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September 1983 USA $2.95

HOT CoCo

THE MAGAZINE FOR TRS-80 COLOR COMPUTER AND TDP-100 USERS T.M.

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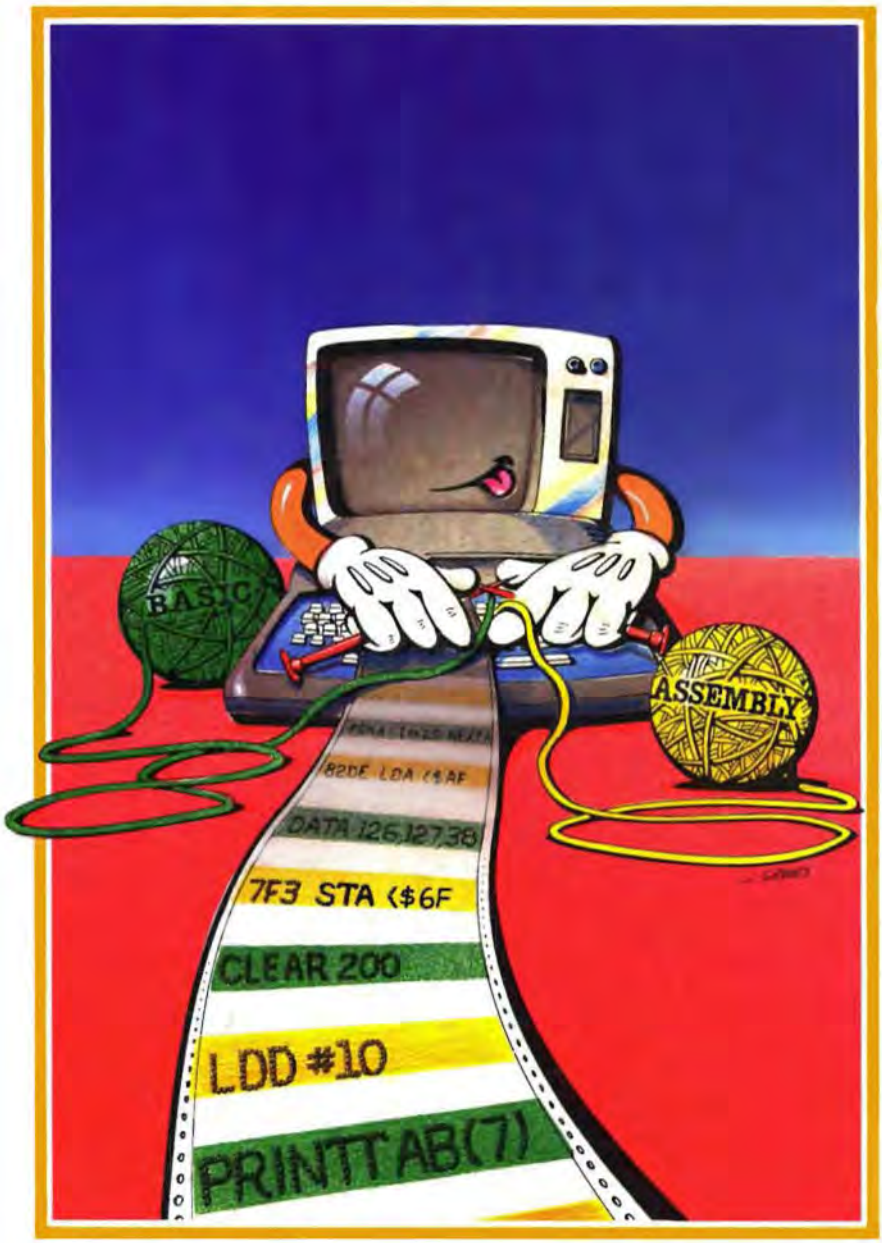

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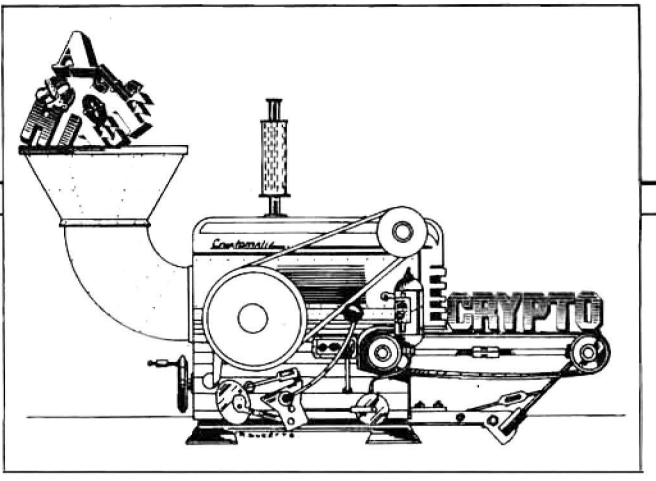
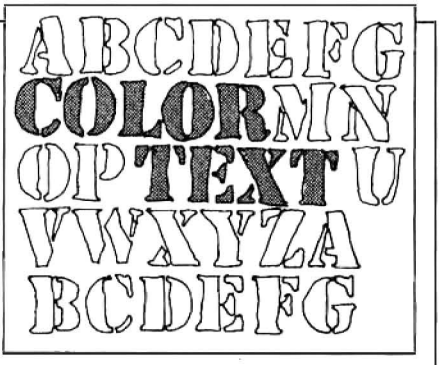


Amazing Andreassen's Color Cryptology Machine—p. 90

Cover art by Jonathan Graves. Cover photo by David Williams

DEPARTMENTS



Colortext—p. 48

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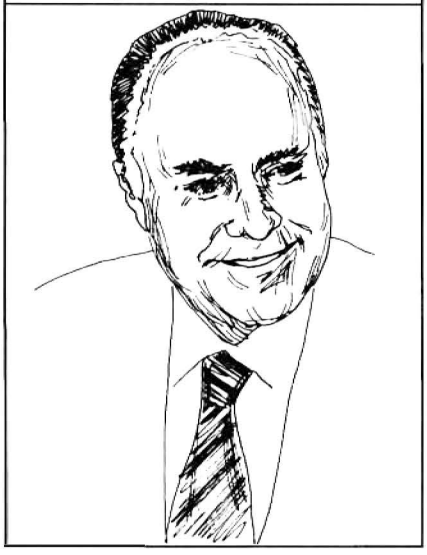
Off Color

GREEN SELLS OUT

by Wayne Green



In a way, you might say that I sold out, but I plead guilty with an explanation. And by the way, if you're interested in joining a fast-rising firm, you could do worse than read on.

It all started this last spring when some chaps from one of the bigger banks called saying that they had a large foreign publisher who was looking to acquire something like my micro publishing empirette. I wasn't much interested because I enjoy what I'm doing more than anything else I can imagine. But what would it cost to listen, right?

So they came to visit and looked over our place. I showed them our growth in sales which has run around 50 percent a year for the last eight years, limited only by all growth being 100 percent self-financed. They mumbled vaguely about $50 million, which I have to admit got my attention. I'd never given much thought to what the whole mess might be worth.

The word that I was thinking of selling began to spread and new suitors started calling every few days. The more I talked with these firms the more I realized that this probably was a good time to merge with a larger firm so that I would have the money to invest in some new projects. I have never had much of a personal need for money, so selling out for a big bundle of cash had little attraction.

No, it would be worth merging if I could get the money to start magazines at a faster rate and thus be able to better keep up with the needs of the microcomputer industry. And I had an idea for a new type of magazine I wanted to try out. If it worked I'd have a way to get perhaps 50 more like it going, each with expected sales on the order of $5 million a year or more.

Then there was my idea of a new type of school, a business/technical institute geared to the needs of the 80s. The more I thought about it, the more ideas for new divisions of Wayne Green Inc. came to mind. With some cash available for getting these new businesses and publications going, we could step up our growth enormously. I did some sales projections and I could see us growing to $1 billion in sales within 10 years just on the plans already in mind.

As I talked with the firms interested in merging, I found several of them excited about my ideas and plans. I've a good record of coming up with innovative ideas in the past, so there wasn't much skepticism about my new ideas. After all, I'd had the idea to start the first magazine for micros—*Byte*. And then I started the first system-specific magazine—*80 Micro*. And I'd pioneered mass-produced software.

As I talked with people I realized that there are very few other visionaries with such good track records.

The final choice of a merger partner was most difficult. Several large firms put it bluntly: They needed me and I could name my price. Now that is fantastic for the ego. I wasn't into shopping around for the highest offer because the difference between $50 million and $100 million is a lot less than the compatibility of the merger. And numbers like that don't mean anything anyway, they are just very big numbers.

On May 22 I signed a preliminary agreement with Pat McGovern. He's the publisher of *Computerworld*, *InfoWorld*, and so on—several times the size of my firm in sales.

The merger means that we'll be able to do more promotion of our current magazines. It means we'll be able to start more magazines, and I have a bunch of them all planned out. Each magazine is going to require a staff, so we'll be needing 200 or 300 people to help out—editors, writers, technicians, programmers, people for advertising sales, typesetters, graphic artists, circulation people, data processors, and so on.

Then there are a number of special projects, such as my planned technical/business college. We're going to need management teams to get these projects going and run them. Most of this is going to be done in New Hampshire, but eventually we'll be growing into other areas of the country.

If you are interested in getting involved with some exciting new ideas, you should get a letter off to me telling me what you can do. I'm looking for nonsmokers with a history of enthusiasm and the ability to make things happen with a minimum of supervision.

There won't be any astronomical salaries when we are starting new projects, but we will plan to make it well worthwhile for those who are the most helpful in starting the new projects.

For instance, there are a number of products which I'd like to have made in Asia and import for sale here. I've got the contacts in Asia to handle that

end, but I need the people to handle the project from the New Hampshire end—setting up the advertising, importation, and distribution of the products. This should grow into a substantial business by itself.

Why New Hampshire? Well, this is one of the best places in the country to live. The quality of life is wonderful and the cost of living far less than in New York or Silicon Valley. We still don't have any state sales or personal income taxes in New Hampshire. We're in a small town with all the advantages of a small town. The people are friendly and the crime rate is so low that few people even bother to lock their houses.

If you are looking for the chance of a lifetime to get in on some new projects, and if you think you can hack it, let me know. You're going to have to prove you can get things done. We have no free rides here, just a bunch of enthusiastic people all having the time of their lives working hard and turning out first-rate products. We're working out of old houses, converted motels and barns, and so on. This is not IBM.

You can be old, young, black, white, red, brown, male, female, or undecided, but if you smoke please don't bother me. The air here is invisible and we want it to stay that way.

If you are looking for retirement benefits and are seriously concerned about vacation days, sick days, and so on, pass us by. Oh we're concerned with these things, but peripherally. We need people who astound us by how much they get done, not people looking for a way to laze through life.

The merger means that we have a guarantee of the money we need to move ahead on as many projects as I can find teams to work on. And if we run out of projects to get started, I'll have more. I come up with an idea for a good solid project every few days.

When you think about it, by the time you put my six magazines together with those Pat is already publishing, we're a very strong combination. I think we'll be able to parlay this group into a pilot model of the college of the future, into perhaps an educational satellite television network.

Pat is much like me—full of ideas and enthusiasm. I think we're going to make things hum in the microcomputer field. Care to join us? ■

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DIGRESSIONS

UTILITIES—TOOLS FOR THE PROGRAMMER

A hardware buff has his toolbox, and so does the programmer: utilities. Utilities are programs or routines that perform a task that makes other programs work better or let the user program more easily. They can also act as "go betweens" for your computer and a peripheral—for example, a routine that lets you use the built-in capabilities of a specific printer.

Utilities make life with your Color Computer a much more enjoyable experience. This issue of *HOT CoCo* focuses on utilities. We've put together a group of articles that will appeal to a wide range of interests and skill levels.

If you are a disk user, turn to page 134. Richard Esposito and Ralph Ramhoff present an incredibly useful collection of short programs that will let you get the most out of your disk drives.

Beginning programmers will find two articles valuable aids. Peter Stoloff's BSearch program finds strings in Basic listings, making program debugging and modifying a little easier. Stephen Hedges' "Don't Be LISTless" is a simple Basic program that puts you in control of program LISTs; type in this program and your eyes will thank you.

Advanced programmers are often faced with the dilemma of whether to program in Basic for ease of modification or in Assembly for speed. Sometimes the best solution is to write a hybrid Basic/Assembly program. William McArthur's "Linkage Editor" provides a convenient way of hooking the two languages together into one working program.

Thomas Rokicki decided that he could improve the CoCo's character set and expand on the 32-column format, too. The results of his efforts are on page 104. This program is not for the novice, but the less-experienced user might find the discussion of character generating interesting.

If you are not a programmer, we haven't forgotten you. Howard Batie has come up with his second "Galaxy Trek" adventure in as many months. If you found August's adventure challenging, this month's is even more so; it requires a minimum of 174 moves to win!

The musically inclined will enjoy Eddie and Daniel Caggiani's "Melody Master." It turns your Color Computer into a piano that teaches you the musical notes.

Beginning this month are two features that nearly every Color Computer user will like: Color Cryptology and Doctor ASCII. Karl Andreassen is a master cryptologist who has become fascinated by the encryption possibilities the CoCo presents. We hope you follow his series and get as enthusiastic about this application as Karl is.

Who is Doctor ASCII? He's an answer man that *HOT CoCo* readers can consult when they have problems with their computers. (He doesn't charge a fee, either.) The authors, Richard Esposito and Ralph Ramhoff, know the Color Computer inside and out, and they are anxious to help solve your problems.

More Readable Listings

Many readers have written to us suggesting that we print the program listings in *HOT CoCo* in a 32-column format—just as they appear on the CoCo screen. We currently print them in a 64-column format to conserve space; it allows for fewer program lines and we can reduce the listings a little more.

We have assumed that our readers would rather get a few more articles in each issue of *HOT CoCo* than have the larger 32-column listings. So now we'll let you decide: Do you prefer the more readable program listings, or would you rather see more articles in

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The left bracket, [, replaces the up arrow used by Radio Shack to indicate exponentiation on our printouts. When entering programs published in *HOT CoCo*, you should make this change.

HOT CoCo formats its program listings to run 64 characters wide. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering Assembly listings.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: *HOT CoCo* Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include an SASE for a copy of our writer's guidelines. Payment for accepted articles is made at a rate of approximately $50 per printed page; all rights are purchased. Authors of reviews should contact the *HOT CoCo* Review Editor, 80 Pine Street, Peterborough, NH 03458.

DIGRESSIONS

HOT CoCo? If you want to know what the 32-column format looks like in the magazine, turn to page 120.

In the next few issues, we will run some listings in the 32-column format, and we will be paying close attention to your response. Write and let us know what you think.

Reader's Forum

When we decided to start a column for short technical tips, advice, or any other aid from our readers, we thought it would be popular. However, we never anticipated the great response we'd get in such short a time. We are receiving numerous submissions daily for Reader's Forum, and it looks like we'll have to expand it.

If you have an item you think is appropriate for Reader's Forum, send it in. We pay $25 for each one that we use. In the case of duplicates, it's a first come, first serve basis.

Next Month

How many times have you been impressed by a program and said, "I wonder how the author did that?"

Well, next month we'll show you some interesting programming techniques that will make your friends wonder how *you* did it.

Henry Grace will show you how to use strings to stuff DATA statements. Not only does Henry describe this technique, but he provides a useful home-budget program to demonstrate it.

Would you like to get your graphic characters to move about on the screen? In October we'll feature two articles on animation. Richard Ramella presents Juggling Judy, whose on-screen skills will amaze you. Don't let her coy looks fool you; she provides a good foundation for learning the fundamentals of animation.

L.W. Gross takes Juggling Judy a step further. His program, Riding Knight, demonstrates how to get your characters to move in front and in back of objects.

James Wood, our Basic Beat columnist, tells you how to incorporate the same routines in different programs. This is a good article for beginning programmers.

We will also have something for the Assembly programmer, the hardware hacker, the cassette user, and the game player, so don't miss us in October.—*M.N.*

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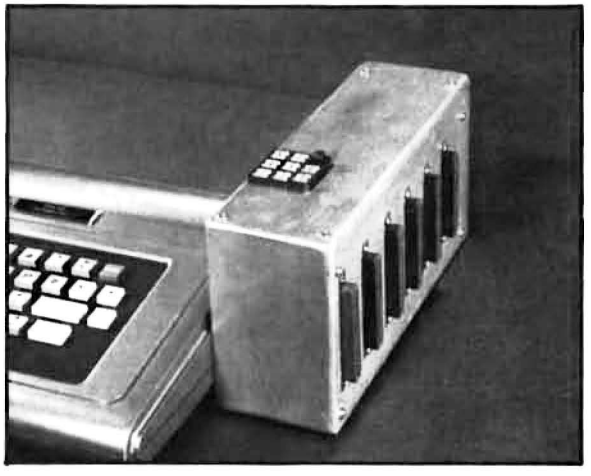

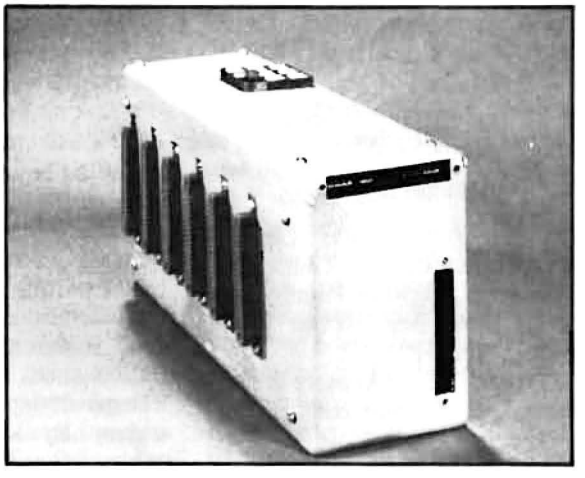

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Feedback

Meet Me In Sarasota

The Color Computer Club of Sarasota meets the last Thursday of every month at 7:30 at Family Computers, 4047 Bee Ridge Road, Sarasota, FL 33582.

CoCo and TDP-100 users are welcome to attend or to contact Ernie Bontrager at 813-921-7510.

Ernie Bontrager
Sarasota, FL

Meet Me In Penn-Jersey

There is now a Color Computer user's group in the eastern Pennsylvania area. We have members from the Allentown, Bethlehem, Easton, PA, and Phillipsburg, NJ, areas. For more information call Bill Jones at 215-253-5733 or Jerry Behler at 215-434-6387.

Jerry Behler
1231 Walnut St.
Allentown, PA 18102

Sangarnet BBS

The Sangarnet Bulletin Board is now on-line 24 hours a day, seven days a week. Sangarnet is a free BBS that features uploading, downloading, electronic mail, bulletins, and much more. This 300-baud BBS also features System Chess, a new concept in electronic computer bulletin boards. Sangarnet can be accessed at 919-758-5261.

Gary L. Davis, Sysop
P.O. Box 8084
Greenville, NC 27834

In Praise of *HOT CoCo*

I have just received the first issue of *HOT CoCo*, and I must say that it is by far the best magazine I have read. I hope all future issues are as good.

I would like to see you start a column on machine-language programming, starting at the beginner's level. It would also be good to see more articles, or even a column, on the CoCo Basic, such as the piece entitled "Demystifying System RAM." It was a great help. Keep up the great work.

R.H. Reuling, Jr.
19 Martindale Drive
Newark, DE 19713

We've got a column on Assembly coming.—eds.

"I have just seen the first issue of HOT CoCo*... I hope all future issues are as good."*

Good Work, Howard

The article by Howard Bassen in the July issue of *HOT CoCo* was a real lifesaver for me. I had been having so much trouble with interference that for a while I was reduced to using a black-and-white set with my CoCo. A $25 service job on my color TV left matters even worse, and then I noticed the "Clean Screen for CoCo" article.

After reading it, I put together a coax cable to replace the antenna switchbox supplied by Radio Shack. I had some coax cable with F-connectors on each end, so I just needed an adapter to go from the phono output jack on the computer to the coax input on the TV set. This $1.79 fix eliminated 95 percent of the interference that had been bothering me.

As far as I am concerned, *HOT CoCo* has already paid for itself by the second issue.

John C. Knight
4233 North 8th St.
Kalamazoo, MI 49009

More Demystification Of System RAM

I am a subscriber to your excellent new magazine, and I found Rusty Le Blang's article on System RAM in your premiere issue illuminating. Let me point out, however, that by typing POKE 359,0 instead of 255, you can still access the graphics screen directly. The screen format remains the same as in the normal setting, with one important difference: Typing in SCREEN 0,1 allows you the use of the elusive second text mode color set. Keep up the fine work.

Scott Warner
RFD 4, Box 278
Ellsworth, ME 04605

Monitor-Driver and Head-Banger Fix

There are two errors that I let through in my two articles in the July *HOT CoCo*.

- On p. 38 of the "Monochrome Monitor Driver" article, the PNP transistor in Fig. 1 should be a 2N2907, not a 2N2709.
- In the article, "Debugging Disk Basic," the EXEC address given under the subhead "What Is the Fix?" should read EXEC &HD66C, not &HDCCG.

Send your letters to Feedback, HOT CoCo, *Pine St., Peterborough, NH 03458.*

Also, the monitor-driver kit I am selling includes circuits for monochrome, color, and sound.

Martin H. Goodman
1529 Addison St.
Berkeley, CA 94703

Addendum to "Speech for the Color Computer"

My article "Speech for the Color Computer" (June, p. 66) has been well received and I appreciate your publishing it. I would like to report a couple of corrections, and to share some things I've discovered since writing the article.

- Figure 1 (p. 68) should show a connection from pin 7 of the 74LS74 to ground. Also, pin 24 on each RAM-EPROM socket should connect to +5 V, as well as to the 0.1 μF bypass capacitors, as shown. I regret these omissions, and apologize for any trouble they might have caused anyone.
- Radio Shack now sells prototyping boards with edge fingers that plug into the cartridge connector. The 1983 catalog lists 276-163 at $4.95 and 276-165 at $9.95, which appear to be easy substitutes for the homemade board I used. These are cheaper than using the Apple prototype board, too.
- Doublecheck your wiring before plugging this or any homemade circuit into the expansion slot. The 6809 microprocessor's address and data buses connect directly to the cartridge socket with no protective buffering, so wiring mistakes could damage the CPU or other parts.

When I wire circuits, I trace over each connection on the circuit diagram with a red pencil as I make the connection. When finished, I use an ohmmeter to verify each connection and retrace its diagram lines in another color. That way, you can hardly miss making or checking any connection.

- The 6522 and the SC-01 are static-sensitive CMOS chips. The person handling them should be grounded. Probably the easiest way to avoid problems is to plug the computer into a grounded (three-prong) outlet and hold onto the outside of the phono jack (where the TV connection is usually made) with one hand, while plugging the ICs in their sockets with the other hand. All power, of course, should be off, and you shouldn't touch anything else that could cause shock while you are grounded.

The article by Ciarcia that I refer to in the text mentions that the SC-01 is particularly vulnerable to static, and I can sadly verify this. Most CMOS chips are OK when plugged in their sockets, because the low impedance paths of the circuit shunt off any static discharges. However, the mere act of removing the circuit board from its case to take the photographs was evidently enough to blow the SC-01, since it failed immediately after I took the pictures.

I strongly recommend that you mount the board in a grounded metal case, as suggested on p. 68 of my article, and that you don't handle the board itself after the chips have been inserted, unless you are grounded.

- Since writing the article, several companies have introduced speech-synthesis hardware and software for the CoCo. In fact, Speech Systems, 32W255 Deerpath Road, Batavia, IL 60510, markets a plug-in synthesizer (at $179.95) that looks similar to mine. Also, Classical Computing Inc., Box 12247, Lexington, KY 40582, advertises a speech-synthesis program for $29.95 that does the job entirely with software, probably through the D/A converter already in the computer.

These are only two of the various offerings for speech products now advertised.

William C. Clements, Jr.
P.O. Box 2662
University, AL 35486

Cornering The Snob Market

I've learned I'm a snob! People like me look down our noses at "computer people." Just today our office cleaning lady asked wistfully how you learn to program "one of those computers," nodding towards my office CoCo. My haughty response was, "Use it just like a toaster—pop in a program and it thinks it's a typewriter."

It occurred to me right then why I have felt so uneasy thumbing through publications such as *Byte*, *Popular Computing*, and the Color Computer magazines. You people are, well, *different*.

First, you seem to have an obsession with games. Some of them must have some educational value, but, with few exceptions, most offer an adult no more intellectual stimulation than killing flies with a rubber band. It absolutely boggles the imagination to realize that there is a fortune being made by cloning more mind-grinders for the masses.

Next, there's "programming." I can understand that there are enthusiasts who want to play with the toys or train themselves for "computer careers." But with all the canned software on the market, I'm such a snob that I won't spend the time to learn how to program. I just want to use my micros to do my work.

I think the big bucks for you guys are in the great middle-class snob market—people who want the convenience of computers, but not the inconvenience involved in learning to understand them.

I bought my first CoCo the day I saw the Telewriter-64 ad. I wanted—and almost got—a computerized typewriter. But to get a printer and ribbons and all the other stuff, I had to read through all these magazines written for computer people.

A strange lot they are, too. A great deal of haggling over obscure languages. Emotional fuss and bother over piracy and the like. And above all, the Insiders write in their own Computer language (not Cobol, Fortran, or Pascal, but *Computer*) to confound the Outsiders.

If you guys want the snob-market money, run some appliance-user stuff—in plain English. Do a real in-depth comparison of Telewriter-64 versus Super "Color" Writer versus whatever is the *best* bulletproof word processor. Tell me what I, happy on the Outside, need to know to get by.

We snobs are too lazy to build or program our own stuff, too cheap to pay IBM prices, and positively infuriating to deal with because we think we ought to get what we pay for. But we spend money just like the Insiders do. Humor us, and we will condescend to deal with you.

William F. Sill
RD 6, Box 62A
Tunkhannock, PA 18657

Meet Me in Indy

Please help pass the word. The Indy

Color Computer Club meets in Indianapolis, Indiana on the first and third Thursdays of each month.

For more information, call Mike Davis at 317-257-3300.

