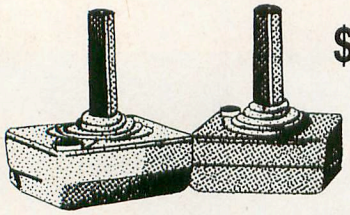

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Continued from page 22

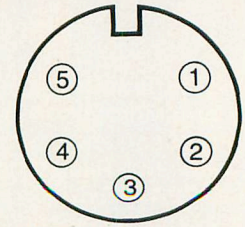
chanically so any movement in any direction changes the resistance in the joystick circuit. This is what it's all about; a change in the voltage due to a change in resistance, which can be referenced to a known voltage (pin 5).

The analog (voltage) is fed in via the input channels (pins 1 and 2) to a channel selector which is programmable for the channel that the Color Computer is to read. It then goes to a comparator to reference the voltage input with that of the digital to analog converter. Approximate by means of the PIA chip, as an integer between 0 and 63. This integer is the Color Computer's conclusion of the analog presented to it from its input channels. The reason for this range of integers is that the Color Computer uses a six-bit digital to analog converter (a shame they didn't use an 8-bit, which would give us integers from 0 – 255), thus allowing a maximum output of 111111 binary or 63 decimal. This somewhat limits the range in calculating different value tables.

## Checking the Outside

Enough information on how the joystick ports function: what are we going to do with all this information? How about building an indoor/outdoor thermometer? An evening's work and about $15.00 of materials will do it! All we do is substitute the pots with other devices that will change their resistance. The device we will use should change its resistance as temperature rises and falls. Such a device is called a Thermistor.

A *thermistor* is a semiconductor that decreases in resistance as temperature increases, and increases in resistance as temperature decreases. They come in a wide range of sizes, shapes, and resistance ranges. Their values are rated in ohms at 25 degrees Celsius, so a 10k



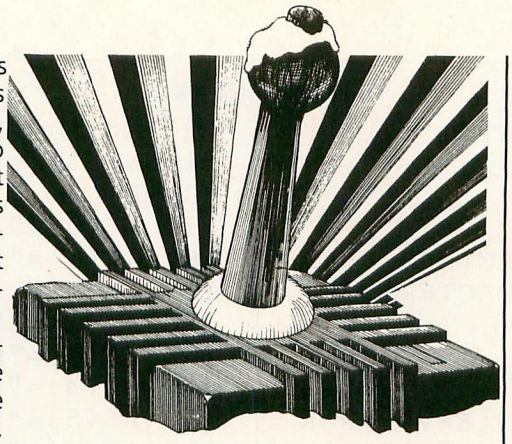

PIN 1 – X CHANNEL
PIN 2 – Y CHANNEL
PIN 3 – GROUND
PIN 4 – **
PIN 5 – 5VDC
** – is used with fire button; when pressed, it shorts to PIN 3

*Figure 1. Joystick Port*

ohm thermistor is said to have 10k ohms of resistance at 25 degrees Celsius. Prices vary from a couple dollars to over $15, depending on the thermistor's ability to give a constantly proportional reading at any given temperature. Such thermistors are referred to as being linear; low-priced thermistors are not linear, but work very well with the Color Computer's digital to analog circuitry.

The thermistor circuit (see Figure 2) incorporates a voltage divider, to reference the differences in voltage due to the changing resistance of the thermistor. When wiring the thermistor, make sure that at least one of its leads is well insulated so you won't get a false reading if it touches the other. I used a small piece of shrink tubing to accomplish this. The numbers in Figure 2 correspond to the pin connections on the joystick plug. I used 15 feet of two-conductor wire for the probe leads. I would assume that longer leads could be used without significantly changing the resistance in the circuit. After assembling the probes, slide another piece of shrink tubing over the probe end, so that about 1/4 inch of the probe is visible. This will protect its fragile end.

The range on this thermometer is +2 degrees Fahrenheit to about +118 degrees Fahrenheit, with an accuracy of 3 degrees. You may want to try other value thermistor and resistor combinations to narrow its range and increase its accuracy. I used a fifth-degree polynomial to plot the temperature curve instead of reading data statements into the program with all the necessary temperatures and analog to digital conversions. The graphic routines in the program are set to print any temperature from −99 degrees Fahrenheit to +118 degrees Fahrenheit, even though the thermometer will only show temperatures from



−30 to +110 degrees Fahrenheit. If you decide to change the range you will have to redefine the temperature curve with your own readings; the function I wrote will not be accurate.

Plug one of the probes into the right joystick port to read indoor temperature, and the other probe into the left joystick port to read outdoor temperatures. Next, place the probes in their respective locations. The program uses the INKEY$ function exclusively. All user input is done by one-key entry. Load and run the program (Extended Basic is required). After the title screen, press any key to continue. Next press an I or an O for the temperature reading you desire. The screen will display a thermometer, and the mercury climbs to the correct temperature. It will also display the temperature in graphic integers.

The next time someone uses the old cliche' "It was so cold...!" you won't have to answer "How cold was it?" You will already know. ■■■

*Please turn to page 26*

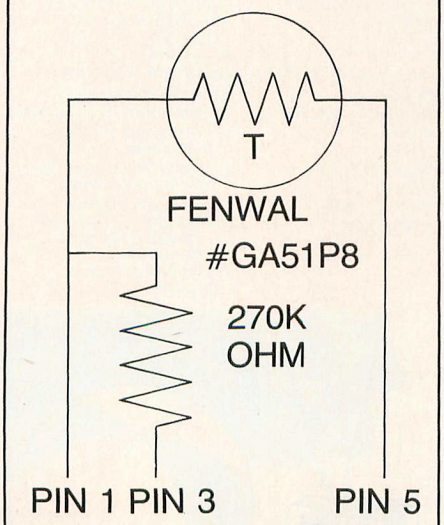



*Figure 2. Thermistor Circuit*

## Parts List

| | |
|---|---|
| 2 | 270k ohm resistors |
| 2 | 100k thermistors (Fenwal GA51P8) |
| 2 | 5-pin DIN plugs (Spectrum Products) |
| 30 feet | two-conductor cable (Radio Shack 278-559) |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*Program Listing*

```
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30 '    2/09/83
50 '    TED HASENSTAUB
70 CLS
90 'DIM GRAPHICS CHARACTERS,DEFI
NE TEMP FUNCTION, CHARACTERS, &
WORDS
110 CLEAR 1000
120 DIM N$(10),A$(18)
130 DEF FNA(X)=-4.40591E-7*R*R*R
*R*R+4.05993E-5*R*R*R*R-3.10596E
-4*R*R*R-.023706*R*R+1.33722*R+2
.90086
140 N$(0)="R4U6L4D6BR9":'0
150 N$(1)="BR1R4BL2U6G1BR7BD5":'
1
160 N$(2)="BU5U1R4D2G4R4BR4":'2

170 N$(3)="R4U3NL2U3L4BR8BD6":'3

180 N$(4)="BR4U6BL4D3R3BD3BR5":'
4
190 N$(5)="R4U3L4U3R4BR4BD6":'5
200 N$(6)="R4U3L4U3D6BR8":'6
210 N$(7)="BR4U6L4D1BD5BR8":'7
220 N$(8)="U6R4D3NL3D3L3BR7":'8
230 N$(9)="BR5U6L4D3R3BD3BR5":'9
240 N$(10)="BR2BU4U2L2D2R1":'# D
EGREE
250 A$(0)="U8R8D8L8BR12":'O
260 A$(1)="BU8R8BL4D8BL4R8BR4":'
I
270 A$(2)="U8F8U8BD8BR4":'N
280 A$(3)="U8R6F2D4G2L6BR12":'D
290 A$(4)="U8BR8D8L8BR12":'U
300 A$(5)="BU8R8BL4D8BR8":'T
310 A$(6)="U8R8BD4L8BD4R8BR4":'E

320 A$(7)="U8F4E4D8BR4":'M
330 A$(8)="U8R8D4L8BD4BR12":'P
340 A$(9)="U8R8D4L8BR4F4BR4":'R
350 A$(10)="U8R8BD8L8BR12":'C
360 A$(11)="U8BR8D8BU4L8BD4BR12"
:'H
370 A$(12)="U8BD8R8BR4":'L
380 A$(14)="BR1BU4R6U1L6D1BD3BR1
0":'-
390 A$(15)="U8R8D4L8BR8D4BR4":'A

400 A$(16)="U8BR8D8H4G4BR12":'W
410 A$(17)="BR12":'SPACE
420 A$(18)="BR6D4U6R4BD3BL1L3":'
```

# Summer Programming Project

We decided to give you something to do this summer: write an original game for the Color Computer. It can be an adventure, simulation, arcade, or any type of game imaginable. It can be written in Basic or assembly language. It can be long or short, it's all up to you. Just make sure you get it to us by Labor Day, September 5, 1983.

Entries should be submitted on cassette tape or disk with clearly written instructions for use. All entries will be held until October 1, 1983. For the return of entries not selected for prizes, include a self-addressed stamped envelope with you program. All winners will be announced in December's issue of **The Color Computer Magazine**. Entries will be judged by **The Color Computer Magazine**'s editorial staff. All decisions are final.

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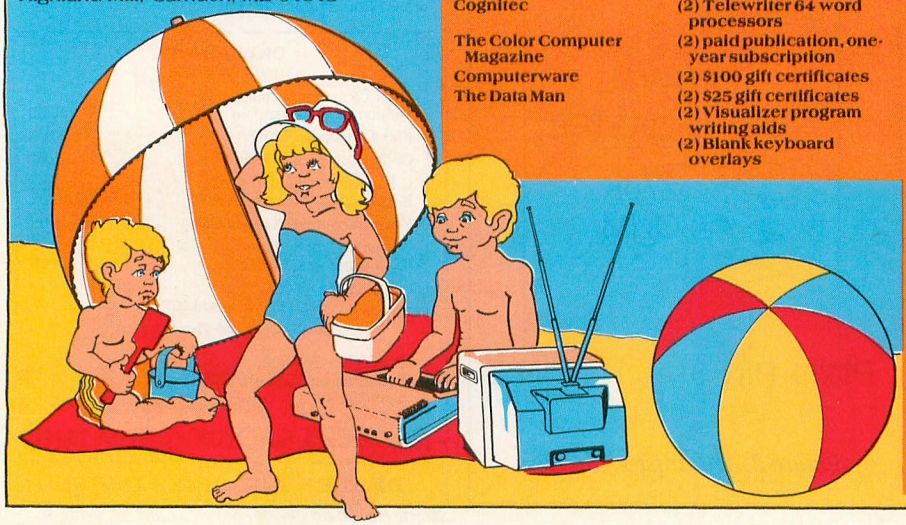

```
F
430 O$=A$(0)+A$(4)+A$(5)+A$(3)+A
$(0)+A$(0)+A$(9):'OUTDOOR
440 CO$=A$(10)+A$(0)+A$(10)+A$(0
):'COCO
450 CL$=A$(10)+A$(0)+A$(12)+A$(0
)+A$(9):'COLOR
460 TM$=A$(5)+A$(11)+A$(6)+A$(9)
+A$(7)+A$(0)+A$(7)+A$(6)+A$(5)+A
$(6)+A$(9):'THERMOMETER
470 W$=A$(16)+A$(11)+A$(15)+A$(5
):' WHAT
480 I$=A$(1)+A$(2)+A$(3)+A$(0)+A
$(0)+A$(9):'INDOOR
490 T$=A$(5)+A$(6)+A$(7)+A$(8):'
TEMP
510 '    DRAW THERMOMETER
530 PCLS
540 PMODE3,1
550 SCREEN1,0
560 COLOR4,2
570 GOTO 880
580 DRAW"C4;S4;BM45,158;U14NR6U2
0NR6U20NR6U20NR6U20NR6U20NR6U20N
R6U10BL8 L 6BR6D20NL6D20NL6D20NL
6D20NL6D20NL6D20NL6D4"
590 DRAW"C3;BM13,158"+N$(3)+N$(0
)
600 DRAW"BM57,147"+N$(2)+N$(0)
610 DRAW"BM11,138"+N$(1)+N$(0)
620 DRAW"BM61,127"+N$(0)
630 DRAW"C4;BM11,118"+N$(1)+N$(0
)
640 DRAW"BM57,107"+N$(2)+N$(0)
650 DRAW"BM13,98"+N$(3)+N$(0)
660 DRAW"BM57,87"+N$(4)+N$(0)
670 DRAW"BM13,78"+N$(5)+N$(0)
680 DRAW"BM57,67"+N$(6)+N$(0)
690 DRAW"BM13,58"+N$(7)+N$(0)
700 DRAW"BM57,47"+N$(8)+N$(0)
710 DRAW"BM11,38"+N$(9)+N$(0)

720 DRAW"BM55,27"+N$(1)+N$(0)+N$
(0)
730 DRAW"S4;BM3,18"+N$(1)+N$(1)+
N$(0)
740 CIRCLE(40,166),12,4,1,.85,.6
6
750 CIRCLE(40,16),9,4,1,.55,.95
770 'SET MERCURY LEVEL TO MATCH
TEMP
790 IF B>110 THEN B=110
800 R=124-(B)
```

*Please turn the page*


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Continued from page 27

```
810 LINE(37,R)-(45,R),PSET
820 PAINT(44,174),D,4
830 Q$=INKEY$
840 IF Q$="" THEN 830
860 ' ALTERNATE COLORS ON TITLE
PAGE
880 PCLS
890 DRAW"C4;S5;BM54,88"+CO$
900 DRAW"C1;BM124,88"+CL$
910 DRAW"C3;BM44,112"+TM$
920 GOTO 1010
930 COLOR X,2
940 DRAW"S5;BM54,88"+CO$:GOTO 10
10
950 DRAW"S5;BM124,88"+CL$:GOTO 1
010
960 DRAW"S5;BM44,112"+TM$:GOTO 1
010
970 X=RND(4): IF X=2 THEN 970
980 COLOR X,2
990 Z=RND(3)
1000 IF Z=1 THEN 940 ELSE IF Z=2
 THEN 950 ELSE IF Z=3 THEN 960
1010 FOR Q=1 TO 15:NEXT
1020 Q$=INKEY$:IF Q$="" THEN 970

1040 '   CHOOSE TEMP TO READ
1060 PCLS
1070 DRAW"C1;S4;BM70,64"+W$+A$(1
7)+T$
1080 DRAW"C4;BM70,92"+A$(1)+A$(1
7)+A$(14)+A$(17)+I$
1090 DRAW"C3;BM70,120"+A$(0)+A$(
17)+A$(14)+A$(17)+O$
1100 Q$=INKEY$
1110 IF Q$="" THEN 1100
1120 IF Q$="I" THEN 1630 ELSE IF
 Q$<>"O" THEN 1100
1140 ' READ JYSTK PORT, CONVERT
TO TEMP, DEFINE TEMP TO GRAPHIC
INTEGERS
1160 COLOR3,2
1170 R=JOYSTK(0)
1180 R=JOYSTK(2)
1190 B=FNA(X)
1200 D=3:L$=O$
1210 I=INT(B):S$=STR$(I)
1220 IF VAL(S$)>99 THEN 1440
1230 IF VAL(S$)>9 AND VAL(S$)<10
0 THEN 1380
1240 IF VAL(S$)>=0 AND VAL(S$)<1
0 THEN 1320
1250 IF INT(I)>-(10) AND INT(I)<
(0) THEN 1270
1260 IF INT(I)<(-10) THEN 1550
1270 H=ABS(I):PCLS
1280 DRAW"BM116,72"+L$
1290 DRAW"BM132,84"+T$
1300 DRAW"S8;BM132,108"+A$(14)+N
$(H)+N$(10)+A$(18)
1310 GOTO580
1320 H=ABS(I)
1330 PCLS
1340 DRAW"BM116,72"+L$
1350 DRAW"BM132,84"+T$
1360 DRAW"S8;BM148,108"+N$(H)+N$
(10)+A$(18)
1370 GOTO 580
1380 B1=VAL(LEFT$(S$,2)):B2=VAL(
RIGHT$(S$,1))
1390 PCLS
1400 DRAW"BM116,72"+L$
1410 DRAW"BM132,84"+T$
1420 DRAW"S8;BM132,108"+N$(B1)+N
$(B2)+N$(10)+A$(18)
1430 GOTO 580
1440 H=VAL(LEFT$(S$,2)):H2=VAL(R
IGHT$(S$,1))
1450 IF H>1 THEN H=1
1460 IF B<110 THEN H1=0:GOTO 149
0
1470 B=B-100:I=INT(B):S$=STR$(I)

1480 H1=VAL(LEFT$(S$,2))
1490 PCLS
1500 DRAW"BM116,72"+L$
1510 DRAW"BM132,84"+T$
1520 DRAW"S8 BM120,108"+N$(H)+N$
(H1)+N$(H2)+N$(10)+A$(18)
1530 B=B+100
1540 GOTO 580
1550 H=VAL(RIGHT$(S$,1))
1560 C=ABS(I):S$=STR$(C)
1570 H1=VAL(LEFT$(S$,2))
1580 PCLS
1590 DRAW"BM116,72"+L$
1600 DRAW"BM132,84"+T$
1610 DRAW"S8;BM122,108"+A$(14)+N
$(H1)+N$(H)+N$(10)+A$(18)
1620 GOTO 580
1630 R=JOYSTK(0)
1640 B=FNA(X)
1650 D=4:L$=I$:COLOR 4,2:GOTO121
0
1670 'JOYSTK READINGS TO SCREEN
1690 CLS
1700 X=JOYSTK(0)
1710 Y=JOYSTK(2)
1720 PRINT@100,X" = JOYSTK(0)"
1730 PRINT@164,Y" = JOYSTK(2)"
1740 GOTO1700
```

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- Over 100 pages of well organized and easy to use documentation with complete descriptions of every command, and examples.
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**Enhancement:**

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- Define 50 data fields, including a comment field, in a single record. Dates, time of day, phone numbers and dollar amounts are automatically formatted. You may also define 24 scratch-pad data fields not contained within your data records.
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- Print files using automatic formatting with options to print report titles, a report date, page numbers, record names, and data field names. Print all or selected data fields or records.

**Enhancements:**

- **Variable length alpha/text data fields.**
- **Use 1 or 2 disk drives.**
- **Range search for alpha/text data fields and record names.**
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- **Extended sort which permits sorting on any position within a comment alpha/text data field.**
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- Define 250 screens of text you can search, sort, display, or print. Reference or select records using record names you assign or by searching for any word or phrase within text records.
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**Enhancements:**

- **Use 1 or 2 disk drives.**
- **A separate printer driver for NEC and OKIDATA printers.**
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- **Print page headings.**
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### Utilities for Data Management and Word Processing

- Generating new files from old files.
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**Enhancements:**

- **Rename files.**
- **Extended summarize and update.**

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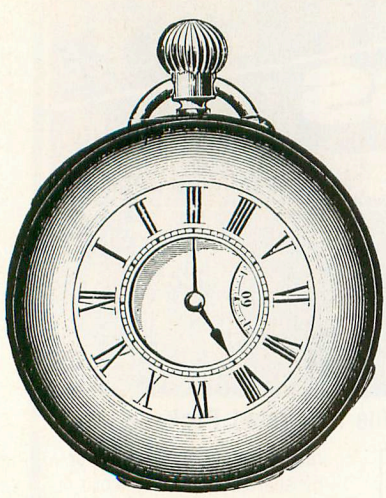

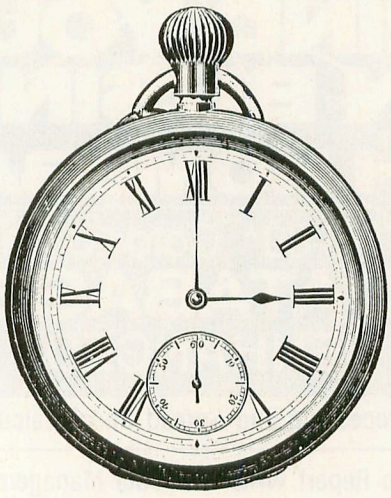

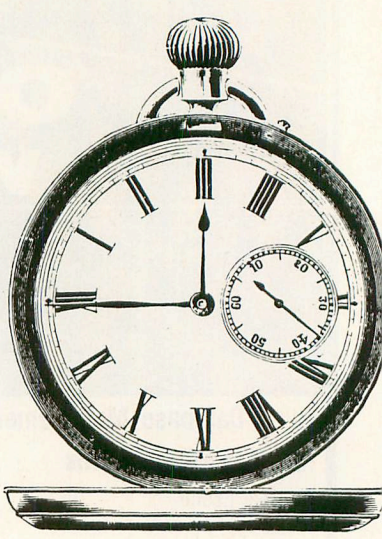

# Flexible Amortization

*by Mel Seder*

AT BEST, most amortization programs require that the compounding periods used in the calculations are tied to the payment intervals you enter. This quiet piece of software lets you enter the compounding periods for a year by responding to the prompt.

The screens have been carefully designed (I know someone out there will improve it, anyway) and provide you with all the information you need to decide whether you should get that disk drive.

If the amount of payment calculates a fractional part of a cent, the payment is rounded up to the next highest cent and the applicable adjustments to principal reduction and balances are made accordingly by the Color Computer.

*Caution:* Do not, under any circumstances show this to your banker. He will be calling you with questions all the time, as the tables he has probably don't provide him with the power and flexibility of this program. ■■■

***Program Listing. Amortization***

```
10 CLEAR 2000:GOTO 5000
20 CLS
30 PRINT"            MEL SEDER'S
40 PRINT"         MORTGAGE PROGRA
M
50 PRINT"              FEB 1983
1000 PRINTSTRING$(32,128);
1020 INPUT"PRINCIPAL";P
1030 PRINTSTRING$(4,239);"ENTER
10% AS 10 NOT .10";STRING$(5,239
);
1040 INPUT"NOMINAL INT. RATE";NR
$:NR=VAL(NR$)
1060 INPUT"YEARS";YR$:YR=VAL(YR$
)
1080 INPUT"PAYMENTS PER YEAR";PY
$:PY=VAL(PY$)
1100 INPUT"INT. PERIODS PER YEAR
";IP$:IP=VAL(IP$)
1120 REM FORMULA'S FOR I N C
1140 I=NR/IP/100:N=YR*PY:C=IP/PY

1160 P1=1-(((1+I)^C)^(-N))
1180 P2=((1+I)^C)-1
1200 R=P/(P1/P2)
```

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*Continued from page 30*

```
1220 REM ROUNDS UP PAYMENT IF GR
EATER THAN 2 DECIMAL PLACES
1240 IF R<>INT(R*100+.5)/100 THE
N R=INT(R*100+.5)/100+.01
1260 PMT=R
1280 GOSUB 3000
1900 REM *** ASKS FOR CHANGES
1901 REM *** TO PREVIOUS INPUTS
2000 PRINTSTRING$(32,255);
2020 PRINT"DO YOU HAVE A CHANGE
?":INPUT"   (Y/N) DEFAULT IS NO"
;CH$
2040 IF LEFT$(CH$,1)="Y" THEN CL
S :  GOTO 2060 ELSE GOTO 4000
2060 PRINTSTRING$(32,159);
2080 PRINTUSINGF1$;P
2100 PRINTUSINGF2$;NR
2120 PRINTUSINGF3$;YR
2140 PRINTUSINGF4$;PY
2160 PRINTUSINGF5$;IP;
2180 PRINTSTRING$(32,159);
2200 PRINT"6- VIEW SUMMARY"
2220 PRINTTAB(5)"YOUR SELECTION
PLEASE";:INPUT SL$:SL=VAL(SL$)
2240 IF SL<1 OR SL>6 THEN CLS:GO
TO 2060
2260 IF SL=1 THEN INPUT"PRINCIPA
L";P
2280 IF SL=2 THENPRINTSTRING$(4,
239);"ENTER 10% AS 10 NOT .10";S
TRING$(5,239);: INPUT"NOMINAL IN
TEREST RATE";NR$:NR=VAL(NR$)
2300 IF SL=3 THEN INPUT "YEARS";
YR
2320 IF SL=4 THEN INPUT "PAYMENT
S PER YEAR";PY
2340 IF SL=5 THEN INPUT"INTEREST
 PERIODS PER YEAR";IP$:IP=VAL(IP
$)
2360 GOTO 1140
2900 REM *** DISPLAYS SUMMARY
2901 REM *** OF TOTAL COSTS,
2902 REM *** TOTAL INTEREST,
2903 REM *** PAYMENT INTERVAL,
2904 REM *** PAYMENT AMOUNT,
2905 REM *** AND PARAMETERS
3000 CLS:PRINTUSINGF1$;P;
3020 PRINTUSINGF2$;NR;
3040 PRINTUSINGF3$;YR;
3060 PRINTUSINGF4$;PY;
3080 PRINTUSINGF5$;IP;
3100 PRINTSTRING$(32,182);
3120 PRINT"PAYMENT EVERY";:PRINT
USINGF0$;12/PY;:PRINT" MONTH(S)"
;:PRINT"          IS ";:PRINTUSI
NG"$$#########,.##";R
3140 PRINTSTRING$(32,182);
3160 PRINT"INTEREST TOTAL ";:PRI
NTUSING"$$#########,.##";N*R-P
3180 PRINTUSING"APROX TOTAL   $$
#########,.##";N*R
3200 RETURN
3900 REM *** CALCULATES AND
3901 REM *** DISPLAYS SCHEDULE
4000 BAL=P
4020 MI=(NR/(IP*100)+1)^(1/(PY/I
P))-1
4040 FOR X= 1 TO N
4060 IF LC>=13 THEN LC=0:PG=PG+1
:INPUT"      HIT [ENTER] TO CONT
";F9$:CLS
4080 IF X= 1 THEN CLS :PRINTTAB(
04)"";:PRINTUSING"ORIGINAL LOAN
$$#######,.##";BAL:LC=LC+1
4100 IN=INT(BAL*MI*100+.5)/100
4120 BAL=BAL+IN-PMT
4140 PR=PMT-IN
4160 IF X=N AND BAL<>0 THEN PMT=
PMT+BAL:PR=PR+BAL:BAL=BAL-BAL
4180 TP=TP+PMT
4200 PRINTUSING"          PYMT NO
. ####";X
4220 PRINTUSING"PYMT ######,.##
";PMT;
4240 PRINTUSING"INT  ######,.##"
;IN
4260 PRINTUSING"PRIN ######,.##
";PR;
4280 PRINTUSING"BAL #######,.##"
;BAL
4300 LC=LC+3
4320 NEXT X
4340 PRINT
4360 PRINTUSING"TOTAL PYMTS ARE
$$#########,.##";TP
4380 INPUT"AGAIN (Y/N) DEFAULT I
S NO";F9$:IF LEFT$(F9$,1)<>"Y"TH
EN CLS:END ELSE RUN
5000 'FORMAT USING STRINGS
5020 F0$="###.##"
5040 F1$="1 PRINCIPAL"+STRING$(8
,32)+"$$#######,.##"
5060 F2$="2 NOMINAL INTEREST RAT
E ####.###"
5080 F3$="3 YEARS"+STRING$(18,32
)+"###.###"
5100 F4$="4 PAYMENTS PER YEAR"+S
TRING$(9,"#")+".###"
5120 F5$="5 INT. PERIODS PER YEA
R ####.###"
5140 GOTO 20
```

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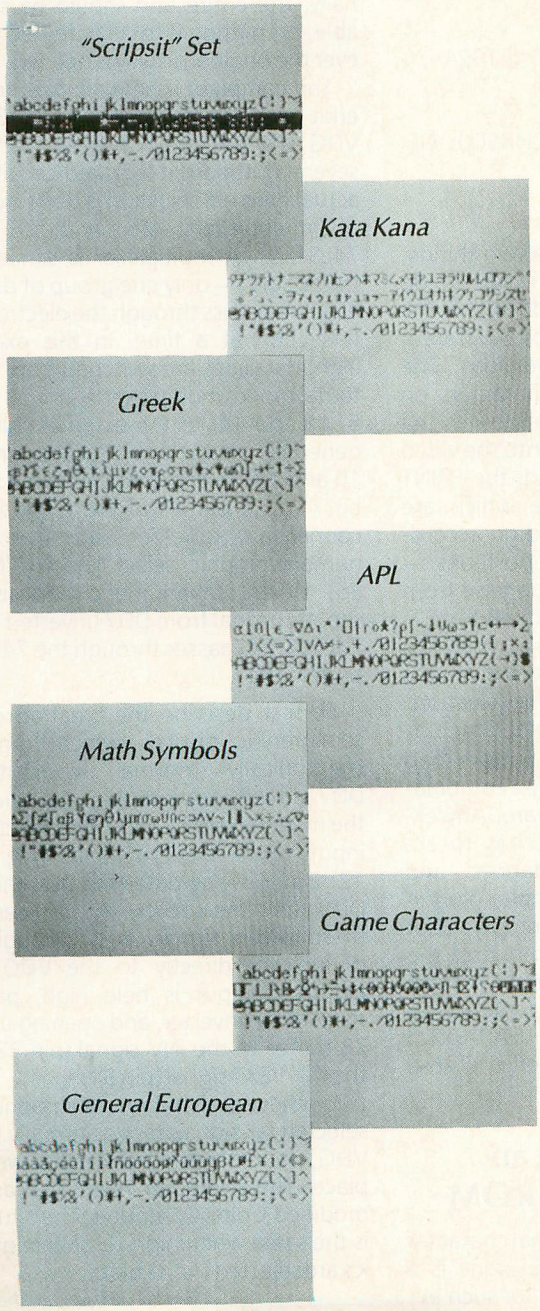


*by Dennis Kitsz*

BY NOW YOU KNOW that your TRS-80 Color Computer is no toy, but have you ever tried convincing a skeptical friend of that? Just one look at the square button keyboard and the ungainly inverse video used to represent lowercase characters is a guaranteed turn-off for the self-ordained computer sophisticate. Next month I'll tackle the keyboard problem with three different solutions; this month's column offers a way to build true, permanent, software-free lowercase for your computer.

Many programs offer software lowercase. Frankly, I've heard all the arguments for software-generated lowercase (redefinable characters, varying line length, etc.) and against hardware (voiding the warranty, the cost, construction time and debugging). Nevertheless, I remain convinced that hardware is the best solution, mainly because I resent giving up 7K of memory just for a software answer. The Lowerkit uses not one byte of your computer's memory, never needs re-loading, and has a restore switch for whenever you need Radio Shack's original character display.

For me, the Lowerkit is the original true solution to the lowercase question, and has a long and curious history. (Dramatic music in.) It is a true story; names have not been changed to protect the innocent. It began when I first squinted at the Color Computer's pretend lowercase. I became suspicious... (music fades).

## A Lowercase Solution

One of the economies which resulted in the low price for a powerful color graphics computer was Radio Shack's decision to use a single video display integrated circuit in place of a cluster of integrated circuits. This is no small matter, for the job of any computer video section is multifold: to provide the character information itself — in the correct order — by extracting the ASCII (American Standard Code for Information Interchange) character codes from memory and converting them into dot patterns. The video section must also provide both vertical and horizontal synchronization signals (called "sync") to lock the television or monitor onto a stable display of the letter dot patterns. And finally, it must provide multiple color information signals that are combined into a screen color display. Furthermore, combined color and high-resolution graphics demand additional electronic definitions that distinguish between alphanumeric characters and colored dots, lines, and circles.

The 6847 Video Display Generator (VDG) performs all these tasks, but with limitations. It permits a resolution of 256 by 192 dots in eight colors — less than some other video systems — and has only 64 ASCII characters built in. By means of a video inversion signal, these 64 black-on-green letters can be extended to 64 green-on-black letters; 96 are used by Basic. To view all 128 characters, plus the 128 "semi-graphics," try this:

```
10 CLS:FORX=0TO255:POKE1024+X,
   X:NEXT
20 PRINT@256,;
30 FORX=0TO255:PRINTCHR$(X);:NE
   XT
40 GOTO40
```

Astute readers will notice two things: first, CHR$(0) to CHR$(31) in line 30 do not print on the screen, and second, the order of 32-character groups is different in the POKE and PRINT versions. The POKE version places the characters on the screen exactly as they appear in the 6847 VDG by forcing them into the video memory; on the other hand, the PRINT version lets Basic translate which are used and where they should go according to the legitimate ASCII positions — symbols from 32 to 63, uppercase from 64 to 95, and lowercase from 96 to 127. The computer's data bit 6 is used for video reversal, and data bit 7 performs the alphanumeric/semigraphic selection.

So it turns out that the Color Computer's character display system is more than the 6847 VDG — it is actually a combination of hardware and software. Any external lowercase generator has to acknowledge these circumstances, and that fact eliminates any simple, plug-in replacement character memory. But there is an answer: I noticed that the 6847 VDG — very new to me when I first tried to find a true lowercase solution — had one connection marked INT*/EXT. I decided to explore further... (Tense music under).

## Implementing an External Display ROM

In theory, adding an external character generator to the 6847 VDG alone is a simple task; it was designed for such expansion. There are three requirements: the external character generator itself; correct selection of EXT on VDG pin 31, and proper timing for character dot-row selection on the screen. Motorola's data sheet describes the External mode as using "an external character generator as well as a row counter. Thus, custom character fonts and graphic symbol sets with up to 256 different 8 x 12 dot 'characters' may be displayed."