Mike Davis, Chairman
Indy Color Computer Club
P.O. Box 68702
Indianapolis, IN 46268

Line Change in "Demystifying System RAM"

I am writing to tell you how much I enjoyed the first issue of *HOT CoCo*. The articles were helpful and interesting, and I enjoyed reading advertisements for equipment I could use.

However, I noticed a few errors in Rusty Le Blang's article entitled "Demystifying System RAM." In Program Listing 1 (p. 110), line 130 should read DSKI$ Z,17,X,A$,B$:C$ = A$ + LEFT$(B$,127).

Utility programs are my favorites, and I would like to see one that would enable you to list a program line by line, and one that would stop the cursor from flashing multiple colors and stay one color. I'm looking forward to future issues.

Gary J. Krouth, M.D., P.A.
222 N. Second St.
Suite 203
Boise, ID 83702

Thanks for the correction and the compliments. Check this issue for a program that lets you list code a line at a time.—eds.

Getting Better, With an Error

I received my premiere issue of *HOT CoCo* yesterday. I am very impressed and figure something good can only get better.

While I'm on the subject of getting better, I would like to suggest that since this is a publication for the CoCo, the program listings would be much more legible and easier to enter in (with less chance of errors) in a 32-character format.

Speaking of listings, I entered Ralph Tenny's "Tape Reliability" program and ran into a problem assembling it. It showed a bad op-code in line 150. Being fairly new at this, I took a chance that the listing was wrong and changed the "STAA SKIP" to read "STD SKIP". Then it assembled OK. I ran it according to the article, and it seemed to work correctly.

Howard E. Porter
2301 Derry Road W.
Apt. 505
Mississauga, Ontario
L5N 2R4 Canada

We are looking into changing our listing format, and the 32-character line is a strong possibility. (See Digressions in this issue.)—eds.

Getting a Trace Printout

Readers of Norman Manchevsky's article, "Print That Trace" (June, p. 64), may be interested in an alternate and simpler way of getting a trace printout. POKE 360,162:POKE 361,191 will cause a copy of all screen output to be routed to the printer. You must enter these POKEs together, separated by a colon, or the program will crash.

This method has the advantage of routing not only the trace output but also all other screen output to the printer, yielding a printout that is easier to follow than an uninterrupted stream of line numbers.

These screen print POKEs will also work in Color Basic (even though TRON does not), provided that you add POKE 359,126.

To restore normal operation, POKE 359,57 in Color Basic; POKE 360,130:POKE 361,115 in Extended Color Basic; or POKE 360,203:POKE 361,74 in Disk Basic.

Arthur J. Flexser
11111 SW 88 St.
Apt. A108
Miami, FL 33176

Meet Me In Anchor-Town

Please tell your Alaskan readers about our new user's group:
Alaska Color Computer User's Group
c/o Rick McDannel
816 N. Pine #2
Anchorage, AK 99504
907-274-5778

Rick McDannel

Program Your Professional Keyboard

People who have bought the Professional Keyboard for the CoCo might want to program its four function keys, F1–F4. One way to do this is with Program Listing 1, which will

assign the following functions to the keys:

- F1 will dump the contents of your screen to a printer when it's pressed with the shift key.
- F2 will function as a repeat key when it's held down. Any key pressed along with F2 will repeat.
- F3 will shift between the uppercase and lowercase displays if you have a lowercase kit.
- F4 is a control key. When used like a shift, it will subtract 64 from the ASCII value. For example, pressing control and the H key will give you a backspace.

Type the program in and run it. It will execute automatically. Because it POKEs information into high memory, it will not interfere with your Basic programs. This version works on tape and disk.

Bob Rosen
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421

Meet Me In Greenville

We are pleased to announce the Metropolitan Greenville (SC) Color Computer Club formed in January 1983 is already almost 50 members strong.

The MGCCC serves the interests of present and prospective CoCo owners in the entire western South Carolina region. As a group, we are 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 p.m. at the Plain Elementary School in Simpsonville, SC.

Anyone wanting more information about this organization may contact me any time.

Ed Lowe,
Secretary/Treasurer
MGCCC
P.O. Box 6
Gray Court, SC 29645
803-876-3928/3812

Modifications in "Colorful ABCs"

Program Listing 2 loads a machine-language program that allows you to put text on the graphics screen. It replaces Program Listings 6a and 6b from my article, "Colorful ABCs" (July, p. 114), and includes the following enhancements:

- A single program handles all PMODEs.
- It works with a disk and prints on any graphics page. The previous versions did not work with Disk Basic and would operate only on graphics page 1.
- It fixes the addresses for POKEing the x and y coordinates in low memory (x into 220 decimal and y into 221). They don't move when the program is relocated.
- You can no longer destroy your Basic program by trying to print a string that is longer than the space left on the graphics screen.

Listing 2 POKEs the machine-language program into memory starting at 10000 decimal. After running it, CLOADM the character set (called TEXT in the article) starting at 10387. Then CSAVEM, or SAVEM if you have a disk, the complete machine-language program with the command CSAVEM"PTEXT",10000,11250,

```
1 A=PEEK(116)*256+PEEK(117)
2 CLEAR 200,A-227:A=PEEK(116)*25
6+PEEK(117):FORX=A-227 TO A:READ
A$:POKE X,VAL("&H"+A$):NEXT:EXEC
 A-227:NEW
10 DATABE,01,6B,0F,FD,9F,F8,BE,0
1,68,AF,8D,00,D4,31,8D,00,15,10,
BF,01,6B,86,7E,B7,01,6A,B7,01,67
,31,8D,00,B1,10,BF,01,68,39,32,6
2,AD,9F,00,F8,0F,70,0D,6F,27,03,
7E,A1,7F,BD,A1,B1,81,BD,27,F9,81
,04,27,F5,81,67,27,45,81,13,10,2
7,00,4E,34,02,B6,01,56,85
20 DATA40,26,1F,86,FF,B7,01,52,B
7,01,53,B7,01,54,B7,01,55,B7,01,
57,B7,01,58,B7,01,59,86,BF,B7,01
,56,35,02,39,B6,01,58,85,40,26,0
D,35,02,81,41,25,06,81,5B,24,02,
80,40,39,35,02,39,34,02,B6,01,57
,85,40,26,BA,35,02,03,FD,4F,39,3
4,36,B6,01,55,85,40,26
30 DATA2F,8E,04,00,C6,20,A6,80,8
1,60,26,04,86,20,20,0E,81,20,24,
04,8B,60,20,06,81,60,25,02,88,40
,84,7F,BD,A2,BF,5A,26,E0,86,0D,B
D,A2,BF,8C,06,00,26,D4,35,B6,0D,
6F,26,0A,0D,FD,27,06,81,41,25,02
,88,20,7E,CB,4A
```

Program Listing 1

```
5 GOTO 320
10 CS=0:CLS
12 '
13 ' BASIC LOADER FOR PTEXT
14 ' BY R.F.MILLER,JR.
15 '
20 FOR I=0 TO 386:READ D$:POKE 10000+I,VAL("&H"+D$):CS=CS+VAL("&
H"+D$):NEXT I
30 IF CS=37538 THEN PRINT"PTEXT LOADED" ELSE 90
40 PRINT"NOW CLOADM THE CHARACTER SET"
50 PRINT"CREATED BY PDATA, STARTING"
60 PRINT"AT 10387.  THEN CSAVEM THE"
70 PRINT"ENTIRE PROGRAM STARTING AT"
80 PRINT"10000 AND ENDING AT 11250.":END
90 PRINT"CHECKSUM ERROR.  CHECK DATA.":END
100 DATA 4D,26,1,39,34,76,6F,8D,1,41,96,DC,44,44,44,D6,B6,C1
110 DATA 4,27,2C,44,97,BE,C1,1,22,5,96,DD,44,97,C0,54,25,15
120 DATA CC,0,B0,ED,8D,1,1D,86,F0,A7,8D,1,19,86,10,A7,8D,1
130 DATA D,20,27,8,BE,6C,8D,1,C,20,2,97,BE,96,B6,81,1,27
140 DATA 4,96,DD,97,C0,CC,1,60,ED,8D,0,F4,86,E0,A7,8D,0,F0
150 DATA 86,20,A7,8D,0,E4,EE,2,D6,C0,3D,DB,BE,89,0,D3,BA,1F
160 DATA 1,6F,8D,0,D5,A6,F8,2,A1,8D,0,CE,26,2,35,F6,6D,8D
170 DATA 0,C6,34,10,27,1A,E6,61,E7,8D,0,BB,E4,8D,0,BC,E1,8D
180 DATA 0,B3,26,A,35,10,EC,8D,0,AE,30,8B,34,10,6F,8D,0,A5
190 DATA E6,C0,C1,7F,26,6,86,8,A7,8D,0,99,C0,20,86,9,3D,EB
200 DATA 8D,0,90,89,0,31,8D,0,C6,31,AB,6D,8D,0,84,27,B,A6
210 DATA 8D,0,7E,E6,8D,0,77,3D,30,8B,6D,8D,0,77,26,24,A6,A0
220 DATA D,B2,26,1,43,9C,B7,25,4,35,10,20,95,A7,84,A6,8D,0
230 DATA 5C,81,8,27,3F,E6,8D,0,51,3A,6C,8D,0,4F,20,DC,A6,A4
240 DATA 44,44,44,44,8D,4A,34,4,A6,A0,84,F,30,1,8D,40,30,1F
250 DATA 35,2,9C,B7,25,5,35,10,16,FF,61,ED,84,A6,8D,0,28,81
260 DATA 8,27,B,E6,8D,0,1D,3A,6C,8D,0,1B,20,A2,6C,8D,0,14
270 DATA 35,10,6D,8D,0,13,26,5,30,1,16,FF,32,30,2,16,FF,2D
280 DATA 10,1E,F,8,0,B0,F0,0,34,40,33,8D,0,11,E6,C6,E4,84
290 DATA 34,4,8B,10,E6,C6,96,B2,3D,EA,60,35,C2,FF,FC,F3,F0,CF
300 DATA CC,C3,C0,3F,3C,33,30,F,C,3,0,0,1,4,5,10,11,14
310 DATA 15,40,41,44,45,50,51,54,55
320 PMODE 0,1:PCLEAR 1:CLEAR 200,9999:GOTO 10
```

Program Listing 2. Basic Loader for PTEXT

```
10 GOTO 200
20 CLS:DEFUSR0=15133
30 INPUT"PMODE (0-4)";M:PMODE M,1
40 INPUT"COLOR SET (0-1)";S
50 IF 2*INT(M/2)=M THEN 80
60 INPUT"BACKGROUND COLOR (1-4)";B
70 INPUT"FOREGROUND COLOR (1-4)";F:GOTO 100
80 INPUT"<N>ORMAL OR <R>EVERSE";C$
90 IF C$="N" THEN B=0:F=1 ELSE B=1:F=0
100 PRINT"NOW TYPE A FEW LINES OF TEXT"
110 INPUT"AND ENTER";A$
120 PRINT"ENTER THE X(0-255) AND Y(0-191)"
130 PRINT"COORDINATES FOR THE FIRST LETTER";
140 INPUT"OF THE TEXT (X,Y)";X,Y
150 PRINT"PRESS ENTER TO START"
160 INPUT"AND @ TO RETURN TO MENU";C$
170 COLOR F,B:PCLS:SCREEN 1,S
180 POKE 220,X:POKE 221,Y:B$=USR0(A$)
190 C$=INKEY$:IF C$="@" THEN 20 ELSE 190
200 CLEAR 200,15132:PCLEAR 4:GOTO 20
```

Program Listing 3. Demo Program

10003.

You can use an offset when you load it later to put it where you wish. I used an offset of 5133 for the demo program shown in Program Listing 3. This is the maximum offset for a 16K machine.

I'll be happy to supply a fully commented source-code tape, in EDTASM+ format, for $5 to anyone interested in modifying the program for his own requirements.

R.F. Miller, Jr.
18608 Heather Court
Homewood, IL 60430

A BBS in The Sunshine State

We'd like to let the readers of *HOT CoCo* know about a color bulletin board system, Colorburst, that is now on line 24 hours a day in Florida. We're devoted to Color Computer users, but all computer users are welcome to visit.

At present, we're featuring eight special-interest sections with diversified topics, such as a Hacker's Haven, a how-to section, a column on health and fitness, and a PEEK and POKE section. We also have numerous other sections that we're getting ready for mid-August.

"Our aim is to provide a forum for CoCo users while giving them a chance to learn about other topics. . ."

Our aim is to provide a forum for CoCo users while giving them a chance to learn about other topics and to share ideas.

We have an upload/download section that is constantly changing and expanding. All callers are invited to use this, and to leave suggestions or request information. We are programmed to accept only ASCII files for upload.

Colorburst is a young system, but we hope to meet the ever-expanding needs of CoCo users everywhere.

We welcome all comments on any and all aspects of Colorburst.

Alan and Elaine Watson,
Colorburst Sysops
4500 S. W. 38 St.
Hollywood, FL 33023
305-525-1192 (data line)

Help!

I bought my Color Computer to play simulation games. Now I would like to program my own in Basic, but I need some instruction and ideas on how it's done.

I'd like to see some programming tips on loading and printing a matrix, determining results from a combat-results matrix, and generating characters and their characteristics in a role-play game.

Of course, I'd also like to see you publish more strategy games. Help!

John Marabella
517 N. 9th St.
Reading, PA 19604

Expect to see simulations in upcoming issues.—eds.

Ma Bell and CoCo And a Kentucky Club

I'm looking for a way in which CoCos can use their cassette plugs to send and receive programs over the phone lines. I saw an ad for a "black box" selling for $69 that would do this, and it wasn't a modem.

If I could get a schematic and a parts list, I could build a few for our CoCo club members. Perhaps we could also interface this circuit for two-meter ham radio. Many CoCo owners in our area are hams, too. If anyone out there has any information that will help me, please send it along.

Also, we have started a new Color Computer Club in the Radcliff, KY, area. We meet on the second Sunday of each month at 2 p.m. at the Kentucky Utilities Building.

The Radcliff Color Computer Club
c/o N4GSB Bryan Harp
287 Highland Drive
Radcliff, KY 40160

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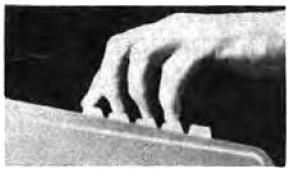

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The Basic Beat

THE FIRST STEPS TO BASIC PROGRAMMING

by James W. Wood

Last month's column stressed graphics generated with the SET command. The examples I used might lead you to believe that you can only create horizontal and vertical lines using SET with FOR loops. They might be the easiest to program, but they're not the only lines possible. Program Listings 1, 2, and 3 show that you can use a little math to draw lines at angles.

Listing 1 draws two lines. Using the FOR loop in line 20, the SET command of line 30 draws a line from the upper left to the lower right corner. Line 40 draws a line from upper right to lower left. This pattern might look good as a laser blast in a video game, but it goes onto the screen a little slowly. Faster graphics methods will be covered in later months. For the present, to make a graphic faster, make it a smaller pattern.

```
10 CLS0
20 FOR A=0 TO 62
30 SET(A,A/2,1)
40 SET(A,31-A/2,1)
50 NEXT A
60 GOTO 60
```

Program Listing 1

```
10 CLS0
20 FOR A=0 TO 63
30 SET(A,10+A/4,(A+8)/8)
40 NEXT A
50 GOTO 50
```

Program Listing 2

System Requirements

4K RAM
Color Basic

```
10 CLS0
20 A$=INKEY$
30 IF A$="F" THEN40ELSE20
40 FOR Y=31 TO 21 STEP-1
50 SET(52-Y,Y,4):SET(10+Y,Y,4)
60 NEXT Y:SOUND100,1:GOTO10
```

Program Listing 3

```
10 CLS0
20 FOR X=1 TO 30
30 FOR Y=1 TO 20
40 SET(X,Y,3)
50 NEXTY
60 NEXTX
70 GOTO70
```

Program Listing 4

```
10 CLS0
20 FOR X=1 TO 30
30 FOR Y=1 TO 20
40 SET(X,Y,3)
50 NEXT X
60 NEXT Y
```

Program Listing 5

Listing 2 draws a line at a slight angle across the screen. The 10 + A/4 in line 30 determines the angle. Experiment to develop other angles. The line contains eight different colors. The third term of the SET command is (A + 8)/8. This makes the color a function of A. As A increases, the color changes.

Any decimal in the third term of a SET command is dropped off. For example, the screen displays SET (25,17,4.62) the same as it does SET (25,17,4).

Listing 3 introduces a new command, INKEY$. Here, INKEY$ holds the program in a loop until you press the F (fire) key.

A$ is a string equal to the key pressed. If A$ = "F", the program proceeds to lines 40-60. These display "phaser blasts" from the bottom of the screen up to a point about one third of the distance to the top. These

```
10 CLS0
20 FOR X=1 TO 30 STEP 4
30 FOR Y=1 TO 20
40 SET(X,Y,3)
50 NEXT Y,X
60 FOR X=40 TO 60 STEP 3
70 FOR Y=1 TO 30 STEP 3
80 SET(X,Y,5)
90 NEXT Y,X
100 GOTO 100
```

Program Listing 6

```
10 CLS
20 FOR X=1 TO 8
30 FOR Y=1 TO 8
40 PRINT X*Y;
50 NEXT Y:PRINT:NEXT X
```

Program Listing 7

✓See List of Advertisers on page 130

blasts are faster than those in Listing 1, but they create a smaller pattern.

When you use INKEY$, you can enter only one character, but you don't need to press the enter key, as you must when you're using INPUT.

SET can be used to draw lines and also areas. To color a rectangular area, a nested FOR loop is handy. Program Listing 4 draws a rectangular area. Lines 50 and 60 of Listing 4 can be replaced by 50 NEXT Y,X. The program sets 600 positions, totaling 30 units wide and 20 units high.

Nested FOR loops must have one variable completely nested inside another. The FOR X came before the FOR Y; therefore, NEXT Y must be before NEXT X. Program Listing 5 shows improper use of a nested FOR loop. The program draws one blue line and stops with an error in line 60.

You can use the STEP extension on any or all of the FOR loops in nested FOR loops. Try STEP on the FOR loops of Listing 4 to create stripes or spotted areas. Lines 20–50 of Program Listing 6 draw a series of vertical lines. A solid area is not colored because of the STEP4 in line 20. Lines 60–90 create an area of rectangular dots in rows and columns due to the STEP on both loops.

You can use nested FOR loops for other things besides creating graphics. Program Listing 7 displays a multiplication table for numbers up to eight times eight. The screen is not wide enough to display any more numbers. The columns are not all straight because the top line has fewer two-digit numbers. Later, when you know more commands, you can create a straight-column multiplication chart.

You can use the INKEY$ command introduced in Listing 3 for more than creating arcade-type games. Program Listing 8 shows you how to program with INKEY$ to ask a question. Notice that line 70 is arranged so that Y and N are the only keys that cause the program to respond. Be sure there is no space between the quotes in line 60.

Now I'll introduce two mathematical commands: INT and ABS. Run Program Listing 9. INT (integer) lowers any number that isn't whole to the closest whole number. ABS (absolute value) makes any number positive.

Line 20 prints 3.75 and 3.75, both positive. Line 30 prints 3 and −4. The next whole number smaller than −3.75 is −4. Line 40 prints 2 and 3. ABS(−2.1) is 2.1, and INT(2.1) is 2. INT(−2.1) is −3, and ABS(−3) is 3. The same numbers, or the same functions, in different order result in different answers.

INT could be used to average numbers with a little change. Program Listing 10 rounds any number to the nearest whole number. By adding .5 to a number and then chopping off the decimal part, rounding is done correctly.

Rounding to anything but a whole number will take a little more work. Program Listing 11 rounds to the nearest 100th. The program multiplies a number by 100, rounds it to the nearest whole number, and divides it by 100.

Another group of Basic commands to learn is AND, NOT, and OR. Run Program Listing 12. Notice that in an IF statement, you can place a math operator (+,*, −, /) on the left side of the equal sign. The AND statement is true if both conditions are true, or if all conditions are true when more than two exist. The OR is true if at least one of the statements is true.

NOT returns a value that is one less than the negative of the number NOTed. For example, NOT(7) = −8 and NOT(−8) = 7. The uses for NOT are somewhat limited in Basic. NOT has more uses in Extended Color Basic graphics and in Assembly-language programming. These are the same AND, OR, and NOT that are used in geometry truth tables.

Remember GOTO from a few les-

```
10 CLS 0
20 FOR X= 1 TO RND(30)
30 FOR Y= 11 TO 11+RND(20)
40 SET(X,Y,8):NEXTY,X
50 PRINT"WANT TO SEE ANOTHER?";
60 A$=INKEY$:IFA$=""THEN 60
70 IF A$="Y" THEN RUN ELSE IF A$="N" THEN END ELSE 60
```

Program Listing 8

```
10 CLS
20 PRINT ABS(3.75),ABS(-3.75)
30 PRINT INT(3.75),INT(-3.75)
40 PRINT INT(ABS(-2.1)),ABS(INT(-2.1))
```

Program Listing 9

```
10 CLS
20 PRINT"TYPE A NUMBER WITH DECIMAL"
30 PRINT"I.E. 27.213"
40 INPUT N
50 PRINT N;"ROUNDS TO";INT(N+.5):PRINT
60 GOTO20
```

Program Listing 10

```
10 INPUT N
20 PRINT(INT(N*100+.5))/100
30 GOTO 10
```

Program Listing 11

```
10 A=4:B=5:C=6
20 IF A+B=9 AND B+C=11 THEN PRINT"AND -- BOTH TRUE"
30 IF A+C=9 OR A-3=1 THEN PRINT "OR--AT LEAST ONE TRUE"
40 IF NOT(A)=-5 THEN PRINT"NOT--RESULT ONE LESS THAN A"
```

Program Listing 12

sons back? It can become cumbersome to use for choices in a program. You can shorten Program Listing 13 by replacing lines 70–90 with line 70: ON A GOTO100,120,140. If A has a value of one, the program continues to the first line listed after the GOTO. If A equals two, the program goes to the second line number listed, and so on.

The factor that limits the number of lines you can list after the ON A GOTO command is the maximum length of a basic program line: 255 characters. You can see where ON A GOTO can save a lot of typing during programming in cases in which a lot of choices are possible (i.e., enter the atomic number of an element).

GOSUB, go subroutine, differs from a GOTO in that GOSUB remembers the line to which it is to return. There are at least two good reasons to use GOSUB. If you want to use a particular design or equation several times, it would be wasteful to type the lines into the program in several places.

Program Listing 14 has a subroutine in lines 1000–1020 that draws a top and bottom border on the screen. This subroutine is used three times, but I only had to type it once. Notice lines 30, 50, and 70 all contain FOR T = 1 TO X: NEXT T. Can you place this time loop at line 2000 and use a GOSUB in each of the lines to make the program divert to line 2000? Don't

```
10 CLS
20 PRINT"TYPE 1 FOR HORIZONTAL LINE"
30 PRINT"TYPE 2 FOR VERTICAL LINE"
40 PRINT"TYPE 3 FOR A BOX"
50 INPUT A:CLS0
60 IF A<1 OR A>3 THEN GOTO 20
70 IF A=1 THEN GOTO 100
80 IF A=2 THEN GOTO 120
90 IF A=3 THEN GOTO 140
100 FOR X=1 TO 63:SET(X,10,3):NEXTX
110 GOTO 160
120 FOR Y=1 TO 31:SET(30,Y,3):NEXTY
130 GOTO 160
140 FOR X=10 TO 20:FOR Y=5 TO 10
150 SET(X,Y,3):NEXTY,X
160 FOR T=1 TO 500: NEXTT: GOTO 10
```

Program Listing 13

```
10 CLS:X=500
20 PRINT:GOSUB1000
30 PRINT"PAGE 1":FOR T=1 TO X:NEXT T
40 CLS:PRINT:GOSUB1000
50 PRINT"PAGE 2":FOR T= 1 TO X: NEXT T
60 CLS:PRINT: GOSUB 1000
70 PRINT"PAGE 3": FOR T = 1 TO X: NEXT T
80 CLS: END
1000 FOR A= 0 TO 63
1010 SET(A,0,5):SET(A,31,5):NEXT A
1020 RETURN
```

Program Listing 14

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forget to include a RETURN statement somewhere—perhaps in line 2010.

GOSUB works to speed up program operation. It sends the program to the indicated subroutine only when that subroutine is necessary. This keeps the program from going to lines that are irrelevant at the time and, therefore, significantly improves the program's efficiency.

For example, in a game such as StarTrek, if you are not firing photon torpedos, you won't want the program going to the lines that count torpedos or prepare them for firing. All lines that pertain to torpedo firing would be in a subroutine that the computer program only executes when you

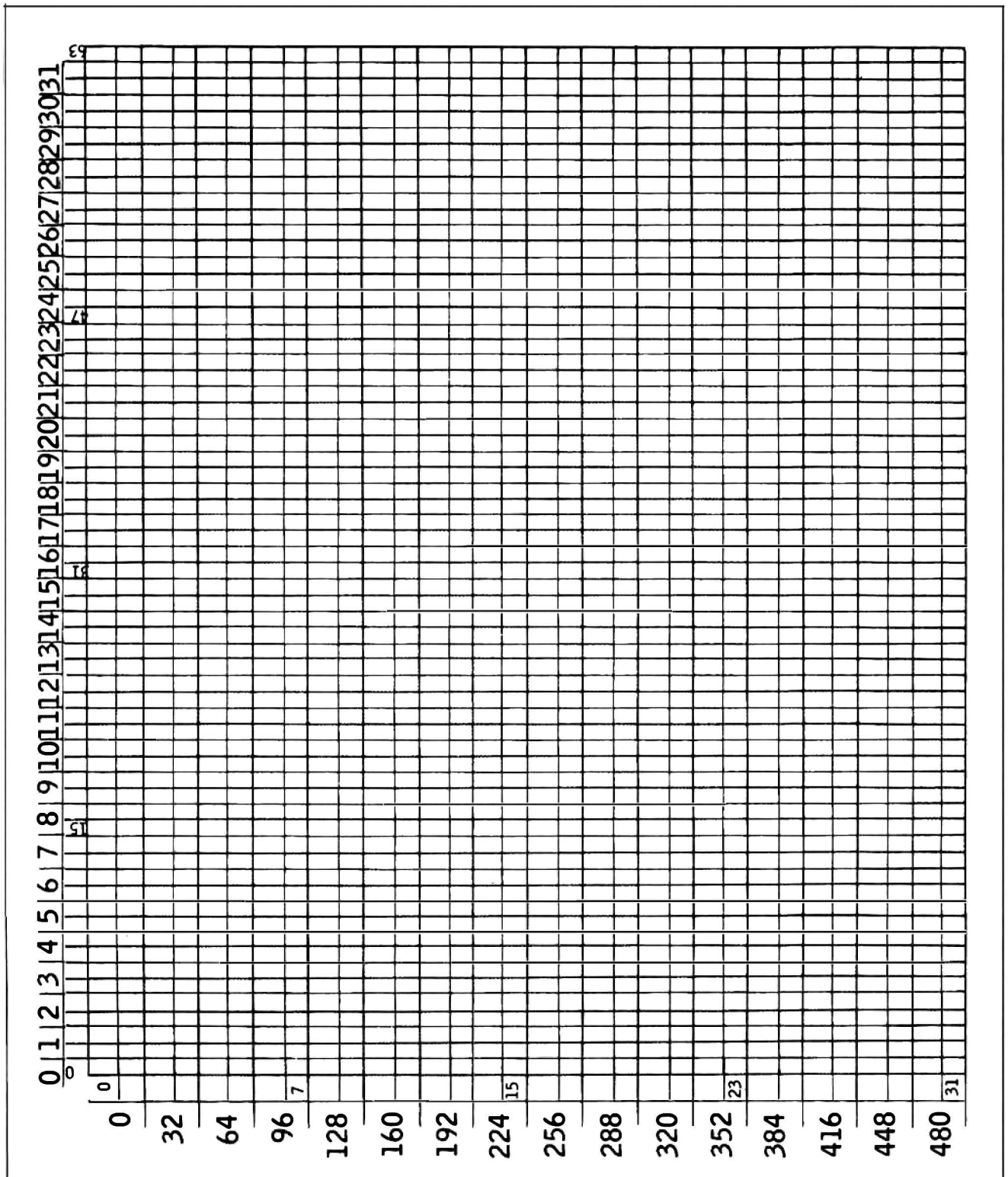

Fig. 1. The PRINT@ and SET pages combined. You can copy this page for use in your programming.

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use a torpedo.

All GOSUBs must have a RETURN. Don't let the program come to a RETURN unless it has come there from a GOSUB. In Listing 14 there is an END in line 80 to prevent the program from continuing into the subroutine starting at line 1000. Remove the END and the program will die with an RG (RETURN without GOSUB) error.

Basic also contains an ON GOSUB command. The line to which the program continues is determined in the same way as is the ON GOTO command. And this new command remembers to which line the program flow returns, just like GOSUB does. You would use ON GOSUB in places at which the same choices are to be made at several points in a program.

Up to now the position of PRINT statements has been difficult to arrange on the screen. If the screen is clear, PRINT starts at the top of the page. Each PRINT goes down one line, unless it ends with a comma or a semicolon. The comma causes the PRINT to go to the next group of 16 columns. A semicolon causes the next PRINT command to be placed close to the last. Run Program Listing 15 for review.

The command PRINT@ allows you to position words easily. Program Listings 16 and 17 give the same display. Try them. You can't use the method in Listing 16 if you don't intend to erase words previously typed near the top of the screen.

Program Listing 18 moves a multiplication sign over the screen while displaying a read out in the upper left corner of the place at which the sign is located. PRINT@ (print at) locations range from 0-511. The screen is 32 characters wide and 16 characters tall.

```
10 CLS
20 PRINT"USE","COMMA"
30 PRINT
40 PRINT "USE";"SEMICOLON"
50 PRINT
60 PRINT"USE"
70 PRINT"NO PUNCTUATION"
```

Program Listing 15

```
10 CLS
20 FOR A=1 TO 7:PRINT:NEXT
30 PRINT"                    MIDDLE"
40 GOTO 40
```

Program Listing 16

```
10 CLS
20 PRINT@237,"MIDDLE"
30 GOTO 30
```

Program Listing 17

```
10 CLS
20 FOR A=1 TO 510
30 PRINT@0,A;
40 PRINT@A,"*";:PRINT@A-1," ";
50 FOR T=1 TO 10:NEXT T
60 NEXT A
70 FOR T=1 TO 500: NEXT T
```

Program Listing 18

The equation 32*16 makes the 512 positions.

PRINT@ must be followed by a number and a comma. After the comma you can use a variable or words in quotes. The number will determine the first position of the characters to be printed. Your manual shows PRINT@ positions. Figure 1 does too, but I'll explain that later.

Find the position you want and add the number to the left of your position to the one directly above. To print "HELLO" in the fifth line starting in the 12th position, add 128 to 11 and the command is PRINT@139, "HELLO";. Anything printed on the bottom line must end with a semicolon to prevent the screen from scrolling upward. If you print a character in the last video position, 511, the screen also scrolls. To display a character in position 511 without scrolling the screen, you must POKE it into video memory, but I'll get to that next month.

You can use PRINT@ animation to move graphics characters (something to look forward to in the coming issues). For now you can use PRINT@ to animate some alphanumerics.

```
10 CLS:PRINT"PRESS 'R' TO SHOOT RIGHT."
20 PRINT "PRESS 'L' TO SHOOT LEFT."
30 INPUT"PRESS ENTER TO CONTINUE";B$
40 CLS
50 A$=INKEY$
60 R1=32*(RND(15)-1)
70 L1=32*(RND(15)-1)+31
80 IF A$="L" THEN GOTO 110
90 IF A$="R" THEN GOTO 120
100 GOTO 50
110 FOR L=L1 TO L1-30 STEP-1:PRINT@L,"<-- ";:NEXT L:GOTO
120 FOR R=R1 TO R1+28:PRINT@R," -->";:NEXT R:GOTO 40
```

Program Listing 19

Program Listing 19 is a game with no losers. Pressing the L or R keys causes an arrow to fly left or right. Line 60 determines the starting position of the right-bound arrow. A whole number between 0–15 is multiplied by 32. Each line starts with a multiple of 32. The arrow has no target to hit.

Program Listing 20 is a complete game. The object is to shoot a moving space ship with an arrow. The character between quotes in line 20 is the white up-arrow key. The program moves a small space ship, <0>, across one of the top five lines of the screen, as determined by program line 30.

Lines 40–70 move the ship across the screen and check to see if you've pressed the up arrow. If you have, the program goes to line 80, which counts the number of shots and starts the arrow moving upward. Line 90 prints the arrow. Line 100 keeps the space ship moving while the arrow flies up-

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```
10 CLS0:PRINT@480,"SCORE=";SC;
20 PRINT@505,"^";
30 A=RND(5)*32
40 FOR B=A TO A+27:PRINT@B," <0>"
50 FOR T=1 TO 5:NEXT T
60 IF INKEY$<>"" THEN 80
70 NEXT B:GOTO 10
80 SH=SH+1:FOR C=505 TO 0 STEP-32
90 PRINT@C,"^";
100 B=B+1:PRINT@B," <0>";
110 FOR T= 1 TO 5:NEXT T
120 IF B+1=C OR B+2=C OR B+3=C THEN PRINT@ B,"HIT":FOR T=1 TO 50
0:NEXT T:SC=SC+10:GOTO 10
125 IF SH>19 THEN  CLS:PRINT"FINAL SCORE";SC:END
130 NEXT C
140 GOTO 10
```

Program Listing 20

```
10 CLS0:A$="U"
20 FOR A=0 TO 63:SET(A,2,4):SET(A,31,4):NEXT A
30 FOR A=3 TO 30:SET(0,A,4):SET(63,A,4):NEXT A
40 X=31:Y=15
50 B$=A$
60 A$=INKEY$
70 IFA$="" THEN A$=B$
80 IFA$="U" THEN Y=Y-1
90 IF A$="N" THEN Y=Y+1
100 IF A$="K" THEN X=X+1
110 IF A$="H" THEN X=X-1
120 IF POINT(X,Y)=0 THEN SET(X,Y,4) ELSE END
130 N=N+1:PRINT@5,N;
140 GOTO 50
```

Program Listing 22

ward. In line 120 the hit occurs if the arrow hits the ship in the front, middle, or end (B+1, B+2, B+3).

C is the position of the arrow; B is the position of the space preceding the space ship. SC=SC+10 increases your score by 10 points.

Line 125 checks to see if you have attempted more than 19 shots, which ends the game. If you haven't missed after 19 shots, the game will never end. That can be a bonus for top-notch players. The loops in lines 50 and 110 slow down the action. You can remove them if you enjoy speed.

Sometimes when programming I want to use SET and PRINT@ on the same display. The PRINT@ positions are on one page of the manual and the SET positions are on another. Reading these and trying to overlap them becomes a nightmare.

My solution is to copy a PRINT@ and a SET page. Cut and scotch tape

```
10 CLS0
20 FOR X=37 TO 60
30 SET(X,27,3):SET(X,30,3)
40 NEXT X
50 SET(37,28,3):SET(37,29,3)
60 SET(60,28,3):SET(60,29,3)
70 PRINT@467,"LOWER";
80 PRINT@473,"RIGHT";
90 FOR T=1 TO 50:NEXT T
100 PRINT@467,"lower";
110 PRINT@473,"right";
120 FOR T=1 TO 50:NEXT T:GOTO 70
```

Program Listing 21

together to make a sheet, as in Fig. 1. Use the large outer numbers to calculate PRINT@ positions. Use the smaller numbers for SET commands. Notice that each PRINT@ box is two SET positions high and wide. If you set any one of the four SET positions after you've printed a letter in its box, the letter disappears.

Program Listing 21 produces a picture in the lower right corner of the screen. The graphics are blue. Pressing SHIFT0 creates the lowercase letters in lines 80 and 90. On the video screen they will be inverse video, green on black. Push SHIFT0 after typing them to return to normal video.

Program Listing 22 is a bonus game. See if you can figure out how to play the game by reading the listing. The object is to not run into anything. A counter at the top of the screen keeps track of how many units you travel.

Tune in next month, same computer magazine, same computer column, for the adventure of POKE, PEEK, and the DATA gang. ■

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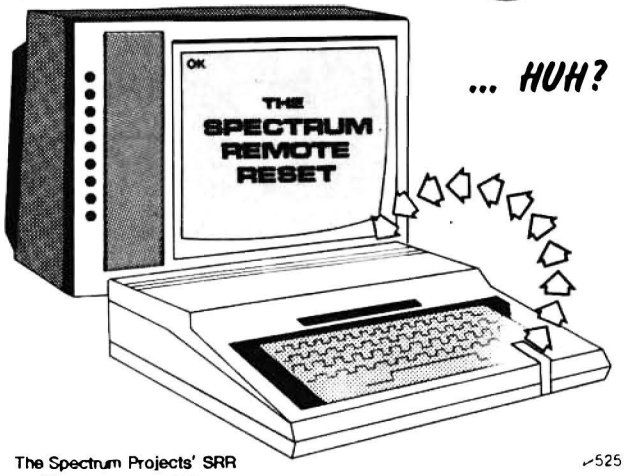

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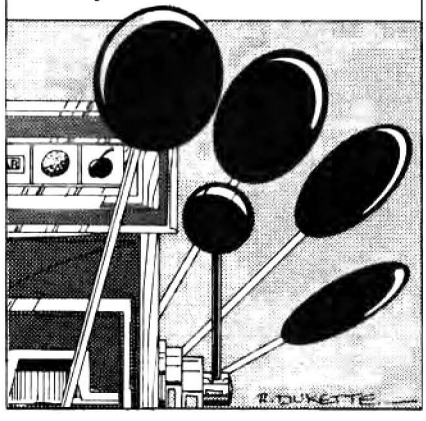
Elmer's Arcade

LOLLIPOPS— A SLOT-MACHINE SIMULATION

by Richard Ramella



Elmer's tawdry joint had a "closed" sign in the window, and Elmer himself was locking up just as I arrived. "You've gone broke," I guessed. "Maybe now you'll come to your senses and get some video games."

"You're wrong. I just had the best week ever," Elmer said as he motioned me into his car.

"Where are we going?" I asked.

"Reno, Nevada," he said.

"Help oh help, kidnap," I replied with a wide grin, and so it was that three and a half hours later we were standing in one of Reno's finest "carpet joints," an old-fashioned term for a fancy casino. The casino had row on row of electronic slot machines, islands of blackjack tables, and craps layouts.

"Go splurge a few nickels while I continue my research into permutations of six-sided cubes," Elmer suggested. He peeled a twenty out of his wallet and departed.

I only had $1.50, which would have kept me going all afternoon at Elmer's Arcade, but at this place it wasn't enough for a Nehi and a Honeybun. So I kept my money to myself and watched a slot-machine mechanic who had opened the front of a one-armed bandit for some work.

"Pardon me," I said, "I write computer games. I could do a good simulation of a slot machine if you'd let me list the symbols on the three reels."

"You system players are all alike," he laughed, slamming shut the machine and leaving.

It was a nickel machine. I put in a coin and pulled the lever just as Elmer returned. "Can you lend me 20 bucks?" he asked.

"Hey, look, three oranges. I won 10 nickels."

"What are we going to do for lunch?" he demanded as if it were my fault. "We'll go to Hannah's Place," he decided.

"A restaurant where you have credit?"

"Naw, a professional acquaintance. Come on."

I had felt like shark bait in the casino, but Hannah's Place was a different story. Hannah was a lady of indeterminate age, and she owned a little store that sold only old slot machines. I was amazed when she lent Elmer $20 without asking to hold his shoes as collateral. He steamed down the street, and I was left in a nice situation.

"You like machines, kid?" Hannah asked. "Here's a nice one called Lollipops for only 400 simoleons." I *did* like Lollipops, a nice old clunky machine with a lot of metallic frills. I had to admit my main interest was peeking at its innards so I could copy the symbols on the three reels and use them in a computer program.

"What computer you got?" she asked.

"A TRS-80 Color Computer with 16K."

"So's my grandkid. Promise to send me a copy of the program, and you got a deal."

I grinned. We shook hands. I listed the reels' symbols and spent a pleasant hour playing the machine for free—and with no reward for the jackpot I got. Then Elmer came back, shaking his fist at the downtown skyline and yelling, "Reno, I'll beat you yet!" It was time to go home and get to work.

Playing the Game

At 193 lines, Lollipops is longer than most programs you will get from me and Elmer. I think it is worth the effort, though, because it is a slot machine that does everything but drop quarters. For example, the reel symbols are based on an actual machine, you can up the odds by playing from

Program Listing. Lollipops

```
100 REM * LOLLIPOPS * A SLOT MACHINE * TRS-80 EXTENDED COLOR BAS
IC 16K
110 REM * ELMER'S ARCADE / SEP. '83 / RICHARD RAMELLA
120 CLS
130 CLEAR 1500
```

Listing continued

System Requirements

16K RAM
Extended Color Basic

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one to five coins, and a save feature puts a little strategy into the game.

Here's how to play. Type RUN and tap enter. The game asks how much money you want, and your answer must be a whole-dollar amount from $1 to $100. Choose the amount and tap enter.

The slot machine appears on the screen. To the right of the machine are the payout figures. The letters in these columns have these meanings: R for red, G for green, O for orange, B for blue, Y for yellow, and $ for jackpot. To start, the payout values are all at zero. Tap the letter I (for insert) to play a quarter. The payouts increase

Listing continued

```
140 PRINT "LOLLIPOPS IS A SLOT MACHINE, SO NAMED BECAUSE THERE A
RE USUALLY A LOT OF SUCKERS AROUND.
150 PRINT "IT'S A QUARTER MACHINE, AND YOU MAY HAVE UP TO $100 I
N QUARTERS.HOW MUCH YOU WANT?"
160 PRINT
170 INPUT Q
180 IF Q>0 AND Q<101 AND Q=INT(Q) THEN 220
190 IF Q<1 THEN PRINT "GET SERIOUS": GOTO 170 ELSE IF Q>100 THEN
 PRINT "I'LL GIVE YOU A HUNDRED BUCKS.": Q=100
200 IF Q<>INT(Q) THEN PRINT " AN EVEN-DOLLAR AMOUNT, PLEASE. HOW
 MUCH... AGAIN?": GOTO 170
210 INPUT "TAP ENTER TO CONTINUE";X
220 CLS0
230 SS$=STRING$(17,128)
240 W$=CHR$(134+112)+CHR$(137+112)
250 D$=STRING$(17,246)
260 S$=STRING$(5,207)
270 M$=STRING$(21,239)
280 R$=STRING$(3,191)
290 Y$=STRING$(3,159)
300 O$=STRING$(3,255)
310 B$=STRING$(3,175)
320 G$=STRING$(3,223)
330 J$=STRING$(3,"$")
340 E$=STRING$(3,207)
350 A$(1)=R$+B$+Y$+R$+O$+R$+B$+B$+G$+R$+Y$+B$+O$+R$+R$+Y$+O$+R$+
J$+B$
360 A$(2)=O$+G$+R$+O$+O$+B$+J$+R$+R$+O$+G$+J$+R$+O$+J$+G$+R$+O$+
R$+R$
370 A$(3)=B$+Y$+O$+Y$+B$+G$+O$+O$+B$+Y$+B$+O$+G$+J$+O$+B$+O$+Y$+
G$+O$
380 FOR A=11 TO 459 STEP 32
390 PRINT @ A,M$;
400 NEXT
410 GOSUB 1910
420 K$="25 CENTS"
430 A=1
440 FOR B=31 TO 255 STEP 32
450 PRINT @ B,MID$(K$,A,1);
460 A=A+1
470 NEXT
480 FOR A=45 TO 60 STEP 3
490 PRINT @ A,W$;
500 NEXT
510 FOR A=109 TO 237 STEP 32
520 PRINT @ A,S$;
530 PRINT @ A+6,S$;
540 PRINT @ A+12,S$;
550 NEXT
560 PRINT @ 0,"BET ";
570 PRINT @ 64,"PAYOUTS:";
580 PRINT @ 96,"R R - ";
590 PRINT @ 128,"R R G ";
600 PRINT @ 160,"R R Y ";
610 PRINT @ 192,"O O $ ";
620 PRINT @ 224,"O O O ";
630 PRINT @ 256,"B B $ ";
640 PRINT @ 288,"B B B ";
650 PRINT @ 320,"G G $ ";
660 PRINT @ 352,"G G G ";
670 PRINT @ 384,"$ $ $ ";
680 PRINT @ 448,"I - INSERT";
690 PRINT @ 480,"P - PLAY  ";
700 GOSUB 1650
710 PRINT @ 0,"BET ";STRING$(7,128);
720 R=0
730 Z$=""
740 M=0
750 P(1)=3
760 P(2)=5
770 P(3)=5
780 P(4)=10
790 P(5)=10
800 P(6)=14
810 P(7)=14
820 P(8)=18
830 P(9)=18
840 P(10)=100
850 FOR A=1 TO 10
860 Q(A)=0
870 NEXT
880 Y=0
```

Listing continued

as you go. You can play up to five coins with repeated taps of the letter I. With each tap, the amount of your bet at the top left of the screen increases, and your stake, shown beneath the machine, decreases.

When you are ready to play, tap P. Do not tap enter during the game.

After every second play the word SAVE appears beneath the machine. You can tap number 1, 2, or 3 on the keyboard to freeze the corresponding reel into position during the next play. You won't see your chosen number displayed anywhere. If you don't want to save any symbols, just tap I and P as usual. When you win, you will see your coins drop.

Lollipops differs from the machine I saw at Hannah's only in its save feature and my decision to increase the jackpot payoff from 60 to 100 coins for each coin played. The computerized slot machine has three reels with 20 color symbols on each. That makes for 8,000 permutations of three-symbol combinations. This isn't exact, but the Lollipops slot machine kept nearly a quarter for every dollar played. The program's feature makes things quite a bit less stingy. If you want an absolute copy of the machine on which this program is based, change line 840 to P(10) = 60 and never use the save feature.

The Program

Looking briefly at the program, lines 280–330 create the six colored symbols used on the reels, and lines 350–370 make the three reels. To see the reels, break into the running program, and type

FOR A = 1 TO 3: PRINT A$(A): NEXT

Listing continued

```
890 GOSUB 1780
900 N=N+1
910 IF N/2=INT(N/2) GOSUB 1970: GOTO 930
920 Q$=INKEY$
930 IF Q$="P" AND Y=0 GOSUB 1880:GOTO 920
940 IF Q$<>"I" AND Q$<>"P" THEN 920 ELSE IF Q$="I" GOSUB 1670 EL
SE IF Q$="P" THEN 960
950 GOTO 920
960 PLAY "T255"
970 X=RND(5)+5
980 Y=X+RND(8)
990 Z=Y+RND(10)
1000 IF M=1 THEN X=0 ELSE IF M=2 THEN Y=0 ELSE IF M=3 THEN Z=0
1010 A=RND(20)*3-2
1020 B=RND(20)*3-2
1030 C=RND(20)*3-2
1040 X=X-1
1050 Y=Y-1
1060 Z=Z-1
1070 IF X<1 THEN 1130
1080 PLAY STR$(RND(12))
1090 V$=MID$(A$(1),A,3)
1100 PRINT @ 142,V$;
1110 PRINT @ 174,V$;
1120 PRINT @ 206,V$;
1130 IF Y<1 THEN 1190
1140 PLAY STR$(RND(12))
1150 V$=MID$(A$(2),B,3)
1160 PRINT @ 148,V$;
1170 PRINT @ 180,V$;
1180 PRINT @ 212,V$;
1190 IF Z<1 THEN 1260
1200 PLAY STR$(RND(12))
1210 V$=MID$(A$(3),C,3)
1220 PRINT @ 154,V$;
1230 PRINT @ 186,V$;
1240 PRINT @ 218,V$;
1250 GOTO 1010
1260 IF X>1 OR Y>1 GOTO 1010
1270 A=POINT(28,8)
1280 B=POINT(40,8)
1290 C=POINT(52,8)
1300 IF A<>B GOTO 710
1310 IF A=4 AND B=4 AND C<>6 AND C<>2 THEN G=Q(1): GOTO 1420
1320 IF A=4 AND B=4 AND C=6 THEN G=Q(2): GOTO 1420
1330 IF A=4 AND B=4 AND C=2 THEN G=Q(3): GOTO 1420
1340 IF A=8 AND B=8 AND C=-1 THEN G=Q(4): GOTO 1420
1350 IF A=8 AND B=8 AND C=8 THEN G=Q(5): GOTO 1420
1360 IF A=3 AND B=3 AND C=-1 THEN G=Q(6): GOTO 1420
1370 IF A=3 AND B=3 AND C=3 THEN G=Q(7): GOTO 1420
1380 IF A=6 AND B=6 AND C=-1 THEN G=Q(8): GOTO 1420
1390 IF A=6 AND B=6 AND C=6 THEN G=Q(9): GOTO 1420
1400 IF A+B+C=-3 THEN G=Q(10): GOTO 1420
1410 GOTO 710
1420 FOR A=365 TO 429 STEP 32
1430 PRINT @A,SS$;
1440 NEXT
1450 T=42
1460 FOR A=1 TO G
```

Listing continued

See List of Advertisers on page 130

Listing continued

```
1470 FOR L=22 TO 27
1480 SET(T,L,5)
1490 IF G>14 GOTO 1520
1500 FOR B=1 TO 10
1510 NEXT B
1520 RESET(T,L)
1530 NEXT L
1540 SOUND 210+RND(20),1
1550 Q=Q+.25
1560 PRINT @ 491,STRING$(19,128);
1570 PRINT @ 491,"STAKE: $"Q" ";
1580 NEXT A
1590 FOR T=1 TO 500
1600 NEXT T
1610 GOSUB 1910
1620 GOTO 710
1630 IF X>0 OR Y>0 OR Z>0 THEN 1010
1640 PRINT @ 491,STRING$(19,128);
1650 PRINT @ 491,"STAKE: $"Q;"  ";
1660 RETURN
1670 R=R+1
1680 IF R>5 THEN PRINT @ 491,"THE LIMIT - PLAY ";: PLAY "T4;C;E;
G": RETURN
1690 IF Q=0 THEN PRINT @ 491,"OUT OF MONEY - PLAY";: RETURN
1700 Y=Y+.25
1710 PRINT @ 0,STRING$(10,128);
1720 PRINT @ 0,"BET ";Y;" ";
1730 FOR A=1 TO 10
1740 Q(A)=Q(A)+P(A)
1750 NEXT
1760 Q=Q-.25
1770 GOSUB 1650
1780 BB=1
1790 FOR A=102 TO 390 STEP 32
1800 PRINT @ A,Q(BB);
1810 PLAY "T40"
1820 PLAY STR$(RND(12))
1830 BB=BB+1
1840 NEXT
1850 IF Q(10)=0 THEN PRINT @ 393," ";CHR$(128);
1860 RETURN
1870 PRINTA$(1):B=RND(30)*3-1:PRINTMID$(A$(1),B,12)
1880 PRINT @ 491,"NO PAY - NO PLAY ";
1890 PLAY "T4;L5;8;L10;3;3;5;L5;3;L5;P20;7;8"
1900 RETURN
1910 PRINT @ 333," ** LOLLIPOPS ** ";
1920 PRINT @ 397," PLAY TO 5 COINS ";
1930 FOR A=301 TO 461 STEP 64
1940 PRINT @ A,D$;
1950 NEXT
1960 RETURN
1970 PRINT @ 491,STRING$(19," ");
1980 PRINT @ 491,"SAVE?";
1990 Q$=INKEY$
2000 IF Q$="" THEN 1990 ELSE IF Q$<>"1" AND Q$<>"2" AND Q$<>"3"
THEN M=0: RETURN
2010 M=VAL(Q$)
2020 RETURN
2030 END
```

When you tap P for play, the program decides how many times each reel will change during the one play by the random values given X, Y, and Z in lines 970–990. Lines 1010–1030 choose a symbol to flash. In lines 1040–1060 the program starts reducing the X, Y, and Z values because it is in a looping process. Lines 1090–1120, 1150–1180, and 1210–1240 do the same thing for each reel.

V$ becomes the symbol chosen randomly. The program prints it in its right place, three deep so it turns into the block seen in the window. This keeps happening until X, Y, and Z are all exhausted.

Lines 1270–1290 are point tests to see what colors the three reels are. Lines 1310–1400 test for winning combinations by checking the point values of the three colored reels. For example, line 1330 says, "If the first reel is red, the second reel is red, and the third reel is yellow, then G equals Q(4), which is the amount owed the player for the win, so go to line 1420 to pay off. ■

"You system players are all alike. . ."

Send questions about the program to Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926. Send a self-addressed, stamped envelope (Canadians send 40 cents coin and a self-addressed, stamped envelope) and a listing as the program is in your machine. If you do not have a printer, include the error message or describe the problem in detail.

✓See List of Advertisers on page 130

Doctor ASCII

Questions And Answers

by Richard E. Esposito and Ralph Ramhoff

Got a problem with your Color Computer? Ask Doctor ASCII to solve it. Write to Doctor ASCII, HOT CoCo, *Pine St., Peterborough, NH 03458.*

Q. I have a Gemini-10 printer that I am using with my TRS-80 Color Computer. I am quite pleased with the printer and can access all its functions without much trouble. However, I cannot figure out how to do a graphic dump to the printer. The printer closely emulates the Epson MX-80 printer. Can you provide me with a listing to do a screen dump of a graphic page to the printer for the Gemini-10?

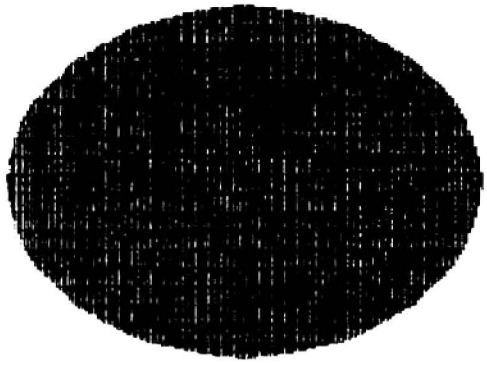


Fig. 1. Circle Printed on Gemini Printer

Program Listing 1. Graphic Dump Routine for Gemini Printer