Additionally, the Color Computer arrangement demands that data bit 7 deselect the external generator and reselect the internal system (for graphics), and that either the character generator ROM or the data lines be adjusted to accomodate the "ASCIIization" (made by Basic) of the 6847's internal characters. And finally, the entire unit should be switchable, permitting it to be defeated whenever the original display is needed.

The complete schematic for the Lowerkit is shown in Figure 1 (p. 36). The VDG is intercepted and connected to several outboard integrated circuits. The actual external selection is done by a pair of multiplexers (Z5 and Z6, type 74LS157). A multiplexer is similar to a traffic light — only one group of data vehicles may pass through the electronic intersection at a time. In this example, eight data lines are switched from the internal mode (multiplexer A inputs, pins 2, 5, 11 and 14) to the external character generator (multiplexer B inputs, pins 3, 6, 10 and 13). In charge of selection is data bit 7 (DD7, pin 40 of the original VDG connection) together with the alphanumeric/graphic select line (A*/G, pin 35). When alphanumeric mode is chosen, the signal from DD7 (inverted by the 74LS04, Z4) passes through the 74LS125 buffer (Z8).

I'll first describe the creation of the semigraphic display, which forms an electronically "normal" computer. If DD7 is high, semigraphics are selected; the multiplexers Z5 and Z6 connect the A inputs to the Y outputs (pins 4, 7, 9 and 12). By following data lines DD0 through DD6 from the socket, you can see that these seven signals pass through the multiplexer directly to the VDG. The eighth A input is held high, passing through an inverter, and opening up one Z8 buffer to the INV signal (pin 32) and the INT*/EXT signal (pin 31).

In other words, when semigraphics are selected, all signals move normally to the VDG, as if no external circuits were in place. The computer reacts like an unmodified Color Computer. The situation is the same when high-resolution graphics are selected (A*/G high).

*Please turn the page*

### Parts List

| | |
|---|---|
| Z1 | 2716–1 EPROM, used as character generator |
| Z2 | 745LS93 counter |
| Z3 | 74LS73 flip flop |
| Z4 | 74LS04 inverter |
| Z5 | 74LS157 multiplexer |
| Z6 | 74LS157 multiplexer |
| Z7 | 74LS 86 exclusive-OR gate |
| Z8 | 74LS125 tri-state buffer |
| C1–C3 | 0.1 mF bypass capacitors |
| R1–R2 | 1k ohm, ¼ watt resistor |
| R3 | 470 ohm, ¼ watt resistor |

Miscellaneous:
24-pin integrated circuit socket
40-pin integrated circuit socket
40 standoff pins (Snap-Strips)

Optional:

| | |
|---|---|
| R4 | 1K ohm, ¼ watt resistor |
| S1 | SPST toggle switch |

### Part Availability

Available from Green Mountain Micro, Roxbury, VT 05569, telephone (802) 485-6112:

Assembled and tested Lowerkit, $79.95
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2716-1 EPROM with standard character generator, $20.00
CHARIT programming software on tape, $15.00
EPROM programming from a CHARIT tape, $25.00
Samtec Snap-Strips, 7 cents per pin

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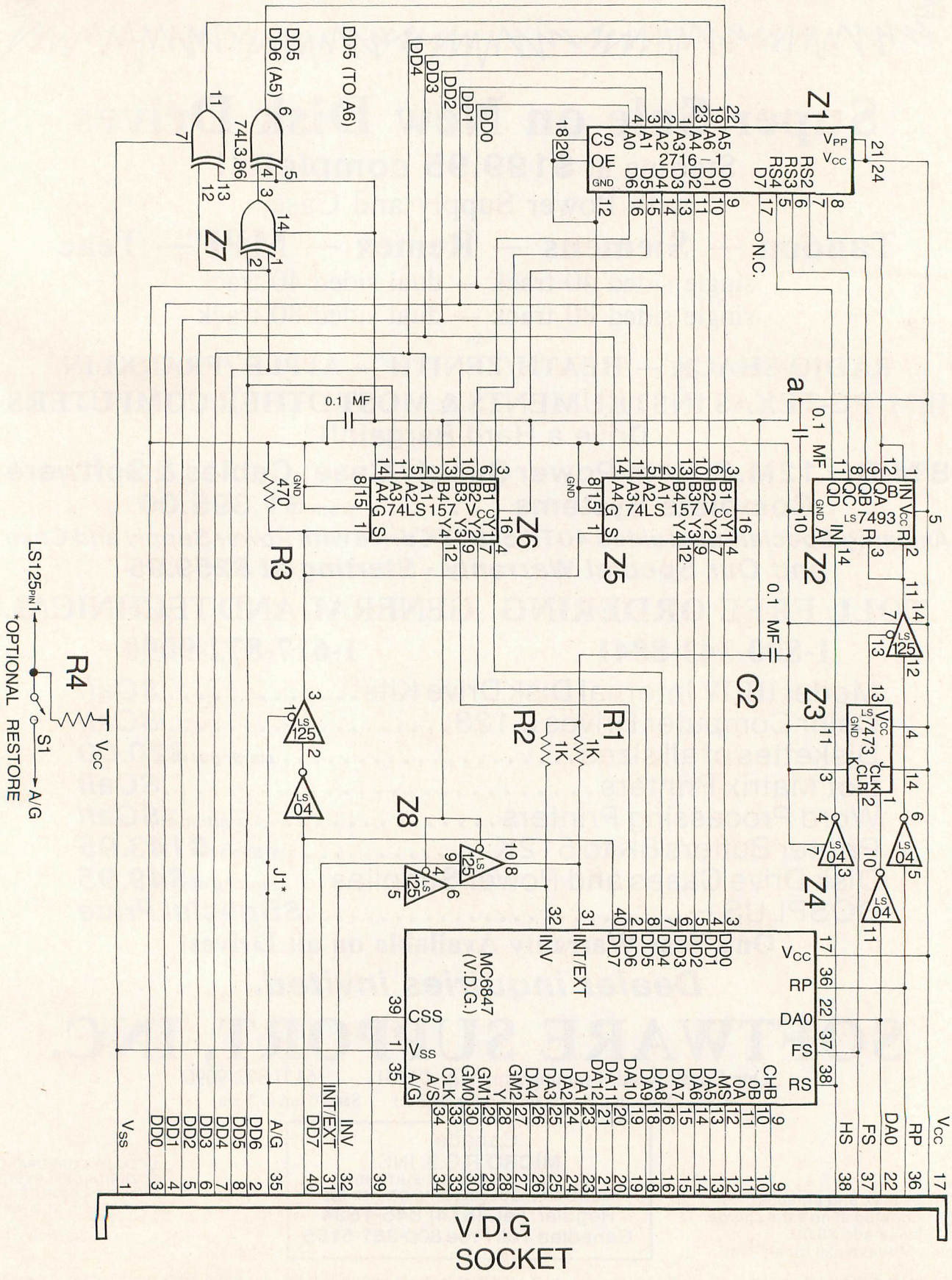
*Figure 1. Complete schematic for the Lowerkit. Optional restore switch is recommended to use non-standard alpha-numeric display software such as the Audio Spectrum Analyzer.*



Continued from page 34

When DD7 goes low — which happens when alphanumerics are to be printed on the screen — the B inputs of multiplexers Z5 and Z6 are connected to the Y outputs, and routed to the VDG. Seven dots are output from character generator (Z1) lines D0 to D6, as selected by the address inputs A0 to A6 (more on this arrangement later). The computer's video display is made up of 16 lines of 32 characters; each character is created from 12 rows of dots and eight columns of dots. Because Z1 must know which set of dots to output to the screen for each line, a counter is set up which counts from 1 to 12 in binary. Each dot row is selected in turn.

The counting is carried off by the combination of a 74LS93 binary counter (Z2) and a 74LS73 flip flop (Z4). Z2 normally counts from one to 16; display scan lines are selected one at a time by a horizontal synchronization clock (HS*) coming from the computer socket's pin 38. The count is properly reset by a row preset pulse (RP*, pin 36), so that the count never gets to 16, restarting from zero after character row 12. Counting through characters stops completely when the video display beam is off the screen; the field sync (FS*, pin 37) guides the Z2 in doing this. Counting begins again when the first character to be displayed on the screen is fetched from memory, initiated by DA0 (pin 22).

The final electronic work must deal with the conversion process accomplished by the Basic software. As I mentioned earlier, the internal character generator only uses six bits of data to create 64 characters, and these characters are arranged differently from the normal ASCII positions. I had two options: to rearrange the character generator at the time of programming, or to provide an electronic rearrangement. Though it might have saved an integrated circuit to select the non-standard pattern for the character generator ROM, I chose to perform the electronic rearrangement. The purpose was to accommodate commercial character generators, for those who wished to used them.

To make the character generator look like the VDG, then, the lowercase must be swapped with the control characters, and numbers swapped with lowercase; uppercase remains the same. The 74LS86 XOR gate (Z7) configured as an exclusive-NOR gate swaps the signals that enter address line 5; DD5 is inverted and given to address line 6.

What does it all mean? Simply that the

Please turn the page

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Lowerkit can be installed in the TRS-80 Color Computer to provide the advantage of lowercase or special characters without the loss of any alphanumeric, graphic, or high-resolution modes.

## The Saga Continues

(Commercial ends; fade in theme music.) Having successfully designed the circuit and debugged the prototype using a Motorola 5 x 7 6670-family character generator pulled from a Model I TRS-80, I confidently ordered samples of a 7 x 9 66700-family generator — theoretically the same family. A preliminary version of the Lowerkit had already been published in a microcomputer magazine, so time was short. Next came drawing a printed circuit board. The character generator samples worked; together with Mike Barton of MSB Electronics, I ordered 500 circuit boards, plus parts. We were anxious to ship the new Lowerkits.

Alas, Motorola's off-the-shelf character generators didn't work as well as the samples. The screen glistened and flickered. Sometimes the letters gave 'way to a screen filled with random blocks and characters. I double-checked specifications; nothing looked wrong, but the character generators were acting peculiar. More Motorola samples were ordered. Some worked, some didn't. Cutting into the side of the character generator and soldering on a wire leading to ground helped, but that certainly wasn't appropriate for a commercial, production product.

The character generator's access time, specified at 350 nS, was too slow! My panicked calls threaded from office to office at Motorola, eventually ending up connected to an engineer who sheepishly admitted that Motorola couldn't get the parts to meet specifications. Instead, they had changed the specifications to reflect the slower 550 nS speed! We were stuck with thousands of dollars of useless stock. (Pathetic music under; low strings, brass.)

We ordered up a passel of fast 2716 EPROMs, and I spent hours creating my own character sets. They worked. Orders went out with 24 trace cuts and wire jumpers, and a certificate for exchange when new printed circuit boards were ready. Cash and enthusiasm disappeared rapidly, but the Lowerkits were finally done. And there were 10 different character EPROMs and character creation software, besides. Things started looking up... (Music brightens, then out).

*Please turn to page 42*

*Table 1. The arrangement for programming a single character, the memory map for all characters, and the technical specifications for the 2716 EPROM used in the Lowerkit.*

Each character is programmed in a 7 x 12 dot matrix:

```
0 X X X X X X X = Byte 1
0 X X X X X X X = Byte 2
0 X X X X X X X = Byte 3
0 X X X X X X X = Byte 4
0 X X X X X X X = Byte 5
0 X X X X X X X = Byte 6
0 X X X X X X X = Byte 7
0 X X X X X X X = Byte 8
0 X X X X X X X = Byte 9
0 X X X X X X X = Byte 10
0 X X X X X X X = Byte 11
0 X X X X X X X = Byte 12
1 1 1 1 1 1 1 1 = Byte 13
1 1 1 1 1 1 1 1 = Byte 14
1 1 1 1 1 1 1 1 = Byte 15
1 1 1 1 1 1 1 1 = Byte 16
```

Bit 7 is always zero; bytes 13 through 16 can remain unprogrammed in the 2716. The character generator must have an access time of 350 nS or less (2716-1 or 27A16). The pinout is used in the following fashion:

| | |
|---|---|
| 1–ASCII bit 3 | 24–Vcc, +5 volts |
| 2–ASCII bit 2 | 23–ASCII bit 4 |
| 3–ASCII bit 1 | 22–ASCII bit 5 |
| 4–ASCII bit 0 | 21–Vpp (to Vcc) |
| 5–Screen Row Select 3 | 20–Chip Select |
| 6–Screen Row Select 2 | 19–ASCII bit 6 |
| 7–Screen Row Select 1 | 18–Output Enable |
| 8–Screen Row Select 0 | 17–Column 0 (NC) |
| 9–Dot Column 1 | 16–Dot Column 7 |
| 10–Dot Column 2 | 15–Dot Column 6 |
| 11–Dot Column 3 | 14–Dot Column 5 |
| 12–Ground | 13–Dot Column 4 |

The ROM character memory map must be in this format:

```
Bytes 000–1FF = Special Characters (hex 00–1F)
Bytes 200–3FF = Numbers & Symbols (hex 20–3F)
Bytes 400–5FF = ASCII Uppercase (hex 40–5F)
Bytes 600–7FF = ASCII Lowercase (hex 60–7F)
```

*Table 2. Data used to program a 2716 EPROM for use as a Lowerkit character generator. The set created here is the APL character set (see the samples).*

```
CHARACTER 0 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 1 = DATA 34 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 2 = DATA 16 , 8 , 4 , 4 , 4 , 4 , 4 , 8 , 16 , 0 , 0 , 0
CHARACTER 3 = DATA 2 , 4 , 8 , 16 , 32 , 16 , 8 , 4 , 2 , 0 , 0 , 0
CHARACTER 4 = DATA 2 , 4 , 8 , 16 , 32 , 16 , 8 , 4 , 2 , 127 , 0 , 0
CHARACTER 5 = DATA 0 , 0 , 0 , 127 , 0 , 127 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 6 = DATA 32 , 16 , 8 , 4 , 2 , 4 , 8 , 16 , 32 , 0 , 0 , 0
CHARACTER 7 = DATA 28 , 4 , 4 , 4 , 4 , 4 , 4 , 4 , 28 , 0 , 0 , 0
CHARACTER 8 = DATA 0 , 65 , 65 , 34 , 34 , 20 , 20 , 8 , 0 , 0 , 0 , 0
CHARACTER 9 = DATA 0 , 8 , 20 , 20 , 34 , 34 , 65 , 65 , 0 , 0 , 0 , 0
CHARACTER 10 = DATA 0 , 1 , 2 , 127 , 8 , 127 , 32 , 64 , 0 , 0 , 0 , 0
CHARACTER 11 = DATA 0 , 0 , 8 , 0 , 127 , 0 , 8 , 0 , 0 , 0 , 0 , 0
CHARACTER 12 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 12 , 12 , 4 , 8 , 0
CHARACTER 13 = DATA 0 , 8 , 8 , 8 , 127 , 8 , 8 , 8 , 0 , 0 , 0 , 0
CHARACTER 14 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 12 , 12 , 0 , 0 , 0
CHARACTER 15 = DATA 0 , 1 , 2 , 4 , 8 , 16 , 32 , 64 , 0 , 0 , 0 , 0
CHARACTER 16 = DATA 62 , 65 , 67 , 69 , 73 , 81 , 97 , 65 , 62 , 0 , 0 , 0
CHARACTER 17 = DATA 8 , 24 , 8 , 8 , 8 , 8 , 8 , 8 , 28 , 0 , 0 , 0
CHARACTER 18 = DATA 62 , 65 , 1 , 1 , 30 , 32 , 64 , 64 , 127 , 0 , 0 , 0
CHARACTER 19 = DATA 62 , 65 , 1 , 1 , 62 , 1 , 1 , 65 , 62 , 0 , 0 , 0
CHARACTER 20 = DATA 2 , 6 , 10 , 18 , 34 , 66 , 127 , 2 , 2 , 0 , 0 , 0
CHARACTER 21 = DATA 127 , 64 , 64 , 64 , 126 , 1 , 1 , 1 , 126 , 0 , 0 , 0
CHARACTER 22 = DATA 62 , 65 , 64 , 64 , 126 , 65 , 65 , 65 , 62 , 0 , 0 , 0
CHARACTER 23 = DATA 127 , 65 , 1 , 2 , 4 , 8 , 8 , 8 , 8 , 0 , 0 , 0
CHARACTER 24 = DATA 62 , 65 , 65 , 65 , 62 , 65 , 65 , 65 , 62 , 0 , 0 , 0
CHARACTER 25 = DATA 62 , 65 , 65 , 65 , 63 , 1 , 1 , 65 , 62 , 0 , 0 , 0
```

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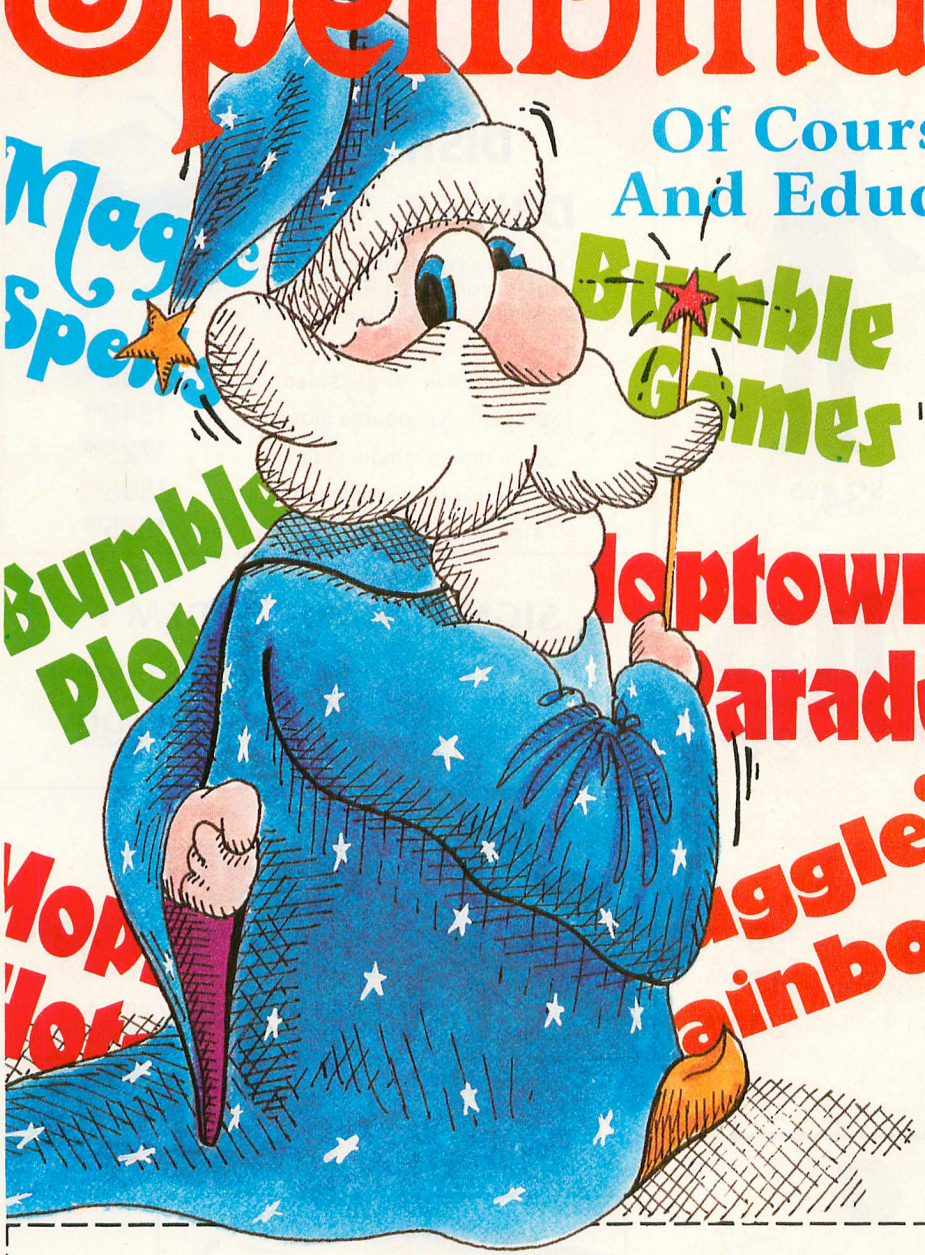


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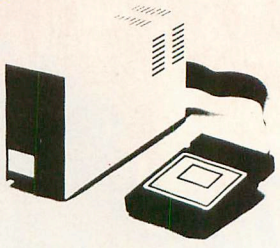

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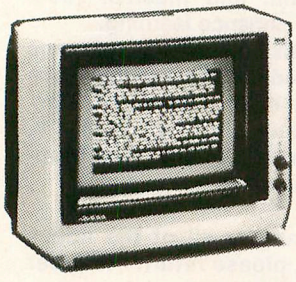

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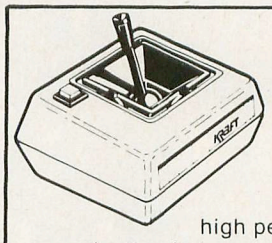

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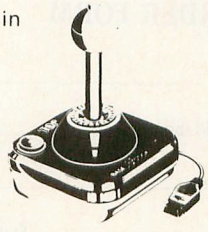

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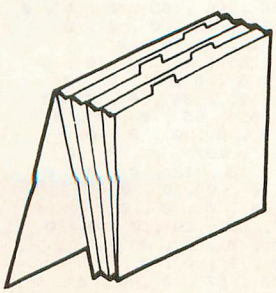

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## Building and Installing the Lowerkit

Construction of the Lowerkit is simple. Since it is fairly noise-free, wire-wrap or point-to-point wiring is fine. However, creating a set of feed-through pins is a little tricky.One method is to obtain a 40-pin wire-wrap socket, and insert it in a circuit board so the pins protrude 5/16 inch below the board. Solder them in place, then cut the top of the socket off, leaving the pins to extend upward as much as possible. The upper pins may then be wire-wrapped from above, and the construction completed. The other method is to purchase some Snap-Strips (made by Samtec; see parts list), which are specifically designed for this type of application.

The EPROM is programmed according to the arrangement shown in Table 1; a 7 x 9 character set is shown in Table 2. Finally, a program to create 7 x 9 characters is given in Listing 1.

A complete Lowerkit built from a circuit board is pictured in Photo 1. The compact 2 1/4 by 4 1/2 inch circuit board (available from Green Mountain Micro — see parts list) is designed to fit inside Color Computers, around the support post, through revision E.

```
CHARACTER 26 = DATA 4 , 8 , 16 , 16 , 16 , 16 , 16 , 8 , 4 , 0 , 0 , 0
CHARACTER 27 = DATA 28 , 16 , 16 , 16 , 16 , 16 , 16 , 16 , 28 , 0 , 0 , 0
CHARACTER 28 = DATA 0 , 0 , 0 , 0 , 12 , 12 , 0 , 12 , 12 , 4 , 8 , 0
CHARACTER 29 = DATA 0 , 0 , 0 , 34 , 20 , 8 , 20 , 34 , 0 , 0 , 0 , 0
CHARACTER 30 = DATA 0 , 0 , 0 , 0 , 12 , 12 , 0 , 12 , 12 , 0 , 0 , 0
CHARACTER 31 = DATA 0 , 64 , 32 , 16 , 8 , 4 , 2 , 1 , 0 , 0 , 0 , 0
CHARACTER 32 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 33 = DATA 8 , 8 , 8 , 8 , 8 , 8 , 0 , 8 , 8 , 0 , 0 , 0
CHARACTER 34 = DATA 36 , 36 , 36 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 35 = DATA 20 , 20 , 20 , 127 , 20 , 127 , 20 , 20 , 20 , 0 , 0 , 0
CHARACTER 36 = DATA 20 , 63 , 84 , 84 , 62 , 21 , 21 , 126 , 20 , 0 , 0 , 0
CHARACTER 37 = DATA 32 , 81 , 34 , 4 , 8 , 16 , 34 , 69 , 2 , 0 , 0 , 0
CHARACTER 38 = DATA 56 , 68 , 68 , 40 , 16 , 41 , 70 , 70 , 57 , 0 , 0 , 0
CHARACTER 39 = DATA 12 , 12 , 8 , 16 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 40 = DATA 4 , 8 , 16 , 16 , 16 , 16 , 16 , 8 , 4 , 0 , 0 , 0
CHARACTER 41 = DATA 16 , 8 , 4 , 4 , 4 , 4 , 4 , 8 , 16 , 0 , 0 , 0
CHARACTER 42 = DATA 8 , 73 , 42 , 28 , 127 , 28 , 42 , 73 , 8 , 0 , 0 , 0
CHARACTER 43 = DATA 0 , 8 , 8 , 8 , 127 , 8 , 8 , 8 , 0 , 0 , 0 , 0
CHARACTER 44 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 24 , 24 , 16 , 32 , 0
CHARACTER 45 = DATA 0 , 0 , 0 , 0 , 127 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 46 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 24 , 24 , 0 , 0 , 0
CHARACTER 47 = DATA 0 , 1 , 2 , 4 , 8 , 16 , 32 , 64 , 0 , 0 , 0 , 0
CHARACTER 48 = DATA 62 , 65 , 67 , 69 , 73 , 81 , 97 , 65 , 62 , 0 , 0 , 0
CHARACTER 49 = DATA 8 , 24 , 40 , 8 , 8 , 8 , 8 , 62 , 0 , 0 , 0 , 0
CHARACTER 50 = DATA 62 , 65 , 1 , 1 , 30 , 32 , 64 , 64 , 127 , 0 , 0 , 0
CHARACTER 51 = DATA 62 , 65 , 1 , 1 , 30 , 1 , 1 , 65 , 62 , 0 , 0 , 0
CHARACTER 52 = DATA 2 , 6 , 10 , 18 , 34 , 66 , 127 , 2 , 2 , 0 , 0 , 0
CHARACTER 53 = DATA 127 , 64 , 64 , 64 , 126 , 1 , 1 , 65 , 62 , 0 , 0 , 0
CHARACTER 54 = DATA 30 , 32 , 64 , 64 , 126 , 65 , 65 , 65 , 62 , 0 , 0 , 0
CHARACTER 55 = DATA 127 , 65 , 2 , 4 , 8 , 16 , 16 , 16 , 16 , 0 , 0 , 0
CHARACTER 56 = DATA 62 , 65 , 65 , 65 , 62 , 65 , 65 , 65 , 62 , 0 , 0 , 0
CHARACTER 57 = DATA 62 , 65 , 65 , 65 , 63 , 1 , 1 , 2 , 60 , 0 , 0 , 0
CHARACTER 58 = DATA 0 , 0 , 0 , 24 , 24 , 0 , 0 , 24 , 24 , 0 , 0 , 0
CHARACTER 59 = DATA 0 , 0 , 0 , 24 , 24 , 0 , 0 , 24 , 24 , 16 , 32 , 0
CHARACTER 60 = DATA 4 , 8 , 16 , 32 , 64 , 32 , 16 , 8 , 4 , 0 , 0 , 0
CHARACTER 61 = DATA 0 , 0 , 0 , 0 , 62 , 0 , 62 , 0 , 0 , 0 , 0 , 0
CHARACTER 62 = DATA 16 , 8 , 4 , 2 , 1 , 2 , 4 , 8 , 16 , 0 , 0 , 0
CHARACTER 63 = DATA 30 , 33 , 33 , 1 , 6 , 8 , 8 , 0 , 8 , 0 , 0 , 0
CHARACTER 64 = DATA 0 , 8 , 20 , 34 , 65 , 34 , 20 , 8 , 0 , 0 , 0 , 0
CHARACTER 65 = DATA 28 , 34 , 65 , 65 , 65 , 127 , 65 , 65 , 65 , 0 , 0 , 0
CHARACTER 66 = DATA 126 , 65 , 65 , 65 , 126 , 65 , 65 , 65 , 126 , 0 , 0 , 0
CHARACTER 67 = DATA 30 , 33 , 65 , 64 , 64 , 64 , 64 , 33 , 30 , 0 , 0 , 0
CHARACTER 68 = DATA 124 , 66 , 65 , 65 , 65 , 65 , 65 , 66 , 124 , 0 , 0 , 0
CHARACTER 69 = DATA 127 , 64 , 64 , 64 , 126 , 64 , 64 , 64 , 127 , 0 , 0 , 0
CHARACTER 70 = DATA 127 , 64 , 64 , 64 , 126 , 64 , 64 , 64 , 64 , 0 , 0 , 0
CHARACTER 71 = DATA 30 , 33 , 64 , 64 , 64 , 71 , 65 , 35 , 29 , 0 , 0 , 0
CHARACTER 72 = DATA 65 , 65 , 65 , 65 , 127 , 65 , 65 , 65 , 65 , 0 , 0 , 0
CHARACTER 73 = DATA 28 , 8 , 8 , 8 , 8 , 8 , 8 , 8 , 28 , 0 , 0 , 0
CHARACTER 74 = DATA 7 , 2 , 2 , 2 , 2 , 2 , 66 , 66 , 60 , 0 , 0 , 0
CHARACTER 75 = DATA 65 , 66 , 68 , 72 , 80 , 104 , 68 , 66 , 65 , 0 , 0 , 0
CHARACTER 76 = DATA 64 , 64 , 64 , 64 , 64 , 64 , 64 , 64 , 127 , 0 , 0 , 0
CHARACTER 77 = DATA 65 , 99 , 85 , 85 , 93 , 73 , 73 , 65 , 65 , 0 , 0 , 0
CHARACTER 78 = DATA 65 , 97 , 81 , 73 , 69 , 67 , 65 , 65 , 65 , 0 , 0 , 0
CHARACTER 79 = DATA 28 , 34 , 65 , 65 , 65 , 65 , 65 , 34 , 28 , 0 , 0 , 0
CHARACTER 80 = DATA 126 , 65 , 65 , 65 , 126 , 64 , 64 , 64 , 64 , 0 , 0 , 0
CHARACTER 81 = DATA 28 , 34 , 65 , 65 , 65 , 65 , 93 , 34 , 29 , 0 , 0 , 0
CHARACTER 82 = DATA 126 , 65 , 65 , 65 , 126 , 72 , 68 , 66 , 65 , 0 , 0 , 0
CHARACTER 83 = DATA 62 , 65 , 64 , 64 , 62 , 1 , 1 , 65 , 62 , 0 , 0 , 0
CHARACTER 84 = DATA 127 , 8 , 8 , 8 , 8 , 8 , 8 , 8 , 8 , 0 , 0 , 0
CHARACTER 85 = DATA 65 , 65 , 65 , 65 , 65 , 65 , 65 , 65 , 62 , 0 , 0 , 0
CHARACTER 86 = DATA 65 , 65 , 65 , 34 , 34 , 20 , 20 , 8 , 8 , 0 , 0 , 0
CHARACTER 87 = DATA 65 , 65 , 65 , 73 , 73 , 73 , 85 , 85 , 34 , 0 , 0 , 0
CHARACTER 88 = DATA 65 , 65 , 34 , 20 , 8 , 20 , 34 , 65 , 65 , 0 , 0 , 0
CHARACTER 89 = DATA 65 , 65 , 34 , 34 , 20 , 8 , 8 , 8 , 8 , 0 , 0 , 0
CHARACTER 90 = DATA 127 , 1 , 2 , 4 , 8 , 16 , 32 , 64 , 127 , 0 , 0 , 0
CHARACTER 91 = DATA 12 , 16 , 16 , 16 , 32 , 16 , 16 , 16 , 12 , 0 , 0 , 0
CHARACTER 92 = DATA 0 , 0 , 1 , 1 , 127 , 1 , 1 , 0 , 0 , 0 , 0 , 0
CHARACTER 93 = DATA 24 , 4 , 4 , 4 , 2 , 4 , 4 , 4 , 24 , 0 , 0 , 0
CHARACTER 94 = DATA 20 , 62 , 85 , 84 , 62 , 21 , 85 , 62 , 20 , 0 , 0 , 0
CHARACTER 95 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 96 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 97 = DATA 0 , 0 , 0 , 58 , 70 , 68 , 68 , 70 , 57 , 0 , 0 , 0
CHARACTER 98 = DATA 8 , 8 , 8 , 8 , 8 , 8 , 8 , 8 , 62 , 0 , 0 , 0
CHARACTER 99 = DATA 0 , 28 , 34 , 34 , 34 , 34 , 34 , 34 , 0 , 0 , 0 , 0
```

Installation in the new revision (called E1, E2, F, 285 or — as Radio Shack dubs it — NC) is a little trickier. The VDG has been moved slightly, and the computer's plastic support post is once again in the way. Rather than redesign the board (again!), I opted for instructions on how to cut out the support post. Here they are:

1. Clamp a single-edged razor blade in the jaw of a heavy pair of pliers, and

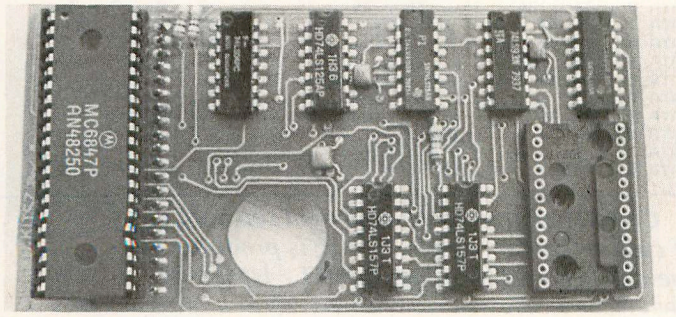


*Photo 1. Lowerkit circuit board, as designed for the original Color Computer circuit boards. By altering a support post and metal cage, late-model Color Computers can accept this plug-in lower case module.*

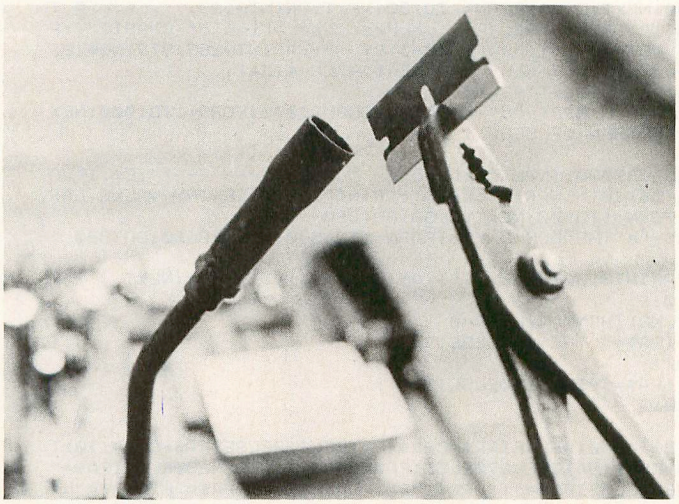

*Photo 2. Holding a razor blade between heavy pliers, and heating it with a propane torch.*

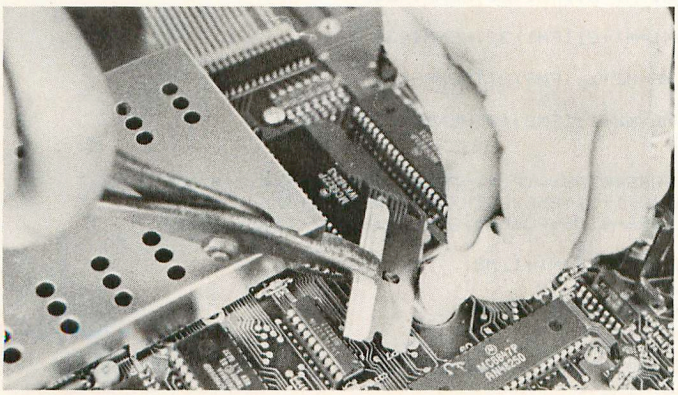

*Photo 3. Melting through the support post with a hot razor blade. The soft plastic melts easily, and the support will pull directly out.*

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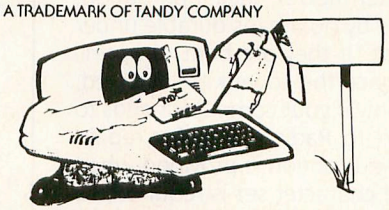

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heat the razor blade in a propane torch (Photo 2).