```
10 PMODE 4,1
20 PCLS
30 CIRCLE(75,75),75
40 SCREEN 1,1
50 PAINT(50,50),1
60 GOSUB1000
70 PRINT#-2,"A CIRCLE"
80 END
1000 PRINT#-2,CHR$(27)+"1"
1010 IF PEEK(49152)=ASC("D") THE
N G=3548 ELSE G=1536
1020 FOR R=0 TO 31
1030 PRINT#-2,CHR$(27)+"K"+CHR$(
191)+CHR$(0);
```

Listing 1 continued

Listing 1 continued

```
1040 FOR C=R TO 6111+R STEP 32
1050 PRINT#-2,CHR$(PEEK(C+G));
1060 NEXT C
1070 PRINT#-2
1080 NEXTR
1090 PRINT#-2,CHR$(27)+"2"
1100 RETURN
```

A. Program Listing 1 puts a circle on a PMODE4 screen and then dumps it to a Gemini printer. The screen dump subroutine starts at line 1000.

Q. Can you use the CoCo with a color monitor? The local Radio Shack sales person said it is possible. Would I have to get an adapter for the CoCo to interface with a monitor?

Bob Hart
Alton, IL 62002

A. The CoCo can use a monitor, but you must bypass the built-in Astec video modulator. If you are a do-it-yourselfer, read "Sweetening the Video," *80 Micro*, Nov. 1981, p. 86, or *HOT CoCo*, August, p. 98. If you are not the soldering type, Computerware, Box 668, Encinitas, CA 92024, 619-436-3512 at $24.95 plus $2 shipping has a solderless adapter.

Q. My CoCo has only 4K RAM. I would like to upgrade using a conversion kit such as advertised in Jameco Electronics. In the near future, I would also like to add a modem, disk drives, and a printer. Could you advise me as to the conversion that would be as high as possible with the least difficulty?

Edward Gocek
Bayville, NJ 08721

A. There are three ways to expand your memory. Since you now have 4K, I assume that you have a D or E board. If you want to go to 16K, an article appeared on that subject in *80 Micro*, March 1982, p. 102. You can install a piggyback 32K modification as outlined in the same issue on p. 126.

If you do the piggyback 32K modification to an E or newer board, the RAM jumpers should be set to 16K, *not* 32K. If you want maximum utility out of your machine, I would go the 64K RAM route as presented in the July issue of *HOT CoCo*, p. 44. Since the 64K chips are now available for about $5 each, this is the route I would go.

If you want to get 40-track disk drives for your CoCo, you can order the controller separately from Radio Shack National Parts (part #AX9060, the PC board, and part

#AZ6839, the cover). Disk Basic uses only 35 tracks, but if you add FLEX, you can use all 40 tracks and both sides at once if the drives you buy have the capability. You can use any printer that has a standard RS-232 serial interface or a Centronics parallel (requires a serial-to-parallel converter). I have had good luck with the Radio Shack DC Modem I.

Q. I am hoping you might help me with a problem, which my local RS Computer Center and even calls to Tandy in Texas have not resolved.

Mine is a 16K Extended Basic Color Computer. While I am not writing programs, I am using it more and more for financial record keeping and personal cataloging. Also, I have recently purchased some investment software. In the near future, I will probably expand this system, or in two or three years, buy a larger one.

The quality of detailed lettering on the present CRT, a 1979 17-inch Sony, is not very good, and no better on Radio Shack's TVs. I would like advice on whether another brand of television might have better resolution, or preferably, if I could purchase a compatible color CRT for use not only as a monitor for this system, but also for another larger system, if and when I move up.

Samuel Baker
Modesto, CA 95350

A. You may want to read the answer to Mr. Hart's letter in this column, but from the tone of your letter, I feel that you are looking for the type of display available on a commercial video display terminal. If you use the FLEX operating system, you can hook up a video display terminal to the CoCo's RS-232 port with the Frank Hogg and Data-Comp versions. Star-Kits is marketing a Rem-O-Term program, which allows use of the Radio Shack ROM Basic from a commercial VDT.

Not all machine-language programs are compatible, though. A commercial VDT would also give you an 80- or even a 132-column display. A black-and-white TV will generally give a better character display than a color one, but, of course, you lose color.

Q. Help! I was recently given a TRS-80 Color Computer and I want to expand it to accept more than one ROM package at a time. I want to make the screen show 80 characters per line and improve the keyboard so that it is better suited to word processing. I also want a modem program that will leave my computer "smart" and not simply a teletype. I want to use the modem in conjunction with a DOS. Is there a way to do all this or should I simply sell my gift and get a Model III?

Dr. R. Theron Dunn
Santa Ana, CA 92701

A. Most ROM packs can be put on disk; see our article on disk utilities elsewhere in this issue. For all practical purposes, the screen cannot be expanded beyond 64 characters per line without extensive hardware modifications because the maximum resolution of the 6847 VDG is 256 by 192 pixels. At 64 characters by 24 lines, you are displaying text characters in a 4-by-8 dot matrix with no spaces between the characters.

There are a number of commercial plug-in keyboard replacements available, or you can buy a $20 wire-wrap keyboard and adapt it yourself. There are a number of "smart" terminal programs currently available for the CoCo. As to your question about trading up (???) to a Model III, for that price, you could purchase an 80-column VDT and the FLEX operating system and have enough money left over to buy some great color graphics games. You would then have a faster machine with many features that the Models II, III, and 4 simply are not capable of.

Q. I own a TRS-80, Model I (500-baud cassette rate) and my friend owns the TRS-80 Color Computer (1,500-baud cassette rate).

Is it possible to make these two computers compatible via cassette tapes using a software modification? I am trying to avoid any hardware modifications if I possibly can.

I am also interested in the different format structures of the cassette schemes on these two different machines. I would appreciate any information you can provide for this problem.

Oscar Ramsey
Bowie, MD 20715

A. Spectral Associates markets a program called Magic Box, which reads Model I cassette tapes into the CoCo via the joystick port with a special cable. The simplest way to transfer programs from one machine to another is via the RS-232 ports with "smart" terminal programs running on both machines. In this manner, Basic programs and ASCII data files can be exchanged between Apples and CoCos, TRS-80s and IBMs, CoCos and mainframes, or any other combination. Comments for a disassembly of the CoCo's cassette routines appeared in the January 1982 issue of *Color Computer News*, p. 52.

Q. I have been told that my TRS-80 Color Computer can work in double or triple precision, but can't find any information on it.

My knowledge of machine language is zilch, and my math ability is limited.

Richard Nichols
Oakland, CA 94604

A. The CoCo compared to the Models I, III, and 4 has 1½ precision (nine significant digits) when using its ROM Basic. To see how this is accomplished, see "Binary Breakfast" in the 1983 Special Anniversary Issue of *80 Micro*, p. 50. If you add the FLEX operating system to a CoCo that has been expanded to 64K RAM and also add TSC's XBasic, you would have extended precision to 17 digits as well as integer variables to 32767.

Q. I have a question about how to use the CLEAR command on the Color Computer. How are you supposed to know how much string space you will use or how are you supposed to know how much string space a program will use?

Also, in the book that I received with my computer, it shows some sample machine-language programs. Unfortunately, the book does not explain how to get into that

mode. I would like to know how to get into that mode and the name of a good book to buy when I start programming in machine language.

Curtis Frazier, Jr.
Enterprise, AL 36330

A. A Basic program requires 1 byte for each string variable that is used as a length pointer in addition to 1 byte for each character stored in string variables. You must also provide about 50 extra bytes for miscellaneous string operations such as space in RAM for the file name of a CLOAD command.

The book does not list machine-language programs, but addresses of machine-language ROM routines. In the stock CoCo, the only access that you have to machine language is via the PEEK, POKE, USR, and EXEC commands. It is difficult to program in machine language without an assembler. Your local Radio Shack dealer can provide you with an EDTASM + ROM pack, which will give you the capabilities that you desire. Radio Shack is expected to have an Assembly-language book written specifically for the CoCo by the time this article appears in print. At this writing, the "6809 Bible" is a book entitled *6809 Assembly-Language Programming*, by Lance Leventhal.

Q. I own a 16K Extended Basic CoCo. I am very familiar with the Basic language. However, I would like to learn Assembly language. I recently bought a book for the Motorola 6809, but I can't understand it. I would like to buy a good book for Assembly language. Do you have any suggestions?

A. I assume you bought the Leventhal book. It is very comprehensive, but is not quite designed for the beginner. I have not seen it yet, but the new Radio Shack book would probably be more suited to your needs. There is also a book entitled *Assembly-Language Graphics*, by Don Inman, which uses the Micro Work's SDS80C editor/assembler. If you have that assembler, Don's book could be quite useful.

Q. I have Color Scripsit and an Epson MX-80 printer. I get garbage between the two. How do I correct the situation?

Kenneth Dunlap
Oswego, NY 13126

A. There are a number of possibilities. First check to see that your Color Basic ROM is version 1.1. This can be determined by typing EXEC 41175.

If the computer displays "Color Basic 1.0," you have the old ROM with the 7-bit printer driver. A replacement ROM is available for $36.30 from Radio Shack National Parts (part #AXX3052). Also, the baud rates must be compatible; when turned on, the CoCo's baud rate is 600.

Q. I have read that you can repair sticky Color Computer keys with a quality tuner cleaner or graphite. However, once I get the keyboard off, how do I access the individual keys to repair them?

Another problem I have is what appears to be internally generated radio-frequency interference. It disappears when I disconnect and reconnect the cable to the TV, then develops again later on. This is rather disconcerting when playing fast-action video games.

Finally, some vendors are advertising joysticks they claim are superior to Radio Shack's. Since I'm having a problem with a couple of my maze games, would an investment in one of these be prudent?

Steve McGibney
Fort Belvoir, VA 22060

A. I would not use graphite; it is a conductor! You do not need to disassemble the keyboard; spray alongside the keys with tuner cleaner, working them up and down, and wipe off the excess with a lint-free cloth. A better solution might be to replace your keyboard with one of those commercially available.

A lot of the interference that you describe is due to the audio cable used to connect the CoCo to the TV switch box. It should have been made of coaxial cable to minimize interference. You can replace it with a 6-foot VTR video/audio cable, part #15-1535, for $3.99 at your local Radio Shack store.

It is rumored that Radio Shack is going to be selling a new version of the Wico potentiometer joystick. The Wico stick designed for the Atari contains switches for direction only and will not work with all CoCo software. Kraft, Spectrum, and Endicott also market potentiometer joysticks. Are they worth it? That depends on how much of a game fanatic you are. Some of these sticks run in excess of $100 per pair.

Q. Could you help me find the treasure chest in Radio Shack's Color Pyramid?

Kevin Collom
Brighton, TN 38011

A. Part of the fun in an adventure is finding the solution for yourself. However, I will say that the treasure chest is in the maze of twisty little passages, all different, and you cannot find the treasure chest until after your treasure has been stolen and put into the chest.

Q. I have a Color Computer with Extended Basic and 16K. I have started my own business, Moose Software. I have a series of adventure games, but I need to find out one thing to make them look more professional: how to get scroll protection for the Color Computer.

Bruce Esposito
Olney, MD 20832

A. Scroll protection is accomplished with the statement POKE359,0. After execution of this statement, only POKEs to screen memory and PRINT@s will show up on the screen. To restore normal operation, execute a POKE359,126.

Q. How do you send 8 bits to the Radio Shack Line Printer VII?

I have read an Assembly-language program in *80 Micro*, Oct. 1982, p. 304, on how to do this on a 4K standard

computer.

But how do you do this with a 16K Extended Basic machine and use EDTASM+ and the LP VII?

I am enclosing the program listing from *80 Micro*.

Richard Jensen
Madera, CA 93637

A. I see from your listing that you ORGed the machine-language program at $0000. If you did not load the program with an offset, it will wipe out Basic's pointers and your machine goes to never-never land. Since the program is 56 bytes long, you should start with a CLEAR 200,16326 and then CLOADM"DRIVER",16327. You should also be sure to have the appropriate DIP switch set for 8 bits on your LP VII when using this driver.

A permanent solution would be to replace your 1.0 Basic ROM with the newer version 1.1 (Radio Shack part #AXX3052 at $36.30). You could then leave your printer in 8-bit mode all the time.

Q. I have a TRS-80 Videotex terminal and I want to know if it is possible to convert the Videotex to a Color Computer. I inquired at the Radio Shack repair center and they said that it was not possible.

Roger Cremer
Salem, SD 57058

A. Yes, it is possible (anything is possible), but is it worth the trouble? To do the conversion would require copies of the service manuals of both machines at a cost of about $30. It would cost $36.30 for the standard Basic ROM. Most likely, you would want to replace the PC board at over $100, unless you are into wire-wrapping. With the Color Computer retailing at $199 and the Videotex at $99, your best bet is to eat the $99 Videotex and buy a CoCo, unless your local Shack store takes trade-ins.

Q. I have a 16K Color Computer with Extended Color Basic. I have a problem with the ROM pack version of Spectaculator. The computer has to strain to handle moderately large amounts of data with Spectaculator.

There are two major problems that I have encountered after entering about 7K bytes:

- My worksheet contained about 50 lines and about 10 columns of data. With the "calculate" command I wanted to calculate percentages associated with the various columns—e.g., column 3 divided by column 1, column 5 divided by column 1, column 7 divided by column 1. and so on. This calculation takes three to five minutes. Is this standard on this computer?

- After about 90 minutes of working with this program, the computer stops functioning. The cursor splits apart, moving in two directions at once. Columns of data merge, and characters appear in haphazard fashion all over the worksheet. Worst of all, my data is lost. The local Radio Shack dealers have been attentive to, but not helpful with my problem. I have received two replacement ROM packs and a new computer. Nothing has helped. Finally a local Radio Shack salesman told me that he suspects that the machine is overheating. What do you think? My only solution so far is to work with Spectaculator for a maximum one hour at a time. I would appreciate any suggestions.

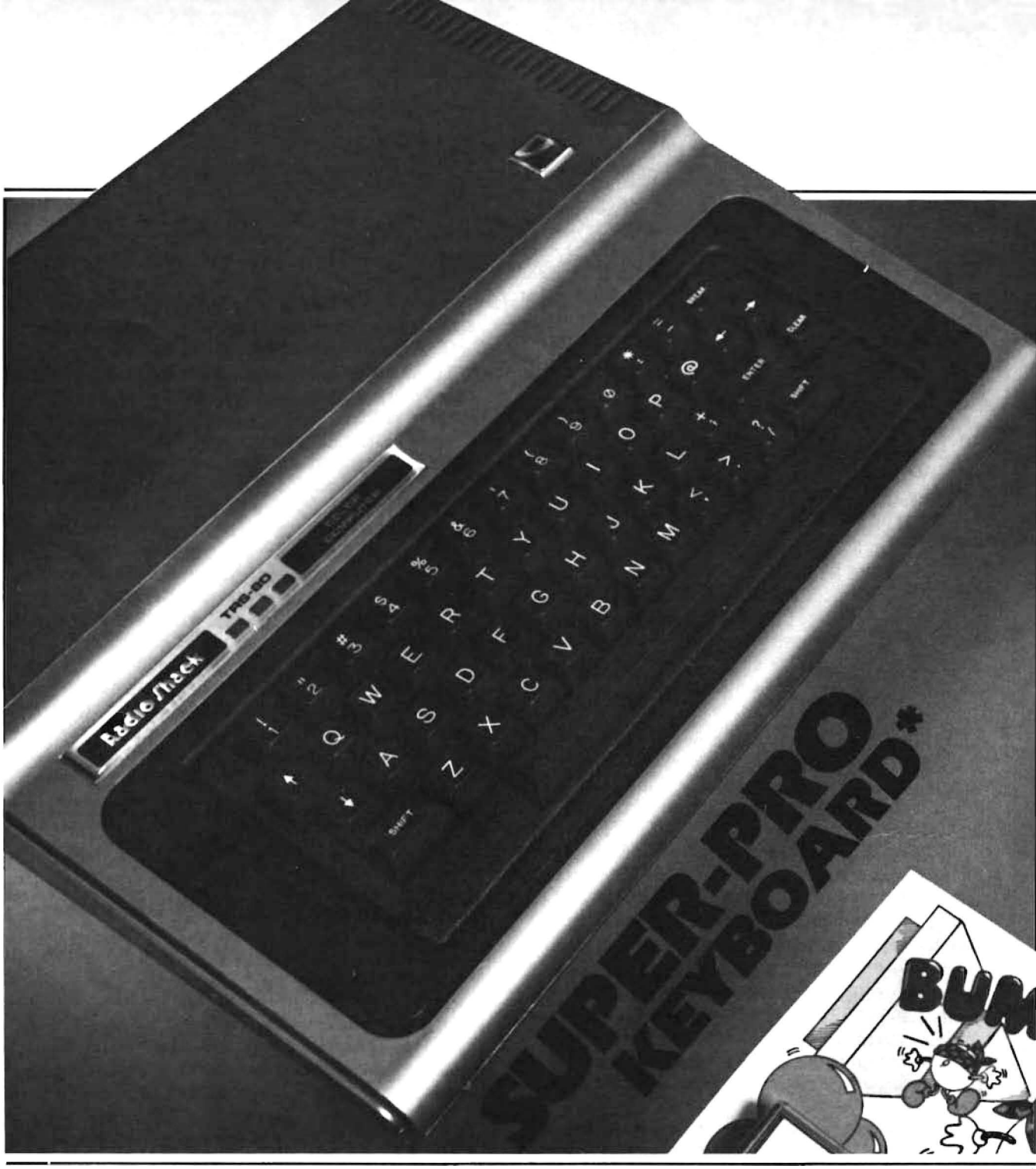
Lawrence Schofer
Philadelphia, PA 19119

A. As far as the speed is concerned, you are doing about 400 floating-point divisions, which makes three to five minutes sound reasonable for any micro.

The other problem sounds more interesting. The overheating theory is plausible, but I use my machine for hours on end with the disk ROM pack plugged in without a similar problem. Some ways to prevent overheating (if that is the problem) include putting a heat sink on the SAM chip, painting the inside of the RF cage black, or installing a cooling fan.

Judging by your description, I suspect that there is a bug in the Spectaculator software. My theory is that the program is crashing into the system stack, which would cause the computer to go bananas as you described. In order to check the validity of my theory, you need to try one of your 7K problems on a 32K machine. If my theory is correct, you would be safe as long as you stayed below 23K of data on the 32K machine. Has anyone else experienced this problem? Did you solve it? If my theory is correct, please let us know. ■

See List of Advertisers on page 130



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Re:FLEX

THE FILE MANAGEMENT SYSTEM

by David L. Wasler

This month I'll look at the file-management system and its various sections to see how they relate to the FLEX DOS. I'll cover the file-management-system file-control block and the file-management-system function codes. In my first column, I promised a listing of the disk-drive input- and output-routine jump addresses for each version of Color Computer FLEX, and that's just what you'll find in Table 1.

		Atomic City		DataComp		Flexplus		Frank Hogg	
READ	$DE00	JMP	$F345	LBRA	$DE7A	JMP	$DE7C	JMP	$E0B0
WRITE	$DE03	JMP	$F3DE	LBRA	$E0DA	JMP	$DF53	JMP	$E12F
VERIFY	$DE06	JMP	$F41C	LBRA	$E12F	JMP	$DFA9	JMP	$E2A8
RESTORE	$DE09	JMP	$F42E	LBRA	$E13C	JMP	$DFBE	JMP	$E300
DRIVE	$DE0C	JMP	$F441	LBRA	$E15A	JMP	$DFCE	JMP	$E32C
CHKRDY	$DE0F	JMP	$F47D	LBRA	$E1B3	JMP	$E016	JMP	$E35#
QUICK	$DE12	JMP	$F47D	LBRA	$E1B3	JMP	$E03F	JMP	$E352
INIT	$DE15	JMP	$FZE1	LBRA	$DE60	JMP	$EE0E	JMP	$E394
WARM	$DE18	JMP	$F381	LBRA	$DE6C	JMP	$DE4B	JMP	$E395
SEEK	$DE1B	JMP	$F39D	LBRA	$E063	JMP	$DEE1	JMP	$E396
MOTOR ON	$DE1E							JMP	$E066
MOTOR OFF	$DE21							JMP	$E050
UNKNOWN	$DE24							JMP	$DF13
UNKNOWN	$DE27							JMP	$E03F

Table 1. Disk-Drive-Routine Jump Table

What is the file-management system (FMS)? It is the heart of FLEX DOS. Without it you couldn't read data from the disk, write data to the disk, or communicate with the disk hardware. It also provides the structure needed to keep the data in order.

The FMS has 20 commands called the function codes, which tell the FMS how to function (read or write a sector, delete a file, and so on). The FMS must also have a buffer area of 320 bytes called the file-control block (FCB).

A well-written DOS must have a very efficient FMS, and it must be able to handle the different types of files, such as Basic, binary, and text. It must also be able to read and write files from a fragmented disk.

You can create a fragmented disk by deleting a file. Assume, for example, that you delete a file on track 1, sectors 3, 4, and 5. Assume again that you create more free sectors on the same disk by deleting another file on track 3, sectors 4, 5, and 6.

When you write a file to that disk, the FMS reads the system-information record on track 0 of the designated drive to find out what sectors are free. Then it writes part of the new file to the available sectors on track 1 and puts the rest of the file into the open sectors on track 3, thus creating a fragmented file.

The FMS can be divided into three parts: the FMS, the FCB, and the function codes.

FMS refers to a group of three subroutines that oversee the whole FMS. They have three entry points (see Table 2) that are the starting addresses of the subroutines the FLEX DOS calls upon when it wants to send data to and from the disk drive via the FMS. The FMS creates a file, which it

$D400	FMS INITIALIZATION	This lets the DOS initiate the FMS when you turn on your machine.
$D403	FMS CLOSE	This subroutine closes the file after the FMS is finished passing data to and from the disk drive.
$D406	FMS CALL	This subroutine passes data to and from the disk drive. To accomplish this task, the FMS must use the file-control block (FCB). The FCB isn't a subroutine, but an area of memory set aside to pass or receive variable information and data to or from the disk drive. I'll take a closer look at the FCB later.

The FMS must have a global variable area that holds the pointer to the FCB. These pointers are as follows:

$D409-$D40A	Points to the start of the FCB.
$D40B-$D40C	Points to the last FCB address that the FMS uses.
$D40D-Verify Flag	Tells the FMS to write verification, if needed, after a sector is written, if this address is nonzero.

Table 2. File-Management-System CALL

can then pass as data to and from the disk. It can also read and write a random byte from a sector. The FMS is initializing when you turn the computer on.

The FCB is a dedicated block of 320 bytes of memory (see Table 3). The FCB memory has only one purpose: to serve as a buffer area for the FMS to use in passing data to and from the disk drive. These 320 bytes can be placed anywhere in memory, but the normal FLEX location is from hex $C840–$C97F.

The first and most important byte in the FCB is the function-code byte at address $C840. It informs the FMS of the type of operation it must perform.

If you want to read or write a single sector, delete a file, rename a file, or find the next drive, look at Table 4. Note that a hex $09 is the function code for a single-sector read. This should be loaded into address $C840.

The next byte is the drive number at $C843. The next 11 bytes, $C844–$C84E, are for the file name and extension. Track information is at address $C85E, and sector information is at $C85F. Addresses $C881–$C971 are for data. I recommend that you study Table 3.

The FMS function codes consist of 20 command numbers, 0–20 decimal, or $0–$14 hex (Table 4). Technical Systems Consultants has designated these 20 commands to inform the FMS of the type of operation it must perform: read or write a sector, delete a file, or rename a file. Note that all these commands in Table 4 have a function number, all of which go into address $C840. Without the function code there could be no FLEX09 DOS.

Using the FMS

Before you can call one of the FMS subroutines, you must set up the FCB area (Table 3). The first 59 of its 320 bytes inform the FMS of the file parameter. The next 252 bytes are the data. To use the FCB you must have a complete understanding of Table 3 and what each byte does.

If you decide that you want to read a single sector, Table 4 shows that the function code for reading a single sector is a hex $09. The FMS needs to know whether to read or write a single sector. Open the directory and read or write a single sector. Assume that you

Address	Byte	Explanation
$C840	Function Code	This byte holds the 20 function codes, before the CALL to the FMC subroutine at address $D406.
$C841	Error Status	This byte holds the error number, if one was detected during an FMS CALL.
$C842	Activity Status	This byte is set to a one if the file is open for a read, or a two if it is open for a write.
$C843	Drive Number	This byte holds a drive number between 0–3.
$C844–$C84B	File Name	These 8 bytes hold the name of the file to which you are referencing (must not be more than 8 bytes).
$C84C–$C84E	Extension	These 3 bytes hold the extension of the referenced file (example: BIN, TXT CMD, etc.).
$C84F	File Attributes	Only the upper 4 of these bytes are used for a disk- or file-protect status. By setting one of these bits high, you invoke one of the protect statuses.
	Bit 4 =	Catalog-Protect
	Bit 5 =	Read-Protect
	Bit 6 =	Delete-Protect
	Bit 7 =	Write-Protect
$C850	Unknown at this time.	
$C851–$C852	Disk Address	These 2 bytes contain the starting track and sector number of the working file (the one being presently used by the DOS).
$C853–$C854	Ending Disk Address	These 2 bytes contain the last track and sector number of the working file.
$C855–$C856	File Size	These 16 bits indicate number of sectors to the file.
$C857	File Sector Map Indicator	This byte indicates whether or not the file is a random-access file.
$C858	Unknown at this time.	
$C859–$C85B	File-Creation Date	These 3 bytes tell when the file was created.
$C85C–$C85D	FCB List Pointer	These 2 bytes contain the last FCB pointer byte.
$C85E–$C85F	Current Position	These 2 bytes contain the current track and sector number being read into or written out of the FCB buffer.
$C860–$C861	Current Record Number	These 2 bytes contain the current sector number.
$C862	Data Index	This byte keeps track of the byte being read into or written out of the FCB buffer.
$C863	Random Index	This byte contains the address of the random byte being read in from the sector.
$C864–$C86E	Temporary storage	Used by the FMS to hold the name of the working file.
$C86F–$C871	Current Directory Address	These 3 bytes contain track and sector number and starting data of directory information.
$C872–$C874	Directory Pointer	These bytes keep track of free space in the directory.
$C875–$C87F	Scratch Bytes	These bytes store the file name and extension for the NAME command.
$C880	Space Compression Flag	This byte tells the DOS if a file is compressed or not when it is read into or written out of the FCB buffer.
$C881–$C971		These 256 bytes are sent to the disk or read in from the disk. The system uses the first 4 bytes to find the next track and sector if the file uses more than one sector.

Table 3. File-Control Block (FCB) Area

want to read a single sector. Load the drive number from which you wish to read into address $C843. Next, load the track number into address $C85E and the sector number into $C85F.

Now you must decide on which FMS subroutine to use. The most likely is the one at address $D406, because this FMS CALL is used most often and is easiest to understand. Again, to use the FMS CALL you must set up the FCB area.

Before setting up the FCB, you must tell the FMS where the FCB resides. You do this by loading an address into the X register. FLEX normally sets it to $C840 when making a FMS CALL. In Table 3, address $C840 is called the function-code address. Look at the FMS function code and find function 9, which is a read single sector.

You can load the code value of hex $09 into the A or B register and then store it into the address $C840. Next, you must load the A or B register again, this time storing the drive number into location $C843. Store the track and sector information into addresses $C85E and $C85F, using the same register. Finally, make a jump to the FMS address $D406.

The code will look something like the following:

```
LDX  #$C840          Start of FCB
LDA  #$09            Function code number
STA  0,X             Function code address
LDA  Drive Number
STA  3,X             Drive Address
LDA  Track Number
STA  30,X            Track Address
LDA  Sector Number
STA  31,X            Sector Address
JMP  #$D406          Call to FMS
```

The above program will run, but after the JUMP to the FMS CALL, you'll need a return to your system monitor or the program will run away. Once you are back into monitor, you can examine memory area $C880–$C97F and find out what you read into those locations.

If you now decide to write a specific track and sector, it would be the same, except that the data you wish to write to this sector would go to the FCB data before you invoke the program. A program to write to a specific track and sector would look something like this:

```
LDX  #$C840          Start of FCB
LDA  #$0A            Function Code Number
STA  0,X             Function Code Address
LDA  Drive Number
STA  3,X             Drive Address
LDA  Track Number
STA  30,X            Track Address
LDA  Sector Number
STA  31,X            Sector Address
JMP  #$D406          Call to FMS
```

As before, you must return to your monitor or the program will run away. Warning: Exercise great care when learning about the FMS area. Use only a working disk in the work drive. Use only a copy of the FLEX System program in the system drive and make sure it is write-protected. ■

Function	0	Read or write next byte or character
Function	1	Open for a read
Function	2	Open for a write
Function	3	Open for update
Function	4	Close a file
Function	5	Rewind file
Function	6	Open directory
Function	7	Get information record
Function	8	Put information record
Function	9	Read single sector
Function	10	($0A) Write single sector
Function	11	($0B) Unknown
Function	12	($0C) Delete a file
Function	13	($0D) Rename a file
Function	14	($0E) Unknown
Function	15	($0F) Next sector
Function	16	($10) Open system-information record
Function	17	($11) Get random byte from sector
Function	18	($12) Put random byte into sector
Function	19	($13) Unknown
Function	20	($14) Find next drive

Table 4. File Management-System (FMS) Function Code

Write David Wasler c/o HOT CoCo, *80 Pine St., Peterborough, NH 03458.*

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Reader's Forum

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Installing a Power-On Light

You might have noticed that the top left of the CoCo or TDP-100 gets hot. This is because power is constantly going to the transformer, even if you've turned the computer off. You can only cut the power by unplugging the computer or by putting a switch in the cord. With this done, a power-on light will let you know when there is voltage going into the machine.

To install the power-on light, purchase a package of neon lamp assemblies, even though you'll need only one of them. I bought mine from Radio Shack (RS #272-708).

Take the top off the computer and drill a hole to accept the neon lamp. Mount it somewhere on the front of the case. Connect the wires to the ac-in side of the transformer. You can make the connection before or after the fuse (see Fig. 1).

Now when you plug in the computer, the new neon light will come on immediately, telling you there is power going to the transformer.

Barry Ruchalski
720 Raymond St.
Elgin, IL 60120

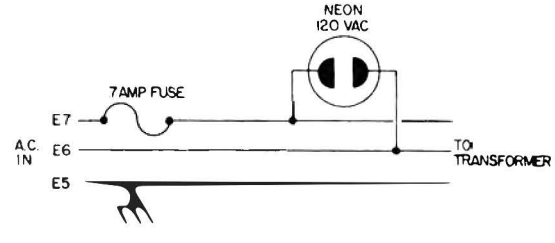

Fig. 1. Connecting the Neon Lamp.

Check Your Printer Status

Tired of sitting and watching a locked-up screen when your little silver box should be sending data to your printer? Is it a hardware problem? More often than we'd like to admit, it's probably a "wetware" problem—forgetting to turn the printer on in the first place.

In PEEKing through memory associated with the peripheral interface adapter (PIA), I found at least two locations that change predictably when the printer is on or off: &HFF22 (65314) and &HFF26 (65318). When the printer is on-line and ready, these locations always yield a 4; when the printer is off, they yield a 5 or 7.

The fact that they're either odd or even allows you to compare them by dividing by 2 and using the INT statement.

So, before you send your data to the printer, incorporate this short subroutine in your programs:

```
10 IF PEEK(&HFF22)/2 = INT(PEEK(&HFF22)/2) THEN 50
20 PRINT @ 452, "TURN ON PRINTER,DUMMY!":SOUND 200,15
30 INPUT "PRESS <ENTER> TO CONTINUE";ENT$
40 IF ENT$ <> "" THEN 30 ELSE 10
50 RETURN
```

Try it and you won't find the CoCo (or you) asleep at the switch.

Stephen R. Brown
3601 W. Richwoods Blvd.
Peoria, IL 61604

Defined Variables as Starting Points in FOR...NEXT Loops

Perhaps some readers have had trouble using defined variables as starting points in FOR...NEXT loops, IF...THEN...ELSE routines, and so on. There have even been articles stating that you cannot use them with the CoCo. But by preceding certain command words with a space or by enclosing the variables in parentheses, you can overcome such problems. (The space before command words is much easier and consumes less memory.)

The following are some examples of routines that will and will not work:

```
10 INPUT"C";C:FORI=CTO10:?I;:NEXT
```
(Will not work—needs space before TO.)

Reader's Forum

10 INPUT"C";C:FORI=C TO10:?I;:NEXT
(This is OK—note space.)

10 INPUT"C";C:FORI=(C)TO10:?I;:NEXT
(This is OK—note parentheses.)

That the TO must be preceded by a number of a delimiter seems to be a quirk in the Microsoft Color Basic. In the example above, the space and the parentheses are both delimiters and create no problem for the program. The quirk occurs elsewhere, so to avoid problems in these areas, conform to the following when using defined variables:

- In FOR...TO...NEXT...STEP statements, precede TO and STEP with a space.
- In IF...THEN...ELSE statements, precede THEN and ELSE with a space.
- In ON...GOTO and ON...GOSUB statements, precede GOTO and GOSUB with a space.

Please keep in mind that although the number 1024 and the statement &H400 represent the same value, the statement &H400 falls under the same rule as a variable and must be enclosed in parentheses or followed by a space, as in this example:

10 FORX=&HA000 TO&HBFFF:?CHR$(PEEK(X));:NEXT

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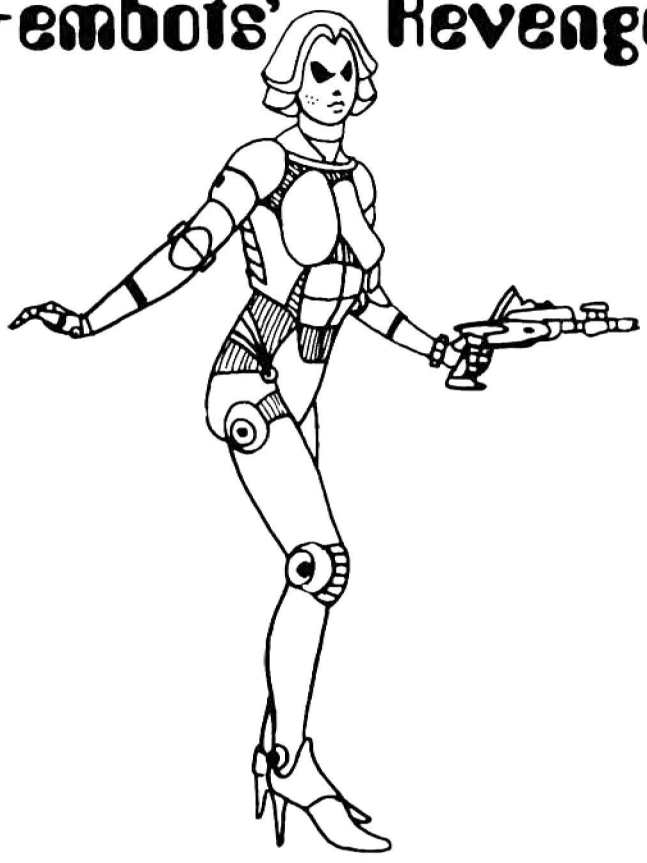

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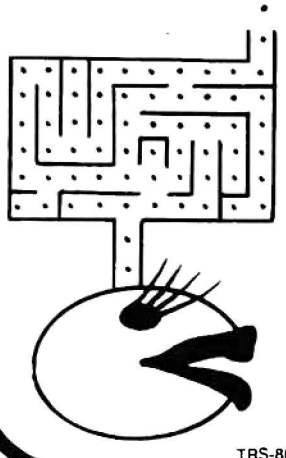

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REVIEWS

REVIEW CONTENTS

edited by Janet Fiderio

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Colored Fonts
Renaissance Game Designs
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by Steve Brown

One of the Color Computer's more vexing idiosyncracies is its inability to combine text and graphics on a single screen. The finest programs featuring peacock graphics turn into ugly ducklings when text must be displayed, because the CoCo must flop back to the familiar dull, green text screen. One way to overcome this is to laboriously invoke the DRAW command and draw each letter of text, ever so slowly, on the graphics screen.

Now, however, there are simpler, more elegant ways. Two new programs, Colortext by Bertamax Inc. and Colored Fonts by Renaissance Game Designs, provide simple solutions to putting snazzy text on your hires screen. Both products produce a similar result, in similar ways.

Colortext

Colortext, one of the Micro School Programs by Bertamax Inc., is a machine-language program that interrupts the return-to-text screen during text displays. It also interrupts INPUT or INKEY$ functions, translates all printed characters into high-resolution characters, and prints them on the screen as if they were normal text.

Used in its simplest form, Colortext replaces the text screen with a PMODE 4 screen, fully supporting the PRINT@ function and text scrolling, while still allowing high-resolution graphics to be displayed on the same screen. But, beyond making your regular screen much more pleasant to work with, Colortext also supports PMODE 3, different-colored text letters, background color changes, size scaling of letters, full upper- and lowercases, AND/OR/XOR writes, and full ability of the programmer to create and use unique character type styles.

The program also lets you redefine the cursor character and disable the break key. If you're huffin' and puffin' to keep up with these features, add in the ability to handle Model I and III graphics and control codes, which, according to the program's authors, allow easier conversion of Model I and III programs to the CoCo's vocabulary.

Colortext requires 32K and is available only on disk. According to the authors, user programs of up to 16K will run with Colortext on 32K machines.

The program is a text driver for its own graphics codes. Its functions can be incorporated in any Basic program and called up with a simple command set. Extended Basic is fully supported. The key command phrase is PRINT CHR$(1)CHR$(X)CHR$(Y), where X and Y are control codes defined in the Colortext manual. For example, to change your screen to display all characters in black on a white background, type PRINT CHR$(1) CHR$(4)CHR$(255).

Features and Functions

Table 1 is a synopsis of functions supported by the control codes. A more thorough investigation of the codes reveals the simplicity of their uses. Following is a brief description of the functions: Two foreground codes flip-flop between red and blue characters on the screen. As the Colortext manual points out, a quirk of the Color Computer causes either red or blue to be set up as the default color when the computer is turned on.

The command PRINT CHR$(1) CHR$(2)CHR$(85) changes blue to red and PRINT CHR$(1)CHR$(2) CHR$(170) reverses the colors. This command allows the user to print letters (or characters) in color. Also, some gentle string manipulation lets you print different-colored characters on the same line.

The command PRINT CHR$(1) CHR$(4)CHR$(255) initializes the screen display to white with black characters. To reverse the effect, type PRINT CHR$(1)CHR$(4)CHR$(0), yielding white characters on a black background. Finally, to reverse everything, type in PRINT CHR$(1)CHR$ (4)CHR$(255). These commands may be given from the command mode or embedded in your Basic programs.

Character size is controlled by the PRINT CHR$(1)CHR$(5)CHR$(Y) command. CHR$(5) is a constant scaling code, while the Y code generates the relative size of the letter in a range from 1 to 15 times normal size.

Colortext does not, however, just increase the size of the characters, but increases the scale of the screen. In effect, invoking the command for increased size takes the entire screenful of characters and blows them up; what you see on the screen is only a window showing a part of the screen.

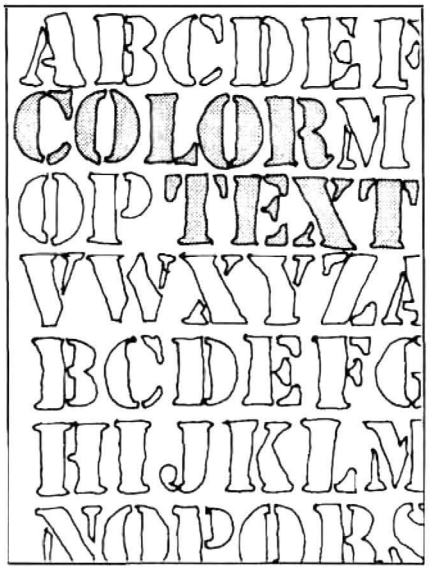
The normal OK prompt goes off the top of the screen, and any command typed in goes off the bottom of the screen, where it remains unseen until it scrolls up later. The whole effect is a lot like looking at a 1-inch square area of an 8-by-10 photo. I haven't found much use for this feature.

Screen scrolling is supported, being variable in speed with the general command PRINT CHR$(1)CHR$(6) CHR$(Y). Six scrolling speeds are offered, Y=1, 2, 3, 4, 6, and 12 with the default being 3. Once the program is executed, you can decide what scrolling speed you want, and it will remain constant until you turn the computer off. I found that a speed of 3 was too slow for my liking; a speed of 12 rolls the lines more like the normal CoCo.

Colortext offers an engaging animation technique by using an exclusive OR (XOR) mode of putting characters on its graphics screen. The general command is PRINT CHR$ (1)CHR$(10)CHR$(Y), where Y equals zero or 255. You can move characters around on the screen and they will merge (or appear to pass through) other characters without erasing the original characters. Want to shoot little arrows through the title of your next game program? XOR them to your delight.

Graphics characters, either user-defined or the Model I and III set, are invoked with the PRINT CHR$(1) CHR$(11)CHR$(Y) command. Y equals zero for the user-defined set, or Y equals 255 for Model I and III set.

If you're tired of that same old chameleon-block cursor, you can change it to any ASCII character. The standard cursor is made by printing eight



color blocks in the same spot in rapid succession.

You can define two ASCII characters—either graphics characters or keyboard symbols—to be used in place of the standard cursor. The PRINT CHR$(1)CHR$(12)CHR$(Y) command defines one of the cursor characters and PRINT CHR$(1) CHR$(13)CHR$(Y) defines the second. The Y code can be any number from 0-255, corresponding with ASCII codes. For a blinking cursor, the second cursor character is defined as CHR$(32), which is a blank. For a steady-state cursor, you define both characters the same.

To keep those little-kid fingers from ruining your best educational program, PRINT CHR$(1)CHR$(14) CHR$(128) disables the break key. However, this command also disables the INKEY$ function and the joystick. But, an alternate INKEY$ routine is clearly spelled out. PRINT CHR$(1)CHR$(14)CHR$(0) reenables the break key.

Finally, PRINT CHR$(1)CHR$ (252) disables a Colortext program and puts you back in the land of dull, green screens.

Colortext supports differing screen resolutions as well; however, PMODE 4 is the standard because at PMODEs 0-3 characters are nearly unreadable unless the character size is increased. PMODE 3 makes four colors possible while PMODE 4 offers only two.

Creating Your Own Characters

The character set for Colortext is the standard ASCII keyboard set with full upper- and lowercase options. Lowercase letters, with descenders, are available using the shift/0 key combination. While the standard characters are nice enough, you can design your own custom set. ADDCHR lets you modify, create, redefine, and edit characters. This program is written for a 32K system with a disk drive. With it you can create a character set pixel-by-pixel on an editing screen.

The editing-screen format is divided into three areas: the editing window, the character-set display, and a command window. The editing window is a large representation of an 8-by-12-pixel block. Characters as large as 8-by-12 can be created, but the normal character resides within a 5-by-7 portion of that matrix.

Five additional pixel rows are available to create true lowercase descenders. To do so, you place a small cursor, movable by use of the arrow keys, over the pixel desired. Pixels are set or erased by two keys. Once you draw the character to your liking, it is saved and displayed along with the other characters shown in the character display set.

Seven commands control the ADDCHR program to activate the driver program, delete character, edit character, load driver, save driver, deactivate driver, and exit. Up to 200 characters can be created or edited. The first time I tried the ADDCHR program, I designed and saved a whole new alphabet within about two hours. The second set went together in about an hour and a half.

Character sets you create can be saved to disk and read into the Colortext driver program. You can call

Function	Effect
Foreground	Changes blue to red
Foreground	Changes red to blue
Foreground	Changes to black
Reverse All	Reverses all foreground and background colors
Background/Foreground	Black characters on white
Size	Up to 15 times normal sized characters
Scroll Speed	Six speeds of scroll
XOR Mode	Enable/disable
Graphics Characters	User defined
Graphics Characters	Model I and III graphics sets
Cursor	Two definable characters
Break Key	Enable/disable
Disable Colortext	Return to text versus graphics

Table 1. Colortext Control-Code Functions.

them in your program just as you would text or by citing the proper ASCII code.

Documentation

The Colortext documentation is superb. Bertamax is to be commended on the completeness and clarity of the 74-page manual. Clear instructions with examples are given for every program phase. Instructions are even given on how to incorporate Colortext on your tape programs. The 41-page technical section will delight the more byte-minded programmer, while the examples in the rest of the manual will satisfy those who are more interested in the end result.

Because Colortext is written in position-independent machine language, it is relocatable in memory. This is a particular advantage to those of us with the 64K modification, because Colortext can be placed above Disk Basic, thus leaving more memory. Colortext Version 1.1 occupies slightly more than 1.6K with the default character set supplied.

At $79.80, Colortext isn't the cheapest product on the market, but considering the thorough documentation and its ease of use, it is a good value. The program makes the CoCo come alive with features.

Colored Fonts

Colored Fonts is also a high-resolution text generator for combining text and graphics on the Color Computer's screen. The program lets you create a custom set of 224 upper- and lowercase (with true descenders) ASCII characters. This machine-language program completely interfaces with Basic through software that interrupts the return to the text screen. The result—a new face for the CoCo.

The package is available in 16K or 32K, cassette or disk versions. One nice feature of the disk version is that it comes with six preprogrammed character sets ready to plug into your programs or to use as resident text on your command-mode screen. The six fonts supplied are:

- ASCII—The standard ASCII keyboard set
- Blippo—A typewriter font with serifs
- Future—A real computer-like type style
- Colossal—A regular-height, double-width ASCII
- Outline—Reminiscent of Art Deco outlined letters
- Apple—A colored letter style similar to the Apple computer's.

To use the program, you simply type: RUN"CFONTS/32K" and the program is in place with the default ASCII character set. To use another

character set, for example, Blippo, type in LOADM"BLIPPO", and all text letters are displayed in that style. To change fonts, repeat the LOADM command with whatever name you desire.

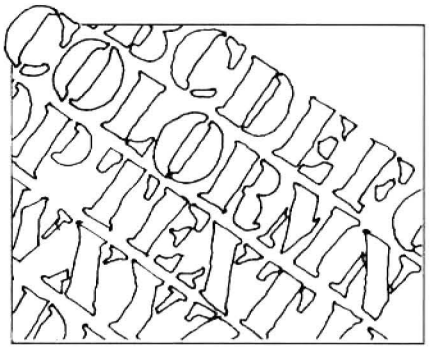
Colored Fonts supports an inverse-character mode, but the standard mode is a black screen with white letters (or colored for the Apple font).

Control Codes

While Colored Fonts doesn't support every function supported by Colortext, most of the important ones are handled well. Text-scrolling speed is not user-changeable, but seems to go at an acceptable pace, if somewhat slowly as compared to standard CoCo speed.

There are three control codes for special functions. Pressing the clear key in the command mode clears the screen as normal with the CoCo; the screen can also be cleared by printing CHR$(12) for use in your Basic programs. Colored Fonts actually clears the screen; use of the clear key with Colortext only homes the cursor leaving whatever is on the screen to scroll off by itself. Colored Font's Clear function is a good one.

The cursor can be turned off and on in the command mode by pressing



the right-arrow key or by toggling CHR$(9). The cursor is not redefinable; however, the cursor position can be programmed. Instead of using the PRINT@ command, the X and Y screen coordinates are POKEd into memory locations 220 and 221, respectively.

The third control code is used to toggle the inverse-character mode on and off. Use of the CHR$(6) command acts much like the regular shift/0, as far as the screen display is concerned. In this mode, all ASCII characters are printed with 96 added to the ASCII number of the character.

Special Functions

Two special functions are also identified; both involve POKEs in memory. In PMODE 4 and SCREEN 1, POKEing 65314 with 155 stretches the characters to a 16-by-24 screen. This mode is similar to the window effect in Colortext; the characters are stretched so that any characters in screen columns 16–31 will be off the screen. Similarly, POKEing 65474 with 0 stretches the screen vertically to make a 32-by-12-line screen. Both POKEs can be done to yield a 16-by-12 screen.

Do It Yourself

Creating a new character set is very similar in both programs. However,

See List of Advertisers on page 130

where Colortext uses a command-based character creator, Colored Fonts' creator is menu-driven. The command RUN "FONTEDIT" takes you to a five-choice menu that lets you edit the character set in memory, save a new character set, load in another set, review the disk directory, or exit the program. Once activated, FONTEDIT presents a complete character set and a pixel grid. A blinking cursor is positioned under the letter you wish to change.

Pressing the enter key shows the pixels set on the grid; a minicursor is moved over the pixels you want to set or reset. The characters you create can be saved and loaded into your program whenever you need them. It took me only about an hour to create a new character set, but I already had some training with Colortext.

The Colored Fonts disk also contains a special program to dump the screen to an Epson MX-70 or MX-80 printer, Also contained on the disk is a short demonstration program.

Documentation

Colored Fonts is a good program and I have the feeling that it is even more versatile than the instructions state. But the program designers are hiding their collective lights under a barrel by providing such skimpy instructions. The documentation consists of four pages sparsely covered with directions on only certain functions. Unfortunately, the documentation doesn't tell you how to turn off certain functions, nor does it show you how to use the functions.

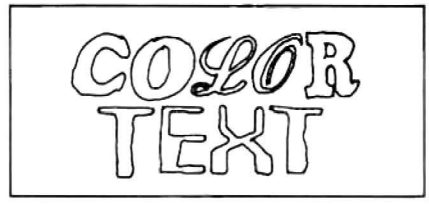
Summary

Colortext and Colored Fonts deliver what they promise, with relative ease and excellent speed. Colortext supports more functions and lets you control, more thoroughly, the screen environment. Colored Fonts, with fewer controls, seems to be a shade easier to use, especially when calling in different type styles from the disk. Both programs support creation of new character styles with approximately equal facility.

It's hard to put a value on Colortext's documentation, but it would be of tremendous help to a serious programmer eager to squeeze everything out of his program. Colored Fonts' preprogrammed character sets probably would cover most programming applications without ever having to create your own. And, for Epson owners, the screen-dump program is a big plus.

I incorporated both programs into a number of my own game and graphics programs and found them flexible and versatile. And, not surprisingly, they added a measure of speed and professionalism that just couldn't be otherwise achieved by drawing characters on the hi-res screen. For those of you who hope to market your software, both manufacturers will discuss licensing agreements, which would allow you to use their programs within your own.

Colortext and Colored Fonts add a needed feature to the Color Computer and can transform it—and your programs—from ugly ducklings to proud peacocks. ■



Fundgraf
Parsons Software
118 Woodshire Drive
Parkersburg, WV 26101
16K
$49.95 cassette
$69.95 disk

by Robert M. Jennings, Sr. and John P. Briscoe

Fundgraf, a new program from Parsons Software, is an important tool for the investor who is technically oriented. This program has excellent visual data displays for comparative analysis, and easy-to-understand instructions.

You use the main program, Fundgraf, to access any of the other seven operational programs. These programs can also be loaded directly, and they are: Add Data, Shortgraf, Longgraf, Moving Average, Printout, Shift Data, and Add Name.

Shortgraf offers a plotting of any group of four stocks or funds in the data files for up to 70 weeks. Longgraf plots any two stocks for up to 200 weeks of data. You can superimpose a

Summary of percentage change in mutual-fund prices for four periods

Name of Fund	10 WKS DEC 30	14 WKS DEC 2	18 WKS NOV 4	25 WKS SEP 16	Price MAR 10 1983
	Last data is for Mar 10 1983				
	% CHANGE				$$
DJ IND AVG (DIV ADJ)	8.33	9.82	8.03	24.02	1120.94
DJ TRANS (DIV ADJ)	13.27	14.34	13.68	39.38	503.10
20TH CENT GROWTH FD	11.98	7.87	10.15	34.89	14.11
NICHOLAS FUND	9.52	13.46	14.00	32.91	24.27
RESERVE FD (% INT.)	-10.24	-12.79	-21.76	-27.52	7.98
U S GOLD FUND	-0.88	14.47	35.45	46.75	7.91
PENN MUTUAL FUND	16.81	16.59	25.43	49.29	5.43
MATHERS FUND	8.51	8.27	7.23	23.94	22.15
ACORN FUND	13.70	12.33	18.40	34.20	29.14
BOSTON CO-CAPITAL FD	9.50	8.14	8.27	36.52	25.01
COLUMBIA FUND	12.62	10.76	16.33	43.45	23.36
CONSTELLATION FUND	17.34	13.24	25.70	60.80	20.10
#9-DREYFUS FUNDS	16.54	18.31	17.67	35.99	10.92
3RD CENT-DREYFUS FD	10.52	10.52	7.73	20.23	7.25
EVERGREEN FUND	13.88	14.33	15.74	36.57	39.30
GT PACIFIC FUND	1.66	8.14	14.18	11.38	14.09
CONTRA-FIDELITY FD	14.34	8.44	4.92	22.44	12.20
EQUITY INC-FIDELITY FD	8.80	8.94	9.93	28.73	24.18
MAGELLAN-FIDELITY FD	17.91	18.96	25.35	52.07	33.38
TREND-FIDELITY FD	10.67	6.39	6.58	26.04	34.32
HARTWELL LEVERAGE FD	18.63	14.16	22.49	62.73	36.11
JANUS FUND	11.52	13.72	15.34	34.94	11.71
LINDNER FUND	11.93	12.29	12.14	25.57	17.73
GUARDIAN-NEU BERM FD	11.03	8.94	10.51	31.11	37.25

Fig. 1. Sample Printout

moving average plot and a selected annual percentage growth rate line on both the Shortgraph and the Longgraf, permitting excellent visual comparison. A negative percentage growth rate line also works. Figure 1 shows a sample data sheet using the printout program.

One of the interesting features of the moving-average program is the automatic triggering of a buy or sell signal. When the price line of a fund or an individual stock is crossed by the moving average, such a signal is given. (The author warns of trying to read too much into such a crossover.)

The advantages of this program are the excellent visual displays for comparative purposes in analysis, and the simplicity of the program instructions. With proper use of the growth percentage lines, the data displays can produce a "what if" model to graph the possibilities of a stock or fund.

Users must be aware that the vertical axis of the graph changes with each fund plotted. Math-oriented users must be aware that the term moving averages in stock-market analysis differs from the same statistical term.

For the investor's use, the data base using the Dow Jones Industrial Average and any of the many funds available provides a good foundation for comparison. The user using the Add Data routine to include Standard and Poor provides the possibility of different comparisons.

Fundgraf is also appropriate for classroom use for the purpose of illustration. For the investor and the instructor alike, Fundgraf is a useful addition to their program libraries. ■

TRS-80 Extended Color Basic
Richard Haskell
Prentice-Hall Inc.
Englewood Cliffs, NJ 07632
Softcover, 170 pp.
$12.95

by John Steiner

The TRS-80 Color Computer is becoming popular among educators. In addition to running prewritten educational software, it is also being used to teach concepts of computer programming.

The Basic manual that comes with the CoCo, though thorough, is a better reference source than it is a programming instruction manual.

To fill the needs of the classroom, and the individual who wants to learn proper programming techniques, Richard Haskell has written *TRS-80 Extended Color Basic.* The book covers Color Basic and Extended Color Basic, but does not include disk Basic. Haskell has written programming texts for the Apple, PET, and Atari computers. Now he brings this expertise to the Color Computer user, covering concepts that are useful for the beginner and the advanced programmer alike.

The book is written with classroom use in mind, but self study is possible, as the author has an easy, readable style.

Chapters include topics regarding keyboard usage, beginning and advanced Basic programming techniques, low- and high-resolution color graphics, and tape data-file handling.

A book of this nature is often compared to the documentation that is provided by the manufacturer. In this case, the Basic programming manual provided by Tandy must take a back seat.

The beginning programmer will learn some useful techniques not provided for in the Radio Shack manual, including concepts of pseudocode, and flowcharting.

Another advantage of the author's approach is that the student learns concepts of program structure and techniques often used by the professional. As an example, in the section on program loops, the author discusses several different loop structures: the repeat...until, repeat...while, do...while, and do...until. These structures, can be executed using the structure and code provided in the book.

The major disadvantage of the text is a lack of file and disk orientation. Though a small section covers tape I/O, there is no mention of disk I/O or file structure.

Machine-language interfacing is mentioned, and there are a few examples of using POKE in a program. However, there is not much detail on calling routines from Basic. The only method mentioned is not applicable to the Extended Basic computer.

As a reference source, the book contains an excellent set of appendices. Sections on the Basic EDIT and PRINT USING functions are especially helpful.

For classroom use and for the individual who wants to become more proficient in Basic, I highly recommend this book. Its few disadvantages are outweighed by the wealth of information on the Color Computer. Good programming texts that are written for only one brand or type of computer are hard to find. ■

Robot Battle
Tandy/Radio Shack
Fort Worth, TX 76102
Catalog No. 26-3070
16K
$39.95 ROM pack

by Carlos Calle

Robot Battle is an educational program that introduces many of the most important concepts and procedures of programming through game playing. It is one of the few successful educational packages that allows children to learn the fundamentals of computer programming.

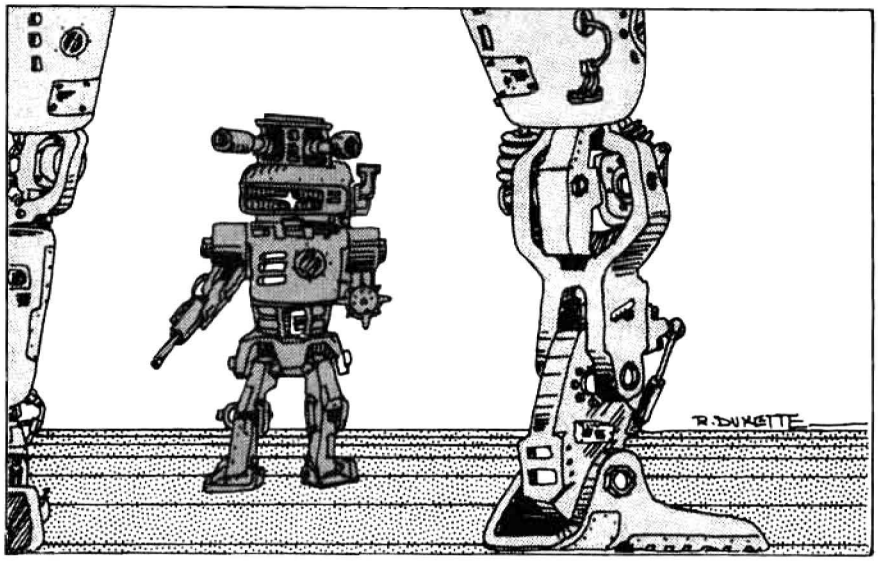
The purpose of the "game" is to instruct two robots where to move, when to fire a missile or a laser gun, and what to do if it runs into a wall or another robot. Two children can independently program one of the robots and then challenge each other's robot in battle. Since the programs remain in memory even after the battle, the child can modify and improve the programs after seeing the other's performance.

Radio Shack's Robot Battle is a good attempt at successfully combining the fun of video games with the fundamentals of programming.

Robot Battle begins by showing the following menu on the screen:

	Left	Right
New	NL	NR
Edit	EL	ER
Save	SL	SR
Load	LL	LR
Compile	CL	CR
Battle	B	

The two-character commands select the options from which to choose to program either the left or the right robot.



To start writing a program for the right robot you type NR, which turns the screen green except for a black bar where your instructions appear. To instruct your robot where and how to move, type in a series of simple commands separated by colons.

The two robots are positioned side by side across the center of the screen, looking upwards. Type L5 to make the robot move five steps to the left. By typing the command R5:XL the robot also fires the laser as it advances.

The commands =R and #R would instruct it to do or not to do a specific action if there is a robot in this octant, and therefore work as "sensors." The command S will allow scanning in all directions. The instructions = and # are used with M (missile), L (laser), or W (wall).

You can also program for randomness and unpredictability with the use of =? or #?.

You can tell the robot to move up, down, left, and right for up to eight steps, and program it to sense for another robot or for a wall and to act accordingly.

You can put together any repetitive action or series of actions in a single line, which can be called with the commands C or G. The CALL instruction allows the use of subroutines by starting a line with a level and calling it with the C command. The program jumps to the labeled line and continues to the following lines. After this action is completed, the computer returns to the spot where the subroutine was called and proceeds with its execution.

Once you finish writing your program you are ready to compile it. After pressing the break key to go back to the main menu you type CR to begin compilation. If there are errors in the use of the commands or labels, your program will not compile. Edit your program to make adjustments. By looking for errors, by adding to and changing your program to make it work, or to improve it, you can learn more about programming than by studying books or taking classes.

The editor in Robot Battle is a simple and easy-to-use screen editor, better than the Color Computer's own editor. The four arrow keys move the cursor in all four directions, and combined with the shift key, move the cursor to the right or left end of the line or up and down a half page.

The clear key deletes all the characters from the cursor position to the end of the line, and pressed simultaneously with shift, kills the entire line. The @ key creates a blank line above the current line, break exits the editor, and "P prints the program displayed on the screen.

Robot Battle is a complete package suitable for teaching a child the basics of computer programming. Children can begin by programming simple moves, progressing as they gain more programming experience to more sophisticated games.

It is hard to find a major flaw with this program. The robots could look more like robots (as they are shown on the cover of the excellent manual) instead of the two little squares with a couple of marks. For $39.95, you can't go wrong with this nice educational game. ■

TRS-80 Models I, III, and Color Computer Interfacing Projects
William Barden Jr.
Howard Sams and Sons
Indianapolis, IN 46268
Softcover, 276 pp.
$14.95

by Russell Hightower

William Barden Jr., describes in *TRS-80 Models I, III, and Color Computer Interfacing Projects*, the inner workings of these computers and their interfaces. He suggests projects to connect telephones, audio inputs, temperature sensors, and clock timers to Color Computers easily and inexpensively.

I reviewed those sections of the book devoted to the CoCo. I've listed the majority of the projects below, including a short discussion of hardware, software and projects applications for each type of interface.

The CoCo normally provides analog-to-digital (A/D) conversion through the joystick port circuitry. Barden describes the circuitry that performs the A/D conversions and shows how the system programming (in ROM) processes the incoming signals through the joystick ports. He includes instructions to build a light sensor and a thermometer that use the joystick A/D circuitry.

If voice synthesis interests you, Barden explains how to use the joystick circuitry and some inexpensive electronic parts to record and then play back voices and other sounds. He explains building a voice synthesizer and supplies programs, in Basic and in Assembly language, that make the synthesizer work.

Barden next delves into the internal workings of the RS-232 standard for asynchronous data communication and how the CoCo implements it through the serial port. He gives directions to build a real-time clock using simple electronic components. This clock, which will keep time for about half a year, can be connected to the computer through the serial port. An Assembly-language program that interprets the clock input is also provided.

Your CoCo can use several methods to monitor external events with the joystick port, cassette port, serial port, and the cartridge connector so the author covers a few of these applications. Plans for an anemometer to

measure wind speed are given as are plans for mechanical, magnetic, and pressure switches to monitor doors, windows and other parts of the home. Again plans and program suggestions are included.

Included in the book is a logic diagram and steps to build an input/output (I/O) board that connects to the I/O bus (cartridge connector). The board is designed around an Intel 8255 programmable peripheral interface (PPI).

The author states that this is the "right" way to perform I/O operations with the CoCo. Rapid event sensing (more often than about 80 events per second) can be detected with Assembly-language routines, while Basic routines are acceptable for slower events.

Also covered within this book's pages are transducer projects and the amplification of A/D inputs.

This book, is a compilation of articles that provide CoCo owners, who have varying levels of expertise and knowledge, the opportunity to learn more about its operation, not to mention extra utility for their CoCo.

Although the author provides reasonable explanations and descriptions, some familiarity with programming Basic and Assembly language is recommended. Also, familiarity with soldering and an understanding of circuits is useful. Thorough understanding of integrated circuitry is not needed.

Toward the end of the book, fewer instructions are given for the assembly and programming of the suggested projects. If you complete each project, you may have gained enough skill to accomplish the projects suggested at the end with no assistance. I found only a few errors in the diagrams and program listings that might be overlooked and cause slight frustration to the reader.

If you want to learn more about how your CoCo works, and in computers in general, this book offers explanations and descriptions you will find helpful. If you're a beginner, you may find it helpful to refer to other magazine articles and books devoted to the CoCo while reading this book.

If you are familiar with simple electronics and programming, these projects will give you additional insights into the Color Computer and provide you with an enjoyable time building these monitoring systems. ■

CCP-1 Serial Interface
Botek Instruments
4949 Hampshire
Utica, MI 48087
$69

by Carlos Calle

By far, the most popular type of low-cost printers use parallel I/O devices. This fact puts the Color Computer owner at a disadvantage when shopping because of that machine's serial I/O port printer. Without a method of adapting a parallel printer, such as the Epson FX-80, to the CoCo, users must pass up some good printer buys.

Enter Botek Instruments. They will sell you a device that plugs into the CoCo's serial port, and allows that computer to use a parallel printer. The package comes with all the necessary cables.

It has switch-selectable baud rates from 300 to 9,600, which you access with appropriate POKEs.

The Botek interface comes ready to operate with an 8-bit Color Computer, with instructions to change a small jumper in a header from one pair of holes to another to enable it to work with a 7-bit computer. This can be easily accomplished with a small pair of pliers.

By PEEKing into location 40988 you can determine if your computer is a 7- or 8-bit model. An 8-bit Color Computer will return a value of 87 in that location and a 7-bit computer will return 81.

If you want to interface a standard parallel printer to your Color Computer and have the added versatility of variable baud rates, the Botek Interface is a good choice. It comes with all the necessary interconnecting cables and is promptly shipped. I highly recommend it. ■

Defense
Space Race
Spectral Associates
114 Harvard Ave.
Tacoma, WA 98466
16K
$21.95 each, cassette

by Beth Norman

Defense, by Thomas Czarnecki, is Spectral Associates' version of the arcade game Missile Command. Using a little blue cross as a joystick-controlled gunsight, you attempt to protect six outposts and two ammunition dumps from laser-beam attacks.

Every time you shoot, you set off a red explosion. The objective of the game is to defend the outposts and dumps by shooting in front of the enemy beams. The beams create another explosion, which makes more fireballs. These are equally deadly to the enemy.

You start each screen with 10 rounds of ammunition and two refills (the dumps). Each time you fire, one of your rounds disappears. When you use up your initial supply, you can reload from a dump by pressing your firing button again.

You can only reload twice, so it is important to conserve your ammunition by carefully placing your shots. If you run out of ammunition before the screen is finished, you cannot defend yourself against laser attacks.

At the end of each screen you get extra points for each surviving outpost and each round of ammunition left.

The more screens you go through, the more enemy beams there are and the faster they move. On the fourth screen, flip charges appear, short lines that turn end over end as they drift toward the ground. You must shoot right in front of them to blow them up.

After the sixth flip charge the Buzz Bombs appear, which are as hard to hit as the flip charges.

After every 10,000 points you get a bonus outpost. The game ends when all your outposts are gone.

A great feature of Defense is the crackling noise the explosions make as they shrink.

There is one error on the instruction sheet: The three addresses needed for saving the game to disk in a 32K system are &H2000, &H3AFF, and &H2800, respectively.

Defense is easy enough for beginners during the first few screens, but the difficulty rapidly increases as you advance. I highly recommend this game.

Space Race

I found Space Race, by Daron Stinett and Rick La Mont, to be a poor game. You play by controlling your spaceship as it moves around the rectangular racetrack.

The game begins with four spaceships, which you lose quickly. Some of your opponents move around ran-

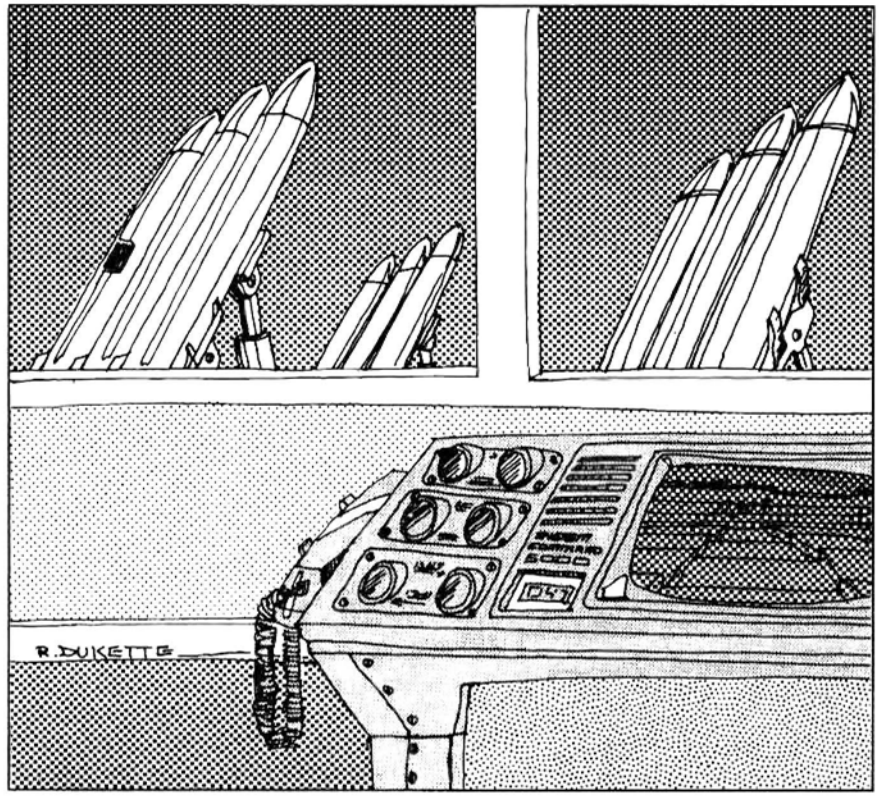
domly; others chase you firing missiles. Every time you clear a screen of aliens you get a fresh screen. It is almost impossible to control your spaceship. You have a choice between using the joysticks or the keyboard, but the keyboard is not easy to use. The 1 key rotates your ship counterclockwise, 2 rotates it clockwise, clear reverses your direction, the left arrow gives you thrust, and the right arrow is your firing control.

These keys are too widely separated for easy control. The action of the game is fast so it's hard to keep track of which key to press when. Of the two control options, the joystick is easier to use.

You have 16 skill levels to choose from, but there is little difference between levels 0 and 15, and none at all in the levels in between.

At the end of the game there is a table of the 10 highest scores in order, with the winners' initials.

Space Race is very difficult, without offering the player the feeling of real control. I would not recommend it. ■



Color Graphics Editor
Larry Ashmun
Soft Sector Marketing
6250 Middlebelt
Garden City, MI 48135
16K, Extended Color Basic
$19.95 cassette

by Richard Ramella

You've learned at least the rudiments of Assembly language. Now you need a systematic way to create high-resolution graphics.

Color Graphics Editor can help. It's a well-done machine-language program that doesn't take long to run and understand.

You'll need an editor/assembler (a program to allow entry of machine-language code). If you don't have a disk system, you must copy hex numbers off the screen for reentry as DATA lines for your magnum opus graphics program.

There must be a bit of the artist in you, or all you will come up with are shapes you could make without such a sophisticated program.

The preceding was a paid announcement on behalf of neophytes everywhere.

The experienced Assembly-language programmer can do quite a bit with Color Graphics Editor (C.G.E.).

The program comes on cassette and is transferable to disk. It can run on a 16K Extended Color Basic cassette system, but that only provides a teaser of its capability, without EDTASM or another editor/assembler.

The user chooses the graphics mode and color set—the PMODE numbers in extended Color Basic. A screen appears with an empty box at top left and hex numbers set at zero values in rows running down the right of the screen.

Using fairly simple key movements, the graphics artist then sets color points within the 16-by-10-point box. In this "dot/draw" mode, tapping numbers 1–4 sets a point color. Numbers 1–3 are colors available in that PMODE, and number 4 is the background color of the workspace.

C.G.E. makes it easy to build squares of graphics. As each point is set, the hex number changes in the column corresponding to the number's position. The program has simple editing features that allow the artist to more or less blunder his way, if necessary, into the shapes and colors desired.

The arrow keys move the cursor in four directions. You can scroll the contents of the workspace in all directions. The box instantly fills with one of the available colors, leaving the other three for creating the shape.

Copying the contents of succeeding boxes to four on-screen buffers, you can create animation effects. To test how well they work, use the command to rotate the contents of the buffers to the box.

This rotation goes through the cycle of four buffers 10 times in about 10 seconds, which makes it easy to discover you have a foot sticking out of your little graphics man's head and thence back to the drawing board.

You can also take the situation over to the rows of hex numbers for direct number entry, which, in a reversal of the "dot/draw" mode, turns on colors in the work box.

The 12-page documentation is clear and direct. It may at first seem overly succinct, but reading it while trying facets of the program reveals there are no missing pieces.

In a world of easy promises, this product is an honest, well-crafted program that doesn't hide the fact that good programs are hard work, even with help from such as C.G.E. ■

↙See List of Advertisers on page 130

REVIEWS

CoCo Cooler
Spectrum Projects
93-15 86th Dr.
Woodhaven, NY 11421
$49.95

by Peter Paplaskas
***HOT CoCo* staff**

The CoCo Cooler is a must for the Color Computer owner. This fan unit includes a radio-frequency (RF) shield for ease of installation. You also get 6 feet of ac line cord for use with another power supply to avoid interference with other peripherals that are attached to the computer.

The idea of the fan and RF shield being one unit serves a specific purpose. It cools the synchronous address multiplexor (SAM) chip, which has a tendency of overheating, especially on the F board versions, and other circuitry.

The unit is well constructed. It consists of a $3^3/_8$-by-$3^3/_8$-by-1-inch muffin-style fan rated at 115 volts ac, 10/9 W, which is already mounted on the black RF shield.

To install this unit, remove the screws holding the top and bottom cases together and lift off the top case. Next remove the original RF shield by lifting up on the metal fingers. Then insert the CoCo Cooler in place of the old RF shield, making sure the metal fingers are securely in place.

Now snake the CoCo Cooler's ac cord through the bottom vents by lifting out the keyboard and connect it to the 6-foot cord.

If you have upgraded your keyboard, the installation time will take just a little bit longer. On most keyboard upgrades you are required to cement the base to the bottom case. It is easier if you can lift the keyboard to snake the cord through.

The noise level is tolerable. I tested the unit for interference with the CoCo and found none, unless I unplugged or plugged in the unit while the computer was on.

The CoCo Cooler is overpriced by comparison to plain muffin-style fans, but this is a one-piece unit not involving any drilling of holes or serious conversion problems. If you don't want to build your own, the price could very well be worth it. ■

Robottack
Intracolor Communications
P.O. Box 1035
East Lansing, MI 48823
16K
$24.95 cassette
$27.95 disk

by Gary Ludwick

If you've been waiting for an excuse to get rid of your Radio Shack joysticks, that excuse has arrived in the form of Intracolor's Robottack.

With so many games on the market using "robot" in the title, it's sometimes a little hard to keep track of which is what. Robottack is not another version of Berserk, but rather a credible clone of that arcade hit, Robotron.

For those who have somehow missed the arcade version, let me give you a brief description of the play action.

You are a superhuman facing a variety of bad guys out to destroy the human race. In Robottack there are five varieties of bad guys, each worse than the other, and each worth more points when destroyed.

In what seems an endless variety of black background screens, the bad guys are phased in as you progress upward in difficulty levels. In the first two screens the only things you have to worry about are the guardian robots and the destroyer robots. The guardians aggressively chase you, while the destroyers try to destroy the humans that are spotted randomly around the play area.

Appearing in the third screen are the gunner robots—tank-like creatures who cruise the play field shooting bombs at you. Finally, in the fourth screen are the mind robots, whose superior intelligence allows them to fire guided missiles at you.

The strategy of Robottack is to careen around the field saving humans, while simultaneously eliminating the bad guys with your ray gun. You begin Robottack with three superhumans and receive another for every 10,000 points, up to a maximum of seven.

The game designer has cleverly given the humans a point value of 1,000 versus 100 or 200 for the robots. Saving humans is therefore a much more rewarding way to play the game. It takes a delicate balance between

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saving and destroying to keep yourself alive in Robottack.

Robottack allows you full movement anywhere on the screen. So, you play the game by running and shooting at the same time. Your superhuman always starts at screen center, surrounded by the various types of invaders and all coming your way. Your left joystick controls the movement direction of your hero, while the right joystick controls the direction of his fire.

That's what makes Robottack unique and frustrating at the same time. If you're not somewhat ambidextrous, you're in trouble. If you're still using Radio Shack joysticks, you're in deep, deep trouble.

The problems come from the Radio Shack sticks' lack of self-centering. In Robottack you go to a new screen and new level of difficulty every 15 or 20 seconds—just as soon as you've destroyed all the guardian robots on that particular level.

The game always tries to put your superhuman at the center of the screen. If your joystick is a little bit off-center itself, your superhuman goes running off, usually right into an enemy.

Atari sticks might be too stiff for the rapid movement necessary in this game. Try to find potentiometer-type joysticks with self-centering spring controls. Wico has just introduced such an analog stick for the Color Computer.

Intracolor's Robbottack

In a market crammed with arcade conversions, this one's a standout. The color and graphics are excellent—so close to the original that there is almost nothing lost in the translation. The machine-gun and explosion sound effects are well executed, too. The effects in Robottack add to the impact rather than detract.

This machine-language game even carries over the arcade "attract mode," where you can watch the game play itself through an infinite number of screens. The graphics don't change from screen to screen, but rather the number and type of invaders, the number of humans and their placement do.

Robottack, among its many other great features, saves the five highest scores from each session. It also gives you a choice between one and two players. Another option is the single-player game with a man on each joystick.

Robottack is an extremely well-executed version of Robotron, one that will both fascinate and frustrate. ■

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SYSTEMS SOFTWARE

MACRO-80C

This is a **disk-based editor, macro assembler and monitor,** written for Color Computer by Andy Phelps. THIS IS IT — The ultimate programming tool!

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**

SOFTWARE DEVELOPMENT SYSTEM

The Micro Works Software Development System (SDS80C) is a complete 6809 editor, assembler and monitor package contained in one Color Computer program pack! Vastly superior to RAM-based assemblers/editors, the SDS80C is non-volatile, meaning that if your application program bombs, it can't destroy your editor/assembler. Plus it leaves almost all of 16K or 32K RAM free for **your** program. Since all three programs, editor, assembler and monitor are co-resident, we eliminate tedious program loading when going back and forth from editing to assembly and debugging!

The powerful screen-oriented Editor features finds, changes, moves, copys and much more. All keys have convenient auto repeat (typamatic), and since no line numbers are required, the full width of the screen may be used to generate well commented code.

The Assembler features all of the following: complete 6809 instruction set; conditional assembly; local labels; assembly to cassette tape or to memory; listing to screen or printer; and mnemonic error codes instead of numbers.

The versatile monitor is tailored for debugging programs generated by the Assembler and Editor. It features examine/change of memory or registers, cassette load and save, breakpoints and more. **SDS80C Price: $89.95**

MICRO WORKS COLOR FORTH

- Forth is faster to program in than Basic
- Forth is easier to learn than Assembly Language
- Forth executes in less time than Basic

Forth is a highly interactive language like Basic, with structure like Pascal and execution speed close to that of Assembly Language. The Micro Works Color Forth is a Rompack containing everything you need to run Forth on your Color Computer.

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**

MICROTEXT: COMMUNICATIONS VIA YOUR MODEM!

Make your Color Computer an intelligent printing terminal with off-line storage! The Microtext module is just what you'll need for:

- Talking to a timeshare system or information service
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- Saving received text to cassette tape
- Re-displaying the received text even while on-line
- Communications with other computers
- Using your computer as a general-purpose 300-baud terminal
- Downloading programs from other computers

The Microtext module is a program pack containing not only firmware but a second serial port so that both your printer and modem can be connected at the same time. Microtext can be configured for any serial printer that will work with the Color Computer, even if it requires line feeds! But even if you don't have a printer, you can keep a permanent copy of your data by storing to cassette tape. Also, any Radio Shack/Centronics-compatible parallel printer may be used by adding the Micro Works' PI80C parallel interface.

For those of you with special terminal applications, Microtext has selectable parity; it sends odd, even, mark or space. With mark parity (which is default) you can send to computers requiring either seven or eight bits. All 128 ASCII codes can be sent. Exchange programs with other Color Computer users! Basic programs may be downloaded from other computers or timesharing systems.

You'll find many uses for this versatile module! Available in ROMPACK, ready-to-use, for **$59.95.**

MACHINE LANGUAGE

MONITOR TAPE: A cassette tape which allows you to directly access memory, I/O and registers with a formatted hex display. Great for machine language programming, debugging and learning. It can also send/receive RS232 at up to 9600 baud, including host system download/upload. 19 commands in all. Relocatable and reentrant. **CBUG Tape Price: $29.95**

MONITOR ROM: The same program as above, supplied in 2716 EPROM. This allows you to use the entire RAM space. And you don't need to re-load the monitor each time you use it. The EPROM plugs into the Extended Basic ROM Socket or the Romless Pak I. **CBUG ROM Price: $39.95**

SOURCE GENERATOR: This package is a disassembler which runs on the color computer and generates your own source listing of the BASIC interpreter ROM. Also included is a documentation package which gives useful ROM entry points, complete memory map, I/O hardware details and more. A 16K system is required for the use of this cassette. **80C Disassembler Price: $49.95**

BOOKS

6809 Assembly Language Programming, by Lance Leventhal, **$16.95**

TRS-80 Color Computer Graphics, by Don Inman, **$14.95**

Assembly Language Graphics for the TRS-80 Color Computer, by Don Inman, **$14.95**

Starting Forth, by L. Brodie, **$19.95**

GAMES

Star Blaster — Blast your way through an asteroid field in this action-packed Hi-Res graphics game. Available in ROMPACK; requires 16K. **Price: $39.95**

Pac Attack — Try your hand at this challenging game by Computerware, with fantastic graphics, sound and action! Cassette requires 16K. **Price: $24.95**

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PARALLEL PRINTER INTERFACE — Serial to parallel converter allows use of all standard parallel printers. PI80C plugs into the serial output port, leaving your Rompack slot free. You supply the printer cable. **PI80C Price: $89.95**

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BY KENNETH C. ANDERSON

INTRODUCTION TO MULTICOLOR GRAPHICS—PART II

*Editor's Note: In Part 1 of this series (*HOT CoCo, *August 1983), the author explained how you can use more than 1,000 colors in 100 unique designs without leaving Basic or buying extra hardware and software.*

Use your own color file to jazz up conventional graphics displays. The possibilities are endless.

Tapping the resources of the Color Computer is a task that begs for the assistance of Color File (Program Listing 1). Before getting into the program, I think a few definitions are in order. For a more detailed explanation of these concepts, refer to Part 1.

Definitions

In each graphics mode, either mixed or straight, two or four colors are available. Think of these as *primary* colors. You work with them in much the same way a painter mixes the two primary colors of blue and yellow to get green. In this case, there are two essential differences: Blue and yellow are primary colors in only one mode, and they do not necessarily combine to create green.

If you are new to computer graphics, add the word *pixel* to your vocabulary. A pixel is the smallest dot of color you can print (plot, if you prefer) on your TV or monitor screen. A pixel is also used to describe screen resolution. The Color Computer offers a maximum screen resolution of 256 by 191, or 256 horizontal pixels by 191 vertical pixels.

Some shades and hues require the combination of only two primary colors, while others require five primary colors. The listing of primary colors required to produce a given secondary color is a color *code*. Color File lets you use any number of primary colors in a code, but if you try anything higher than 256, it will not fit on the screen.

A color code of 22 and a color code of 222 produce the same primary color. The same is true for all codes in which all the numbers are the same. On the other hand, even though the codes 342 and 342342 are essentially the same combination of colors, they do not produce an identical secondary color. Duplicate shades and hues occur, but not where you expect them.

Codes of more than five colors can produce interesting results, but for painting (and filing) purposes, I have found five to be the practical limit for color codes. A code of one color yields only the four primary colors. A code of two colors gives you 16 possible combinations, four of which are primary colors and a few others duplicates.

Each time you add one color to the number of primary colors in the code, the number of possibilities increases by four. By the time you have filed all the possible combinations using up to five colors in a code, you have a total of 1,334 secondary colors.

If you have a finely honed sense of color, you can distinguish shades and hues for about 75 percent of those, allowing for duplicates and four primary colors in each code. This gives you 1,000 colors to use—in one mode. When you switch modes, the same colors are available, but the code for each is different.

Color *modules* are the basis for the entire concept of multicolor graphics. By definition, a color module is a unit of any specific color, but not necessarily the smallest possible unit. I tend to compare a module to the splotch of color an artist brushes on the canvas. You might prefer to think of a module as a big pixel.

The number of colors required for a module's code determines its horizontal size. A color that requires five primary colors for its code obviously needs five adjacent LINEs to produce the smallest module.

Slant also affects horizontal size to some extent. Slant is the number of pixels, right or left, for one of the four LINE coordinates. A slant of 0 produces a vertical line. A slant of −1 yields a diagonal line that leans slightly to the left. A slant of +1 causes a line to

System Requirements

16K RAM
Extended Color Basic

lean slightly to the right. The horizontal size of the module requires one pixel for each degree of slant, in addition to one pixel per color in the code.

If all modules have the same degree and direction of slant, they will work well together. If, however, your project uses varying slants, you will find some undesirable "mixing" of colors.

Color File allows you to choose any degree of slant from −255 to +255. A larger number causes the program to crash. For practical use in painting, you can obtain the best results when the slant is equal to the vertical size of the module. In Color File, I recommend that you start with either −5 or +5, but don't hesitate to experiment.

Vertical size is the number of vertical pixels in a module. This can vary, according to your tastes, from 1 to 191. I suggest that you begin with a vertical size of 5, which produces a module large enough for you to tell what color it is. Smaller sizes are useful when you are actually using the colors in a painting, but when your objective is to file them, it helps if you can see the color.

Running Color File

At this point, you should be able to run Color File and understand the computer's first three questions. The fourth question asks for the number of modules you want to appear horizontally on the screen. The fifth asks for the number of vertical modules you want. If you ask for more modules than a screen will hold, the program will break to an error code. Return it and choose fewer modules.

Before you get to the actual filing procedure, try some of the combinations to see how they work. Begin by setting all the variables to 5, then change one of them at a time to see how much flexibility you have.

If you want to see the code for one of the colors, press T (for text) before the color is completed. The computer switches you to the text screen, prints the code, and waits for your input. Because the program is set up for filing purposes, you might want to name the color before pressing enter, which displays another color.

You can also change program variables without running the program again. Just press N (for next) when you are ready to change. Some of your previous modules will remain on the screen for comparison.

Don't get so interested in this program that you forget its primary objective—to generate a file of colors you can use to produce multicolor graphics. Even with the help of the computer, it will take you a while to get all the possible colors under control.

When you are ready to start your file, be aware that your computer might tend to switch two primary colors when you turn it off and on. This also happens sometimes when you press the reset key. If red and blue reverse, your entire file of color codes will be useless.

Here is a short test program to help you detect the problem:

```
1000 PMODE 4,1:SCREEN 1,1:PMODE 3,1
1010 FOR R=0 TO 5
1020 FOR X=1 TO 4:PCLS X
1030 FOR T=1 TO 400
1040 NEXT:NEXT:NEXT
```

In mixed mode 3 on 4, the computer should produce black, red, blue, white—five times, in that order. If blue comes between black and red, press the reset key and type RUN 1000 again. You can enter this test program after any program you already have in RAM.

Filing Colors

When you are ready to file colors, you might want to make a few changes

```
10 '   C O L O R   F I L E
20 '
30 CLS:PCLS
40 DIM C(255),CO(255)
50 '
60 '    INITIAL VARIABLES
70 '
80 X=0:Y=0
90 INPUT"HOW MANY COLORS IN CODE";I
100 INPUT"VERTICAL SIZE OF MODULE";V
110 INPUT"DEGREE Or SLANT (MINUS O.K)";S
120 INPUT"HOW MANY MODULES ACROSS";MA
130 INPUT"HOW MANY MODULES DOWN";MD
140 PRINT
150 '
160 ' COLOR CODE CALCULATION
170 '
180 FOR CO=1TOI
190 C(CO)=RND(4)
200 NEXT
210 '
220 '    MAIN PROGRAM LOOP
230 '
240 PMODE4,1:SCREEN1,1:PMODE3,1
250 IF X+S<0 THEN X=X+1:GOTO250
260 GOSUB 470
270 '
280 ' CHANGE VARIABLES FOR NEXT
290 '        COLOR MODULE
300 '
310 X=X+((MA*I)+MA)+1
320 IFX+((MA*I)+MA)+1=>255THENX=0
330 IFX=<1THENY=Y+(MD*V)+1
340 IF Y+(MD*V)+1=>191 THEN Y=0
350 '
360 '      SELECT OPTIONS:
370 '   "N" FOR NEW VARIABLES
380 '"T" TO PRINT PREVIOUS CODE
390 '
400 C$=INKEY$
410 IF C$="N"THEN 90
420 IFC$="T" THEN 710 ELSE 180
430 '
440 ' SUBROUTINE TO PLOT
450 '    COLOR MODULES
460 '
470 Y1=Y+V:Y2=Y
480 FORF=1TOMD
490 X1=X:X2=X+S
500 FORG=1TOMA
510 GOSUB610
520 X1=X1+1:X2=X2+1
530 NEXT
540 Y1=Y1+V:Y2=Y2+V
550 NEXT
560 RETURN
570 '
580 ' NESTED SUBROUTINE TO
590 '    DRAW ONE MODULE
600 '
610 FORCO=1TOI
620 COLOR C(CO)
630 LINE(X1,Y1)-(X2,Y2),PSET
640 X1=X1+1:X2=X2+1
650 NEXT
660 RETURN
670 '
680 ' SUBROUTINE TO PRINT THE
690 '    PREVIOUS COLOR CODE
700 '
710 FORCO=1TOI
720 PRINTC(CO);
730 NEXT
740 INPUTE$ 'PRESS <ENTER> KEY
750 GOTO180
```

Program Listing 1. Color File

```
10 '  C O L O R   8 0
20 '
30 DIM I(21),C$(21),C(21)
40 PCLS
50 CLEAR 500
60 '
70 ' SET UP LETTER AND NUMBER
80 '         STRINGS
90 '
100 CC$="L4D8R4U2L2U4R2U2"
110 OO$="R6D8L6U8D2R4D4L2U4"
120 LL$="R2D6R2D2L4U8"
130 RR$="D8R2U3F3R2H3R2U5L6"
140 N8$="R8D6G1F1D6L8U6E1H1U6D2R6D3L4U3BM+0,7D3R4U3L4"
150 N0$="D14R10U14L10D2BM+2,0D10R6U10L6"
160 '
170 '  MAIN PROGRAM LOOP
180 '
190 PCLS
200 PMODE4,1:SCREEN1,1:PMODE3,1
210 X=4:Y=90:H=4:V=108
220 FORS=1TO21
230 S$="S"+STR$(S)
240 FOR I=1TO4
250 '
260 ' MULTI-COLOR REVISION
270 '
280 C(I)=RND(4)
290 C$(I)="C"+STR$(C(I))
300 '
310 ' CONNECTIONS AND VARIABLES
320 '
330 BM$="BM"+STR$(X)+","+STR$(Y)+"E"
340 MM$="BM"+STR$(H)+","+STR$(V)+"R"
350 A$=C$(I)+BM$+S$
360 B$=C$(I)+MM$+S$
370 '
380 ' PUT THE PIECES TOGETHER
390 '   AND DO THE DRAWING
400 '
410 X$=A$+CC$+"BM+2,2"+OO$+"BM+6,1"+LL$+"BM+6,2"+OO$+"BM+6,0"+RR
$
420 DRAW X$
430 X$=B$+N8$+"BM+10,-10"+N0$
440 DRAW X$
450 '
460 ' CHANGE VARIABLES FOR NEXT
470 '    TIME THROUGH LOOP
480 '
490 X=X+1:Y=Y-1:H=H+1
500 NEXT I,S
510 GOTO 210
```

Program Listing 2. Color 80

in Color File. The original idea was to let the computer generate random colors while you select the codes you want by pressing T. This works fine when a color has only two or three codes. But when the computer gets about halfway through, it selects the same colors more often than it selects new colors. The only way to be sure you have seen all the possibilities is to take a more logical approach.

This involves making the following changes to the original Color File program, especially for codes of four or more primary colors:

```
190 PRINT"COLOR #"CO":";:INPUTC(CO)
420 FORW = 1TO400*5:NEXT:GOTO710
```

These changes allow you to select the color code. For codes of five colors, the logical order of selection is 11111 (black), 11112, 11113, 11114, 11121 . . . 44443, 44444 (white).

This program prints the codes and color names only on the screen, requiring that you generate a handwritten list of your own. If you have a printer or disk drive, you have to rewrite lines 710–740 to create a complete file on disk or to print it.

For the actual filing process, I found it easier to use general names for color categories. I chose the rainbow colors for the category names and then broke down each general category into subcategories. Some examples are violet, blue-violet, blue, blue-green, green, and so on.

When filing, you also find many off-whites, gray tones, and other colors that are difficult to name. I started one file for colors that do not fit into any other category. I call this file "garbage," but I do not intend to throw it out because I might find uses for some of these colors in the future.

After you have a full set of colors in each category, subdivide the general categories into various hues and shades. I use the same variation of Color File, with fewer modules across and down, to put more colors on the same screen. For my file, I use a letter to designate different hues of, say, orange. Then I break down each hue into several shades, which I number from 0 to 9. First I locate a "norm" for each hue, which I number 5, and then I find darker shades on one side and lighter on the other.

"Color modules are the basis for the concept of multicolor graphics."

It is difficult to assign hues and shades in the categories for earth colors and neutrals, which include flesh, peach, and the like. In these cases, you might be better off naming each code.

Line 240 controls the mode in which you are working. The program puts you in mixed mode 3 on 4, but you can change this to any other mode, straight or mixed, that you prefer. My only suggestion is that you work with one mode until your color file is complete, then go on to another.

Renovating Old Programs

It takes months to file all the colors, so you might want to take a break from filing and apply these new techniques to some old programs. Some of them will work well in a mixed mode, while others will work nicely if you add more colors. You can use multicolor potential with CIRCLE, LINE, and DRAW commands in any graphics program. Some programs, however, do not work as well in multicolor or mixed modes.

I have included two programs to illustrate how you can add more color to existing programs. I originally wrote the first, Color 80 (Program Listing 2), in PMODE4,1:SCREEN1,1. I have marked the section of the program that adjusts it for multicolor use. This program works well with the computer's double-speed option. Older computers do not have this option, so be sure yours does before you enter POKE 65495,0 to double the speed. Be sure to slow down

```
10 '   N E O N   W R E A T H
20 '
30 PMODE 4,1
40 PCLS
50 SCREEN 1,1
60 PMODE 3,1
70 V=256/210:PI=3.14592654
80 FOR K=1 TO RND(3)+6
90 FOR I=1TO6:A(I)=RND(4):NEXT
100 X=RND(96):Y=RND(96)
110 R=SQR(X^2+Y^2):IF R>96 THEN      100
120 T=RND(96):Z=RND(96)
130 S=SQR(T^2+Z^2):IF S>96 THEN      120
140 GOSUB 200
150 Y=-Y:Z=-Z
160 GOSUB 200
170 NEXT K
180 FOR Q=0TO400*5:NEXT
190 GO TO 30
200 W=ATN(Y/X):Q=ATN(Z/T)
210 FOR J=1 TO 6
220 W=W+PI/3:Q=Q+PI/3
230 X2=R*COS(W):Y2=R*SIN(W):T2=S*COS(Q):Z2=S*SIN(Q)
240 F1=X2*V+128:G1=Y2+96:F2=T2*V+128:G2=Z2+96
250 '
260 ' REVISION FOR MULTI-COLOR
270 '
280 FOR I=1TO5
290 COLOR A(I),0
300 LINE(F1,G1)-(F2,G2),PSET
310 F1=F1+1:G1=G1+1
320 F2=F2+1:G2=G2+1
330 NEXT I
340 NEXT J
350 RETURN
```

Program Listing 3. Neon Wreath

the computer with POKE 65494,0 before you try to do anything with cassette, disk, or sound.

Neon Wreath (Program Listing 3) is a multicolor adaptation of one of my favorite demo programs. In line 90, the computer chooses six random primary colors. I marked the program where I used five of the six colors. You can change the 5 in line 280 to a 6 if you want to see all the colors.

You should be able to adapt any program to use random multicolor graphics by lifting the appropriate lines from Neon Wreath. It does not require any confusing jumps to subroutines, and you can choose the colors at one place and use them at another, as they are here. If you prefer Pastel Wreath to Neon Wreath, change to PMODE 3,1 in the straight mode.

Next month I will discuss two utility programs, which you need a color file to use. Both require two joystick controllers. ■

Address correspondence to Kenneth C. Anderson, 1055 Zophi St., Nashville, TN 37216.

✓See List of Advertisers on page 130

BY JOHN S. CULLINGS

THE MIGHTY MITE MC-10

Radio Shack's entry into the low-priced micro market reveals its secrets: CoCo power at a poco price.

Meet the MC-10. Radio Shack's new TRS-80 Micro Color Computer is the latest addition to the Color Computer family. At one-sixth the size of a CoCo and at a retail price of $119.95, the new MC-10 will generate much interest with personal-computer enthusiasts (see Photo 1).

What's this computer really like? How compatible is it with the Color Computer? What's under the hood? What hidden features does it have? How are musical tones generated? Is machine-language programming possible? Sit down, relax, and enjoy the potpourri of MC-10 knowledge to follow.

A Quick Example

Let's get started by jumping off at the deep end to answer the last question first. Program Listing 1 is a Basic program that POKEs a machine-language program, a short routine that plays a tune and changes the screen color, into memory. Try it, just for fun. Type in the program exactly as shown (you can omit the remarks at lines 11, 31, and 61).

Type RUN, and press enter. After the OK prompt, type EXEC and press enter. You have just run your first machine-language program on the MC-10! I'll give more information on machine-language programming later in this article. For the curious reader, hex address FFAB is the Basic ROM's entry point for the SOUND command.

A Look Inside

The MC-10 consists of 20 ICs for the computer hardware (Photo 2) and a video modulator (Photo 3). Most of the ICs are from the standard 7400 family. There are four key ICs: the MC6803 microprocessor, MC6847 video-display generator (VDG), and two NEC PD4016, 2048-by-8-bit static RAMs. The MC-10

```
10 REM  MC10 MACHINE LANGUAGE
11 REM  *SOUND & SCREEN DEMO*
15 CLEAR 100,20000
20 FOR  I=20000 TO 20041
25 READ A: POKE I,A: NEXT I
30 POKE 16927,78: POKE 16928,32

31 REM  LDD snd len JSR  FF  AB
35 DATA 204,120,002,189,255,171
40 DATA 204,154,002,189,255,171
45 DATA 204,176,002,189,255,171
50 DATA 204,189,004,189,255,171
55 DATA 204,176,002,189,255,171
60 DATA 204,189,006,189,255,171