2. Hold the support post, and press the hot blade against it. It should take two heatings of the blade to melt cleanly through the post (Photo 3).

3. Lift the post off and clean out any plastic bits that may have dropped off.

Next, the memory case cover has to be trimmed slightly to fit. Pull the case straight up, with firmness. The metal straps bent underneath will eventually let go. On the back left corner of this metal cage, mark out a rectangle 1/2 inch side-to-side, and 1 3/4 inches front to back. With metal snips and pliers, trim and bend the metal cage to this new shape. Replace the metal shield, slide your hand under the board, and bend the metal tabs over. The Lowerkit will not fit in place conveniently; see Photo 4. If you don't live in an apartment building, and if the rest of your family doesn't object, you can remove the shield completely. It will increase the radio-frequency interference (surprisingly little, I discovered), but will make installation easier.

*"The Lowerkit character generator can create many unique characters or combinations."*

Now a word about the Snap-Strips. These are terrific for their application, but they are by no means durable under constant use. If they are bent, they will break; so once the Lowerkit is inserted, remove it only if your computer needs to be returned to Radio Shack for repair. The switch-out option is provided when the original character set is required, so removing the Lowerkit is not necessary.

Carpentry for the switch-out option is simple. An ordinary SPST switch of the type sold by Radio Shack (number 275-624) fits admirably between the cassette and serial jacks at the back of the computer. Just snap off the plastic piece on the case top, and fasten the switch between the two jacks.

## Final Comments

The Lowerkit character generator, being a simple programmable memory, can create many unique characters or combinations. Aside from the sets which I've created — game characters, Kata Kana, European, APL, math symbols, Greek, etc. — you can make up customized symbols for displays, games, etc. By using a low-insertion-force socket or ex-

```
CHARACTER 100 = DATA 16 , 16 , 16 , 16 , 16 , 16 , 16 , 16 , 16 , 28 , 0 , 0
CHARACTER 101 = DATA 0 , 0 , 0 , 28 , 32 , 60 , 32 , 32 , 30 , 0 , 0 , 0
CHARACTER 102 = DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 127 , 0 , 0
CHARACTER 103 = DATA 0 , 127 , 65 , 34 , 34 , 20 , 20 , 8 , 0 , 0 , 0 , 0
CHARACTER 104 = DATA 0 , 8 , 20 , 20 , 34 , 34 , 65 , 127 , 0 , 0 , 0 , 0
CHARACTER 105 = DATA 0 , 0 , 0 , 24 , 8 , 8 , 8 , 12 , 0 , 0 , 0 , 0
CHARACTER 106 = DATA 28 , 20 , 28 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 107 = DATA 12 , 12 , 12 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 108 = DATA 127 , 65 , 65 , 65 , 65 , 65 , 65 , 65 , 127 , 0 , 0 , 0
CHARACTER 109 = DATA 8 , 8 , 8 , 8 , 8 , 8 , 8 , 8 , 8 , 8 , 0 , 0
CHARACTER 110 = DATA 0 , 0 , 0 , 28 , 16 , 16 , 16 , 16 , 16 , 0 , 0 , 0
CHARACTER 111 = DATA 0 , 0 , 0 , 28 , 34 , 34 , 34 , 28 , 0 , 0 , 0 , 0
CHARACTER 112 = DATA 8 , 8 , 28 , 127 , 62 , 28 , 54 , 99 , 0 , 0 , 0 , 0
CHARACTER 113 = DATA 28 , 34 , 34 , 2 , 4 , 8 , 8 , 0 , 8 , 0 , 0 , 0
CHARACTER 114 = DATA 0 , 0 , 0 , 28 , 34 , 34 , 34 , 60 , 32 , 32 , 32 , 32
CHARACTER 115 = DATA 28 , 16 , 16 , 16 , 16 , 16 , 16 , 16 , 16 , 16 , 0 , 0
CHARACTER 116 = DATA 0 , 0 , 0 , 48 , 73 , 6 , 0 , 0 , 0 , 0 , 0 , 0
CHARACTER 117 = DATA 8 , 8 , 8 , 8 , 8 , 8 , 62 , 28 , 8 , 0 , 0 , 0
CHARACTER 118 = DATA 0 , 34 , 34 , 34 , 34 , 34 , 34 , 28 , 0 , 0 , 0 , 0
CHARACTER 119 = DATA 0 , 0 , 0 , 34 , 65 , 73 , 73 , 73 , 54 , 0 , 0 , 0
CHARACTER 120 = DATA 0 , 0 , 0 , 62 , 1 , 1 , 1 , 62 , 0 , 0 , 0 , 0
CHARACTER 121 = DATA 8 , 28 , 62 , 8 , 8 , 8 , 8 , 8 , 8 , 0 , 0 , 0
CHARACTER 122 = DATA 0 , 0 , 0 , 62 , 64 , 64 , 64 , 62 , 0 , 0 , 0 , 0
CHARACTER 123 = DATA 0 , 0 , 16 , 48 , 127 , 48 , 16 , 0 , 0 , 0 , 0 , 0
CHARACTER 124 = DATA 0 , 0 , 64 , 64 , 127 , 64 , 64 , 0 , 0 , 0 , 0 , 0
CHARACTER 125 = DATA 0 , 0 , 4 , 6 , 127 , 6 , 4 , 0 , 0 , 0 , 0 , 0
CHARACTER 126 = DATA 32 , 16 , 8 , 4 , 2 , 4 , 8 , 16 , 32 , 127 , 0 , 0
CHARACTER 127 = DATA 0 , 0 , 0 , 0 , 127 , 0 , 0 , 0 , 0 , 0 , 0 , 0
```

***Listing 1. CHARIT character development software eases design of custom character sets. A tape is produced containing the character set by using <SHIFT> Up Arrow.***

```
10 PMODE0:PCLEAR1:CLEAR500:DIMA$(128):DIMA(12,12):CLS:PRINTSTRIN
G$(32,164):PRINT:PRINT:PRINT:X=0:Q=0:Q1=0:B=0:C=0:M1=0:M2=0:S=0:
U=1
30 PRINT"        *  C H A R I T  *":PRINT:PRINT"Lowerkit ROM Dev
elopment Program";:PRINT:PRINT"        Copyright (C) 1981":PRINT"
      Green Mountain Micro":PRINT"      Roxbury, Vermont 05669":P
RINT@480,STRING$(31,161);:POKE1535,161:SCREEN0,1
40 FORN=1TO2000:NEXT:CLS0:FORN=1TO100:NEXT:PRINT@129,"        A T
 T E N T I O N !":PRINT@193,"For correct operation of CHARIT";:P
RINT@225,"  do NOT edit lines 1000-1127  ";:PRINT@289,STRING$(2,
159)"If you need help, touch "CHR$(34)"H"CHR$(34);
50 PRINTSTRING$(2,159);:TIMER=0
60 A$=INKEY$:IFA$="H"ORA$="h"THENCLS0:GOSUB2000:FORN=1TO1000:NEX
T:ELSEIFTIMER>400THEN70ELSE60
70 CLS0
80 GOSUB1000:GOSUB3000:INPUT"Character Number --------)";C$:IFVA
L(C$)>127ORVAL(C$)<0THENPRINT:PRINT:PRINT"        ENTRY VALUE ERR
OR":SCREEN0,1:FORN=1TO500:NEXT:CLS0:GOTO80
90 IFC$="H"ORC$="h"THENGOSUB2000:FORN=1TO1500:NEXT:CLS0:GOTO80
100 C=VAL(C$)
110 FORX=1TO6:PRINT@138+X*32,MID$(A$(C),(X-1)*7+1,7);:NEXT
120 M1=20:M2=10
130 IFPOINT(M1,M2)THENQ=1ELSEQ=0
140 A$=INKEY$:IFA$=""THEN150ELSE190
150 RESET(M1,M2)
160 A$=INKEY$:IFA$=""THEN170ELSE190
170 SET(M1,M2,2)
180 GOTO140
190 IFA$=CHR$(8)THEN210ELSEIFA$=CHR$(9)THEN230ELSEIFA$=CHR$(10)T
HEN250ELSEIFA$=CHR$(94)THEN270ELSEIFA$=CHR$(13)THEN290ELSEIFA$="
D"ORA$="d"THEN360ELSEIFA$="I"ORA$="i"THEN340ELSEIFA$="H"ORA$="h"
THENGOSUB2000ELSEIFA$="+"ORA$=";"THEN380ELSEIFA$="-"THEN400
200 IFA$="X"ORA$="x"THEN70ELSEIFA$=CHR$(12)THEN420ELSEIFA$=CHR$(
95)THEN500ELSE160
210 GOSUB7000:M1=M1-2:IFM1<20THENM1=20
220 GOTO130
230 GOSUB7000:M1=M1+2:IFM1>32THENM1=32
240 GOTO130
250 GOSUB7000:M2=M2+1:IFM2>21THENM2=21
260 GOTO130
270 GOSUB7000:M2=M2-1:IFM2<10THENM2=10
280 GOTO130
290 GOSUB7000
300 FORX=1TO6:FORB=0TO6:A(B,X)=PEEK(1024+138+X*32+B):NEXT:NEXT
310 Q=VARPTR(A$(C)):Q1=256*PEEK(Q+2)+PEEK(Q+3)
320 FORX=1TO6:FORB=0TO6:POKEQ1,A(B,X):Q1=Q1+1:NEXT:NEXT
330 GOTO130
340 RESET(M1,M2):RESET(M1+1,M2)
350 GOTO130
360 SET(M1,M2,2):SET(M1+1,M2,2)
370 GOTO130
380 C=C+1:IFC>127THENC=127
390 CLS0:GOSUB3000:PRINT"CHARACTER NUMBER --------)";C:GOTO110
400 C=C-1:IFC<0THENC=0
410 GOTO390
420 N$="":CLS:PRINT:PRINT:PRINT:PRINT"Enter name of file to save
.":PRINT"Hit <ENTER> to exit.":INPUT"Name of file";N$:IFN$=""THE
N70ELSEAUDIOON:CSAVEN$:PRINT"File saved.":SCREEN0,1:FORN=1TO500:
```

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## FOR THE COLOR COMPUTER AND TDP SYSTEM 100

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tender cable for the character generator, complete fonts can be popped in and out as needed. See the first page of the article for a sample of the character sets available.

## Updates

There have been many questions from new Color Computer owners about the NC-revision boards. Among them: how is the TV Buff (March issue) hooked up? Answer: Ground is soldered to the case; an easier solder point is found to the left of C28. Power is fed from the lower half of C31. Input from the computer is provided at the lower end of R44. Output goes to the user's video jack.

Looking for a good place to hook an audio output? Try TP7 on all boards through revision E; it's TP1 on revision NC. Be sure to put a 1 to 10 mF capacitor in series between the test point and the output jack. If the volume is too low, a second TV Buff will work just fine. Hook the input wire to TP7 (TP1) and send the output to your audio amp.

Next month: a professional keyboard for your Color Computer; 64K RAM and a few variants; comparison of the original color Computer boards with the new NC revision; comments and anecdotes. See you then. ■■■

```
NEXT:GOTO70
500 GOSUB7000:PRINT@480," "CHR$(34)"T"CHR$(34)" to transmit, "CH
R$(34)"X"CHR$(34)" to exit  ";
510 A$=INKEY$:IFA$="T"ORA$="t"THEN515ELSEIFA$="X"ORA$="x"THEN70E
LSE510
515 PRINT@480," Load Tape and Press <ENTER>    ";:SCREEN0,1
520 A$=INKEY$:IFA$=""THEN520ELSEIFA$()CHR$(13)THEN520ELSESCREEN0
,0:AUDIOON:OPEN"O",#-1,"CHARS":PRINT@480,"Transmitting Serial Da
ta:       ";:FORX=0TO127:PRINT@505,X;:PRINT#-1,A$(X):NEXT:CLOSE:P
RINT@506,"DONE";:SCREEN0,1:FORN=1TO1500:NEXT:GOTO70
530 GOTO530
1000 A$(0)="MOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMO
TORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORM
OTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTORMOTOR
MOTORMOTORMOTORMOTORMOTORMOTORMOTOR
```

*Lines 1000 to line 1127 hold identical data for A$ (0) to A$ (127).*

```
1127 A$(127)="CONTMOTORSETCONTMOTORSETCONTSETCONTMOTORSETCONTMOT
ORSETMOTORSETCONTMOTORSETCONTMOTORCONTMOTORSETCONTMOTORSETCONTSE
TCONTMOTORSETCONTMOTORSETMOTORSETCONTMOTORSETCONTMOTORMOTOR
1128 RETURN
2000 PRINT@116,"<ARROWS> to ";
2010 PRINT@148," move cursor";
2020 PRINT@180,"<ENTER> to  ";
2030 PRINT@212," store char.";
2040 PRINT@244,"<CLEAR> to  ";
2050 PRINT@276," save a tape";
2060 PRINT@308,"<D> = delete";
2070 PRINT@340,"<I> = insert";
2080 PRINT@372,"<+> moves to";
2090 PRINT@404," next char. ";
2100 PRINT@436,"<-> moves to";
2110 PRINT@468," prev. char.";
2120 PRINT@500,"<X> to exit";
2130 POKE1535,110:PRINT@480,"   H E L P   ";:FORX=1024+96TO1024+
448STEP32:POKEX,138:NEXT:RETURN
3000 PRINTSTRING$(3,239)"If you need help, touch "CHR$(34)"H"CHR
$(34)STRING$(2,239):RETURN
7000 IFQ=0THENRESET(M1,M2)ELSESET(M1,M2,2)
7010 RETURN
```

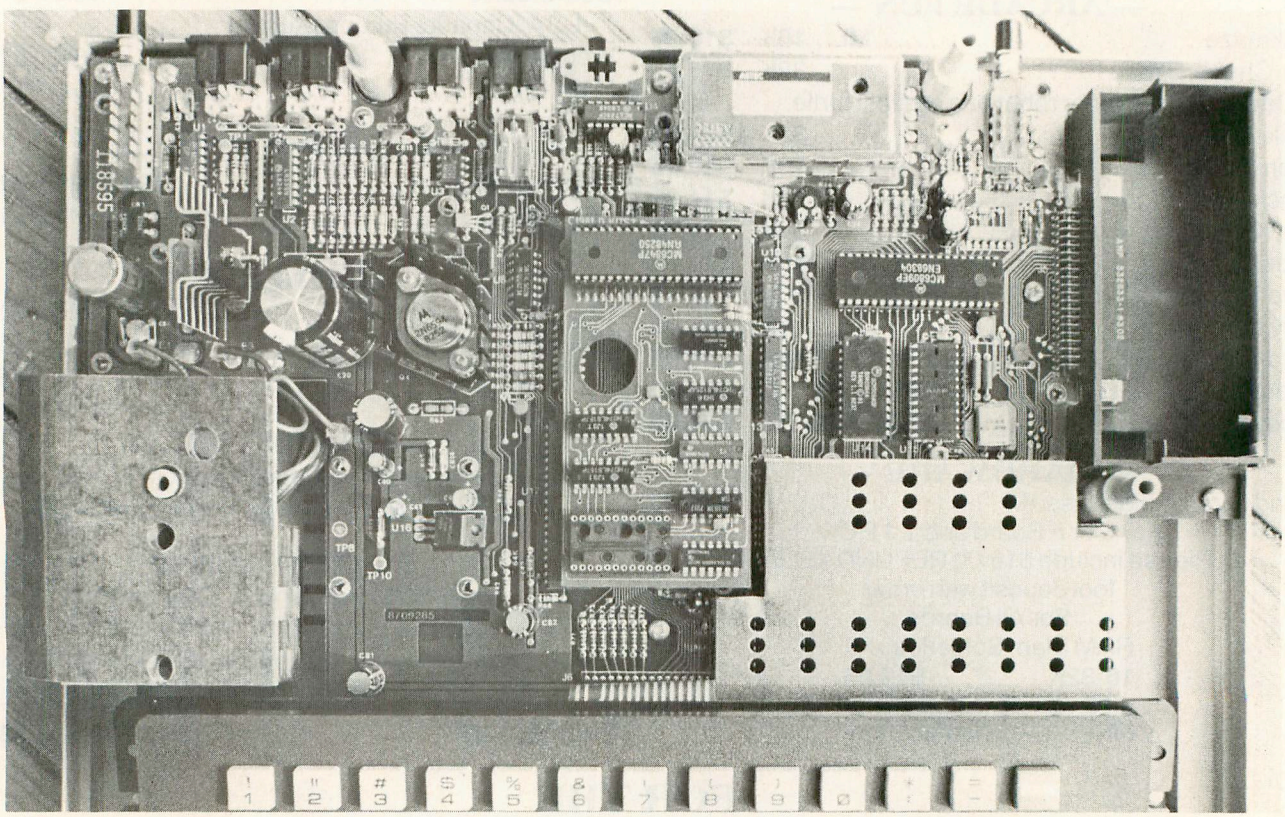

*Photo 4. The Lowerkit installed in a late-model (revision NC) Color Computer. The support post has been removed, and the metal cage remodeled to make room for the board.*

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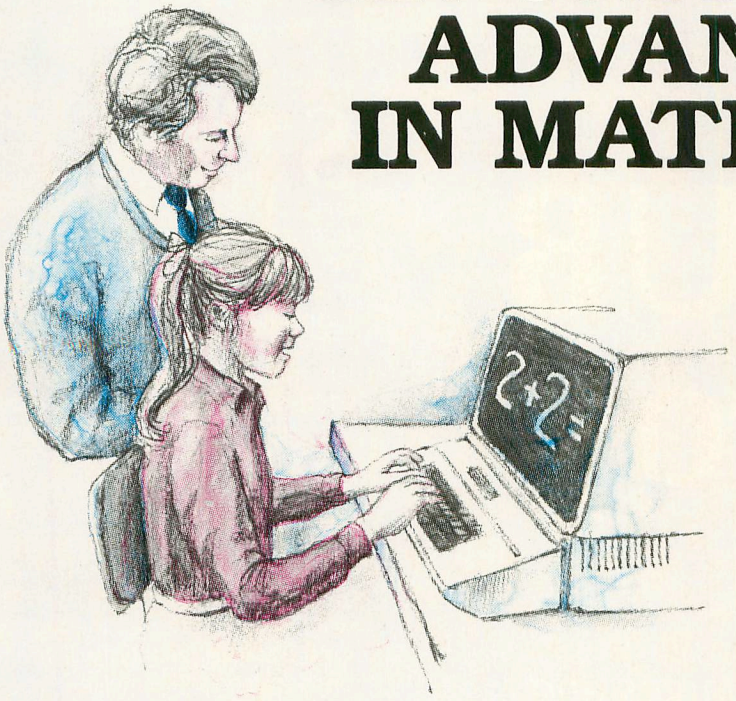


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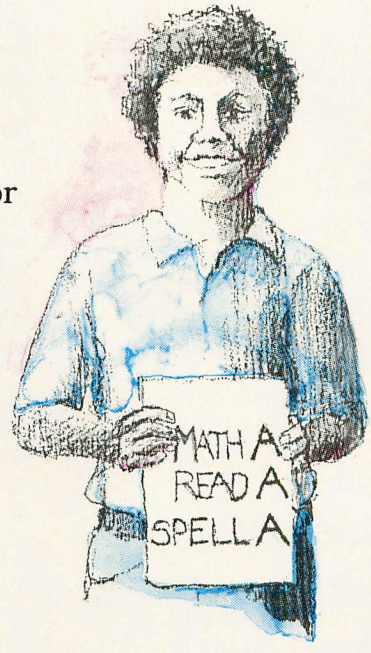


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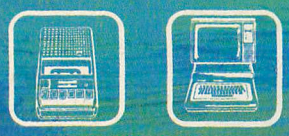


4K Color Basic

*by Robert Toscani*

# GO SUB Destroy

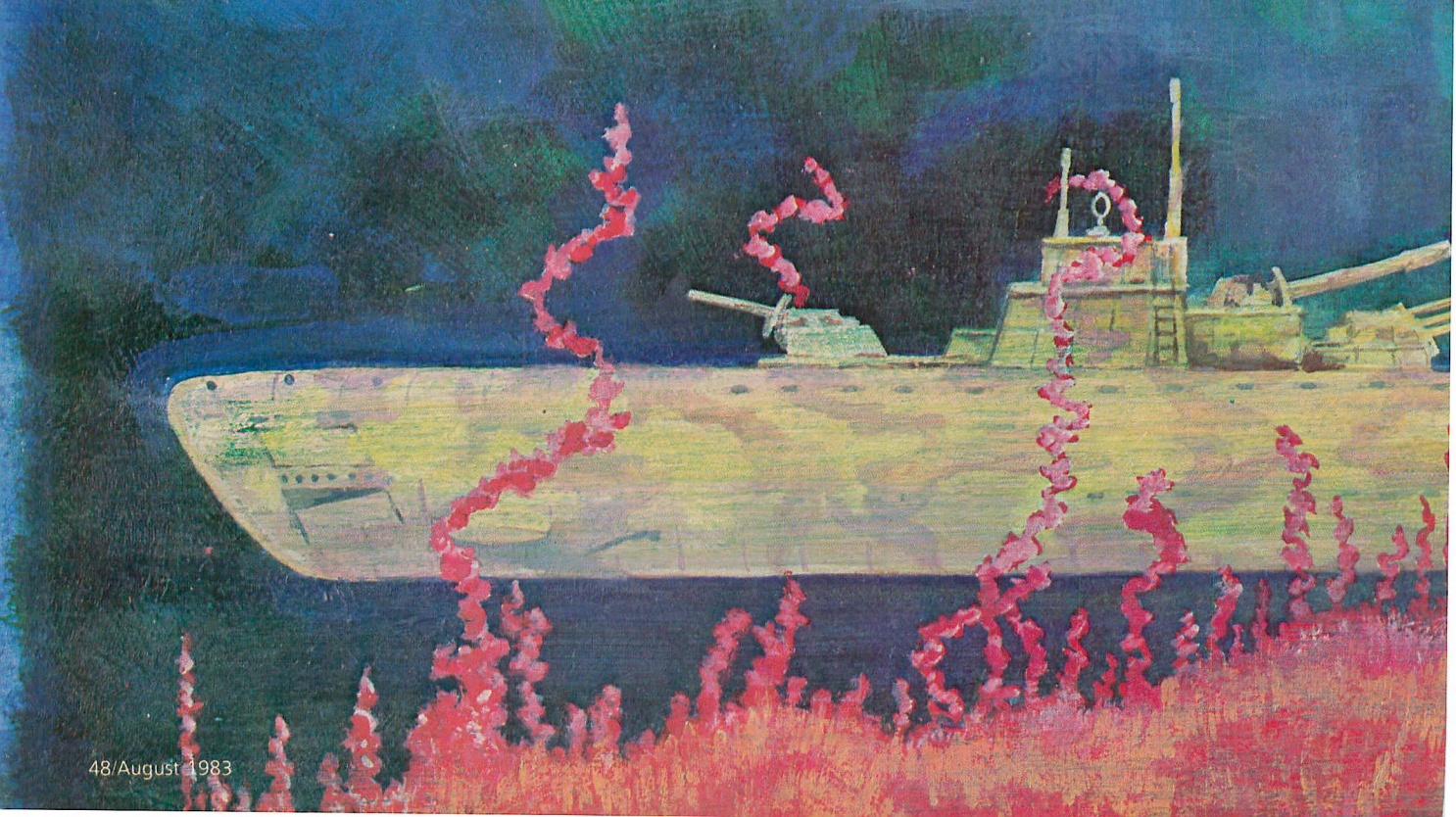
*Submarines, depth charges and excitement abound in this 4K game.*

SOME MONTHS AGO I saw a game called Sub Destroy in another computer magazine. It required 16K and Color Basic, and was a conversion from a Model I game. There were a number of things I didn't like about it, and, I thought it could fit into 4K. So, without further ado, here is 4K Sub Destroy.

There are three subs that move from left to right on your screen, and your white ship. You control your ship with the arrow keys to move left and right, and with the down arrow to fire depth charges. The subs will shoot torpedos back at you, but they have bad aim. If they hit you three times, your ship sinks.

The Listing starts at line 2, where you are asked for a difficulty level. The subs will fire more often at the higher levels. In fact, at level ten there will be a torpedo on the screen at all times.

Line 3 sets initial variables. AV is used for the sound when the ship is sunk and B is the value for the ship's position. Lines 5 – 7 draw the ship and the three subs. The ship has blank characters in front and back, and the subs have blank char-



s in front. When each new figure is
n the blank characters are also
n and erase the old figures.
ne 11 sends the program to three
UB routines that pick the sub's initial
ting point. They also will be called to
a new depth each time a sub com-
es the trip across the screen. I'll go
the subroutines at those lines.
ine 12 checks the keyboard. Line 13
ves the ship left if the left arrow is
shed, and line 14 moves it right if the
ht arrow is pushed. Line 15 stops the
ip from moving off the level chosen for
Line 16 fires the depth charge, but
nly if no other depth charge is still in
lay. You can move the ship at any time
ut can fire only one charge at a time. D
s the variable that checks that condition.
f D is 0, then no charge is currently in
olay; if it is 1, then a charge has been
fired.

Line 17 prints the ship. Line 18 sends the program to the routine that moves the subs, and line 19 prints the three subs. Line 21 checks to see if a torpedo has been fired. If it has, it sends the program to the routine to update its movements, or else it checks to see if a torpedo should be fired. L is the controlling variable.

Line 22 sends the program to the depth charge update routine if a depth charge has been fired. Line 23 prints the number of times you have been hit, and how many subs you have sunk (variables T and S, respectively). Line 24 cycles the whole thing back to the INKEY$ instruction.

We now start with the subroutines. Lines 25 – 35 pick the sub's depth and set the sub at the left of the screen. Each sub is controlled by two variables. For instance, the first sub is located with variable E, and is stopped when it gets to the other side by I. In lines 36 – 37, I keeps a count of how many times the sub moves. When I reaches 26, the sub has crossed the screen and it is erased, a new depth is picked, and the sub reappears on the left and starts moving again. Lines 39 – 44 do the same for the other subs.

Lines 45 – 50 print the depth charge and check to see if it is at the same position as any of the subs. If it isn't, lines 51 – 53 erase the charge, move it down, erase it for good if it has reached the bottom, and allow the player to fire a new charge. If the charge has hit a sub, a damaged sub is printed, a sound is played, the score is increased, a new depth is picked, the old sub is erased, and a new one appears on the left. All this is controlled by lines 54 – 63.

Line 66 starts the torpedo firing sequence. A number from one to ten is picked at random, then the data numbers are read (up to the difficulty level you picked). If the numbers match, a torpedo is fired. The higher level you pick, the more numbers will be read, and the greater chance there is of a number matching.

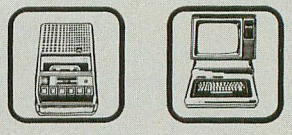
Lines 72 – 74 pick the sub to fire the torpedo. Lines 75 – 77 print the torpedo, erasing it to move it up, and if it reaches the surface without hitting your ship, erasing it for good. Line 78 checks if it has hit your ship; if it has, line 79 tells you this and checks whether you have been hit three times. If you have, you are sunk (lines 81 – 84 sink you). The game then ends.

Simple? Perhaps a reader can design a way to make the subs fire more than one torpedo at a time or to do it when close to the ship while still staying within 4K. Until then, have fun. ■■■

*Please turn the page*

*Program Listing. 4K Sub Destroy*

```
1 REM 4K SUB DESTROY BY ROBERT T
OSCANI, 4744 WHITAKER AVE. PHILA
. PA. 19120
2 CLS:INPUT"WHAT LEVEL 1(EASY)-1
0(HARD)";U
3 AV=250:B=128:CLS0
5 Z$=CHR$(128):E$=Z$+Z$+Z$
6 A$=Z$+CHR$(199)+CHR$(195)+CHR$
(203)+Z$
7 C$(1)=Z$+CHR$(147)+CHR$(159)+C
HR$(147):C$(2)=Z$+Z$+CHR$(163)+C
HR$(175)+CHR$(163):C$(3)=E$+CHR$
(179)+CHR$(191)+CHR$(179)
11 GOSUB25:GOSUB28:GOSUB32
12 B$=INKEY$
13 IF B$=CHR$(8)THENB=B-1
14 IF B$=CHR$(9)THEN B=B+1
15 IF B<128THEN B=128ELSE IF B>1
55THEN B=155
16 IF B$=CHR$(10)AND D=0THEN D=1
:C=B+32
17 PRINT@B,A$;
18 GOSUB36
19 PRINT@E,C$(1);:PRINT@F,C$(2);
:PRINT@G,C$(3);
21 IF L=0GOSUB66ELSE GOSUB75
22 IF D=1GOSUB45
23 PRINT@2,"HITS "T;:PRINT@20,"S
CORE "S;
24 GOTO12
25 E=RND(15)
26 IF E<7THEN25
27 E=E*32:I=0:RETURN
28 F=RND(15)
29 IF F<7THEN28
30 F=F*32:IF F=E THEN28
31 J=0:RETURN
32 G=RND(15)
33 IF G<7THEN32
34 G=G*32:IF F=G OR G=E THEN 32
35 K=0:RETURN
36 E=E+1:I=I+1
37 IF I>26THEN PRINT@E,E$;:GOSUB
```



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```
25
39 F=F+2:J=J+2
40 IF J>25THEN PRINT@F,E$;:GOSUB
28
42 G=G+3:K=K+3
43 IF K>23THEN PRINT@G,E$;:GOSUB
32
44 RETURN
45 PRINT@C,CHR$(194);
46 FORX=1TO3
47 IF C=E+X GOSUB54
48 IF C=F+1+X GOSUB58
49 IF C=G+2+X GOSUB62
50 NEXTX
51 PRINT@C,CHR$(128);
52 C=C+32:IF C>510THEN D=0
53 RETURN
54 S=S+1:D=0
55 PRINT@E+1,CHR$(153)+CHR$(150)
;:SOUND50,3:PRINT@E+1,E$;:GOSUB2
5:RETURN
58 S=S+2:D=0
59 PRINT@F+2,CHR$(169)+CHR$(166)
;:SOUND100,3:PRINT@F+2,E$;:GOSUB
28:RETURN
62 S=S+3:D=0
63 PRINT@G+3,CHR$(185)+CHR$(182)
;:SOUND150,2:PRINT@G+3,E$;:GOSUB
32:RETURN
66 M=RND(10)
67 FOR N=1TO U
68 READ P(N):IF P(N)=M THEN72
69 NEXTN
70 DATA5,2,10,4,9,1,3,6,8,7
71 RESTORE:RETURN
72 L=RND(3)
73 IF L=1THEN Q(L)=E+2ELSE IF L=
2THEN Q(L)=F+3ELSE IF L=3THEN Q(
L)=G+4
74 RESTORE
75 PRINT@Q(L),Z$;
76 Q(L)=Q(L)-32:IF Q(L)<128THEN
L=0:RETURN
77 PRINT@Q(L),CHR$(245);
78 IF Q(L)<=B OR Q(L)>B+3THEN RE
TURN
79 SOUND200,4:T=T+1:IF T<3THEN
RETURN
81 J$=CHR$(201)+CHR$(195)+CHR$(1
98)
82 PRINT@B+1,J$;:SOUND AV,4:PRIN
T@B+1,E$;
84 AV=AV-16:B=B+32:IF B>510THENE
ND ELSE82
```


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# Learning Games

- *Unscramble*
- *Hangman*
- *Flashcards*
- *States and Capitals*

*by David Stevens*

THE THREE GAMES which draw the most attention in my third grade classroom are Hangman, Unscramble, and Flash. My students even stay in from recess to play them. I thought you readers might enjoy all three games written into one package. It is a rather long listing, but provides three good, educational games to improve your child's (or your) own spelling.

To use the spelling programs, once you have typed in the words you want to practice, Run the program. You have three choices: Scramble, Hangman, and Flashcards. Choose the game you want by pressing the letter indicated on the screen.

In Scramble, the screen presents a scrambled word that you must type in correctly. You work against time depicted by a burning fuse bomb.

In Hangman, a traditional set-up appears on the screen. Type a letter—if it's in the word, it appears in the correct place on top of the screen. If the letter is not in the word, a part of the hanged man is drawn and the rejected letter is listed at the bottom of the screen.

In Flashcards, a word is flashed quickly on the screen. The user then types in the word he saw flashed. An incorrect entry produces a screen with the correct word.

Further instructions are presented before each game. Return to the menu by pressing the Break key.

To change the words which come with this program, simply type Lines 30 and 40 over again, inserting your words. Be sure you have 50 words for the computer to read, or edit Line 50 from: WD$(50) to: WD$(n), and change Line 70 from: FOR RD=1 to 50 to: FOR RD=1 to n. Don't type in the REM statements because there won't be enough room left over on a 16K machine to Run the program properly.

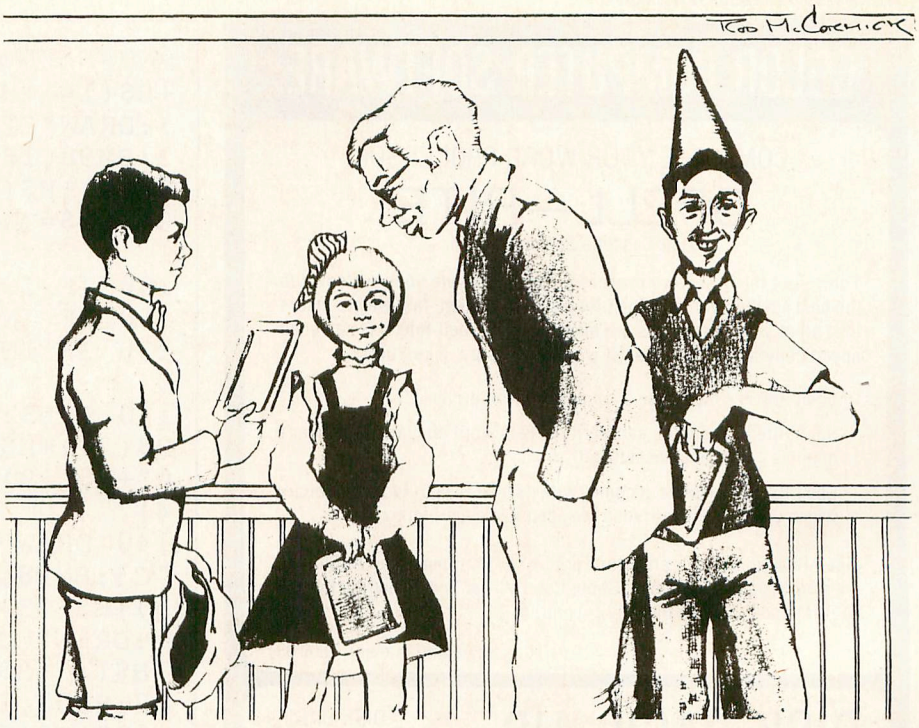
I put a timing device into these programs (a fused bomb) so my students wouldn't fall sleep using them. If you would like to eliminate this threat, simply defuse it by changing Line 310 from: FD=2 to: FD=0. Then be sure to select "speedy" for fuse speed and don't get more than three in a row wrong. This program features a self-adjusting fuse, and if you get three in a row right the speed will shift up to the next speed until it reaches speedy. The fuse will reverse in the same way if you get three in a row wrong.

***Program Listing. Spelling Games***

```
10 DATAU4E4F4NL8D4BR8,U8R7FD2GNL
7FD2GNL7BR9,U8R8D1BD6D1NL8BR8,R2
U8L2R6F2D4G2NL6BR11,U8R8L8D4NR6D
4R8BR8,U8NR8D4NR6D4BR16,U8R8D2BD
3NL3D2GNL7BR9,U8D4R8U4D8BR8,R4U8
NL4R4BD8NL4BR8,NU2R8NU8BR8,U8D4R
4NE4F4BR8,NU8R8BR8,U8F4E4D8BR8,U
8F8NU8BR8
20 DATAU8R8D8L8BR16,U8R8D4L8D4BR
16,U8R8D8L8R6H2F4H2R2BR8,U8R8D4L
8R4F4BR8,R8U4L8U4R8BD8BR8,BR4U8N
L4R4BD8BR8,U8BR8D8NL8BR8,BR4H4U4
BR8D4G4BR12,NU8E4F4NU8BR8,E8BL8F
8BR8,BR4U4NH4E4BD8BR8,E8L8BD8R8B
R8,
30 DATAMONKEY,BILLION,BOUND,ALER
T,ASTRONAUT,ADVENTURE,FUDGE,CIRC
UIT,FIDDLE,CURIOUS,CREATURE,COZY
,COWARD,DAMAGE,EXAMINE,EQUIPMENT
,FANCY,FLICK,FURIOUS,GAZE,GRAVIT
Y,GUITAR,HAWK,HUMAN,LEVEE,LIZARD
,MAGICIAN,MISSION,MONSTER,MUNCH,
ORBIT,PITCH,POUNCE,PRESENT
40 DATA PRICKLY,RAGE,REMARK,SCUR
RY,SEARCH,SILENTLY,SNARL,STARTLE
,SUBMARINE,SWISH,TEMPER,TRAMPLE,
TRUE,UNDER,WAIL,WEIGHTLESS
50 CLEAR 400:DIM H$(26),WD$(50),
AR$(15),B(26),T$(15),S(1)
60 FOR RD=1 TO 26:READ H$(RD):NE
XT RD:FOR RD=0TO50:READWD$(RD):N
EXTRD:N=RD-1
70 PMODE3,1:SCREEN1,1:PCLS:DRAW"
C4;BM50,80"+H$(23)+H$(8)+H$(9)+H
$(3)+H$(8):DRAW"BM172,80"+H$(7)+
H$(1)+H$(13)+H$(5):DRAW"C2;BM50,
120"+H$(1):DRAW"C3;BM98,120"+H$(
21)+H$(14)+H$(19)+H$(3)+H$(18)+H
$(1)+H$(13)+H$(2)+H$(12)+H$(5):D
RAW"C2;BM50,140"+H$(2)
80 DRAW"C3;BM98,140"+H$(8)+H$(1)
```

*Please turn to page 54*

## States and Capitals Quiz




This year I'm asking my third grade class to learn the United States states and capitals, one group at a time. I wrote this program so that non-Extended Basic machines could use it as well. I don't know if it will fit on a 4K machine, as I don't have one to try it on.

When you run the States and Capitals quiz, the computer will randomly put the capital of a state or a state name on the screen. The user has to match the given name with its complement.

The program checks each letter as it is entered, and provides immediate feedback if you type an incorrect letter.

This program will provide you with clues if you are totally stumped for the first half of the word. Simply type any key; if it is wrong the computer will ask whether you want a clue. There is a score card at the end to let you know how you did during the session. ■■■

***Program Listing. States and Capitals***

```
10 CLEAR 50
20 DATA ALABAMA,MONTGOMERY,ALASK
A,JUNEAU,ARIZONA,PHOENIX,ARKANSA
S,LITTLE ROCK,CALIFORNIA,SACRAME
NTO,COLORADO,DENVER,CONNECTICUT,
HARTFORD,DELAWARE,DOVER
30 DATA FLORIDA,TALLAHASSEE,GEOR
GIA,ATLANTA,IDAHO,BOISE,HAWAII,H
ONOLULU,ILLINOIS,SPRINGFIELD,IND
IANA,INDIANAPOLIS,IOWA,DES MOINE
S,KANSAS,TOPEKA,KENTUCKY,FRANKFO
RT
40 DATA LOUISIANA,BATON ROUGE,MA
INE,AUGUSTA,MARYLAND,ANNAPOLIS,M
ASSACHUSETTS,BOSTON,MICHIGAN,LAN
SING,MINNESOTA,ST. PAUL,MISSISSI
PPI,JACKSON,MISSOURI,JEFFERSON C
ITY
50 DATA MONTANA,HELENA,NEBRASKA,
LINCOLN,NEVADA,CARSON CITY,NEW H
AMPSHIRE,CONCORD,NEW JERSEY,TREN
TON,NEW MEXICO,SANTA FE,NEW YORK
,ALBANY,NORTH CAROLINA,RALEIGH
60 DATA NORTH DAKOTA,BISMARCK,OH
IO,COLUMBUS,OKLAHOMA,OKLAHOMA CI
TY,OREGON,SALEM,PENNSYLVANIA,HAR
RISBURG,RHODE ISLAND,PROVIDENCE,
SOUTH CAROLINA,COLUMBIA,SOUTH DA
KOTA,PIERRE
70 DATA TENNESSEE,NASHVILLE,TEXA
S,AUSTIN,UTAH,SALT LAKE CITY,VER
MONT,MONTPELIER,VIRGINIA,RICHMON
D,WASHINGTON,OLYMPIA,WEST VIRGIN
IA,CHARLESTON,WISCONSIN,MADISON,
WYOMING,CHEYENNE
80 DATA Z
90 DIM W$(50,2),Z(50):CLS:INPUT
"WOULD YOU LIKE A REVIEW OF ALL
 THE STATES AND CAPITALS";E$:IF
E$="Y" THEN 110 ELSE 140
100 IF E$="Y" OR E$="YES" THEN 1
10 ELSE 140
110 CLS:FOR R=U TO U+19:READ W$:
PRINT W$,:IF W$="Z" THEN 140 ELS
E NEXT R
120 T$=INKEY$:IF T$="" THEN 120
130 U=U+10:IF U=50 THEN 140 ELSE
 110
140 RESTORE:CLS:INPUT "HOW MANY
STATES AND CAPITALS DO YOU WANT
TO WORK WITH";D:FOR S=1 TO D:FOR
 C=1 TO 2:READ W$(S,C):NEXT C:NE
XT S:CLS:CT=0:B=0:L=0:FOR S=1 TO
 D:Z(S)=0:NEXT S
150 FOR G=1 TO D
160 FOR G=1 TO D
170 PRINT @ 96,"WHAT GOES WITH:"
:S=RND(D):C=RND(2):IF Z(S)=1 THE
N 170
180 Z(S)=1:PRINT @ 160,"
 "W$(S,C):IF C=1 THEN C=2 ELSE C
=1
190 PRINT @ 224,"          ":CT=C
```

*Please turn to page 55*

Circle No. 35 on Reader Service Card

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*Continued from page 52*

```
+H$(14)+H$(7)+H$(13)+H$(1)+H$(14
):DRAW"C2;BM50,160"+H$(3):DRAW"C
3;BM98,160"+H$(6)+H$(12)+H$(1)+H
$(19)+H$(8)
90 IN$=INKEY$:IF IN$="A" THEN Q=
1
100 IF IN$="B" THEN Q=2
110 IF IN$="C" THEN Q=3
120 IF IN$<"A" OR IN$>"C" THEN 9
0
130 PCLS:DRAW"C4;BM50,80"+H$(6)+
H$(21)+H$(19)+H$(5):DRAW"BM172,8
0"+H$(19)+H$(16)+H$(5)+H$(5)+H$(
4)
140 DRAW"C2;BM50,120"+H$(1):DRAW
"C3;BM98,120"+H$(19)+H$(12)+H$(1
5)+H$(23):DRAW"C2;BM50,140"+H$(2
):DRAW"C3;BM98,140"+H$(13)+H$(5)
+H$(4)+H$(9)+H$(21)+H$(13):DRAW"
C2;BM50,160"+H$(3):DRAW"C3;BM98,
160"+H$(6)+H$(1)+H$(19)+H$(20):D
RAW"C2;BM50,180"+H$(4)
150 DRAW"C3;BM98,180"+H$(19)+H$(
16)+H$(5)+H$(5)+H$(4)+H$(25):IF
SK=1 THEN 230
160 IN$=INKEY$:IF IN$="A" THEN F
S=1
170 IF IN$="B" THEN FS=2
180 IF IN$="C" THEN FS=3
190 IF IN$="D" THEN FS=4
200 IF IN$<"A" OR IN$>"D" THEN 1
60
210 IF Q=3 THEN 220 ELSE 280
220 PCLS:SK=1:DRAW"C4;BM50,80"+H
$(6)+H$(12)+H$(1)+H$(19)+H$(8):D
RAW"BM172,80"+H$(19)+H$(16)+H$(5
)+H$(5)+H$(4):GOTO 140
230 IN$=INKEY$:IF IN$="A" THEN S
P=500
240 IF IN$="B" THEN SP=200
250 IF IN$="C" THEN SP=50
260 IF IN$="D" THEN SP=0
270 IF IN$<"A" OR IN$>"D" THEN 2
30
280 IF FS=1 THEN FD=.10
290 IF FS=2 THEN FD=.5
300 IF FS=3 THEN FD=1
310 IF FS=4 THEN FD=2
320 PMODE3,1:SCREEN1,1:RT=0:SK=0
:HS=0:D=0:EN=0:XP=0:C=0:FOR R=1
TO 26:B(R)=0:NEXT R
325 'choose word
330 PCLS:D=0:L=0:C=INT(RND(N)):I
F C=0 THEN 330
340 DRAW "BM60,100"
```

Continued from page 53

```
T+1:L=LEN(W$(S,C)):FOR B=1 TO L
200 I$=INKEY$:IF I$="" THEN 200
210 PRINT" "I$;:V$=MID$(W$(S,C),
B,1):IF I$=V$ THEN NEXT B ELSE 2
80
220 RD=RND(4):ON RD GOTO 230,240
,250,260
230 PRINT @ 320,"       SUPER JOB
 !!!":GOTO 270
240 PRINT @ 320,"         YES IND
EED!!!":GOTO 270
250 PRINT @ 320,"         YOU DID
 GREAT!!!":GOTO 270
260 PRINT @ 320,"YOU'RE ALMOST A
S SMART AS I AM!":GOTO 270
270 FOR PP=1 TO 12:PRINT "     "C
HR$(137+64);:SOUND 182,2:NEXT PP
:CLS:IF G=D THEN 400 ELSE NEXT G

280 SOUND230,2:SOUND200,2:SOUND1
70,2:SOUND140,2:SOUND110,2:SOUND
60,8:PRINT:PRINT" YOU GOT THAT L
ETTER WRONG.":IF B=<INT(L/2) THE
N 300
290 PRINT "SORRY, I'M FRESH OUT
OF CLUES.  THINK HARD AND TRY AG
AIN.":FOR TI=1 TO 2500:NEXT TI:G
OTO 340
300 PRINT" WOULD YOU LIKE A CLUE
?"
310 I$=INKEY$
320 P$=INKEY$:IF P$="" THEN 320
330 IF P$="Y" THEN 360 ELSE 340
340 CLS:IF C=1 THEN C=2 ELSE C=1

350 GOTO 180
360 CL=CL+1:PRINT @ 384," THE ";
B;" LETTER IS: ";V$
370 FOR TI=1 TO 1000:NEXT TI:CLS
380 IF C=1 THEN C=2 ELSE C=1
390 GOTO 180
400 PRINT "YOU HAD ";CT-D;" MIST
AKE(S)          ON ";D;" PROBLEM
S.":PRINT "YOU WERE GIVEN ";CL;"
 CLUE(S).":PRINT "DO YOU WANT TO
 TRY:                    A) REVI
EW THE LIST              B) TRY
ANOTHER SET              C) END
PROGRAM":CT=0:D=0
410 T$=INKEY$:IF T$="" THEN 410
420 IF T$="A" THEN 110
430 IF T$="B" THEN 140
440 IF T$="C" THEN 450 ELSE 410
450 PRINT "THANKS FOR JOINING ME
!!":END
```

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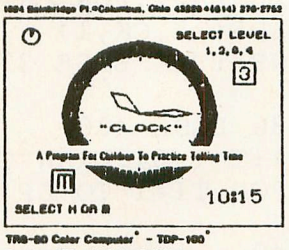


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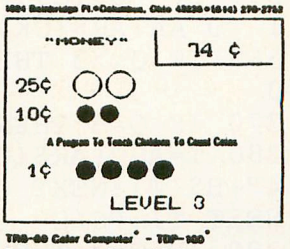


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Continued from page 55

```
350 A$=WD$(C):AA=LEN(A$):FOR CK=
1 TO AA:AR$(CK)=MID$(A$,CK,1)
360 IF Q<>3 THEN NEXT CK ELSE 37
0
370 IF Q=3 THEN 380 ELSE 400
380 T=ASC(AR$(CK)):T=T-64:DRAW"C
4"+H$(T):NEXT CK:FOR TI=1 TO SP:
NEXT TI:PCLS
390 IF Q=3 THEN 440
400 IF Q<>2 THEN 420
405 'set up hangman screen
410 DRAW "C2;BM65,13":FOR BK=1 T
O AA:DRAW "BR8R8":NEXT BK:DRAW "
C3;BM5,129;R59D10R4D10R4D8L13U25
L49D25L13U141R38D13L4U11L30D110"
:PAINT(6,130),3,3:GOTO 440
420 R=RND(AA):IF B(R)=1 THEN 420

430 B(R)=1:L=ASC(AR$(R)):L=L-64:
DRAW"C3"+H$(L):XP=XP+1:IF XP=AA
THEN 440 ELSE 420
435 'draw bomb
440 DRAW "C4":LINE(220,130)-(240
,180),PSET,BF:CIRCLE(230,130),10
,3,.4,3:CIRCLE(230,180),10,4,.4,
3:PAINT(230,128),2,3:PAINT(230,1
82),4:DRAW"C3;BM230,130;U110"
450 DRAW "C4;BM230,20;NH4NU5E4"
460 PLAY "T250O1DA":F=13:X=58:Y=
142
470 FOR Z=1 TO AA+3
475 'burn fuse and get input
480 T$=INKEY$:F=F+FD:GET(226,F)-
(234,F+7),S,G:LINE(226,F)-(234,F
+7),PRESET,BF:PUT(226,F+FD)-(234
,F+7+FD),S,PSET
490 IF F>120 THEN 760
500 IF T$="" THEN 480
510 IF Q=2 THEN 770
520 T$(Z)=T$:S=ASC(T$):IF S=8 TH
EN Z=Z-1
530 IF Z<1 THEN Z=1
535 'erase letter if backspace
540 IF S=8 THEN 550 ELSE 560
550 X=X-16:LINE(X,Y)-(X+12,Y+8),
PRESET,BF:DRAW "BL16":GOTO 480
560 IF S=13 THEN 620
570 IF S<64 OR S>90 THEN 480
580 X=X+16:S=S-64
590 DRAW "C2;BM60,150":IF Z=1 TH
EN 610
600 FOR BK=1 TO Z-1:DRAW"BR16":N
EXT BK
```


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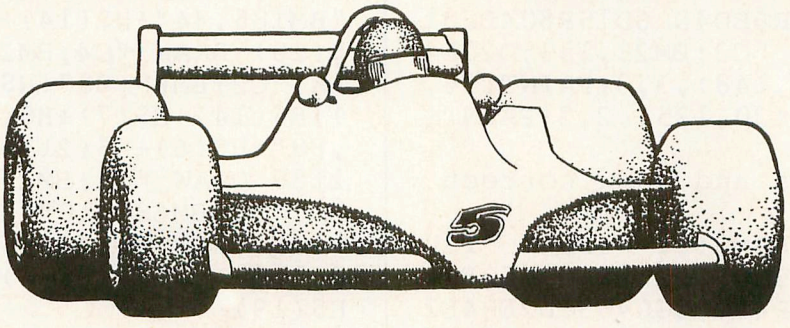
```
610 DRAW H$(S):NEXT Z
615 'check answer
620 FOR CK=1 TO AA:IF T$(CK)=MID
$(A$,CK,1) THEN NEXT CK ELSE 690

630 IF Z-1>AA THEN 690
635 'good work response
640 PLAY "V15T603GGL2GL4FE":PCLS
(4):PLAY "L1E":PCLS:PLAY "DL2E":
PCLS(3):PLAY "L1E":CT=CT+1:MS=0
650 IF CT=3 THEN FS=FS+1
660 IF FS>4 THEN FS=4
670 IF CT=3 THEN CT=0
680 T$=INKEY$:GOTO 1160
685 'error in answer
690 CT=0:MS=MS+1:PLAY "O5":FOR I
P=1 TO 4:PLAY "T25O-GEC":NEXT LP
:DRAW "C3;BM40,40"+H$(20)+H$(8)+
H$(5):DRAW "BR16"+H$(23)+H$(15)+
H$(18)+H$(4):DRAW "BR16"+H$(23)+
H$(1)+H$(19)
700 DRAW "BM60,80"
710 FOR TT=1 TO AA:L$=MID$(A$,TT
,1):L=ASC(L$):L=L-64:DRAW H$(L):
NEXT TT:FOR TI=1 TO 2000:NEXT TI
:T$=INKEY$
720 IF MS=3 THEN FS=FS-1
730 IF FS<1 THEN FS=1
740 IF MS=3 THEN MS=0
750 GOTO 1160
755 'bomb explodes
760 PCLS:PLAY"O1":FOR LP=1 TO 4:
PCLS(LP):PLAY "T250O+V30DFDGD":N
EXT LP:SCREEN1,1:PCLS:GOTO 690
765 'hangman routine
770 IF T$<"A" OR T$>"Z" THEN 480
780 T=ASC(T$):T=T-64:IF B(T)=1 T
HEN 480
790 B(T)=1
800 FOR CK=1 TO AA
810 I$=MID$(WD$(C),CK,1):IF I$=T
$ THEN 1060 ELSE NEXT CK
820 IF RT=1 THEN 830 ELSE 840
830 RT=0:GOTO 480
840 DRAW "BM30,180"
850 D=D+1:FOR LP=1 TO D:DRAW "BR
16":NEXT LP:CL=RND(3):ON CL GOTO
 860,870,880
860 DRAW "C2":GOTO 890
870 DRAW "C3":GOTO 890
880 DRAW "C4":GOTO 890
890 DRAW H$(T)
895 'hang him
```

*Please turn the page*


# YOUR COLOR COMPUTER JUST GOT WHEELS!



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*Circle No. 37 on Reader Service Card*

*Continued from page 57*

```
900 HS=HS+1:ON HS GOTO 910,920,9
30,940,950,960,970,980
910 CIRCLE(36,44),8,2,2,2:GOTO 1
050
920 CIRCLE(34,42),1,3:CIRCLE(38,
42),1,3:DRAW "BM36,43;D3":DRAW "
BM34,50;R4":DRAW "C4":LINE(35,57
)-(39,62),PSET,BF:GOTO 1050
930 DRAW "C3;BM36,62;L8D23F8E8U2
3L8":CIRCLE(36,70),4:CIRCLE(36,7
5),4:CIRCLE(36,80),4:PAINT(36,64
),3,3:GOTO 1050
940 DRAW "C3;BM30,62;G22F4E17":G
OTO 1050
950 DRAW "C3;BM44,62;F22G4H17":G
OTO 1050
960 DRAW "C4;BM44,85;BG7F11D25R8
U4L2U30H9":GOTO 1050
970 DRAW "C4;BM30,85;BF6D37L12U4
R5U39R16":PAINT(36,87),4,4:GOTO
1050
980 LINE(8,31)-(82,128),PRESET,B
F:DRAW "C4;BM36,36;U7":CIRCLE(36
,44),8,2:CIRCLE(34,42),1,3:CIRCL
E(38,42),1,3:DRAW"C2;BM36,43;D3"
:DRAW"BM34,48;R4":DRAW"C4":LINE(
35,51)-(39,56),PSET,BF
990 DRAW"C2;BM36,56;D6L16D40R4U3
5R4D28BR16U28R4D35R4U40L16":DRAW
"BM28,95;D34NR6BD4NR6D11L2D4R8U1
5BU4U24R4D24NR6BD4NR6D15R8U4L2U1
1BU4U34":DRAW "C3;BM23,133;D20L4
U20":PAINT(21,148),3,3:PAINT(36,
63),2,2:PAINT(30,135),2,2:PAINT(
42,135),2,2
995 'play taps and show correct
word
1000 MS=MS+1:HS=0:CT=0:PLAY "T3V
10O2L2GL4GL2O3CP4O2L2GL4O3CL2EP4
L2O2GL4O3CL2EP4L2O2GL4O3CL2EP4L2
O2GL4O3CL2EP4L2O3CL4EL2GP4L2EL4C
L2O2GP4V4GL4GL1O3C"
1010 PCLS:DRAW "C2;BM50,50;"+H$(
20)+H$(8)+H$(5):DRAW "C3;BM114,5
0;"+H$(23)+H$(15)+H$(18)+H$(4):D
RAW "C4;BM194,50;"+H$(23)+H$(1)+
H$(19):DRAW "C3;BM80,120"
1020 FOR LT=1 TO AA:T$=MID$(WD$(
C),LT,1):T=ASC(T$):T=T-64:DRAW H
$(T):NEXT LT:FOR TI=1 TO 2000:NE
XT TI:PCLS
1030 FOR T=1 TO 26:B(T)=0:NEXT T
:D=0:EN=0
1040 IF CT=3 THEN 650 ELSE 720
1050 SOUND 132,2:GOTO 480
1060 RT=1:DRAW "BM40,10":FOR W=0
 TO CK:DRAW "BR16":NEXT W
1065 'good letter response
1070 CL=RND(3):ON CL GOTO 1080,1
090,1100
1080 DRAW "C2":GOTO 1110
1090 DRAW "C3":GOTO 1110
1100 DRAW "C4":GOTO 1110
1105 'hangman wins
1110 DRAW H$(T):PLAY "T8V15O3CEG
O4L2CO3L4GO4L2C":CK=CK+1:EN=EN+1
:IF EN=>AA THEN 1120 ELSE 1140
1120 PLAY"T4L2O4AL4GL8GEDEL4GCP8
L4GL8O4AO3GDCBL2C":PCLS:DRAW"C2;
BM80,40;"+H$(20)+H$(8)+H$(1)+H$(
14)+H$(11)+H$(19):DRAW "C4;BM40,
80;"+H$(6)+H$(15)+H$(18):DRAW"BM
114,80;"+H$(19)+H$(1)+H$(22)+H$(
9)+H$(14)+H$(7)
1130 DRAW"C3;BM70,120;"+H$(13)+H
$(25):DRAW"BM118,120;"+H$(12)+H$
(9)+H$(6)+H$(5):FOR TI=1 TO 2000
:NEXT TI:CT=CT+1:MS=0:GOTO 1030
1140 IF CK>AA THEN CK=0 ELSE 810

1150 RT=0:GOTO 480
1160 BB=BB+1:IF BB=8 THEN 1170 E
LSE 280
1165 'menue to change games
1170 BB=0:PCLS:DRAW "C3;BM55,44"
+H$(23)+H$(8)+H$(1)+H$(20):DRAW
"BM185,44"+H$(14)+H$(5)+H$(24)+H
$(20):DRAW "C4;BM25,88"+H$(1):DR
AW "C2;BM68,88"+H$(3)+H$(8)+H$(1
)+H$(14)+H$(7)+H$(5):DRAW "BM180
,88"+H$(6)+H$(21)+H$(19)+H$(5)
1180 DRAW "C4;BM25,110"+H$(2):DR
AW "C2;BM68,110"+H$(3)+H$(8)+H$(
1)+H$(14)+H$(7)+H$(5):DRAW "BM18
0,110"+H$(7)+H$(1)+H$(13)+H$(5)+
H$(19)
1190 DRAW "C4;BM25,132"+H$(3):DR
AW "C2;BM68,132"+H$(5)+H$(14)+H$
(4):DRAW "BM137,132"+H$(16)+H$(1
8)+H$(15)+H$(7)+H$(18)+H$(1)+H$(
13)
1200 DRAW "C4;BM25,154"+H$(4):DR
AW "C2;BM68,154"+H$(19)+H$(1)+H$
(13)+H$(5):DRAW "BM148,154"+H$(1
9)+H$(20)+H$(21)+H$(6)+H$(6)
1210 T$=INKEY$:IF T$="" THEN 121
0
1220 IF T$="A" THEN 130
1230 IF T$="B" THEN 70
1240 IF T$="C" THEN END
1250 IF T$="D" THEN 320
```

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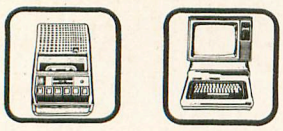

16K Extended Color Basic

# Wide Printing

*by Robert C. Lake, CDP*

COLOR SCRIPSIT is a fine Radio Shack word processing program. It has many features commonly found only on more expensive products. For example, it is highly screen-oriented; it allows on-screen movement of the cursor: up or down, left or right. Text appears on the screen the same way it will be printed. If the expected line width is greater than the screen width, Color Scripsit gives you a moveable window through which to view the text.

This product also includes commands that allow global replace, ghost hyphens, automatic headers and footers, flexible tabbing, and many other advanced features. Color Scripsit is menu-driven and extremely user-friendly.

What Color Scripsit does not boast is the ability to use many of the features available on modern printers. Even the inexpensive Radio Shack LP VII, for example, allows for wide and narrow printing. Many printers offer several fonts, pitches, etc. None of these capabilities are available to the Color Scripsit user.

My Basic program is an attempt to partially remedy this deficiency in an otherwise useful product. The MOVSCRIP program listing moves Color Scripsit to user RAM (starting at 24576) in a 32K system and then modifies it to allow use of the wide and narrow printing capabilities of many printers.

Since the modified version uses about 8K (including about 1K bytes for possible further changes), it leaves sufficient space for slightly more than 23,000 characters. Although written for a 32K system, the program can be easily changed to put Color Scripsit at 8192, leaving about 7K bytes for the user with a 16K Color Computer.

The following procedures will produce a machine language tape that you can CLOADM and EXEC when you want to run a wide-printing version of Color Scripsit.

- Key in and inspect the Basic program MOVSCRIP in Program Listing 2. When correct, CSAVE the program.
- Looking at your Color Scripsit cartridge from the bottom, push back the sliding door and you will see 14 metal teeth. Tape over the right-most of these teeth. This disables the auto-start mechanism.
- With your computer off, insert the cartridge.
- Turn on the computer. The normal Basic logo should appear, and you will not be in Color Scripsit.
- CLOAD the MOVSCRIP program that you had previously saved.
- RUN MOVSCRIP. The program prompts you for the additional steps required.

The Color Scripsit code is modified at 26155 to set the memory size to 24576 and at 28142 to branch to new instructions at 31000. Program Listing 1 is an assembly language listing showing the instructions used to allow wide printing. The new code traps each character before it is printed. The wide-printing function toggles are off or on if a special control character is found. If the printer is then in the wide-print mode, the wide printing function turns on.

As written, the program uses the percent sign (%) as the control code. The control character can be changed, however, by POKEing the ASCII value of the desired character into location 31003 before executing Color Scripsit from RAM (e.g., POKE 31003, ASC("&")). When the control character is found, a CHR$(31) or CHR$(30) is sent to the printer to set the wide or narrow print modes, respectively. If your printer uses other codes, POKE the wide-print code into locations 31023 and 31056 and POKE the narrow-print code into location 31014 before execution. Once the appropriate POKEs have been made, you can EXEC and/or CSAVEM your personalized version by:

```
CSAVEM "SCRIPMOD", 24576, 32000,
  24576
```

To use the modified version of Color Scripsit produced by the program, CLOADM and EXEC the machine-language tape produced by the program (or by the CSAVEM above if you changed

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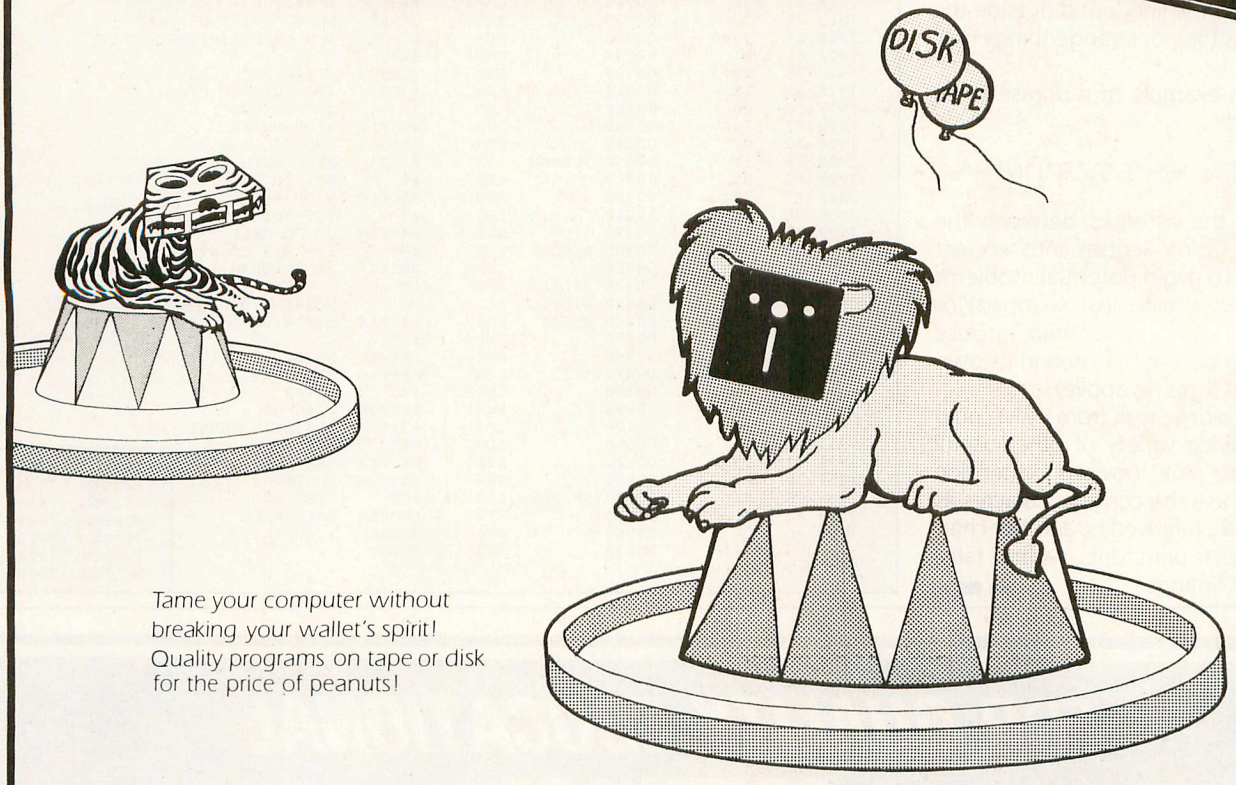


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any of the codes). When you want double-width printing, surround the appropriate word(s) with percent signs. Also, leave a space or other character (which will not be printed) between each letter so that Color Scripsit can correctly compute the margins and the alignment of the lines. I use an asterisk between letters. This lets me use Color Scripsit's search and replace feature if I change my mind about print width. To put an alignment code on the line, put it outside the percent signs (%), or strange things may happen!

Here is an example of a phrase to be wide printed:

```
%T*E*X*T%  %H*E*A*D*I*N*G%
```

Notice how the asterisks between the letters trick Color Scripsit into correct positioning. To avoid potential problems with line-feeds being lost (skipped) or page-breaks not being honored, enclose each word to be wide-printed in its own set of percent signs (as above).

Running Color Scripsit from RAM could allow for a wide variety of other useful modifications. An obvious extension would be to use the control character as an escape code followed by another character that selects print fonts, widths, tabs, or other print options. ■■■

***Program Listing 2. MOVESCRIP—Basic***

```
                        00120 * THIS CODE IS BRANCHED TO FOR  *
                        00130 * EVERY CHARACTER OUTPUT TO THE *
                        00140 * LINE-PRINTER.  IF THE CONTROL *
                        00150 * CHARACTER (%) IS FOUND, THE   *
                        00160 * WIDE-PRINTING FUNCTION IS    *
                        00170 * TOGGLED OFF OR ON AS REQUIRED *
                        00180 * IF NOW WIDE-PRINTING, PROGRAM *
                        00190 * CHECKS TO SEE IF A SPACE IS   *
                        00200 * TO BE SKIPPED (FOR CORRECT    *
                        00210 * ALIGNMENT).                   *
                        00230 ***********************************
7918                    00240          ORG     31000T
7918 A6   E4            00250 START    LDA     ,S        GET CHARACTER
791A 81   25            00260          CMPA    #$25      A SWITCH?
791C 26   23            00270          BNE     CKSKP     NO-GO PRINT OR SKIP
791E B6   7940          00280          LDA     WIDFLG    NOW WIDEPRINTING?
7921 81   01            00290          CMPA    #1T
7923 26   09            00300          BNE     TURNON    NO-GO SET FLAG
7925 86   1E            00310          LDA     #30T      YES-TURN IT OFF
7927 C6   00            00320          LDB     #0        SET TO NOT
7929 F7   7940          00330          STB     WIDFLG    WIDE-PRINT
792C 20   0C            00340          BRA     RETURN    AND GO BACK
792E 86   1F            00350 TURNON   LDA     #31T      SEND PRTR CODE
7930 C6   01            00360          LDB     #1        SET TO
7932 F7   7940          00370          STB     WIDFLG    WIDE-PRINT
7935 C6   00            00380          LDB     #0        SET SKIPFLAG
7937 F7   793F          00390          STB     SKPFLG    TO NO-SKIP
793A C6   08            00400 RETURN   LDB     #8T       SET BIT COUNT
793C 16   F4B3          00410          LBRA    28146     AND RETURN
793F      00            00420 SKPFLG   FCB     0T        0=NOSKIP
7940      00            00430 WIDFLG   FCB     0T        NOTWIDE=0
7941 F6   7940          00440 CKSKP    LDB     WIDFLG    NOW WIDE-PRINTING?
7944 C1   01            00450          CMPB    #1T
7946 26   F2            00460          BNE     RETURN    NO-SO GO PRINT
7948 F6   793F          00470          LDB     SKPFLG    READY TO
794B C1   01            00480          CMPB    #1T       SKIP?
794D 26   09            00490          BNE     SKIPON    TURN ON & PRT
794F 86   1F            00500          LDA     #31T      YES-SEND DUMMY
7951 C6   00            00510          LDB     #0T       AND SET
7953 F7   793F          00520          STB     SKPFLG    SKIPFLAG OFF
7956 20   E2            00530          BRA     RETURN    GO PRINT DUMMY
7958 C6   01            00540 SKIPON   LDB     #1T       TURN ON
795A F7   793F          00550          STB     SKPFLG    SKIP FLAG
795D 20   DB            00560          BRA     RETURN    & GO PRINT
          7918          00570          END     START
00000 TOTAL ERRORS

CKSKP   7941
RETURN  793A
SKIPON  7958
SKPFLG  793F
START   7918
TURNON  792E
WIDFLG  7940
```


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*Program Listing 1. MOVSCRIP—Assembly Language*

```
100 REM ************************
110 REM *                      *
120 REM *       MOVSCRIP       *
130 REM *                      *
140 REM * ROBERT C. LAKE, CDP  *
150 REM *                      *
160 REM *  PROGRAM TO MODIFY    *
170 REM *                      *
180 REM *       scripsit       *
190 REM *                      *
200 REM *   TO ALLOW PRINTER   *
210 REM *       CONTROL        *
220 REM *                      *
230 REM ************************
240 CLEAR200,24575 'RESERVE SPAC
E FOR SCRIPSIT
250 REM *********
260 REM WARNING *
270 REM *********
280 CLS0:SOUND20,10
290 SUM=0
300 FOR J=1120 TO 1212:READN:SUM
=SUM+N:POKEJ,N:NEXTJ
310 IF SUM<>5115 THEN PRINT "ERR
OR IN DATA STATEMENT - 1":STOP
320 DATA 87,65,82,78,73,78,71
330 DATA 32,83,79,70,84,87,65,82
,69,32,80,73,82,65,67,89,32,73,8
3,32,65,32
340 DATA 32,32,32,32,32,32,32,67
,82,73,77,69,32,32,32,32,32,32,3
2,32,32,32,32,32,32,32,32,32
350 DATA 32,32,32,32,32,32,32,32
,32,32,32,32,32,32,85,83,69,32,8
9,79,85,82,32,79,87,78,32,67,65,
82,84,82,73,68,71,69
360 SOUND 20,100
370 REM ************************
380 REM MOVE CARTRIDGE TO RAM *
390 REM ************************
400 CLS:PRINT"MOVING scripsit TO
 RAM"
410 FOR J=49152 TO 57000
420 POKE(J-24576),PEEK(J)
430 PRINT@24,J
440 NEXT J
450 REM ********************
460 REM CHECK FOR CHANGES *
470 REM ********************
```

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Continued from page 63

```
480 PRINT:PRINT"MAKING CHANGES T
O OPERANDS FOR  SELECTED OP CODE
S"
490 FOR J=24576 TO 32000
500 IF PEEK(J)=16 AND PEEK(J+1)=
142 THEN GOSUB1080  '$108E=LDY
510 IF PEEK(J)=206 OR PEEK(J)=14
2 OR PEEK(J)=204 THEN GOSUB 1110
'LDU;LDX;LDD
520 PRINT @120,J
530 NEXT J
540 REM ************************
550 REM  PATCH ADDRESS TABLES *
560 REM ************************
570 PRINT:PRINT"PATCHING ADDRESS
 TABLES"
580 READ BEG,FIN
590 IF BEG=0 THEN 660
600 FOR J=BEG TO FIN STEP 2
610 POKE(J-24576),PEEK(J-24576)-
(24576/256)
620 NEXT J
630 GOTO 580
640 DATA 50372,50420,50823,50833
,0,0
650 REM ************************
660 REM PATCH MEMORY SIZE CODE*
670 REM ************************
680 SUM=0
690 PRINT:PRINT"PATCHING MEMORY
SIZE TO 24576"
700 FOR J=26155 TO 26183
710 READ N:POKEJ,N
720 SUM=SUM+N
730 NEXT J
740 IF SUM <> 870 THEN PRINT "ER
ROR IN DATA STATEMENT - 2":STOP
750 DATA 142,96,0,159,21,32,24
760 DATA 18,18,18,18,18,18,18,18
,18,18,18,18,18,18,18,18,18,18,1
8,18,18,18
770 REM ************************
780 REM NEW CODE TO WIDE PRINT*
790 REM ************************
800 PRINT:PRINT"PATCHING IN CODE
 FOR WIDE-PRINT"
810 SUM=0
820 FORJ=31000 TO 31070
830 READN:POKEJ,N
840 SUM=SUM+N
850 NEXT J
860 IF SUM <> 7600 THEN PRINT "E
RROR IN DATA STATEMENT - 3":STOP
870 DATA 166,228,129,37,38,35,18
2,121,64,129,1,38,9,134,30
880 DATA 198,0,247,121,64,32,12,
134,31,198,1,247,121,64,198,0
890 DATA 247,121,63,198,8,22,244
,179,0,0,246,121,64,193,1,38
900 DATA 242,246,121,63,193,1,38
,9,134,31
910 DATA 198,0,247,121,63,32,226
,198,1,247,121,63,32,219
920 REM ********************
930 REM BRANCH TO NEW CODE *
940 REM ********************
950 PRINT:PRINT"PATCHING IN BRAN
CH TO NEW CODE"
960 POKE 28142,22:POKE28143,11:P
OKE28144,39
970 REM ***************
980 REM WRITE TO TAPE *
990 REM ***************
1000 SOUND 50,5:CLS:PRINT"INSERT
 CASSETTE AND PUSH play   AND re
cord.  PUSH <enter> WHEN  CASETT
E DECK IS READY"
1010 A$= INKEY$ : IF A$= "" THEN
 1010
1020 FORJ=1TO3:CSAVEM "SCRIPT24"
,24576,32000,24576:NEXTJ
1030 CLS:PRINT "YOU NOW HAVE A C
OPY OF scripsit ON TAPE.  TO RUN
, KEY IN        cloadm:exec"
1040 END
1050 REM *************
1060 REM SUBROUTINES *
1070 REM *************
1080 IF (NOT(PEEK(J+2)>=&HC0 AND
 PEEK(J+2)<=&HF0)) THEN RETURN
'WITHIN RANGE OF CARTRIDGE????
1090 POKE(J+2), PEEK(J+2)-(24576
/256)
1100 RETURN
1110 IF (NOT(PEEK(J+1)>=&HC0 AND
 PEEK(J+1)<=&HF0)) THEN RETURN
'WITHIN RANGE OF CARTRIDGE????
1120 POKE J+1, PEEK(J+1)-(24576/
256)
1130 RETURN
```

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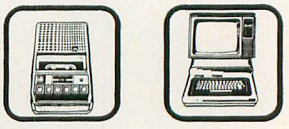
# RECOVER!

## Hit your Reset button and lost your program? Don't panic—this program will find it and fetch it back for you.

*by Kenneth Van Camp*



**16K Extended Color Basic**

THE TRS-80 COLOR COMPUTER is a good quality machine. But the Reset button is a problem area on many of them.

When you press this button, the computer should respond by clearing the screen and giving an OK prompt. Sometimes the computer gives its start-up message instead. If you had a program in memory before this happened, it appears to be wiped out; typing LIST or RUN yields only an OK.

A quick diagnosis of the problem suggests a power interruption, clearing all memory and starting fresh. The program seems to have vanished. Fortunately, this is not the case. The program is still in memory and can easily be retrieved.

A bad reset is similar to entering a NEW command. The program is not actually erased; instead, a special code is put into memory to tell the computer no program exists.

My program, RECOVER, finds this code and puts it back the way it was before losing your program. Everything will return to normal, as if no interruption had occurred.

RECOVER works for a faulty reset or an accidental NEW command, and can recover Basic or Extended Basic programs.

I have included two listings of the program; one in Basic and one in assembly language. The Basic listing is the only one necessary; the second is for readers who want to understand how the program works. Do not type in this second listing.

The easiest way to use RECOVER is to get a copy of **The Color Computer Magazine** monthly tape, which contains every program published in that issue. Information on obtaining this tape can be found elsewhere in this issue.

When a reset problem occurs, the first step is to position this tape. The way you load it will vary, depending on your memory size and level of Basic (see Table 1 for details).

Extended Basic users should note that if the special PCLEAR 0 mode was used by POKEing 25,6, then follow the instructions for non-Extended Basic.

When you get an OK from the load command, type EXEC and press Enter. Your program is recovered.

Extended Basic programmers won't need the CCM tape; they can simply type in and RUN the program. To do this, enter the Basic listing. Double check the Data statements, then RUN the program once. Position your tape and press play and record.

After you have saved a few copies, RECOVER will always be ready. When a reset problem occurs, just CLOADM "RECOVER" and EXEC. This should provide a speedy recovery from your lost program blues.

## Assembly Language Notes

Here are a few notes to help assembly language programmers understand RECOVER.

- RECOVER is written in relocatable code so it can reside anywhere in memory.
- Locations $19 and $1A hold a pointer to the first byte of the Basic program, plus one. (I'll call it FWA+1.)
- Locations $1B and $1C hold a pointer to the last byte of the Basic program, plus one (LWA+1).
- In Basic's special coding, each new line of the program begins with a zero byte, followed by the address of the next line's first byte.
- Basic marks the end of a program (and the beginning of variable storage), by placing zeros in the last three bytes of the program: LWA–2, LWA–1, and LWA.
- When a faulty reset or NEW command occurs, Basic resets the LWA pointer to FWA+3 and places three consecutive zeros in FWA, FWA+1, and FWA+2. *No other memory is changed.* However, the last two of these three zeros are written over the address of the program's second line. The first task accomplished by RECOVER is finding the second line of the program by searching for the first zero after FWA+3. The address of this second line is then stored at FWA+1, FWA+2.
- The second task accomplished by RECOVER is to find the true end of the program by searching for three consecutive zeros beyond the presently stored LWA. The address of the byte following the

third zero is stored in $1B and $1C. It is also stored in $1D and $1E, and $1F and $20 to move the end of variable and array storage to the end of the program which is where Basic assumes they start).

Unfortunately, this clears all variables from memory.

The *Color Computer Tape Loader* will run this program on all systems; as listed in the magazine, Extended Basic is required. ■ ■ ■

### *Program Listing 1. Basic Listing*

```
10 PMODE 0 : PCLEAR 1
100 C= 0 : FOR I= 2832 TO 2861
110 READ D : POKE I,D
120 C= C + D : NEXT I
130 IF C <> 3566 THEN PRINT " BA
D CHECKSUM: CHECK YOUR DATA" : L
IST 200-
140 PRINT "READY CASSETTE AND PR
ESS <ENTER>"
150 IF INKEY$ < > CHR$ (13) THEN
 150
160 CSAVE M "RECOVER", 2832, 286
1, 2832
170 PRINT "FOR ANOTHER COPY,"
180 GO TO 140
200 DATA 16,158,25,48,35,166
210 DATA 128,38,252,175,164,166
220 DATA 128,38,252,166,128,38
230 DATA 248,166,128,38,244,159
240 DATA 27,159,29,159,31,57
```

### *Program Listing 2. Assembly source code*

```
0B10                    00100          ORG     $B10     ; RECOVER * for BASIC programs
                        00110
0B10 109E 19            00120 START    LDY     $19      ; Y= [FWA]+1
0B13 30   23            00130          LEAX    3,Y      ; X= [FWA]+4
0B15 A6   80            00140 LOOP     LDA     ,X+      ; Look for 1st Zero byte
0B17 26   FC            00150          BNE     LOOP     ; not 0, LOOP again
0B19 AF   A4            00160          STX     ,Y       ; Found! Put its Addr. in [FWA]+1
                        00170
                        00180 * Now search for Last Line (3 Zeroes together)
0B1B A6   80            00190 FIRST    LDA     ,X+      ; Find 1st of 3 Zeroes
0B1D 26   FC            00200          BNE     FIRST    ; Not Zero? Try again
0B1F A6   80            00210 SECOND   LDA     ,X+      ; Another Zero?
0B21 26   F8            00220          BNE     FIRST    ; No. Start over
0B23 A6   80            00230 THIRD    LDA     ,X+      ; A third Zero?
0B25 26   F4            00240          BNE     FIRST    ; NO!(?) Start over
                        00250
0B27 9F   1B            00260          STX     $1B      ; YES! Found end, store in LWA
0B29 9F   1D            00270          STX     $1D      ; and in First Var. Addr. (CLEAR)
0B2B 9F   1F            00280          STX     $1F      ; as well as First Array Addr.
0B2D 39                 00290          RTS              ; Back to BASIC with program recovered
          0B10          00300          END     START
00000 TOTAL ERRORS

FIRST    0B1B
LOOP     0B15
SECOND   0B1F
START    0B10
THIRD    0B23
```

### *Loading Instructions*

| Machine Type | Command |
|---|---|
| Extended Basic (any size memory) | CLOADM "RECOVER" |
| 4K Non-Ext. Basic | CLOADM "RECOVER", 1215 |
| 16K Non-Ext. Basic | CLOADM "RECOVER", 13500 |
| 32K Non-Ext. Basic | CLOADM "RECOVER", 29880 |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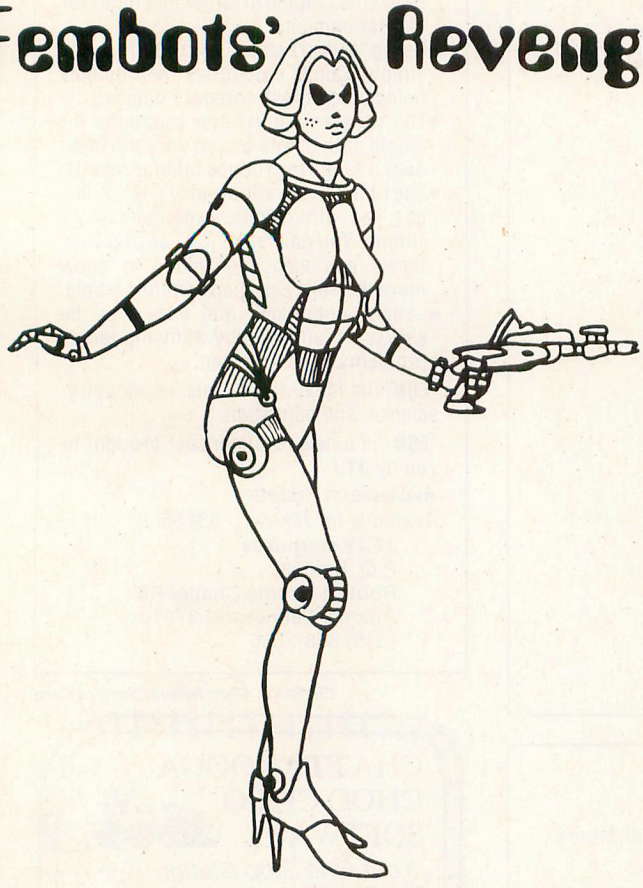

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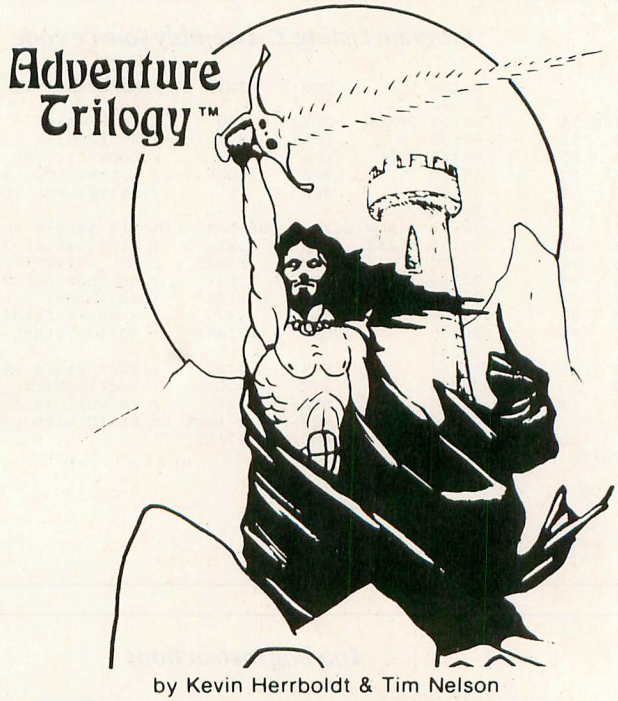

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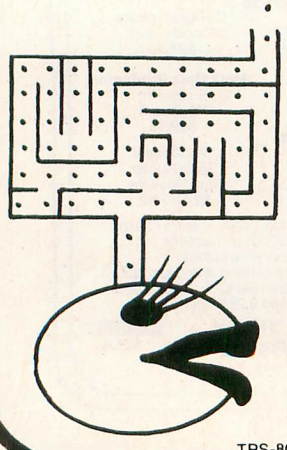

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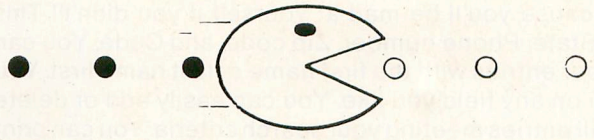

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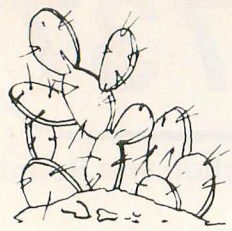

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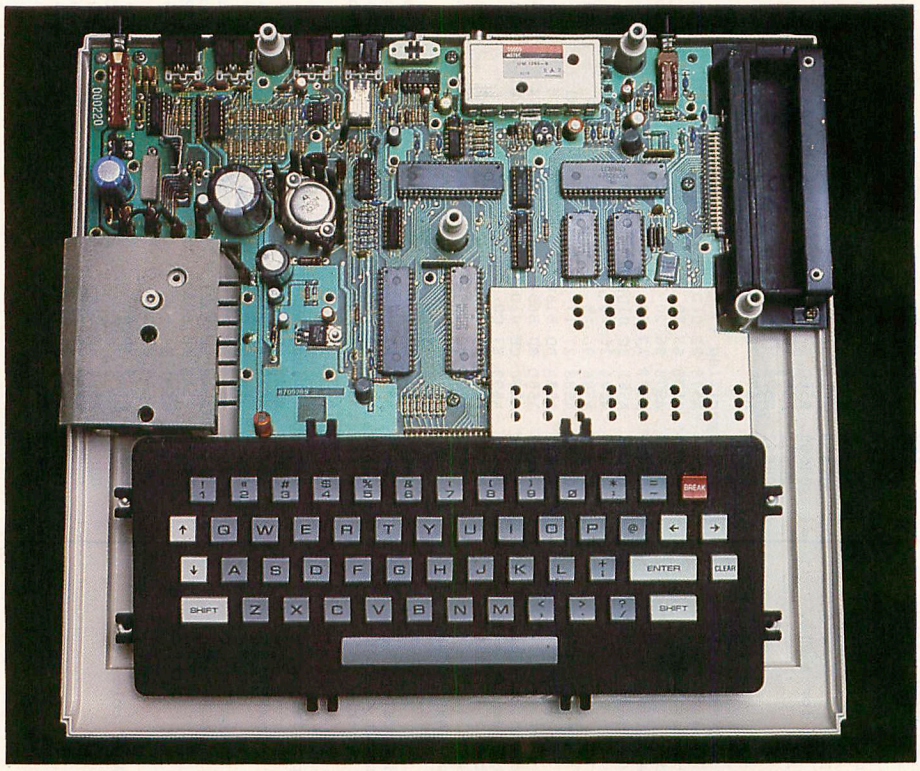
# Dissecting Your ROM

*Color Basic ROM explained. The second of 12 articles.*



**by Jake Commander**

LAST MONTH JAKE presented us with part one of his disassembly. Each month he'll cover a little more than 1K of disassembly, building up a full reference on 16K Extended Color Basic. Jake apologizes for the crypticness of some of his comments: They were kept short and to the point, as they were originally meant only for his own use. Also, to keep the overall picture in mind, he had to work fast. The following is a repeat of some of his other comments:

"The disassembly is just the way you'd get it by using the disassembler presented last month, with one exception. Relative branches are shown jumping to absolute addresses in order to leave more space in the comments column. Where the code isn't really machine code but is ASCII text or tables, the comments will make this clear. No attempt is made to clean up the disassembly to make it appear more like source code. It will look just as output from the disassembler looks.

"Where trick pieces of code are used, this will be commented, too. For instance, it's possible to jump into the middle of certain codes and have a different instruction carried out than appears in the disassembly. An example of this is the code at $A304 which appears as CMPX #$9E97. Notice that if this code is jumped to at location &A305, the MPU will execute a LDX<$97 instruction. This can be used by a sneaky machine code programmer to mask certain code. It isn't done for secrecy, but it saves a jump over the unwanted op code. Once again this will be commented where it occurs.

"All this may give a false impression. The comments are not at their most useful at each and every op code. They give the best idea of the working of the code when you take a step back. Like an artist viewing his work, too close a view doesn't give the right picture. So, don't take each commented op code too literally, but try to get a picture of each section of code that performs a particular function. That's another reason why some comments remain cryptic."

So here we are: Round Two. This portion of ROM deals with cassette I/O (program and data), INKEY$, and cursor positioning for PRINT @.

Continued from page 71

```
CSAVE
00539  A44C BD A578      JSR   $A578     ;-> Initialize filename.
00540  A44F 9D A5        JSR   <$A5      ;-> Parse current chr.
00541  A451 27 16        BEQ   $A469     ;-> If End Of Line, jmp to A469
00542  A453 BD B26D      JSR   $B26D     ;Syntax check for ","
00543  A456 C6 41        LDB   #$41      ;"A"
00544  A458 BD B26F      JSR   $B26F     ;Syntax check for "A"
00545  A45B 26 EE        BNE   $A44B     ;-> If not ASCII, jump to A44B.
00546  A45D 4F           CLRA            ;file type = BASIC
00547  A45E BD A65C      JSR   $A65C     ;O/p file header blk for ASCII.
00548  A461 86 FF        LDA   #$FF      ;Set Device # = -1.
00549  A463 97 6F        STA   <$6F
00550  A465 4F           CLRA            ;Set ZF for list.
00551  A466 7E B764      JMP   $B764     ;-> List to tape.
00552  A469 4F           CLRA            ;Filetype=BASIC. =>CMPRSSD CSAVE
00553  A46A 9E 8A        LDX   <$8A      ;Delimiter for filename.
00554  A46C BD A65F      JSR   $A65F     ;-> Output file header block.
00555  A46F 0F 78        CLR   <$78      ;File mode = header.
00556  A471 0C 7C        INC   <$7C      ;Last block if negative.
00557  A473 BD A7D8      JSR   $A7D8     ;->Start tape, o/p headr pulses.
00558  A476 9E 19        LDX   <$19      ;=> BASIC start.
00559  A478 9F 7E        STX   <$7E      ;=> Output area.
00560  A47A 86 FF        LDA   #$FF      ;Number bytes in cassette block.
00561  A47C 97 7D        STA   <$7D
00562  A47E DC 1B        LDD   <$1B      ;=> End of BASIC text (+1).
00563  A480 93 7E        SUBD  <$7E      ;= total bytes to end of Prog.
00564  A482 27 0D        BEQ   $A491     ;If no bytes left, Jump to A491.
00565  A484 108300FF     CMPD  #$00FF    ;Is number of bytes > FF (255)?
00566  A488 24 02        BHS   $A48C     ;If more, <$7D is OK.
00567  A48A D7 7D        STB   <$7D      ;Else replace block byte count
00568  A48C BD A7F4      JSR   $A7F4     ;Output cassette block.
00569  A48F 20 E7        BRA   $A478     ;Do next block.
00570  A491 00 7C        NEG   <$7C      ;Set last block indicator.
00571  A493 0F 7D        CLR   <$7D      ;# of bytes to output
00572  A495 7E A7E7      JMP   $A7E7     ;Output cassette block

CLOAD
00573  A498 0F 78        CLR   <$78      ;Clear Input/Output indicator
00574  A49A 81 4D        CMPA  #$4D      ;Is it CLOADM?
00575  A49C 27 60        BEQ   $A4FE     ;-> If yes, jump to A4FE
00576  A49E 32 62        LEAS  2,S       ;Pop Return
00577  A4A0 BD A5C5      JSR   $A5C5     ;-> get filename to buffer
00578  A4A3 BD A648      JSR   $A648     ;-> get cassette file header
00579  A4A6 7D 01E4      TST   $01E4     ;ASCII tape?
00580  A4A9 27 1D        BEQ   $A4C8     ;If not
00581  A4AB B6 01E3      LDA   $01E3
00582  A4AE 27 1D        BEQ   $A4CD     ;-> FM ERROR
00583  A4B0 BD AD19      JSR   $AD19     ;-> Initialize BASIC cold
00584  A4B3 86 FF        LDA   #$FF      ;Set device = -1
00585  A4B5 97 6F        STA   <$6F
00586  A4B7 0C 78        INC   <$78      ;Set Input
00587  A4B9 BD A635      JSR   $A635     ;-> Read Tape to memory
00588  A4BC 7E AC7C      JMP   $AC7C     ;-> Direct Command Mode

00589  A4BF BD 0185      JSR   $0185     ;-> RAM Vector
00590  A4C2 BD A42D      JSR   $A42D     ;-> Do output
00591  A4C5 7E AC73      JMP   $AC73     ;-> O.K.
00592  A4C8 B6 01E2      LDA   $01E2     ;File type?
00593  A4CB 27 03        BEQ   $A4D0     ;OK if BASIC
00594  A4CD 7E A616      JMP   $A616     ;-> FM ERROR
00595  A4D0 BD AD19      JSR   $AD19     ;-> Initialize BASIC cold
00596  A4D3 BD A77C      JSR   $A77C     ;-> Get Header pulses
00597  A4D6 9E 19        LDX   <$19      ;=> BASIC start
00654  A561 DD 88        STD   <$88      ;To cursor position.
00655  A563 39           RTS

INKEY
00656  A564 96 87        LDA   <$87      ;INKEY char. from Pause check.
00657  A566 26 03        BNE   $A56B     ;->if already have character,
                                         ; jump to A56B
00658  A568 BD A1C1      JSR   $A1C1     ;-> Otherwise scan the keyboard.
00659  A56B 0F 87        CLR   <$87      ;-> Remove INKEY store.
00660  A56D 97 53        STA   <$53
00661  A56F 1026 111C    LBNE  $B68F     ;->If have char, jump to B68F.
00662  A573 97 56        STA   <$56      ;otherwise return a null string.
00663  A575 7E B69B      JMP   $B69B

Get specified Filename.
00664  A578 8E 01D1      LDX   #$01D1    ;Initialize # of filename chars.
00665  A57B 6F 80        CLR   ,X+
00666  A57D 86 20        LDA   #$20      ;Spaces to
00667  A57F A7 80        STA   ,X+       ;01D2 - 01D9
00668  A581 8C 01DA      CMPX  #$01DA
00669  A584 26 F9        BNE   $A57F
00670  A586 9D A5        JSR   <$A5      ;Parse current chr
00671  A588 27 17        BEQ   $A5A1     ;-> If end of line, jump to A5A1
00672  A58A BD B156      JSR   $B156     ;-> Evaluate variable.
00673  A58D BD B654      JSR   $B654     ;->String pointer - X, #chrs - B
00674  A590 CE 01D1      LDU   #$01D1    ;Save number of filename chars.
00675  A593 E7 C0        STB   ,U+
00676  A595 27 0A        BEQ   $A5A1     ;RTS if null
00677  A597 8C C608      CMPX  #$C608    ;(LDB #8) @ A598

Copy B bytes from (X) -> (U).
00678  A59A A6 80        LDA   ,X+       ;Byte from source
00679  A59C A7 C0        STA   ,U+       ;To destination
00680  A59E 5A           DECB            ;number bytes left to be moved.
00681  A59F 26 F9        BNE   $A59A     ;Continue until done
00682  A5A1 39           RTS

Get specified Device #
00683  A5A2 BD B26D      JSR   $B26D     ;-> Syntax  Check for ","
00684  A5A5 81 23        CMPA  #$23      ;"#"?
00685  A5A7 26 02        BNE   $A5AB     ;if not, jump to A5AB
00686  A5A9 9D 9F        JSR   <$9F      ;Parse next chr
00687  A5AB BD B141      JSR   $B141     ;Compute numeric variable
00688  A5AE BD B3ED      JSR   $B3ED     ;FPAC1 to INT in D
00689  A5B1 59           ROLB            ; * 2
00690  A5B2 89 00        ADCA  #0
00691  A5B4 26 69        BNE   $A61F     ;->If A>FF and MSB B=1,
                                         ; then jump to A61F (DN ERROR)
00692  A5B6 56           RORB            ;restore #
00693  A5B7 D7 6F        STB   <$6F      ;Save Device number
00694  A5B9 BD 0161      JSR   $0161     ;-> RAM
00695  A5BC 27 06        BEQ   $A5C4     ;->If it's 0, jmp to A5C4 (O.K.)
00696  A5BE 2A 5F        BPL   $A61F     ;->If not minus, jmp to A61F
                                         ; (DN ERROR)
00697  A5C0 C1 FE        CMPB  #$FE      ;Is it equal to -2?
00698  A5C2 2D 5B        BLT   $A61F     ;->If<-2, jmp to A61F (DN ERROR)
                                         ;      (-3, -4, etc.)
00699  A5C4 39           RTS

Get Filename
00700  A5C5 8D B1        BSR   $A578     ;-> Initialize filename
00701  A5C7 9D A5        JSR   <$A5      ;Parse current char <-- SN
                                         ;  check end Stmnt
```

**Program Listing. ROM Dissection**

```
00598  A4D8 9F 7E        STX   <$7E      ;Save load pointer
00599  A4DA DC 7E        LDD   <$7E
00600  A4DC 4C           INCA            ;look for another 256 bytes
00601  A4DD BD AC37      JSR   $AC37     ;-> check memory
00602  A4E0 BD A70B      JSR   $A70B     ;-> load block to memory
00603  A4E3 26 13        BNE   $A4F8     ;I/O ERROR
00604  A4E5 96 7C        LDA   <$7C      ;Last block indicator
00605  A4E7 27 0F        BEQ   $A4F8     ;I/O ERROR
00606  A4E9 2A ED        BPL   $A4D8     ;more to do
00607  A4EB 9F 1B        STX   <$1B      ;next BASIC pointer setup
00608  A4ED 8D 4C        BSR   $A53B     ;-> turn motor off
00609  A4EF 8E ABEC      LDX   #$ABEC    ;=> "OK"
00610  A4F2 BD B99C      JSR   $B99C     ;Print "OK"
00611  A4F5 7E ACE9      JMP   $ACE9     ;-> Reset vars., line pointers,
                                         ;-> go into direct mode
00612  A4F8 BD AD19      JSR   $AD19     ;-> Reset BASIC
00613  A4FB 7E A619      JMP   $A619     ;-> I/O ERROR

CLOADM
00614  A4FE 9D 9F        JSR   <$9F      ;Parse next chr
00615  A500 8D 76        BSR   $A578     ;Initialize filename.
00616  A502 BD A648      JSR   $A648     ;-> Get cassette file.
00617  A505 9E 8A        LDX   <$8A      ;= 0 initial offset.
00618  A507 9D A5        JSR   <$A5      ;Parse current chr
00619  A509 27 06        BEQ   $A511     ;->If end of line, jump to A511.
00620  A50B BD B26D      JSR   $B26D     ;-> Syntax check for ","
00621  A50E BD B73D      JSR   $B73D     ;-> Get offset to X.
00622  A511 B6 01E2      LDA   $01E2     ;file type.
00623  A514 81 02        CMPA  #2        ;Is it binary?
00624  A516 26 B5        BNE   $A4CD     ;-> FM ERROR if not
00625  A518 FC 01E5      LDD   $01E5     ;Entry Point.
00626  A51B 33 8B        LEAU  D,X       ;add offset.
00627  A51D DF 9D        STU   <$9D      ;save  E.P.
00628  A51F 7D 01E4      TST   $01E4     ;Is it a BASIC file?
00629  A522 26 A9        BNE   $A4CD     ;FM ERROR if so
00630  A524 FC 01E7      LDD   $01E7     ;load address
00631  A527 30 8B        LEAX  D,X       ;add offset
00632  A529 9F 7E        STX   <$7E      ;save it
00633  A52B BD A77C      JSR   $A77C     ;-> get header pulses
00634  A52E BD A70B      JSR   $A70B     ;->load cassette block to memory
00635  A531 26 C8        BNE   $A4FB     ;-> IO ERROR
00636  A533 9F 7E        STX   <$7E      ;save load address
00637  A535 0D 7C        TST   <$7C      ;last block indicator
00638  A537 27 C2        BEQ   $A4FB     ;-> IO ERROR
00639  A539 2A F3        BPL   $A52E     ;-> If more to do, jump to A52E
00640  A53B 7E A7E9      JMP   $A7E9     ;-> Turn motor off

EXEC
00641  A53E 27 05        BEQ   $A545     ;->If no parameters, jmp to A545
00642  A540 BD B73D      JSR   $B73D     ;-> Get entry point
00643  A543 9F 9D        STX   <$9D      ;- Save entry point
00644  A545 6E 9F009D    JMP   (009D)    ;-> (initially FC ERROR)
Check for pause if not Cassette O/P
00645  A549 BD 017F      JSR   $017F     ;-> RAM
00646  A54C 96 6F        LDA   <$6F      ;Device number
00647  A54E 4C           INCA
00648  A54F 27 50        BEQ   $A5A1     ;-> RTS if cassette output
00649  A551 7E ADEB      JMP   $ADEB     ;-> otherwise check for BREAK or
                                         ;  SHIFT "@"

Set cursor for "PRINT@"
00650  A554 BD B3E4      JSR   $B3E4     ;-> Evaluate position to D.
00651  A557 83 01FF      SUBD  #$01FF    ;Is it greater than 511?
00652  A55A 1022 0EEC    LBHI  $B44A     ;-> FC ERROR if so
00653  A55E C3 05FF      ADDD  #$05FF    ;Restore and add screen offset.
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00702  A5C9 27 F9        BEQ   $A5C4     ;-> If end of line, jump to A5C4
00703  A5CB 7E B277      JMP   $B277     ;Otherwise SN ERROR

EOF
00704  A5CE BD 0188      JSR   $0188     ;-> RAM
00705  A5D1 96 6F        LDA   <$6F      ;Device number
00706  A5D3 34 02        PSHS  A
00707  A5D5 8D D7        BSR   $A5AE     ;-> Check if device number OK
00708  A5D7 BD A3ED      JSR   $A3ED     ;-> Check if file is Open
00709  A5DA 5F           CLRB            ;default
00710  A5DB 96 6F        LDA   <$6F      ;Device number
00711  A5DD 27 05        BEQ   $A5E4     ;If normal I/O, jump to A5E4
00712  A5DF 0D 79        TST   <$79      ;Number of bytes in block
00713  A5E1 26 01        BNE   $A5E4     ;If not EOF, jump to A5E4
00714  A5E3 53           COMB            ;Otherwise sign =-1 = true
00715  A5E4 35 02        PULS  A         ;Restore device number
00716  A5E6 97 6F        STA   <$6F
00717  A5E8 1D           SEX             ;# to D
00718  A5E9 7E B4F4      JMP   $B4F4     ;Return INT as F.P.

SKIPF
00719  A5EC 8D D7        BSR   $A5C5     ;-> Get filename
00720  A5EE 8D 58        BSR   $A648     ;-> Get cassette file
00721  A5F0 BD A6D1      JSR   $A6D1     ;I/P file
00722  A5F3 26 24        BNE   $A619     ;If IO ERROR, jump to A619
00723  A5F5 39           RTS
OPEN
00724  A5F6 BD 015E      JSR   $015E     ;-> Ram vector
00725  A5F9 BD B156      JSR   $B156     ;->Compute variable ("I" or "O")
00726  A5FC BD B6A4      JSR   $B6A4     ;-> LEFT$
00727  A5FF 34 04        PSHS  B         ;save mode
00728  A601 8D 9F        BSR   $A5A2     ;-> Get device number
00729  A603 BD B26D      JSR   $B26D     ;-> Syntax check ","
00730  A606 8D BD        BSR   $A5C5     ;-> Get filename
00731  A608 96 6F        LDA   <$6F      ;Hold device number
00732  A60A 0F 6F        CLR   <$6F      ;Default to keyboard/Video
00733  A60C 35 04        PULS  B         ;Restore mode
00734  A60E C1 49        CMPB  #$49      ;Is it "I"?
00735  A610 27 12        BEQ   $A624     ;If it is, jump to A624
00736  A612 C1 4F        CMPB  #$4F      ;Is it "O"?
00737  A614 27 42        BEQ   $A658     ;If it is, jump to A658
00738  A616 C6 2A        LDB   #$2A      ;FM ERROR
00739  A618 8C C628      CMPX  #$C628    ;IO ERROR (LDB #$28 @A619)
00740  A61B 8C C624      CMPX  #$C624    ;AO ERROR (LDB #$24 @A61C)
00741  A61E 8C C626      CMPX  #$C626    ;DN ERROR (LDB #$26 @A61F)
00742  A621 7E AC46      JMP   $AC46     ;ERROR
OPEN "I"
00743  A624 4C           INCA            ;Device number
00744  A625 2B EF        BMI   $A616     ;->If=-2, jmp to A616 (FM ERROR)
00745  A627 26 2E        BNE   $A657     ;-> If video, jump to A657 (RTS)
00746  A629 8D 1D        BSR   $A648     ;->Check to see if already open
00747  A62B B6 01E3      LDA   $01E3
00748  A62E B4 01E4      ANDA  $01E4
00749  A631 27 E3        BEQ   $A616     ;-> If FM ERROR, jump to A616
00750  A633 0C 78        INC   <$78      ;- Set input mode
00751  A635 BD A701      JSR   $A701     ;->Read tape blk to memory <--EP
00752  A638 26 DF        BNE   $A619     ;-> If IO ERROR, jump to A619
00753  A63A 0D 7C        TST   <$7C      ;Last block indicator
00754  A63C 27 DB        BEQ   $A619     ;-> If IO ERROR, jmp to A619
00755  A63E 2B 17        BMI   $A657     ;->If last blk, jmp to A657(RTS)
00756  A640 96 7D        LDA   <$7D      ;Number of bytes in block
00757  A642 27 F1        BEQ   $A635     ;If block empty, jump to A635
00758  A644 97 79        STA   <$79      ;Setup wrk tally # bytes in bffr
00759  A646 20 0A        BRA   $A652     ;-> Refresh I/O buffer work ptr
```

*Please turn the page*

Continued from page 73

```
Search for cassette file
00760  A648 0D 78        TST   <$78      ;Is the file open?
00761  A64A 26 D0        BNE   $A61C     ;->If so, jmp to A61C (AO ERROR)
00762  A64C 8D 33        BSR   $A681     ;-> Search for filename on cass.
00763  A64E 26 C9        BNE   $A619     ;-> IO ERROR.
00764  A650 0F 79        CLR   <$7       ;zero number bytes of I/O
00765  A652 8E 01DA      LDX   #$01DA    ;=> I/O buffer start
00766  A655 9F 7A        STX   <$7A      ;refresh I/O working pointer
00767  A657 39           RTS

OPEN "O"
00768  A658 4C           INCA
00769  A659 26 FC        BNE   $A657     ;-> RTS.
00770  A65B 4C           INCA
00771  A65C 8E FFFF      LDX   #$FFFF    ;= ASCII
00772  A65F 0D 78        TST   <$78      ;Check Output file.
00773  A661 26 B9        BNE   $A61C     ;->If open, jmp A61C (AO ERROR).
00774  A663 CE 01DA      LDU   #$01DA    ;=> Get filename.
00775  A666 DF 7E        STU   <$7E      ;Save pointer.
00776  A668 A7 48        STA   8,U       ;=> 01E2  (filetype)
00777  A66A AF 49        STX   9,U       ;=> 01E3
00778  A66C 8E 01D2      LDX   #$01D2    ;=> filename
00779  A66F BD A598      JSR   $A598     ;copy filename to output buffer.
00780  A672 0F 7C        CLR   <$7C      ;not last block
00781  A674 86 0F        LDA   #$0F      ;number of bytes to output = 15
00782  A676 97 7D        STA   <$7D
00783  A678 BD A7E5      JSR   $A7E5     ;-> Output filename block
00784  A67B 86 02        LDA   #2        ;Set output mode
00785  A67D 97 78        STA   <$78
00786  A67F 20 CF        BRA   $A650

Search for filename on cassette
00787  A681 8E 01DA      LDX   #$01DA    ;Cassette load address
00788  A684 9F 7E        STX   <$7E
00789  A686 96 68        LDA   <$68      ;Direct mode?
00790  A688 4C           INCA
00791  A689 26 0B        BNE   $A696     ;If not, jump to A696
00792  A68B BD A928      JSR   $A928     ;-> CLS
00793  A68E 9E 88        LDX   <$88      ;=> Cursor
00794  A690 C6 53        LDB   #$53      ;load B with "S"
00795  A692 E7 81        STB   ,X++      ;Character to screen.
00796  A694 9F 88        STX   <$88      ;new cursor position
00797  A696 8D 69        BSR   $A701     ;load cassette & off
00798  A698 DA 7C        ORB   <$7C
00799  A69A 26 34        BNE   $A6D0     ;- RTS
00800  A69C 8E 01DA      LDX   #$01DA    ;=> Filename found
00801  A69F CE 01D2      LDU   #$01D2    ;Requested Filename buffer
00802  A6A2 C6 08        LDB   #8        ;number of characters
00803  A6A4 6F E2        CLR   ,-S       ;initialize cmpr status
00804  A6A6 A6 80        LDA   ,X+       ;chr from buffer
00805  A6A8 109E68       LDY   <$68      ;current line number
00806  A6AB 31 21        LEAY  1,Y       ;+1
00807  A6AD 26 05        BNE   $A6B4     ;-> If not direct, jump to A6B4
00808  A6AF 0F 6F        CLR   <$6F      ;reset output device
00809  A6B1 BD A282      JSR   $A282     ;-> print to screen
00810  A6B4 A0 C0        SUBA  ,U+       ;Is it the same character?
00811  A6B6 AA E4        ORA   ,S        ;save compare status
00812  A6B8 A7 E4        STA   ,S
00813  A6BA 5A           DECB            ;Is it all done?
00814  A6BB 26 E9        BNE   $A6A6     ;->If not, jump to A6A6 (cont.).
00815  A6BD A6 E0        LDA   ,S+       ;cmpr OK?
00816  A6BF 27 0A        BEQ   $A6CB     ;-> If it is, jump to A6CB
00817  A6C1 6D 57        TST   -9,U      ;Is the number of characters =0?
00818  A6C3 27 06        BEQ   $A6CB     ;-> If yes, jump to A6CB
00819  A6C5 8D 0A        BSR   $A6D1     ;-> Skip over the file
00853  A708 D6 81        LDB   <$81      ;-> Get Input/Output status
00854  A70A 39           RTS

Load Cassette Block to memory
00855  A70B 1A 50        ORCC  #$50      ;Disable interrupts
00856  A70D 8D E4        BSR   $A6F3     ;-> LHS screen character flip
00857  A70F 9E 7E        LDX   <$7E      ;=> Input buffer
00858  A711 4F           CLRA            ;Initialize input byte
00859  A712 8D 41        BSR   $A755     ;-> Get input bit to CF
00860  A714 46           RORA            ;CF into A
00861  A715 81 3C        CMPA  #$3C      ;Got a header byte?
00862  A717 26 F9        BNE   $A712     ;->If no, jmp to A712 (do again)
00863  A719 8D 2E        BSR   $A749     ;-> Input byte
00864  A71B 97 7C        STA   <$7C      ;Save first byte (BLKTYP)
00865  A71D 8D 2A        BSR   $A749     ;-> Input byte
00866  A71F 97 7D        STA   <$7D      ;Number bytes to input (BLKLEN)
00867  A721 9B 7C        ADDA  <$7C      ;Start checksum
00868  A723 97 80        STA   <$80      ;Checksum to memory
00869  A725 96 7D        LDA   <$7D      ;Block length
00870  A727 97 81        STA   <$81      ;Set up working tally
00871  A729 27 10        BEQ   $A73B     ;->If Blck Length=0, jmp to A73B
00872  A72B 8D 1C        BSR   $A749     ;-> Get Input byte
00873  A72D A7 84        STA   ,X        ;To Memory
00874  A72F A1 80        CMPA  ,X+       ;Has it gone in?
00875  A731 26 11        BNE   $A744     ;If not, jump to A744
00876  A733 9B 80        ADDA  <$80      ;Checksum
00877  A735 97 80        STA   <$80
00878  A737 0A 81        DEC   <$81      ;Is the whole block loaded?
00879  A739 26 F0        BNE   $A72B     ;->If no, jmp to A72B (continue)
00880  A73B 8D 0C        BSR   $A749     ;-> Input checksum
00881  A73D 90 80        SUBA  <$80      ;Is checksum OK?
00882  A73F 27 05        BEQ   $A746     ;If yes, jump to A746
00883  A741 86 01        LDA   #1        ;Bad checksum
00884  A743 8C 8602      CMPX  #$8602    ;Illegal load addr
                         (LDA   #2    at A744)
00885  A746 97 81        STA   <$81      ;Flag status
00886  A748 39           RTS

Input Casette byte
00887  A749 86 08        LDA   #8        ;Bit count
00888  A74B 97 82        STA   <$82
00889  A74D 8D 06        BSR   $A755     ;-> Input a bit
00890  A74F 46           RORA            ;put it in A
00891  A750 0A 82        DEC   <$82      ;Are all 8 bits in?
00892  A752 26 F9        BNE   $A74D
00893  A754 39           RTS

Get Input Bit to Carry Flag
00894  A755 8D 06        BSR   $A75D     ;Get wavelength to <$83
00895  A757 D6 83        LDB   <$83      ;Wavelength detected
00896  A759 5A           DECB
00897  A75A D1 8F        CMPB  <$8F      ;Short pulse = 1, Long pulse = 0
00898  A75C 39           RTS

Get Wavelength to <$83
00899  A75D 0F 83        CLR   <$83      ;Reset wavelength timer
00900  A75F 0D 84        TST   <$84      ;Is cass polarity rvrsed?
00901  A761 26 10        BNE   $A773     ;If reverse polarity
00902  A763 8D 07        BSR   $A76C     ;Strobe & time -cass I/P
00903  A765 25 FC        BLO   $A763     ;until bit =0
00904  A767 8D 03        BSR   $A76C     ;Strobe & time cass I/P
00905  A769 24 FC        BHS   $A767     ;until bit =1
00906  A76B 39           RTS

Strobe & Time Cassette Input
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```
00820  A6C7 26 07        BNE   $A6D0     ;-> RTS if bad I/O
00821  A6C9 20 BB        BRA   $A686
00822  A6CB 86 46        LDA   #$46      ;"F"
00823  A6CD 8D 29        BSR   $A6F8     ;->Display "F" if in direct mode
00824  A6CF 4F           CLRA
00825  A6D0 39           RTS

00826  A6D1 7D 01E4      TST   $01E4
00827  A6D4 26 09        BNE   $A6DF
00828  A6D6 BD A77C      JSR   $A77C     ;-> get header pulses
00829  A6D9 8D 30        BSR   $A70B     ;->Load cassette block to memory
00830  A6DB 8D 08        BSR   $A6E5     ;-> Flash screen if OK.
00831  A6DD 20 FA        BRA   $A6D9

00832  A6DF 8D 20        BSR   $A701     ;-> Do complete tape block Input
00833  A6E1 8D 02        BSR   $A6E5     ;-> Flash screen if OK
00834  A6E3 20 FA        BRA   $A6DF

00835  A6E5 26 06        BNE   $A6ED
00836  A6E7 96 7C        LDA   <$7C      ;Is this the last block?
00837  A6E9 40           NEGA
00838  A6EA 2B 07        BMI   $A6F3     ;-> If no, jump to A6F3
00839  A6EC 4A           DECA
00840  A6ED 97 81        STA   <$81      ;Save Input/Output status
00841  A6EF 32 62        LEAS  2,S       ;Pop return
00842  A6F1 20 12        BRA   $A705     ;->Turn motr off, Get I/O status

Flip top LHS character
00843  A6F3 B6 0400      LDA   $0400     ;chr frm LHS top scrn
00844  A6F6 88 40        EORA  #$40      ;Flip color
00845  A6F8 D6 68        LDB   <$68      ;Line Number Most Signif. Byte
00846  A6FA 5C           INCB            ;Is it Direct?
00847  A6FB 26 03        BNE   $A700     ;If not, jmp to A700 (no disply)
00848  A6FD B7 0400      STA   $0400     ;Else send character to screen
00849  A700 39           RTS

00850  A701 8D 79        BSR   $A77C     ;-> Get timing pulses
00851  A703 8D 06        BSR   $A70B     ;->Load cassette block to memory
00852  A705 BD A7E9      JSR   $A7E9     ;-> Turn cassette motor off
```

```
00907  A76C 0C 83        INC   <$83      ;bump timing counter
00908  A76E F6 FF20      LDB   $FF20     ;Check waveform crossover
00909  A771 56           RORB            ;To carry flag
00910  A772 39           RTS

00911  A773 8D F7        BSR   $A76C     ;Strobe & time cass I/P
00912  A775 24 FC        BHS   $A773     ;until bit =1
00913  A777 8D F3        BSR   $A76C     ;Strobe & time cass I/P
00914  A779 25 FC        BLO   $A777     ;until bit =0
00915  A77B 39           RTS

Get cassette timing pulses
00916  A77C 1A 50        ORCC  #$50      ;Disable Interrupts
00917  A77E 8D 4A        BSR   $A7CA     ;-> Motor on
00918  A780 0F 82        CLR   <$82      ;clear pulse count
00919  A782 8D DF        BSR   $A763     ;- Get input wave
00920  A784 8D 27        BSR   $A7AD     ;Check pulse width
00921  A786 22 0F        BHI   $A797     ;-> If above window
00922  A788 8D 1D        BSR   $A7A7     ;-> time til next falling edge
00923  A78A 25 0F        BLO   $A79B
00924  A78C 0A 82        DEC   <$82      ;Decrement pulse count
00925  A78E 96 82        LDA   <$82      ;take a look
00926  A790 81 A0        CMPA  #$A0      ;Have 96 been done
00927  A792 26 EE        BNE   $A782     ;-> continue if not
00928  A794 97 84        STA   <$84      ;Save cass I/P polarity
00929  A796 39           RTS

00930  A797 8D 0E        BSR   $A7A7     ;Time til next falling edge
00931  A799 22 E9        BHI   $A784     ;If long
00932  A79B 8D 10        BSR   $A7AD
00933  A79D 25 E9        BLO   $A788
00934  A79F 0C 82        INC   <$82
00935  A7A1 96 82        LDA   <$82
00936  A7A3 80 60        SUBA  #$60
00937  A7A5 20 EB        BRA   $A792
00938  A7A7 0F 83        CLR   <$83      ;Zero timing counter
00939  A7A9 8D BC        BSR   $A767     ;-> Get next falling edge
00940  A7AB 20 04        BRA   $A7B1
```

*Please turn the page*


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Continued from page 75

```
Check cassette pulse width
00941  A7AD 0F 83        CLR   <$83      ;Zero timing counter
00942  A7AF 8D C6        BSR   $A777     ;Time lower half wave
00943  A7B1 D6 83        LDB   <$83      ;timed pulse width
00944  A7B3 D1 90        CMPB  <$90      ;upper allowable pulse width
00945  A7B5 22 03        BHI   $A7BA     ;- If pulse width above window
00946  A7B7 D1 91        CMPB  <$91      ;lower allowable pulse width
00947  A7B9 39           RTS

00948  A7BA 0F 82        CLR   <$82      ;Re-initialize pulse counter
00949  A7BC 39           RTS

Motor
00950  A7BD 1F 89        TFR   A,B
00951  A7BF 9D 9F        JSR   <$9F      ;-> Parse next chr
00952  A7C1 C1 AA        CMPB  #$AA      ;Is it OFF?
00953  A7C3 27 24        BEQ   $A7E9     ;If yes, jump to A7E9
00954  A7C5 C1 88        CMPB  #$88      ;Is it ON?
00955  A7C7 BD A5C9      JSR   $A5C9     ;Syntax check OK
00956  A7CA B6 FF21      LDA   $FF21     ;Turn Cassette on    <- MOTOR on
00957  A7CD 8A 08        ORA   #8        ;Bit 3 on
00958  A7CF 8D 1F        BSR   $A7F0     ;->  Bit to $FF21
00959  A7D1 9E 8A        LDX   <$8A      ;Literal zero       (Delay)
00960  A7D3 30 1F        LEAX  -1,X      ;IX=IX-1
00961  A7D5 26 FC        BNE   $A7D3     ;countdown til zero
00962  A7D7 39           RTS             ;Tape up to speed

Start Tape, Output Timing Pulses
00963  A7D8 1A 50        ORCC  #$50      ;Disable Interrupts
00964  A7DA 8D EE        BSR   $A7CA     ;-> Motor on
00965  A7DC 9E 92        LDX   <$92      ;Number of header bytes (128)
00966  A7DE 8D 48        BSR   $A828     ;-> Output Sync Header bytes
00967  A7E0 30 1F        LEAX  -1,X      ;Are all of them done?
00968  A7E2 26 FA        BNE   $A7DE     ;Loop til done
00969  A7E4 39           RTS

Complete tape output
00970  A7E5 8D F1        BSR   $A7D8     ;->Start Tape, o/p header pulses
00971  A7E7 8D 0B        BSR   $A7F4     ;-> Output cassette block
00972  A7E9 1C AF        ANDCC #$AF      ;Enable interrupts  <- MOTOR OFF
00973  A7EB B6 FF21      LDA   $FF21
00974  A7EE 84 F7        ANDA  #$F7      ;Motor off
00975  A7F0 B7 FF21      STA   $FF21     ;Cmd to PIA
00976  A7F3 39           RTS

Output cassette block
00977  A7F4 1A 50        ORCC  #$50      ;Disable Interrupts
00978  A7F6 D6 7D        LDB   <$7D      ;number of bytes to output
00979  A7F8 D7 81        STB   <$81      ;working tally
00980  A7FA 96 7D        LDA   <$7D      ;Number bytes = initial checksum
00981  A7FC 27 07        BEQ   $A805     ;->If null block, jump to A805
00982  A7FE 9E 7E        LDX   <$7E      ;=> To Output Block
00983  A800 AB 80        ADDA  ,X+       ;Update checksum
00984  A802 5A           DECB            ;decrement counter
00985  A803 26 FB        BNE   $A800     ;If not done jmp to A800 (cont.)
00986  A805 9B 7C        ADDA  <$7C      ;Block type
00987  A807 97 80        STA   <$80      ;save checksum
00988  A809 9E 7E        LDX   <$7E      ;=> Output block
00989  A80B 8D 1B        BSR   $A828     ;-> output $55 to cassette
                                         ;   (final sync pulses)
00990  A80D 86 3C        LDA   #$3C      ;Header byte for 8-bit sync
00991  A80F 8D 19        BSR   $A82A     ;-> output $3C to cassette
00992  A811 96 7C        LDA   <$7C      ;BLKTYP
00993  A813 8D 15        BSR   $A82A     ;-> output block type
00994  A815 96 7D        LDA   <$7D      ;BLKLEN
00995  A817 8D 11        BSR   $A82A     ;-> Output # bytes in block
00996  A819 4D           TSTA            ;Null block?
00997  A81A 27 08        BEQ   $A824     ;- If null block, jump to A824
00998  A81C A6 80        LDA   ,X+       ;Byte to output
00999  A81E 8D 0A        BSR   $A82A     ;Do cassette output byte

01000  A820 0A 81        DEC   <$81      ;Decrement tally
01001  A822 26 F8        BNE   $A81C     ;Loop until all bytes O/P
01002  A824 96 80        LDA   <$80      ;Checksum
01003  A826 8D 02        BSR   $A82A     ;Do checksum, followed by $55
Output Byte to cassette
01004  A828 86 55        LDA   #$55
01005  A82A 34 02        PSHS  A
01006  A82C C6 01        LDB   #1        ;Initialize count to bit zero
01007  A82E 96 85        LDA   <$85      ;Last voltage O/P to cass
01008  A830 B7 FF20      STA   $FF20     ;send it again
01009  A833 108EA85C     LDY   #$A85C    ;=> Waveshape table
01010  A837 E5 E4        BITB  ,S        ;Zero or a one to be output?
01011  A839 26 0D        BNE   $A848     ;If one, jump to A848
01012  A83B A6 A0        LDA   ,Y+       ;         Output Long Pulse - 0
01013  A83D 108CA880     CMPY  #$A880    ;End of waveshape table?
01014  A841 27 12        BEQ   $A855     ;-> If yes, jump to A855
01015  A843 B7 FF20      STA   $FF20     ;Else send voltage to cass
01016  A846 20 F3        BRA   $A83B     ;Loop til end waveform
01017  A848 A6 A1        LDA   ,Y++      ;Number from table -
                                         ;  Output Short Pulse - 1
01018  A84A 108CA880     CMPY  #$A880    ;End of waveshape table?
01019  A84E 27 05        BEQ   $A855     ;-> If yes, jump to A855
01020  A850 B7 FF20      STA   $FF20     +else send voltage to cass
01021  A853 20 F3        BRA   $A848     ;Loop til end waveform
01022  A855 97 85        STA   <$85      ;Hold current O/P voltage
01023  A857 58           ASLB            ;shift bit counter
01024  A858 24 D4        BHS   $A82E     ;Loop til 8 bits o/p
01025  A85A 35 82        PULS  A,PC
Waveshape Table for CSAVE
01026  A85C 82 92        SBCA  #$92
01027  A85E AA BA
01028  A860 CA DA        ORB   #$DA
01029  A862 EA F2        ORB   ,-S
01030  A864 FA FAFA      ORB   $FAFA
01031  A867 F2 EADA      SBCB  $EADA
01032  A86A CA BA        ORB   #$BA
01033  A86C AA 92        ORA   ,-X
01034  A86E 7A 6A52      DEC   $6A52
01035  A871 42
01036  A872 32 22        LEAS  2,Y
01037  A874 12           NOP
01038  A875 0A 02        DEC   <2
01039  A877 02
01040  A878 02
01041  A879 0A 12        DEC   <$12
01042  A87B 22 32        BHI   $A8AF
01043  A87D 42
01044  A87E 52
```

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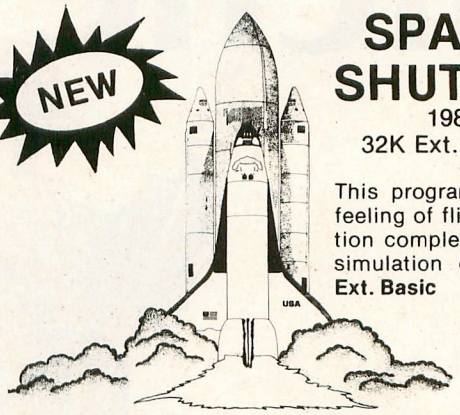

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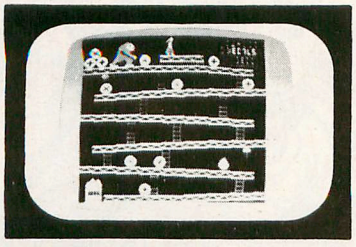

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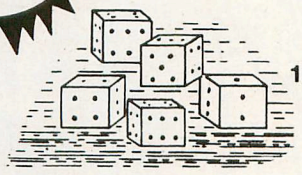
(C) 1983



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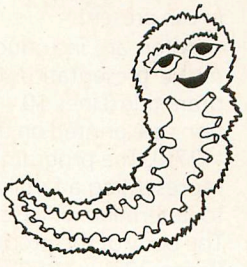

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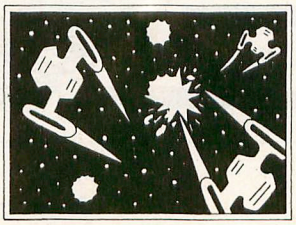

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# Cliché

16K Extended Color Basic





*by George Aftamonow*

FRIENDS GATHERING AT my house for a party or informal get-together are invariably drawn to my computer, looking for entertainment. Most computer games, however, can be played by only one, or at the most, two users at one time. Looking on during a game soon loses its entertainment value for the rest of the gathering.

I decided that a game for a group was needed, and set out to develop one. CLICHE was the result. It isn't an exciting adventure game, but it is a great party game for a group, and lets everyone see some of the graphics the Color Computer can present.

After an introductory graphics and music presentation of credits and program title (Lines 10 – 140), game instructions are printed on the screen (Lines 150 – 270). The program presents a diagram representing a familiar cliche; players try to determine which cliche is represented. The body of the program uses text screen (Lines 280 – 1050) and graphic screen (Lines 1060 – 1350). Players do not have to enter a response, but the program will verify an answer or give a correct answer upon request. Closing graphics and music follow (Lines 1360 – 1510).

To play CLICHE, load the program and Run it. The screen will present a set of four clues for four cliches in a graphic depiction. Players must look at the relationship each part has to the other in order to guess the answer. Pressing the number of the cliche you are working on will bring the correct answer onto the screen. Pressing the C key will present a new set of cliches to guess. An example of the type of graphic depiction to expect is presented in the screen instructions that appear when you run the program.

CLICHE uses 8K and requires Extended Color Basic.

*Program Listing. Cliché*

```
10 'CREATED BY GEORGE AFTAMONOW
    46 HOWE ST.  MILFORD, CT
20 CLEAR2000
30 PMODE3,1:SCREEN1,0:PCLS
40 DRAW"BM38,80;S16G2NU2L6NU2HU2
FR6E2L2GL2NE3L2E5D2R2NDUENL3BEFN
D2GNL2D2NEL2BDD2 BRD2R7EU2GND2L7
BEBR2NR2E6D2G4R3 BR2BD"
50 DRAW"D2R2U2NL2E7D2G7BR5 HU2FD
```

```
2R6E2U2NG2L2GBFND2L6BENR4E5NR3D2
NG3R2NDUNER2ENHD2GNU2NL2BD3"
60 DRAW"D2R2NE3U2NL2E3NR4D2R2NE2
GNR2D2R2U2E4BL2L2NEL2E3D2BR4NGE2
D2G7 BR4"
70 DRAW"U2R7D2NL7EU2NGNENU2L5E2N
D2R3END2L3E2ND2R4D2NL3EU2NGBH2 D
H2UF2"
80 PAINT(1,1),2,4
90 PLAY"T3O2L8DD+EO3L4CO2L8EL4O3
CO2L8EO3L2CO4L8CDD+ECDL4EO3L8BO4
L4DL2CP4"
100 CLS0:PRINT@232,"************
******";:PRINT@264,"*  CREATED
 BY   *";:PRINT@296,"*
     *";
110 PRINT@328,"*GEORGE AFTAMONOW
*";
120 PRINT@360,"*****************
*";
130 SCREEN0,1
140 PLAY"T3O4L8CDECDL4EL8CDCECDL
4EL8CDCECDL4EL8O3BO4L4DC"
150 CLS:INPUT"DO YOU NEED INSTRU
CTIONS (Y/N)";A$
160 IFA$="N" THEN280
170 CLS:PRINT"TO SOLVE THIS PUZZ
LE,SIMPLY FINDA SAYING,PHRASE OR
 CLICHE."
180 PRINT"            ***********
                      * WORKING *
                      *  TIME   *
                      ***********
190 INPUT"FOR EXAMPLE:IN THE SAM
PLE ABOVE THE WORD 'WORKING' APP
EARS OVER  THE WORD 'TIME'. SO T
HE ANSWER  WOULD BE WORKING OVER
TIME.      PRESS 'ENTER' TO CONT
INUE";B$
200 IFB$="B" THEN210
210 CLS:PRINT"THERE ARE 4 BOXES
ON EACH SCREENYOU ARE TO GUESS T
HE CLICHE IN  EACH (DO NOT INPUT
 YOUR ANSWER) TO FIND OUT WHETHE
R YOU WERE    RIGHT PRESS ITS CO
RRESPONDING   NUMBER."
220 PRINT"        *********"
230 PRINT"        * 1 * 2 *"
240 PRINT"        *********"
250 PRINT"        * 3 * 4 *"
260 PRINT"        *********"
270 INPUT"PRESS 'C' TO CONTINUE
OR TO GET A  NEW SCREEN";C$
280 CLS:FORI=10TO60:SET(I,3,3):S
ET(I,13,3):SET(I,23,3):NEXT
290 FORI=3TO23:SET(10,I,3):SET(3
```

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Continued from page 79

```
5,I,3):SET(60,I,3):NEXT
300 PRINT@72,"SOCIETY";
310 PRINT@147,"WAY YIELD";
320 PRINT@265,"STAND";:PRINT@299
,"I";
330 PRINT@277,"LOVERS";:PRINT@31
0,"TORN";:PRINT@341,"LOVERS";
340 SCREEN0,1
350 AA$=INKEY$:IFAA$="" THEN350
360 IFAA$="C" THEN440
370 IFAA$="1" OR AA$="2" OR AA$=
"3" OR AA$="4" THEN380 ELSE350
380 AA=VAL(AA$)
390 ON AA GOTO400,410,420,430
400 PRINT@448,"#1 HIGH SOCIETY":
SCREEN0,1:GOTO350
410 PRINT@448,"#2 YIELD RIGHT OF
 WAY":SCREEN0,1:GOTO350
420 PRINT@448,"#3 I UNDERSTAND":
SCREEN0,1:GOTO350
430 PRINT@448,"#4 TORN BETWEEN 2
 LOVERS":SCREEN0,1:GOTO350
440 CLS
450 FORI=10TO60:SET(I,3,4):SET(I
,13,4):SET(I,23,4):NEXT
460 FORI=3TO23:SET(10,I,4):SET(3
5,I,4)
470 SET(60,I,4):NEXT
480 PRINT@71,"BET YOUR";:PRINT@1
68,"DOLLAR";
490 PRINT@116,"SAFETY";:PRINT@12
4,"8";:PRINT@82,"2";:PRINT@87,"0
";:PRINT@155,"5";:PRINT@182,"71"
;:PRINT@188,"4";:PRINT@147,"12";
:PRINT@151,"3";
500 PRINT@265,"DAY";:PRINT@393,"
DAY";
510 PRINT@244,"SWEAR";:PRINT@276
,"BIBLE";:PRINT@308,"BIBLE";:PRI
NT@340,"BIBLE";
520 BB$=INKEY$:IFBB$="" THEN520
530 IFBB$="C" THEN610
540 IFBB$="1" OR BB$="2" OR BB$=
"3" OR BB$="4" THEN550 ELSE520
550 BB=VAL(BB$)
560 ON BB GOTO 570,580,590,600
570 PRINT@448,"#1 BET YOUR BOTTO
M DOLLAR":GOTO520
580 PRINT@448,"#2 SAFETY IN NUMB
ERS":GOTO520
590 PRINT@448,"#3 DAY IN, DAY OU
T":GOTO520
600 PRINT@448,"#4 SWEAR ON A STA
CK OF BIBLES":GOTO520
610 CLS:FORI=10TO35:SET(I,3,5):S
ET(I,23,5):NEXT:FORI=10TO60:SET(
I,13,5):NEXT
620 FORI=3TO23:SET(10,I,5):SET(3
5,I,5):SET(60,I,5):NEXT
630 PRINT@74,"0";:PRINT@105,"B.S
.";:PRINT@137,"M.A.";:PRINT@169,
"PHD.";
640 PRINT@85,"BATHING";:PRINT@11
8,"SUIT";
650 PRINT@264,"STRIKE";:PRINT@29
6,"STRIKE";:PRINT@328,"STRIKE";:
PRINT@392,"YOU'RE";
660 PRINT@310,"PIT";
670 CC$=INKEY$:IFCC$="" THEN670
680 IFCC$="C" THEN760
690 IFCC$="1" OR CC$="2" OR CC$=
"3" OR CC$="4" THEN700 ELSE670
700 CC=VAL(CC$)
710 ON CC GOTO720,730,740,750
720 PRINT@448,"#1 THREE DEGREES
BELOW ZERO":GOTO670
730 PRINT@448,"#2 TOPLESS BATHIN
G SUIT":GOTO670
740 PRINT@448,"#3 THREE STRIKES,
YOU'RE OUT":GOTO670
750 PRINT@448,"#4 BOTTOMLESS PIT
":GOTO670
760 CLS:FORI=10TO62:SET(I,1,7):S
ET(I,15,7):SET(I,26,7):NEXT
770 FORI=1TO26:SET(10,I,7):SET(3
5,I,7):SET(62,I,7):NEXT
780 PRINT@42,"S";:PRINT@74,"P";:
PRINT@106,"0";:PRINT@138,"R";:PR
INT@170,"T";:PRINT@202,"S";
790 PRINT@89,"C";:PRINT@121,"O";
:PRINT@153,"M";:PRINT@185,"I";:P
RINT@217,"C";
800 PRINT@326,"CALM STORM";
810 PRINT@340,"NOON GOOD";
820 DD$=INKEY$:IFDD$="" THEN820
830 IF DD$="C" THEN910
840 IFDD$="1" OR DD$="2" OR DD$=
"3" OR DD$="4" THEN850 ELSE820
850 DD=VAL(DD$)
860 ON DD GOTO870,880,890,900
870 PRINT@448,"#1 SPORTS COLUMN"
:GOTO820
880 PRINT@448,"#2 STAND UP COMIC
":GOTO820
890 PRINT@448,"#3 CALM BEFORE TH
E STORM":GOTO820
900 PRINT@448,"#4 GOOD AFTERNOON
":GOTO820
910 CLS:FORI=10TO60:SET(I,3,8):S
ET(I,13,8):SET(I,23,8):NEXT
920 FORI=3TO23:SET(10,I,8):SET(3
```

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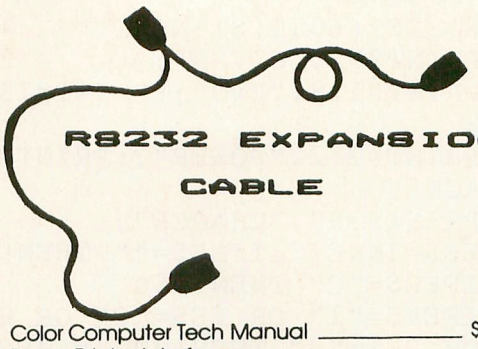


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Continued from page 80

```
5,I,8):SET(60,I,8):NEXT
930 PRINT@72,"COVER";
940 PRINT@118,"END";:PRINT@150,"
END";
950 PRINT@277,"POWER";:PRINT@405
,"BLACK";
960 PRINT@392,"CHANCE";
970 EE$=INKEY$:IFEE$="" THEN970
980 IFEE$="C" THEN1060
990 IFEE$="1" OR EE$="2" OR EE$=
"3" OR EE$="4" THEN1000 ELSE970
1000 EE=VAL(EE$)
1010 ON EE GOTO1020,1030,1040,10
50
1020 PRINT@448,"#1 COVER UP":GOT
O970
1030 PRINT@448,"#2 END OVER END"
:GOTO970
1040 PRINT@448,"#3 OUTSIDE CHANC
E":GOTO970
1050 PRINT@448,"#4 POWER BLACKOU
T":GOTO970
1060 PCLS:PMODE4,1:SCREEN1,1
1070 DRAW"BM20,10;S16 R28ND40R28
D20NL56D20L56U40"
1080 DRAW"BM40,60;S16U2RDNLBRNRN
D2U2RD4 BFBRU6BR2ND7FD5FU8BEBRNR
D5RD5L"
1090 DRAW"BM150,70;S32 U2NU3R2NU
3D2BRU4RD2NLD2BRU3BFND2RDLFBRR2"

1100 DRAW"BM40,120;S16 RULURBRRN
D2RBRND2RDLFBRNRU2RD2BRU2BRGFBRN
RUNRURBRNRDRDL"
1110 DRAW"BM40,150;S16 E2D2NHENF
U3BGR2BDND2FDENDURD2NLENDEBU2BLD
3FREULDFE2D2H"
1120 DRAW"BM170,140;S32 L2HUER2D
LDRDBR NU2RURDRU2BL3ERFBRNUDRDRU
RU2L3"
1130 FF$=INKEY$:IF FF$="" THEN11
30
1140 IF FF$="C" THEN1220
1150 IF FF$="1" OR FF$="2" OR FF
$="3" OR FF$="4" THEN1160 ELSE11
30
1160 FF=VAL(FF$)
1170 ON FF GOTO1180,1190,1200,12
10

1180 CLS:PRINT@448,"#1 GROWING P
AINS":GOSUB1510:GOTO1060
1190 CLS:PRINT@448,"#2 RECEDING
HAIRLINE":GOSUB1510:GOTO1060
1200 CLS:PRINT@448,"#3 DIFFERENT
 STROKES":GOSUB1510:GOTO1060
1210 CLS:PRINT@448,"#4 FAT CAT":
GOSUB1510:GOTO1060
1220 PCLS:PMODE4,1:SCREEN1,1:DRA
W"BM20,10;S16 R28ND40R28D20NL56D
20L56U40"
1230 DRAW"BM60,60;S16 U2F2U2BRFN
RLDR2U2BRND2R2ND2BR2D2NLR"
1240 DRAW"BM230,20;S16 DNDR2BD2D
LNULNUBDDRNURNUBDGULDR2BD2L2NUDB
DDRURD"
1250 DRAW"BM45,130;S12L3U2R3BR2D
2BR2U2R3DL2NLFBR2NR3U2R3BR2D2R3U
2BR2D2BR4U2NL2R2"
1260 DRAW"BM160,110;S24 D2ND2RNU
2D2 BRNRU4RND4BR D4RNU4BR NRU2RB
D2D2NLBR NRU2NRU2R"
1270 GG$=INKEY$:IFGG$="" THEN127
0
1280 IF GG$="C" THEN1360
1290 IF GG$="1" OR GG$="2" OR GG
$="3" OR GG$="4" THEN1300 ELSE12
70
1300 GG=VAL(GG$)
1310 ON GG GOTO1320,1330,1340,13
50
1320 CLS:PRINT@448,"#1 TURN UPSI
DE DOWN":GOSUB1510:GOTO1220
1330 CLS:PRINT@448,"#2 SIDE STRE
ET":GOSUB1510:GOTO1220
1340 CLS:PRINT@448,"#3 SHORT CIR
CUIT":GOSUB1510:GOTO1220
1350 CLS:PRINT@448,"#4 SPLIT LEV
EL HOUSE":GOSUB1510:GOTO1220
1360 PLAY"T3O2L4EEL8DL2DL4FFL8EL
2EL4GGL8FL2FL4AGP4O3L4O3CCO2L8AL
2FL4AGL8EL2CL4EFAL2O3CL4DL2C"
1370 PMODE4,1:SCREEN1,1:PCLS
1380 A$="U2NL2R2BR DNDR2NUDBR NR
2UNRUR2"
1390 A1$="L2UNRUR2BR ND2F2U2BR R
2D2LNU2L"
1400 FORS=1TO62
1410 B$="S"+STR$(S)
1420 DRAW"C3BM90,120;XB$;XA$;"
1430 DRAW"C0BM90,120;XB$;XA$;"
1440 NEXTS
1450 FORS=1TO62
1460 B$="S"+STR$(S)
1470 DRAW"C3BM100,120;XB$;XA1$;"

1480 DRAW"C0BM100,120;XB$;XA1$;"

1490 NEXTS
1500 CLS0:END
1510 FORQ=1TO1000:NEXTQ:RETURN
```

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## The Composer

by Rich Parry
Speech Systems
38 W. 255 Deerpath Rd.
Batavia, IL 60510

***$24.95 Cassette***
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*IT'S EXPECTED* that certified accountants will review payroll and spreadsheet software, business executives will review path management programs, and working engineers will review engineering applications packages. Finally, even professional writers are evaluating text editors. So why not, at last, have a musician review a music generation program?

I can think of three possible answers, based on most of the music software I've seen: nobody thought of it (unlikely); nobody could find a musician to do it (less likely); or nobody dared (my choice). "The Composer," an excellent program written for the TRS-80 Color Computer by Speech Systems' Rich Parry, is the best piece of music software in an overall miserable lot. The program deserves an A-plus for technique, but an F for musicality.

The lack of musicality isn't Rich Parry's fault, and if you happen to like any of the music programs marketed for small computers, then you'll love this one. Read no more; buy it.

### Music Theory by Kitsz

Now that's said; if you're still with me, consider that the problem is this: if we're talking about music, let's talk about music. In the early days, personal computers were scorned for their limited memory and inability to do a decent job on usual "computer tasks," such as accounting or engineering calculations (remember Apple Integer Basic or TRS-80 Level 1?). It was an admitted problem. The small machines have grown up in capability, growing up to respectability. Long strides have been made from the KIM-1 to 64K Visicalc.

But music isn't Visicalc; it's a sophisticated sensory as well as intellectual process. Unlike painting or sculpture, it does not wait for us to come to it; it plays as we listen—in its time. Unlike agglomerated arts such as television, it cannot contrapose form, color, image, sound, and words into an emotional/intellectual mélange. It is sound, and in sound the operant phrase for three decades has been fidelity—"hi-fi." Of course, computer-generated musical sound is faithful to nothing, because it is not a reproductive form. It originates, it does not regenerate.

Yet I suggest that, since in programs such as "The Composer" traditional harmonic and scale patterns are used, there should be—my opinion, remember—a "fi" to the musical constructs to which we have been acculturated. In other words, it should sound good.

Don't get me wrong; I am definitely not against electronic music or electronic realizations of other music. I've been composing for 17 years, and have used every means at my disposal to achieve the sound I wanted, including the conception, design and construction of acoustic and electronic instruments of all kinds. At least two dozen of my compositions are purely electronic. That's not the difficulty I have with microcomputer sound programs.

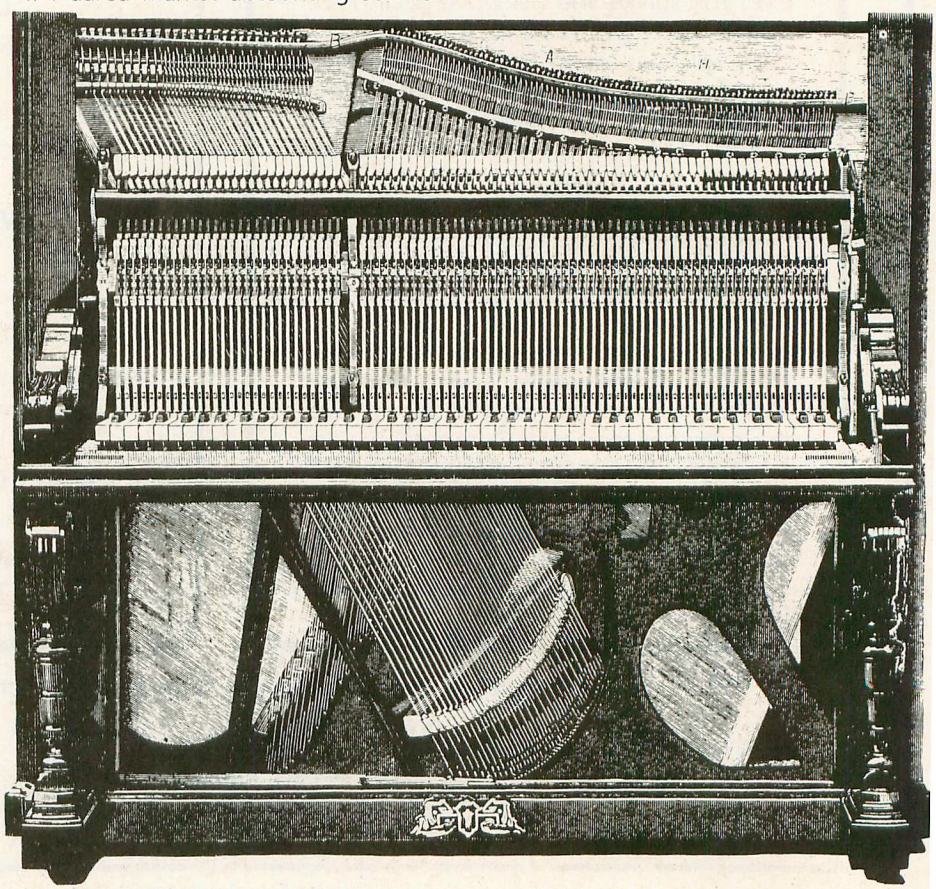
The trouble is the sound. The hardware of small computers is simply incompetent to produce music: Period. Effects, yes. Tones, yes. Even recognizable melodies and harmonies. But music, no. If I dared market accounting software which did its math as accurately as microcomputer music programs produce music, I would be laughed out of the business—if not personally lynched by an angry mob of pin-striped business managers.

The philosophical dilemma is that music, an art form, is treated in our educational system as an ephemeral part of the program. It seems unimportant that the ancient Greek civilization, which we seek to emulate in so many other ways, treated music as second only to mathematics in the order of universal values. Background music, cheap entertainment, and a misplaced sense of democratization have conspired to make music as a whole our societal vaudevillian. No matter; even as simple musical entertainment, microcomputer music programs are vacuous, sterile, and, as a whole, unpleasant.

If that is my given—you've got my bias now, right?—then how does "The Composer" rank with the rest of this kind of software?

### Back to the Review

It is, in fact, quite good. The music editor follows the dreadful tradition of



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# Setting The Standards

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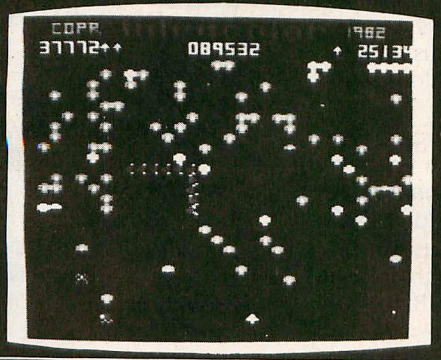

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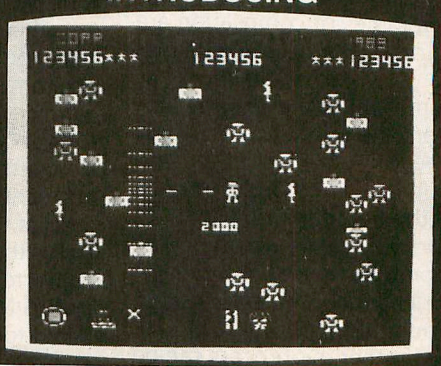

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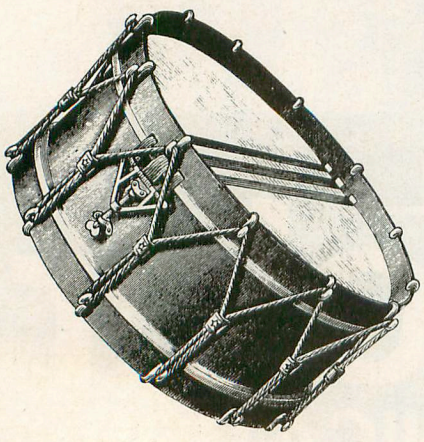
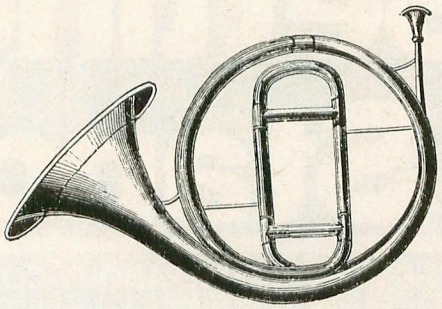
breaking a coherent visual score into note-names and rhythmic values, and then creating long lists of this anonymous and distinctly unmusical-looking data. I am no fan of this computer-bound tradition, although I admit to using it in my own software (more out of laziness than anything else); but I am still looking for the program that provides an interactive compiler with the musical score displayed as a horizontally scrolling stream. (Anyone listening?)

Once the music has been entered as a list of letters and numbers, the compiler is set to work. For a long piece in four-part harmony (about a minute of music), three to five minutes of compilation are needed. The piece can be played either through the television speaker, or by hooking an amplifier to the cassette output connector. The music can be transposed to other keys (it must be recompiled), sped up or slowed down (it must be recompiled), or edited (it must be recompiled). Do you sense a complaint? Since the compiler is not interactive, every *minor change* requires another three-to-five minute wait.

I can't say whether this process can be made faster, though I would hope it could. No programming information is provided on the internal organization and operation of the editor, compiler, or playback routines, nor is a simple way of creating a cassette back-up copy permitted. (Since my cassette version of "The Composer" arrived with the record-lockout tabs intact, I managed to erase part of the program.) Unhappily, this requires that the original tape be used every time any music is to be created. Disk users, on the other hand, can make copies in the usual way.

The resulting sound is somewhat in tune (better than most), and the compilation is correct. The sound, however, is





gritty—best when played through a low-fi television, worst when fed through an amplifier. The reason for this are two-fold: processor speed versus memory economy, and digital-to-analog quantization noise.

The Color Computer microprocessor slowness results in a certain grittiness, and contributes to the occasional slipperiness of the intonation. More problematically, the Color Computer uses a 6-bit converter, resulting in very high noise figures (S/N of worse than 40 dB), as compared to—just for illustration—the Sony PCM digital recorder which uses a 14-bit (optionally 16-bit) converter, giving 90 dB or better signal-to-noise ratio. (If you're interested in theoretical details, you can obtain reprints of Micro/Sonics, my column for *Programmer* magazine).

In summary, "The Composer" is a solid program, well-constructed, accurate, and reasonably versatile. Rich Parry is to be commended on the work and the documentation, with the few reservations I've noted. It is state-of-the-art software for the Color Computer, and an excellent technical demonstration.

*— by Dennis Bathory Kitsz*

## Armadillo Bug

Armadillo Int'l Software
PO Box 7661
Austin, Texas 78712

*ARMADILLO BUG* is a Basic program written for Color Computers with minimum 4K memory. It will work with or without Extended Basic. If you are beginning to work with machine language or would like to use machine language programs listed in books or magazines, this program will help.

Armadillo Bug loads from cassette with a CLOAD "ARMBUG" command. The program opens with a menu when run. You can examine memory, jump to a memory location, clear the screen, move blocks of memory, fill blocks of memory, save memory to tape, or load from tape. Each is achieved by the program's organized use of the PEEK and POKE commands.

The EXAMINE command lets you see or change the contents of any memory address. Memory is referred to and displayed in hexadecimal notation. (This is the base 16 number system usually used in machine language programming.)

By changing the memory contents you can enter a machine-language program, then, using the JUMP command, you can run the program you just entered.

The MOVE command lets you move blocks of memory from one area of the computer's memory to another. You might use the EXAMINE command to change the memory corresponding to the video screen and draw a picture. You can move that picture to another part of memory and store it there.

The FILL command fills blocks of memory with specific bytes. Filling the block of video screen memory between 0400H to 05FFH with 41H will fill the screen with the letter A.

Once you enter a machine-language program into memory you can save it to cassette tape. It is important to realize that the program on the tape can only be loaded back into memory with Armadillo Bug's LOAD command. Also, the LOAD command will only work with programs saved using Armadillo Bug.

An interesting feature of the LOAD command is called offset. When you load, for example, a picture saved previously, you are asked where you would like the information loaded. This does not mean a machine-language program which was designed to run in one part of memory can be made to operate at another.

The documentation is although short, but takes the user through each command and includes plenty of sample uses. The text is easy to understand and well-written. The samples included give the user a thorough understanding of the uses and operation of Armadillo Bug.

Armadillo Bug organizes the Basic PEEK and POKE commands and makes them easier to use. Although of some help to a beginner, this program is limited in its usefulness to more advanced users as a monitor or debugger. The functions normally associated with a monitor, such as placement of breakpoints to stop execution or register displays to see the value of registers (machine-language variables), are noticably absent.

*— by Mark Robinson*

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Each program is in a multiple choice questionnaire format where the user is querried as to a response to a specified management situation. Tutorials help the user learn new management skills and insights. The programs include voice annotation from the author, Mr. Terry Barker. "BEING BOSS" is based in part on his forthcoming management books "BOSS TALK" and "THEORY C."

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# TRS-80 Micro Color Computer

Radio Shack
One Tandy Center
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***$119.95***

*RADIO SHACK* has just given birth to a 29½ ounce baby brother to the Color Computer, called the TRS-80 MC-10. Designed to compete with computers such as the VIC-20, Sinclair/Timex 1000, and the Texas Instruments TI-99/2, the MC-10 is loaded with features that will please the experienced computer hobbyist, while maintaining a price low enough to remain accessible for the general public. For the price, we believe the MC-10 is a better buy than its competitors.

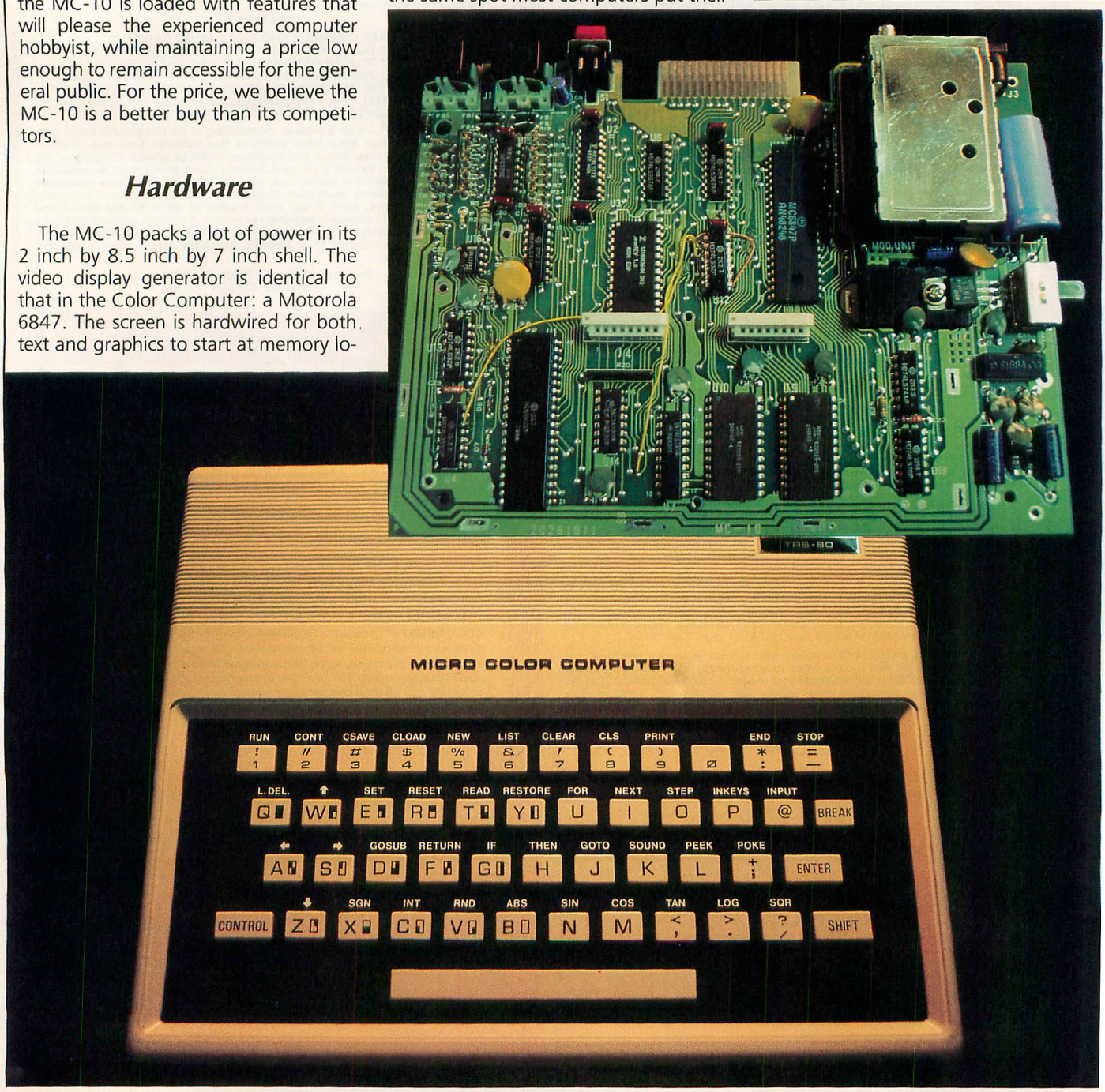
## Hardware

The MC-10 packs a lot of power in its 2 inch by 8.5 inch by 7 inch shell. The video display generator is identical to that in the Color Computer: a Motorola 6847. The screen is hardwired for both text and graphics to start at memory location $4000. Micro Color Basic, used in the MC-10, does not support high resolution graphics, but by using machine language the programmer can get all the graphics modes possible with the Color Computer. The text screen is the familiar black on green; POKE 32768,64 provides the user with black on red. Lowercase is achieved, as in the Color Computer, by a Shift 0 command.

The keyboard seems to be the primary area of cost reduction. The MC-10 has an undersized calculator-style 48-key keyboard. Some of the keys are in annoying places; for example, the Control key is in the same spot most computers put their right shift key. For those who are used to the Color Computer's layout, other

| | |
|---|---|
| 0–127 | 6803 Input/Output |
| 128–191 | Internal CMOS Memory |
| 192–255 | Internal Scratchpad Memory |
| 256–16383 | Not Used |
| 16384–16895 | Text Video Memory |
| 16384–20479 | 4K RAM |
| 16384-32767 | 16K RAM |
| 32768–49151 | 6847 VDG |
| 49152–57343 | Not Used |
| 57344–65535 | Micro Color Basic |

*Table 1. General Memory Map*



poorly located placement is the Break key and the four arrow keys. On the plus side, the keyboard does have positive tactile feedback, unlike the Sinclair Computer. Some keys also have graphics symbols, which can be embedded in strings simply by pressing the Shift key along with the letter key. Another nice feature of the keyboard is that Basic words are assigned to individual letters on the keyboard, as on the Sinclair machine. For example: to use the word PRINT in a Basic program, the user can type either: control 9, ?, or PRINT (on the Sinclair, Basic words cannot be entered letter by letter).

The memory map for this computer was not available from Radio Shack at the time of this writing, but we believe we have a fairly accurate map derived from our experiences with the computer. This map is shown in Table 1.

One of the nicest features of the MC-10, that puts it out of the class of the other small microcomputers, is the built-in RS-232C serial interface. According to the users manual, the port is compatible

Suped-up 6800 CPU

| | |
|---|---|
| **ABX** | Adds B to X |
| **ADDD** | Adds to D |
| **ASLD** | Arithmetic Shift Left D |
| **BRN** | Branch Never |
| **LDD** | Loads D Register |
| **LSRD** | Logical Shift Right D |
| **MUL** | Multiply A times B |
| **PSHX** | Pushes X to the Stack |
| **PULX** | Pulls X off the Stack |
| **STD** | Store Register D |
| **SUBD** | Subtract from D |

Internal timer

| | |
|---|---|
| **$0008** | Timer Control/Status |
| **$0009** | Counter's High Byte |
| **$000A** | Counter's Low Byte |
| **$000B** | Output Compare High Byte |
| **$000C** | Output Compare Low Byte |
| **$000D** | Input Capture High Byte |
| **$000E** | Input Capture Low Byte |

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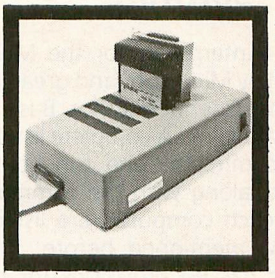
Serial Input/Output

| | |
|---|---|
| **$0010** | Rate and Mode Control |
| **$0011** | Transmit and Receive Status |
| **$0012** | Receive Data Register |
| **$0013** | Transmit Data Register |

Internal Clock

*Table 2. 6803 Features*


# Switchable Expansion Is Here



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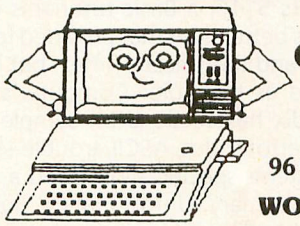

# INTERNATIONAL COLOR COMPUTER CLUB

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with the Color Computer, has a baud rate of 600 bps (bits per second), one start bit, seven data bits, two stop bits, and no parity. When outputting to a printer, the computer is automatically set for 132 columns with a carriage return at the end of the line, as in the Color Computer.

Radio Shack has strayed away from the 6809 CPU in the Micro Color Computer. They did, however, stay within the 6800 family. The new processor is a Motorola 6803, a direct decendant of the 6801. Some of the features of the 6803 are listed in Tables 2 and 3.

The cassette interface on the MC-10 is *almost* fully compatible with the Color Computer. We have had success transferring machine language programs written in 6800 code from the Color Computer to the MC-10. Limited success has also been achieved transferring Basic files in ASCII format from the Color Computer to the MC-10, but not from the MC-10 to the Color Computer. One last difference between the two interfaces is the fact that the MC-10 does not shut the tape recorder off when it is not loading or saving.

| | |
|---|---|
| 68000 | |
| 6809 | |
| 6801 | |
| 6803 | Increasing Power |
| 6802 | |
| 6808 | |
| 6800 | |

*Table 3. 6800 Family Tree*

Micro Basic Words Not in Color Basic:

| | |
|---|---|
| **CLOAD*** | Loads data from cassette into an array |
| **CSAVE*** | Saves data from an array to cassette |
| **LPRINT** | Same as Color Basic's PRINT#–2 |

Micro Basic Words Not in the Reference Manual

| | |
|---|---|
| **EXEC** | Transfers control of a program to machine language at the specified address |
| **CLOADM** | Loads a machine language program from cassette tape |

Color Basic Words Not in Micro Basic

| | |
|---|---|
| **AUDIO ON** | **JOYSTK** |
| **AUDIO OFF** | **MOTOR ON** |
| **CLOSE** | **MOTOR OFF** |
| **CSAVEM** | **OPEN** |
| **EOF** | **USR** |

*Table 4. Micro Color Basic*

## Software

The Basic interpreter for the MC-10 was written by Microsoft, and greatly resembles non-Extended Color Basic on the bigger machine. A complete list of all the Basic commands and functions in Micro Basic, along with the commands unique to each computer, are listed in Table 4. As mentioned before, Micro Color Basic has no provisions for high resolution graphics, but in Program Listing 1 we show how you can accomplish high resolution using POKEs. We have obtained a complete disassembly of the Basic interpreter using Philip Lucido's FLEX program "Dynamite" (Phil is our club president), and in future articles we will disclose more of this information, along with some useful programs.

Many programs written for the Color Computer will run on the MC-10 with little or no modification necessary, as long as the original programs do not require graphics. Although 6809 and 6800 machine code are different, their source code is similar and should be able to be adapted to each other.

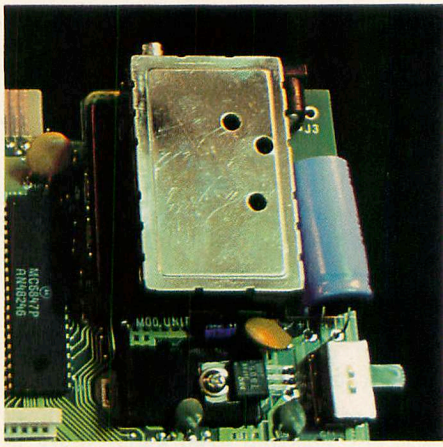
The documentation for the MC-10 is sketchy but adequate. In Chapters 1–4, the manual goes into details of how to set up and operate the computer. In Chapters 5–16, a Basic tutorial is given which is better than that provided for the VIC-20 and the Sinclair/Timex, but is not as good as the Color Computer's. The Appendix has sections on sample programs, error codes, ASCII, trouble-shooting, systems specificiations, and a command summary. Unfortunately, nothing is mentioned with respect to machine language, ROM entry points, or system variables. Also included is a handy reference card which beginners may use until they get used to Basic.

## Performance

Speed is the primary attribute of the MC-10. In our benchmark tests, shown in Program Listing 2 and 3, the MC-10 performed almost 20 percent faster than the Color Computer. Although the exact clock speed is unknown, we suspect that a high clock speed would be the only way a 6803 can beat a 6809.

The cost of the MC-10 is $119.95. For an additional fee of $49.95, 16K of RAM can be added. This brings the cost of a fairly powerful microcomputer down to the level where nearly everyone can afford one. ■ ■ ■

*— by Tim McFadden and Doug Kelley*



```
 10  'DRAW A SPACE INVADER IN
 20  'HI-RESOLUTION GRAPHICS
 30  POKE 32768, 255
 40  FOR C=16384 TO 16384+511
 50  POKE C,0
 60  NEXT C
 70  FOR A=16384+32*5 TO 16384+32*11
     STEP 32
 80  READ Z: POKE A+14,Z
 90  NEXT A
100  GOTO 100
110  DATA 24,102,255,60,36,66,129,66
```

***Program Listing 1***

```
 10  'PRIME NUMBER GENERATOR
 20  FOR X=1 TO 1000
 30  FOR Y=2 TO X-1
 40  IF X/Y=INT(X/Y) THEN 70
 50  NEXT Y
 60  PRINT X
 70  NEXT X
```

Time to run on MC-10: 16:07
Time to run on Color Computer: 21:40

***Program Listing 2***

```
  5  'FACTORIAL GENERATOR
 10  FOR Z=1 TO 100
 20  FOR X=0 TO 33
 30  GOSUB 80
 40  PRINT Z;X;A
 50  NEXT X
 60  NEXT Z
 70  END
 80  A=1
 90  IF X=0 THEN RETURN
100  FOR C=1 TO X
110  A=A*C
120  NEXT C
130  RETURN
```

Time to run on MC-10: 5.42
Time to run on Color Computer: 8:14

***Program Listing 3***

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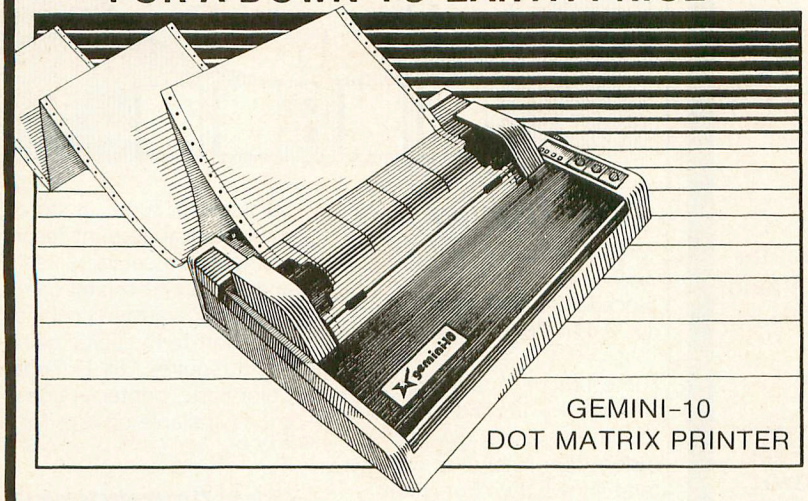


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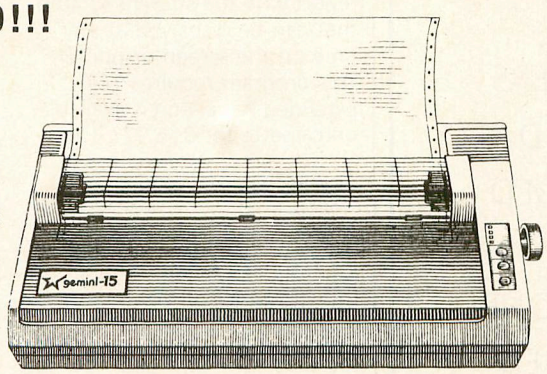


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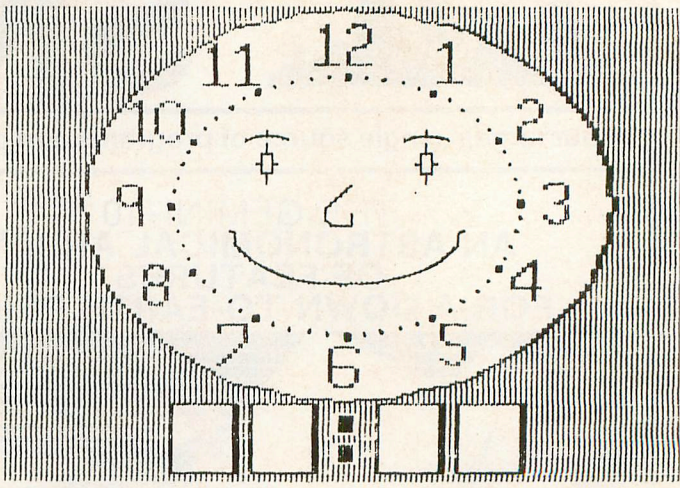

## Time Teacher

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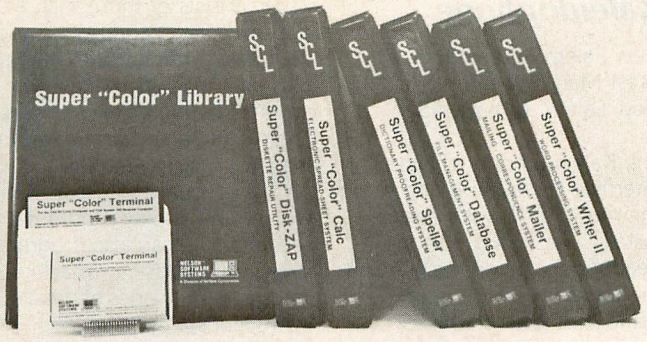


## *Super Color Terminal*

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Super Color Terminal, version 3.0, is an advanced data communications program available for the TRS-80C Color Computer and TDP system 100 Personal Computer. You can use it to communicate with all popular information services, such as Dow Jones; Compuserve; The Source; and local BBSs and clubs. You can also communicate with other Color Computers, Apples, IBM PCs, etc., via RS-232 or direct connect. The Super Color Terminal creates files totally compatible with other programs in the Super Color Library. SCT will work on any size Color Computer from 16K on up. The ROMpak version offers a full 61K of buffer space in a 64K machine, and up to 51.5K are available with a disk system and 53K with a tape system. The Super Color Terminal also offers a choice of eight hi-res displays, 32 by 16, and 51, 64 and 85 by 21 or by 24, with real lowercase descenders. The user is also provided with word wrap-around. It also supports automatic color graphics communications so you can receive pictures from bulletin boards and information systems. Other features include lowercase masking, selectable character trapping, Xon/Xoff and programmable upload prompts. The user can change word length, parity, duplex status, and stop bits. It supports disk and cassette I/O to save and load ASCII files, machine code and Basic programs, and allows printing of buffer contents. With a disk version one can save, load, kill, and rename disk files, and read a directory. The Super Color Terminal also provides 10 keystroke multipliers, each up to 255 characters long, for automatic message transmission. The Super Color Terminal is available for $49.95 on tape, $59.95 on ROMpak, and $69.95 on Disk.

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Auto Run is a utility program for the TRS-80* Extended Basic Color Computer. It is used to add convenience and professionalism to your software.

Auto Run will help you create your title screen with the graphics editor. The graphics editor allows you to choose a background color and border style. Using the arrow keys and several other commands you can draw pictures, block letters and also include text.

Auto Run will generate a machine language loader program to preceed your program on the tape. Then, to start up your program, simply type CLOADM to load in the Auto Run loader program, which will then automatically start itself up, display your title screen, load your program and then RUN or EXEC it.

Also you may record a vocal or musical introduction preceding your program. The Auto Run loader will control the audio on/off.

Basic programs can be set to load anywhere in memory above $600 (the PCLEAR 0 page).

Software authors: The Auto Run prefix may be appended to your software products.

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way across a congested video highway and swiftly dodge the oncoming traffic. There are up to 12 lanes and the level of difficulty increases automatically. The sooner a player reaches the other side, the higher his bonus score. All animation is done in machine language, which makes up most of this 16K program. Versions for both Extended and regular Basic are included. This is a very colorful game that was designed to be easy enough for children, yet challenging enough for even the most dedicated game player. It uses the four arrow keys, no joystick required, and is available on cassette for $16.97.

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## The Talking Speller

Superior Graphic Software Products
P.O. Box 451
Canton, NC 28716

The Talking Speller uses the capability of the Color Computer to control a cassette recorder from within a Basic program, and play back the list of spelling words through the monitor speaker. Teachers or parents can enter a list of spelling words, then record the words. The Talking Speller will play back the word, wait for a response from the keyboard, and keep score of the student's performance. After three wrong attempts, the correct spelling is displayed with appropriate sound effects. In a noisy classroom setting, earphones may be substituted for the speaker to provide individualized testing or drill and practice. The Talking Speller is all menu driven, and very easy for even inexperienced persons to use. Recording the spelling lists is a step by step process, with screen prompts for each activity. Play back and testing is equally easy. The speller requires Extended or non-Extended Basic, and is available on tape for $19.95.

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## Kaleidophone

New Salem Research
West Main Street
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The Kaleidophone lets you interface to any hi-fi and see the music on TV. It's easy to install — just plug into the headphone jack on the hi-fi and the joystick port on your computer. Besides the hardware (which includes all necessary plugs and cables), you receive a free issue of *Kaleidophonics,* a cassette magazine of programs for the Kaleidophone. The current issue consists of more than a dozen display programs in Basic (just choose them from a menu) plus nine machine language routines for high speed effects. There's also an instant program feature — just type in letters on the keyboard to create a whole new display program in seconds. You can also program it yourself in Basic or machine language. Ten pages of detailed instructions are included. Kaleidophone requires 16K, Extended or non-Extended Basic, and is available for $49.95.

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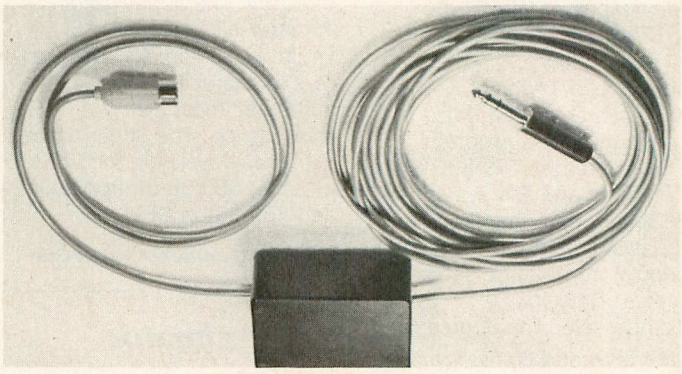

# Advertiser's Index


| Advertisers | Page | RS No. | Advertisers | Page | RS No. |
|---|---|---|---|---|---|
| Aardvark | 13 | 10 | Light House Data | 37 | 24 |
| Adventure International | IV | 65 | Mark Data | 31 | 21 |
| Amdek | 23 | 16 | | 59 | 38 |
| Armadillo | 6 | 6 | Micon | 50 | 33 |
| Basic Technology | 89 | 55 | Microcom | 42 | 27 |
| Bertamax | 47 | 32 | Micronix | 15 | 12 |
| Better Software | 79 | 18 | Micro Works | 14 | 11 |
| B5 Software | 55 | 36 | Moreton Bay Software | 92 | 59 |
| Chattanooga Choo Choo | 67 | 44 | Nelson Software | 20, 21 | 15 |
| Chromasette | 61 | 39 | | 68, 69 | 45 |
| Classical Computing | 27 | 19 | Owls Nest Software | 55 | — |
| Cognitec | 11 | 9 | Platinum Software | 63 | 41 |
| Color Computer Magazine Tape Loader | 65 | 42 | Prickley Pear | 70 | 46 |
| Color Software Services | 87 | 54 | Program Store | 5 | 4 |
| Colorware Inc. | 8, 9 | 8 | Quasar Animations | 1 | 2 |
| Computerware | 40, 41 | 26 | | 83 | 52 |
| Data Comp | 37 | 23 | Radio Shack | 16,17 | 13 |
| Dataman | 75 | 48 | | III | 64 |
| DSL Products | 45 | 31 | Skyline Marketing | 3 | 3 |
| Duggar's Growing Systems | 25 | 50 | | 91 | 58 |
| Eigen Systems | 54 | 35 | Software Support | 35 | 22 |
| 80 Plus | 93 | 62 | Soundworks Productions | 92 | 60 |
| Follett | 39 | 25 | Spectral Associates | 7 | 7 |
| Green Mountain Micro | 43 | 29 | Spectrum Projects | 24 | 17 |
| Homebase Computer | 29 | 20 | | 81 | 51 |
| Hoyt Stearns | 75 | 47 | Sugar Software | 93 | 61 |
| Inter + Action | 57 | 37 | Superior Graphic Software | 56 | — |
| International Color Computer Club | 89 | 56 | Synapse | 95 | 63 |
| Intracolor Communications | 85 | 53 | T & D Software | 43 | 30 |
| J.I.B. Company | 19 | 14 | T.C.E. | 62 | 40 |
| L & E Electro | 51 | 34 | Tom Mix | 77 | 49 |
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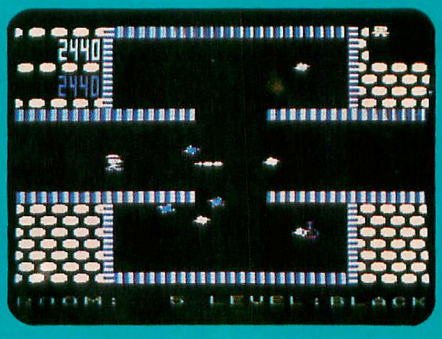


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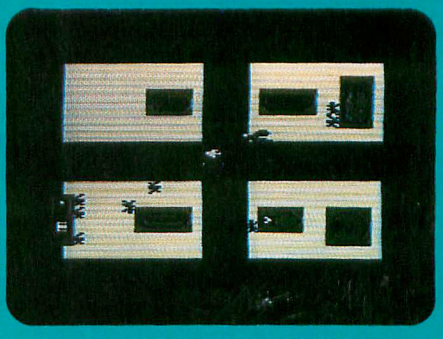

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# END OF FILE

Society has always glorified the pirate. Everyone knows fantastic tales of pirate adventures, from Bluebeard to Captain Hook. Every kid has fancied himself a pirate sailing the open seas. The software pirate is a different story, however. Unquestionably, *software piracy* is the ugliest phrase in computer jargon.

For the past two months **The Color Computer Magazine** has featured stories of TRS-80 User Groups. It is our intention to support the continuation and formation of user groups, as the best way to share information and learn more about your computer. But, there is an aspect to user groups that we don't support—the illegal sharing of copyrighted software.

Not all user groups are guilty of this; hopefully most are not. Shawn Jipp explained in his June article that his group worked hard figuring out how to create and use a club software library without violating copyrights. Most club officers I have spoken with have sought to be honorable about the rights of software authors and manufacturers. It's not easy—after all, the primary purpose of user groups is to share.

Most computer users have seen, used, or owned unauthorized software at sometime. It seems the problem is more prolific among TRS-80 users than users of other systems. The reason for this is both complimentary and ominous. The compliment refers to how active, widespread, and resourceful TRS-80 users are. The bad aspect is that some software manufacturers have stopped or won't consider publishing TRS-80 software as a consequence.

Many disgruntled software vendors point an accusing finger at user groups as the reason for rampant piracy. While a blanket condemnation is not fair, it is not difficult to see their point.

Imagine the scenario: A user group of 30 people is having their monthly meeting. A new blockbuster game has come out a week before the meeting. One of the group's members bought the game, and brings it to the meeting. Everyone plays and loves it. Before next month's meeting, someone has figured out how to break the game's security technique. By the end of the meeting the group's 30 members all have illegal copies of the game. The software vendor made one sale and now 30 people have the game. The software's author made a percentage of that one sale, yet 30 people are enjoying his work.

Worse than that scenario is another, where the user group takes money from its treasury to buy the one copy to place in their software library. Someone makes a copyable version and all a member has to do is check the piece out of the library, then go home and make his own. The vendor and author still have their one sale. What makes this scenario worse than the first is that the group's intent was to buy for the sole purpose of illegal distribution of the game.

Now, take that hypothetical example and multiply it by 10 user groups; the vendor and author now have 10 sales and 300 users. Sales are cut even deeper, while the user number increases.

How realistic are these scenarios? *Very*, if you ask a software vendor. *Unfair*, if you ask a user group member. Both are sincere in their response; and both are probably right.

Steve Bjork performed a programming wonder for Data Soft with his "Zaxxon." Within a week after its release an independent bulletin board operator had broken the protection scheme and placed the game on his download section for all to have, for the price of the phone call to his BBS. Imagine the thoughts and feelings that went through Steve's head when he heard about it. Imagine the Data Soft folks' thoughts the next time they consider buying the software license to an arcade blockbuster.

Big Five software decided a while ago not to produce software for TRS-80 computers because of piracy. They produced quite a few enjoyable game programs for the Models I and III, but because of rampant piracy, they couldn't make enough money to justify the cost to produce the software.

What happens? Software prices rise to increase profit margins to compensate for stolen sales. The honest user pays for someone else's theft. But then the problem escalates.

Higher prices mean the good guy will buy less software. Or, even worse, he'll obtain a pirated copy himself next time. With higher prices causing less sales, software vendors and authors turn away from the Color Computer, and we're left with a lower quality of software.

Although I use games as an example, the problem is not isolated to game software.

The search for a solution to software piracy has progressed very little since the problem was first discussed years ago. No matter how a vendor attempts to make his software uncopyable, people break through. Besides, protection routines anger and frustrate the honest user because he can't make legitimate back-ups of software he has paid for.

The answer lies somewhere deep within the conflict. It is my belief that if vendors want to take the wind out of a pirate's sails, he must realize that protection and prices will do little to stop piracy. People will always be able to break through protection routines. At the same time, users need to express their concerns to vendors.

If vendors and users don't find common ground soon, both will lose. Color Computerists have no quality software available to them. Vendors will not have a receptive marketplace to sell their goods.

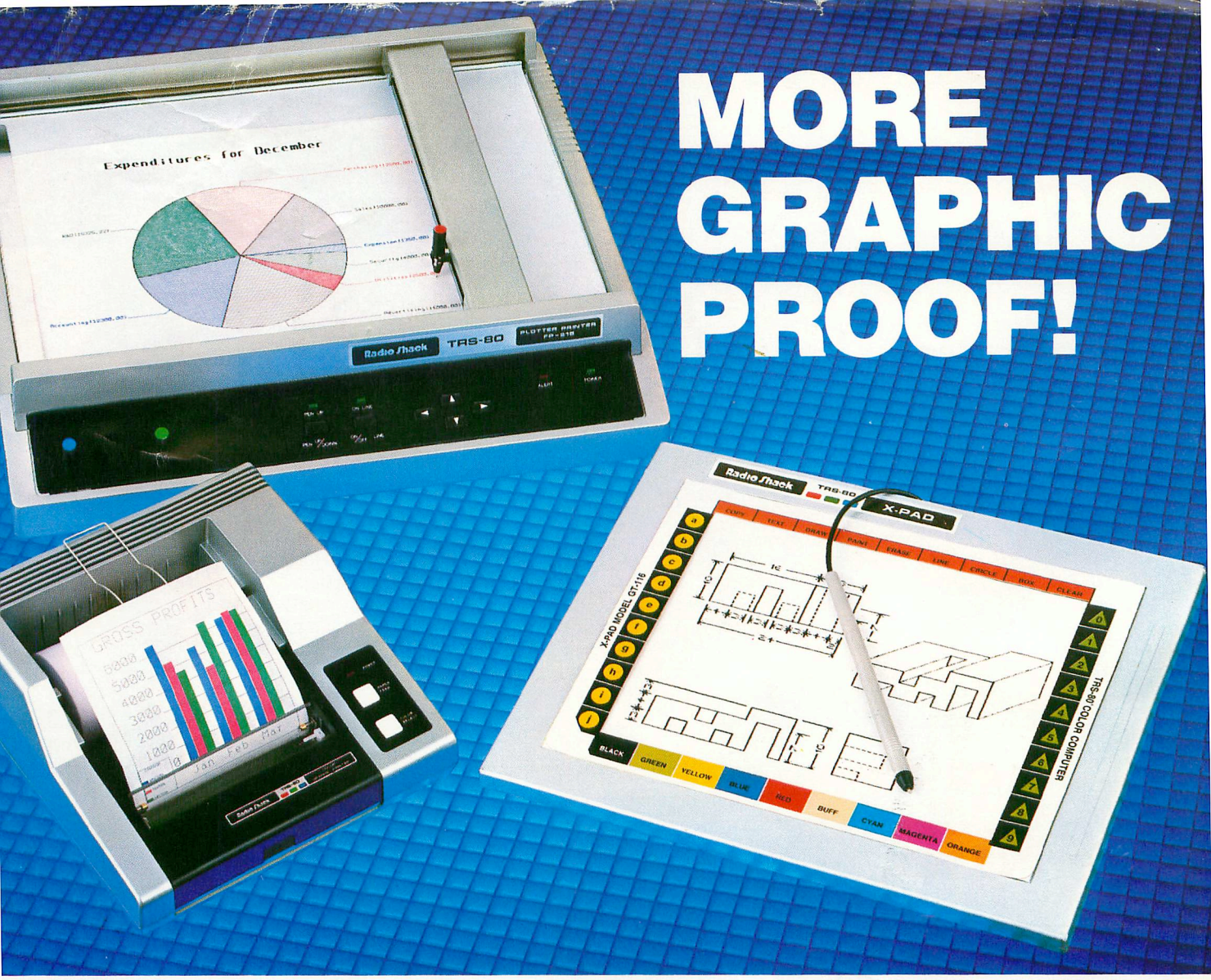
Whether user groups are the worst offenders or not, it should become their responsibility to help vendors stem the growth of the piracy problem. A dialogue between user groups and vendors is needed. Color Computer users and vendors have similiar interests in the continued success of the Color Computer. We would like to hear from all those concerned: it's time to start the ball rolling. — *K.L., Editor*

# FOR...NEXT (09,83)

SEPTEMBER MEANS back to school for children and a lot of our readers who are in the educational field. It also means that parents will be helping their children with study habits, homework, and school projects. Much of that homework will find its way into the Color Computer you have at home, as more and more schools see the need for computer literacy.

To make this easier for kids, teachers and parents, you'll want to be sure you read the back-to-school issue. Jean Plesser has a new column for computing kids that's almost as neat as peanut butter. A teacher for the Asa Adams school in Orono takes a look at Logo. We also have examples of educational programs from Shirley Georgi.

For those of you who don't need education, The Sorcerer will be back with more mind-boggling games, Commander's Disassembly will continue, Kitsz has an upgrade modification planned, and a host of other surprises that will keep you busy for hours.

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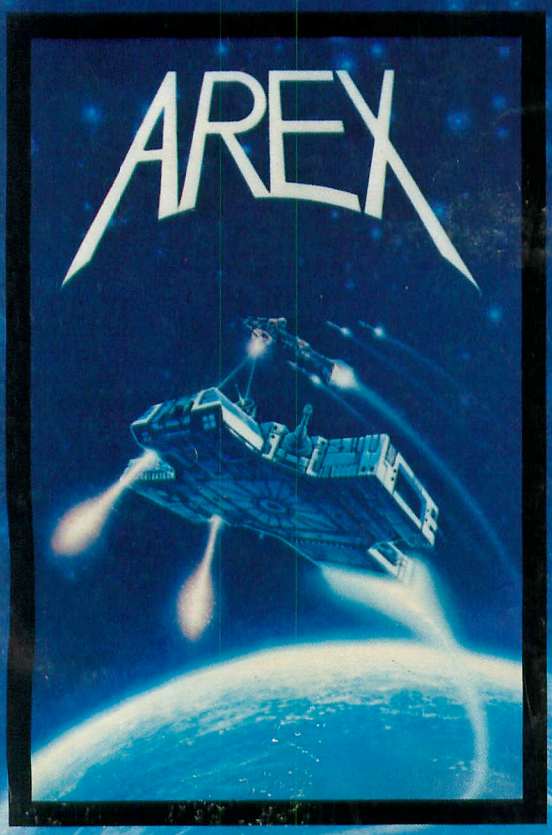


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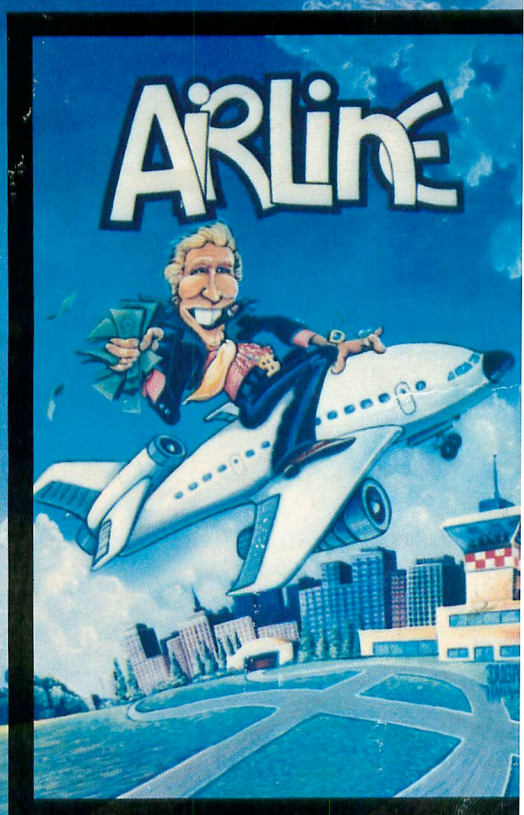


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