61 REM LDAA #88 STA  BF  FF RTS
65 DATA 134,088,183,191,255,057
```

Program Listing 1. Machine-Language Sound and Screen Demo

Photo 1. The MC-10 Micro Color Computer

System Requirements

The MC-10
4K RAM

CoCo Functions Not in MC-10	MC-10 Functions Not in Color Basic
'	LET
ELSE	LPRINT
CSAVE,A	↑
OPEN	SQR
CLOSE	LOG
MOTOR	EXP
AUDIO	COS
SUB	TAN
EOF	VARPTR
JOYSTK	CLOAD*
	CSAVE*

Table 1. Basic Command Differences

video modulator is a new design, which uses an MC1372 IC for generating the RF. The old-style modulator used a transistor to generate the RF.

Another function of the new modulator is the generation of the clock signals for the MC6803 microprocessor. The internal clock frequency of the MC6803 is 0.8949 MHz. The MC-10 uses an inexpensive color TV crystal at 3.5795 MHz, which is located inside the video-modulator package. The MC6803 takes the color crystal frequency and divides it by four to get the internal clock frequency of 0.8948 MHZ. The color crystal supplies the color-burst frequency to the MC1372, which generates the colors of the MC-10 computer.

The heart of the MC-10 is the MC6803 microprocessor, which is an 8-bit IC (Fig. 1). The MC6803 is unique in a number of ways. It has 128 bytes of internal RAM; a 16-bit, three function programmable timer; serial interface; and 29 parallel I/O and two handshaking control lines.

One of the outstanding features of the MC6803 is the 29 parallel I/O lines (Fig. 2). Figure 2 shows the MC6803 having four ports. These ports are much the same as a peripheral interface adapter (PIA). A PIA function is to provide a universal means of interfacing peripheral devices to the computer, such as the VDG, printer, or keyboard.

The MC6803's four ports are more than just a PIA. These four ports can function as bidirectional, 8-bit data ports or multiplexed as an address or data bus. Port 1 decodes the keyboard. Port 2 provides interfacing from the cassette and printer. Port 3 is a multiplex port; it is multiplexed between the data bus lines D0 through D7 and the lower-memory address line A0 through A7. Port 4 provides the upper-memory line A8 through A15.

The MC6803 has 128 bytes of internal

Photo 3. The Video Modulator

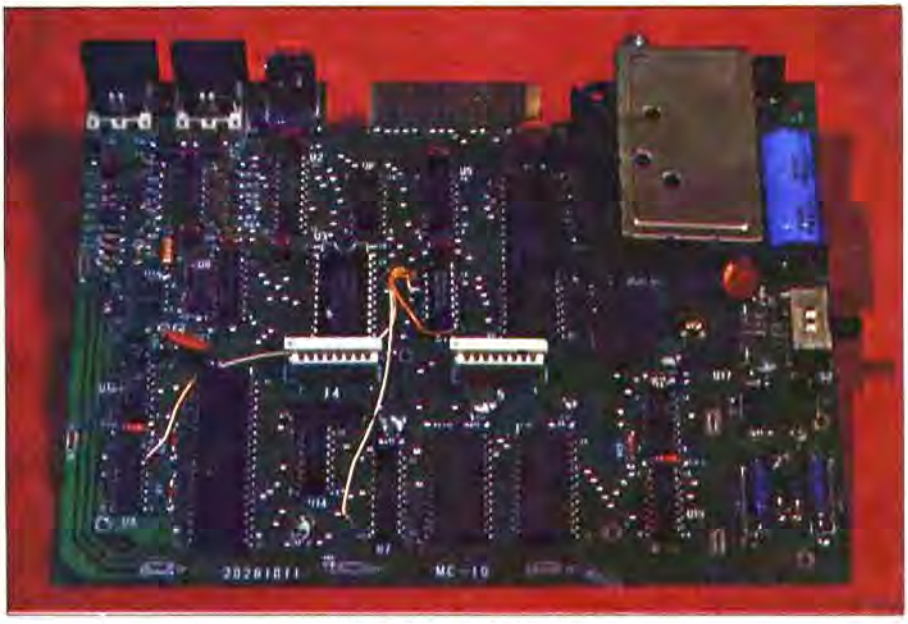

Photo 2. Inside the MC-10

memory from decimal 128 to 255 or hex 0080 to 00FF. This memory area serves as the operating-system work area. Another feature of the MC6803 is its reduced IC count, made possible by the way the MC6803 handles the 29 I/O lines. This makes the MC6803 a very powerful computer for its low IC count.

The MC-10 memory consists of two NEC PD4016 2K static RAM ICs. (Figure 3 shows its pin configuration.) The RAM goes from decimal 16384 to 20479 or hex 4000 to 4FFF. U9 provides the first 2K of RAM, and U10 provides the second 2K.

Table 4 shows the MC-10's memory map. Decimal 0000 to 0031 is for internal addresses of the ports. Decimal 128 to 255 is the internal RAM of the MC-6803. Decimal 16384 is the start of the video-display area. Basic starts at decimal 17222 and can run up to decimal 20377 for a 4K MC-10. The stack pointers are stored from decimal 20378 to 20479.

The MC-10 uses the MC6847 video-display generator, but not to its full potential. The MC6847 needs 6K of memory for the highest-resolution graphics mode. The MC-10 supports the full color set of the MC6847: four different alphanumeric modes; two semigraphics modes, and nine colors.

CoCo Comparison

How does the MC-10 keyboard compare with the CoCo keyboard? It uses real push-button keys, but the keyboard

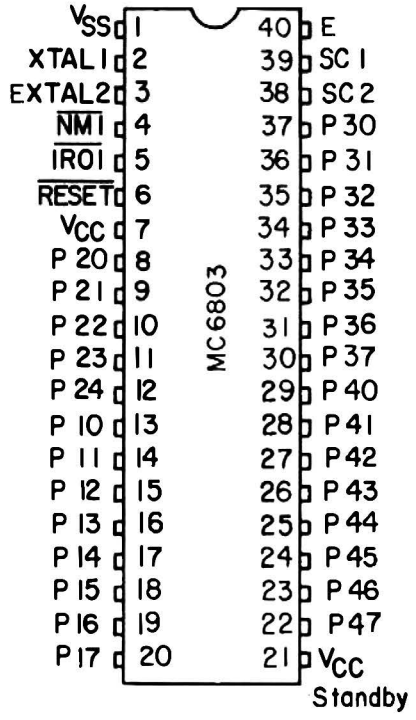

Fig. 1. The MC6803 Microprocessor IC

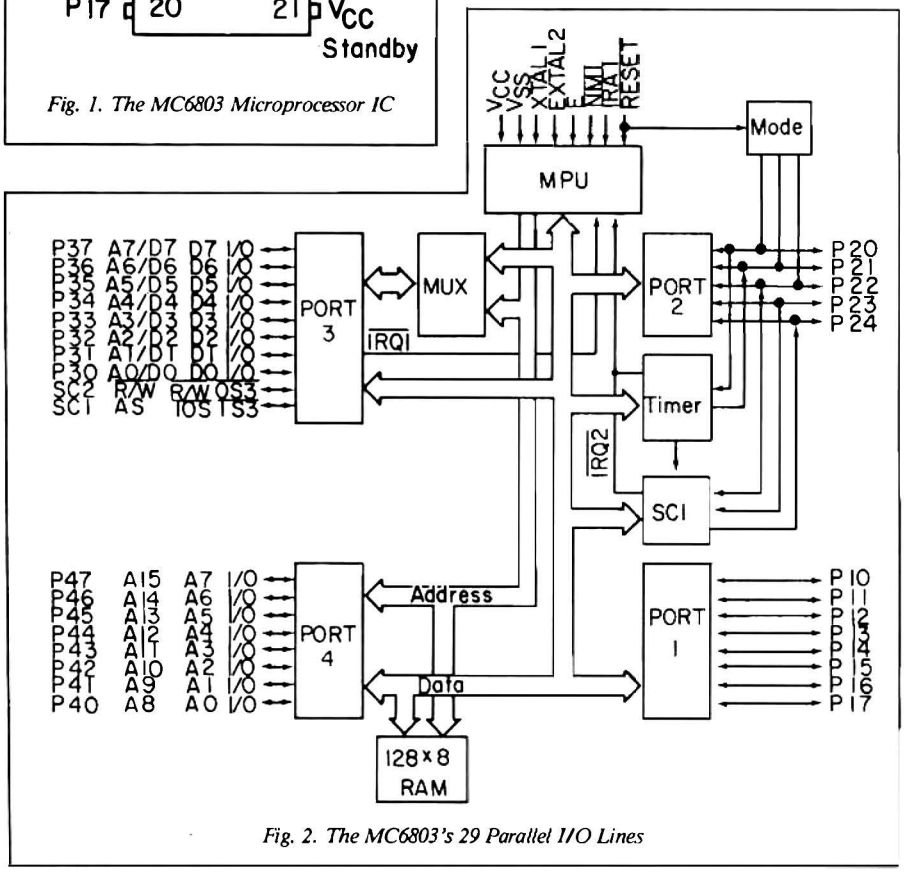

Fig. 2. The MC6803's 29 Parallel I/O Lines

is only three-quarters size. Touch typists won't be pleased. Also, the loss of five keys (48 vs. 53), including the left shift key, makes typing more difficult.

On the positive side, you can enter 38 Basic keywords by pressing the control key and another key together. Also, you can enter all 16 graphic characters with eight different background colors (128 total) by pressing shift and one of 16 alphabetic keys together. The actual screen display is the reverse of the keyboard symbols, however.

Most of the MC-10 Basic commands are the same as the Color Computer (non-Extended) commands. Table 1 summarizes the Basic command differences. The MC-10 command set includes six scientific functions, which require the Extended Basic option on the CoCo. Machine-language programmers take note: The Color Computer Basic commands CLOADM, EXEC, USR, and VARPTR are all included in the MC-10 command set.

Although the Basic commands are similar, most of the Basic machine-code tokens are not. This means that Basic programs on cassette will not run, list or renumber properly on the other type computer.

Fortunately, it seems that cassette tape file formats are compatible. I have been able to SKIPFile, CLOAD, and CLOADM MC-10 cassette programs on my revision E, Extended Color Basic Color Computer. It should be possible to write a translation program to convert MC-10 Basic programs to CoCo Basic programs and vice-versa. Machine-language programs for the MC-10's 6803 microprocessor could be written and assembled on the CoCo. The machine-language cassette tape could then be CLOADMed into the MC-10.

Music Anyone?

The MC-10 operation manual describes the SOUND command, but does not describe which tone number produces which musical note. For example, SOUND 102,14 produces a middle C for one second. Table 2 shows a piano keyboard layout with tone numbers for about 3½ octaves. As the tone number increases, the precision of the musical pitch decreases. Not being particularly musically inclined, I will leave the compositions to you.

9,600 Baud?

For those of you with serial printers that operate at rates of other than 600 baud, don't give up. The MC-10 will run at almost any rate you choose. Although the 6803 microprocessor chip includes a serial output port, Radio Shack has chosen to implement the serial output function the CoCo way. By POKEing a number into location 16931 and 16932 (hex 4223 and 4224), you can select a variety of baud rates. For all baud rates from 300 up, only one POKE is required because location

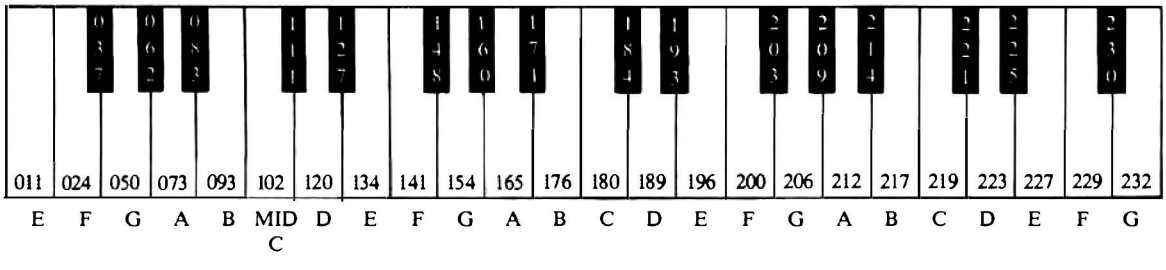

Table 2. Tone Numbers for Musical Notes

16931 contains a zero for these speeds.

Baud rates from 110-4,800 have worked 100 percent with a Hewlett-Packard Model 85 computer at the other end. A 9,600 baud rate did not work. Apparently the MC-10 skips over the 9,600 baud rate—too fast or too slow. My 9,600-baud buffered printer does work with the MC-10. Try it, maybe it will work for you. Table 3 lists the values to POKE for all the common baud rates.

Teleprinter users might be interested in an end-of-line delay POKE. The two addresses immediately above the baud-rate addresses 16933 and 16934 (hex 4225 and 4226) control the amount of delay at the end of each line. I cannot recommend a precise value, but try POKEing large numbers (less than 255) into address 16933.

Baud	ADDR 16931	ADDR 16932
110	2	163
300	0	241
600	0	118
1200	0	57
2400	0	26
4800	0	10
9600	0	2**

**This baud rate may be too far off for reliable operation.

Table 3. Baud Rates

```
0 REM  MODS TO MIMO

66 A=A+48-7*(A>9)

245 GOSUB30:IF ER=1THEN255
247 POKE SDA,DB:CDB=PEEK(SDA)

320 IF MO=1THEN405
322 GOSUB120

805 PRINT"MIMO COMMANDS:M,D,F,C,J,E"

845 IFC$="E"THENEXEC63278

*** DELETE LINES:
    840,950,955,960,965,970
```

Program Listing 2. Modifications to MIMO Program

```
5 REM  CSAVEM  *USE DECIMAL NRS*
10 POKE 16999,2: GOTO 30
20 A=INT(DA/256):B=DA-256*A:RETURN
30 INPUT"STRT";DA: GOSUB 20
40 POKE 17004,A: POKE 17005,B
50 POKE 17007,A: POKE 17008,B
60 INPUT" END";DA: GOSUB 20
70 POKE 17009,A: POKE 17010,B
80 INPUT"TXFR";DA: GOSUB 20
90 POKE 17002,A: POKE 17003,B
100 INPUT "NAME";N$
110 PRINT"PUSH RECORD AND ENTER"
120 K$=INKEY$:IF K$="" THEN 120
130 EXEC 64603 N$:FOR I=1TO3000
140 NEXT: PRINT"DONE": SOUND66,3
```

Program Listing 3.

MC-10 Monitor

A useful and essential utility for machine-language programming is a monitor which examines and changes individual bytes in memory, and displays large blocks of memory in hex code and in ASCII (alphanumeric) representation.

I decided to modify the MIMO Basic monitor of Sergio Zigras (*80 Micro*, Jan. 1983, pp. 252-256) for the MC-10. Originally written for the 16K RAM Color Computer, this little monitor does an excellent job on the MC-10. It even includes a Find routine to search for any character or string.

(If you do not have a copy of the January *80 Micro*, send a self-addressed, stamped envelope to *HOT CoCo*, Pine St., Peterborough, NH 03458. We will send you a copy of the article.)

The modification of MIMO turned out to be very simple. Only one Basic command is not supported by the MC-10—the ELSE command in lines 66, 245, and 320. Why did Radio Shack eliminate this useful command? Also the Basic reentry address of line 845 needs to be changed to the appropriate MC-10 address (63278).

Finally, I deleted lines 840, 950, 960, 965, and 970 (the Verify function) to save memory. With these changes, a 4K MC-10 has approximately 750 bytes of user memory available for a machine-language program. Use the command CLEAR 100, 19630 to reserve space for such a program. Program Listing 2 lists the necessary changes to the MIMO program.

Pièce de Résistance

Here's where we get to the greatest challenge, and possibly the most interesting facet of the MC-10 Micro CoCo. My goal is not to teach beginning Assembly-language programming, but to point out the real possibility of serious machine-language programming on the little CoCo. MC-10 machine-language programming is quite similar to that of the Color Computer; however, the operation manual gives no clue to this capability.

The 6803 microprocessor is very similar to the 6800, but with some added features such as an internal 128-byte RAM and an internal PIA. It is also similar to the 6809 chip with many iden-

HEX	DECIMAL	FUNCTION
0000-001F	00000-00031	6803 micro I/O
0080-00FF	00128-00255	Direct Page RAM
4000-41FF	16384-16895	Screen Memory
4200-4284	16896-17028	System overhead
4285-42AE	17029-17070	RAM hooks
42B2-4334	17074-17204	Key entry buffer
4346-4F99	17222-20377	BASIC area
4F9A-4FFF	20378-20479	System stack
5000-8FFF	20480-36863	RAM expansion
E000-FFFF	57344-65535	BASIC ROM
FFDC-FFED	65500-65517	ROM subr entry addr
FFF0-FFFF	65520-65535	6803 Interupts

Table 4. MC-10 Memory Map

HEX PNTR ADDR	DECIMAL PNTR ADDR	FUNCTION NAME	FUNCTION DESCRIPTION
FFDC F883	65500 63619	POLCAT	Poll keyboard
FFDE F9C6	65002 63942	CHROUT	Char out
FFE0 FF4E	65504 65358	CRSDON	Tape startup
FFE2 FEB9	65506 65209	BLKIN	Read block
FFE4 FCC0	65508 64704	BLKOUT	Write block
FFE6 FFAB	65510 65451	SNDOUT	Sound out
FFE8 FCB7	65512 64695	WRTLDR	Write leader
FFEA ECE3	65514 60643	GIVABF	2 bytes → BASIC
FFEC EBC7	65516 60359	INTCNV	BASIC → 2 bytes

Table 5. Subroutine Entry Addresses

tical operation codes. However, it does not contain a U or Y register, and it has fewer addressing modes. It is much more difficult to write position-independent code with the 6803.

For more information on the 6803 chip, I recommend reading *6801, 68701, and 6803 Microcomputer Programming and Interfacing*, by Andrew C. Staugaard, Jr. The pocket reference guide by Motorola is also worth having. Ask for the *MC6801/68701/6803 Microcomputer Instruction Set Summary* from Motorola Inc., Integrated Circuits Division, 3501 Ed Bluestein Blvd., Austin, TX 78721.

A necessary Basic command for use with machine-language programming is CSAVEM (save a maching-language program to cassette). This is an Extended Basic command on the CoCo. Program Listing 3 is a short Basic program that performs the CSAVEM function. The start, end, and transfer addresses must be given as decimal numbers, usually near the top of RAM. I use decimal 20000 (hex 4E20) for a convenient starting address.

Efficient machine-language programming on any computer requires a knowledge of its architecture, memory use, ROM subroutine addresses, and RAM hooks. Table 4 shows the overall memory map of the MC-10. Addresses are listed in both decimal and hexadecimal notation.

Of special interest is the table of pointers to useful ROM subroutines. Table 5 lists these subroutine pointers and the addresses to which they point. For information on the operation of these subroutines, refer to Radio Shack's book *Getting Started with Color Basic* section IV, part B, pp. 267–270.

The ROM subroutine entry-address table in the MC-10 is a list of addresses where you find the various subroutines. For example, the POLCAT address of 65500 (hex FFDC) points to 63619 (hex F883). The correct way to use the ROM subroutine entry points is as follows:

```
POLCAT  EQU  65500
        LDX  POLCAT   Get POLCAT
                      pointer
        JSR  0,X      Jump subr there
```

If the X register cannot be used or if memory is to be conserved, POLCAT can be called directly by JSR $F883, but this method is somewhat risky. Some future version of the Basic ROM might not use the same subroutine addresses.

Key-Code Example

Program Listing 4 is a Basic program with an imbedded machine-language subroutine. This program illustrates the use of POLCAT, GIVABF, and USR subroutine calls. This program was adapted from a Color Computer program on page 268 of *Getting Started with Color Basic*.

The machine-language subroutine listing (Program Listing 5) is given for reference. You can gain much insight into the differences between 6803 and 6809 machine-language programming by comparing this listing with the Radio Shack original.

The key-code program can be especially useful to the MC-10 user because it shows the ASCII codes for all the graphic characters and keyboard Basic commands. Just type in and run Listing 4. After you press each subsequent key, the character and its ASCII code will display. To get control codes 1–26, press control Z and any character from A to Z. To exit this program press enter.

Inconclusions

The MC-10 keyboard is good. The keyboard is bad. The Basic is powerful—but not powerful enough. The price is low. The price is too high.

Take your pick. A few things are clear to me:

- 4K memory is not enough (more is promised).
- The missing left shift key is a pain in the. . . finger.
- That 6803 is one powerful microprocessor.
- Where's the joystick port???
- The small size is *neat*. Where can I get a matching TV?
- A high-resolution graphics mode is not likely.
- Integrated circuits should be in sockets.
- A direct video output would sure be nice.

Radio Shack, I love/hate you. ■

Address correspondence to the author c/o HOT CoCo, *Pine St., Peterborough, NH 03458.*

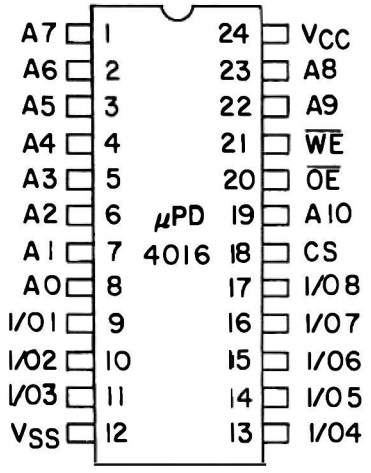

Fig. 3. Pin Configuration of the NEC PD4016 Static RAM IC

```
10 REM  ASCII KEY CODE
20 CLEAR 100,20000
30 FOR I=20000 TO 20027
40 READ A: POKE I,A: NEXT I
50 DATA 254,255,220,173,000,039
60 DATA 249,129,010,038,010,173
70 DATA 000,039,252,129,065,045
80 DATA 002,128,064,022,079
90 DATA 254,255,234,110,000
100 POKE 16918,78: POKE 16919,32
110 A=USR(0)
120 IF A=13 THEN END
130 PRINT CHR$(A);" =";A
140 GOTO 110
```

Program Listing 4. ASCII Key Code

```
HEX CODE          SOURCE CODE        COMMEMTS

 FE FFDC  LOOP1    LDX  POLCAT   Addr of POLCAT
 AD 00             JSR  0,X      Poll for a key
 27 F9             BEQ  LOOP1    if none, try again
 81 0A             CMPA #10      Control key
 26 0A             BNE  OUT      Exit if not
 AD 00    LOOP2    JSR  0,X      Yes, get next key
 27 FC             BEQ  LOOP2    if none, try again
 81 41             CMPA #65      is it A to Z?
 2D 02             BLT  OUT      if lower, exit
 80 40             SUBA #64      convert to CTRL
 16        OUT     TAB           get rtn byte ready
 4F                CLRA          zero MSB
 FE FFEA           LDX  GIVABF   Addr of GIVABF
 6E 00             JMP  0,X      go there
           POLCAT  EQU  65500
           GIVABF  EQU  65514
                   END
```

Program Listing 5. The Assembly Version of Listing 4

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BY HOWARD F. BATIE

GALAXY TREK ADVENTURE 2

All right, adventurers! Here's one for you Trekkies out there—and not just a beginner's tour around the Enterprise. In this full-blown adventure, you'll have to investigate five full levels in the Enterprise, locate and collect the equipment necessary to safely explore the surface of a strange and dangerous planet, combat a deadly plague, and outwit the ruthless Romulans aboard their Battle Cruiser. Even if you do make it back safely to the Enterprise, you'll have to stay alert to avoid the armed Romulan guards sent to capture the ship as a war prize for their Empire!

This challenging adventure will test the limits of your resources and provide hours of play.

Don't leave anything to chance, and investigate everything thoroughly. Deadly traps are set for you, and you never know when you may run into an armed Romulan with an itchy trigger finger. They don't always play fair, so do unto them before they do unto you! Keep your wits about you and your phaser ready! OK, Captain, are you ready to begin?

Line	Checksum	Line	Checksum
135	5759	235	13492
150	3392	240	10185
160	2425	245	5783
170	1765	265	4341
180	15203	280	8230
185	15806	295	9877
190	13718	310	1706
195	14891	325	7890
200	8385	330	7239
215	1533	335	6757
230	7814	340	6446

Table 1. Checksum Values for DATA Statements.

Captain's Log—Stardate 2846.5

Several days have passed since we received notification on the subspace priority channel that further peace negotiations between our Federation and the Romulan Empire will probably be fruitless. It appears that our already delicate truce will degenerate into a state of conflict, if not outright war.

Although the Enterprise is fully battle-ready and staffed with the best technicians and equipment in the Federation, Star Fleet Command has directed that we undertake a sensitive and secret mission to obtain all possible information on a new device reportedly developed by the Romulans: a device that provides a cloak of invisibility for an entire starship so that it cannot be detected by any ship's sensors.

Such a cloaking device could significantly alter the balance of advantage in an armed conflict. The Enterprise has been directed to obtain one of these intact, through any means necessary, and to return it to the nearest Starbase for detailed examination.

However, as important as this primary mission is, we have intercepted a weak signal on the emergency distress frequency coming from the planet Tycho IV. An epidemic of deadly Par-

System Requirements

32K RAM
Color Basic

melian fever has spread to this observation post near the edge of the Federation/Empire neutral zone.

If not checked within the next few hours, the spores causing the fever could mutate into a form that cannot be controlled. This would endanger all life forms in this entire quadrant of the galaxy.

Dr. McCoy is preparing a vaccine he says is effective against the Parmelian spores before they mutate; however, its magnetic properties are such that the vaccine would be made useless if transported to the planet's surface in the normal manner. Therefore, Dr. McCoy and I must deliver the vaccine to the colony hospital on Tycho IV by the shuttlecraft Galileo. Bones assures me that the vaccine will be ready by the time the Enterprise is in stable orbit.

Tycho IV is a small Class M planet, the fourth of seven orbiting an aging twin star. Mr. Spock has scanned the surface of the planet and found it to be within human limits: a thin but breathable atmosphere, and an average temperature somewhat cooler than earth.

Coordinates of the hospital have been entered into Galileo's guidance section. There is, however, a slight but unusual magnetic anomaly detected occasionally, but the exact source can't be located by our ship's sensors. I have instructed Spock to continue his analysis of this anomaly.

Ensign Chekhov has just informed me that we have achieved stable orbit around Tycho IV, and that the Galileo is ready. Mr. Spock is in the Science Laboratory and will be in charge while we deliver the vaccine.

The Enterprise will remain in condition yellow, ready to go instantly to full alert at the first indication of danger. I am now proceeding to sick bay to get Dr. McCoy and the vaccine; together we will proceed to the Galileo.

Report to continue upon return from Tycho IV.

Program Instructions

If using Extended Color Basic, execute PCLEAR1 before CLOADing or entering the program. At any time during the adventure, you can review the items you're carrying by typing INV (for inventory), you can ask Mr. Spock for assistance by typing HELP, or you can end the adventure by typing QUIT. Full adventure instructions for taking other actions are included within the program.

One final note on the listing: It is lengthy and keystroke errors are quite probable if you manually enter the program from the magazine listing. Therefore, I've included checksum values at the end of each program line which is not a DATA statement. The DATA statement checksums are given in Table 1. An article in *80 Micro* (November 1982, pp. 410-413) described the method for deriving the checksums.

When you type in the listing, omit the apostrophe and checksum value at the end of lines 100-9999. Then run 63000. The checksum values shown on the screen can be compared with those at the end of each line; if they don't agree, check for an error in that line. When all errors are fixed, lines 63000-63070 can be deleted and the good program CSAVEd on a new cassette.

If this sounds like too much work, a prerecorded cassette tape of Galaxy Trek Adventure #2 is available for $10, postpaid, from HFB Enterprises, 12002 Cheviot Drive, Herndon, VA 22070.■

You can contact Howard F. Batie at the above address.

Program Listing

```
10 '   STAR TREK ADVENTURE #2
15 '
20 '     COPYRIGHT 1983 BY
30 '      HOWARD F. BATIE
80 '
100 CLS:CLEAR200:PRINT@135,"S T A R   T R E K":PRINT@196,"A D V
E N T U R E   # 2":PRINT@392,"COPYRIGHT  1983":PRINT@424,"HOWARD
 F. BATIE"'6743
110 DIMQL$(59),QS$(59),QO$(11),QV$(31),QN$(28),LV$(5),LO(11),DM(
59,3)'3571
120 CL=25:LC=15:BL=1:CA=1:PS=1:RG=1'2761
130 FORI=1TO5:READLV$(I):NEXT'1525
135 DATABRIDGE,PERSONNEL SECTION, TECHNICAL DEPARTMENTS, SECURIT
Y SECTION, ENGINEERING
145 READA$,B$:FORI=1TO5:QL$(I)=A$:QL$(I+5)=B$:NEXT'3030
150 DATAAT THE ENTRANCE TO A TURBOLIFT, IN A TURBOLIFT
155 READA$:FORI=11TO18:QL$(I)=A$:NEXT'2085
160 DATAIN A CORRIDOR OF THE ENTERPRISE
165 READA$:FORI=19TO22:QL$(I)=A$:NEXT'2098
170 DATAIN A VENTILATION DUCT
175 FORI=23TO43:READQL$(I):NEXT'1667
176 READA$:FORI=44TO46:QL$(I)=A$:NEXT'2113
177 FORI=47TO59:READQL$(I):NEXT'1682
180 DATAAT THE SCIENCE OFFICER'S STATION,AT THE HELMSMAN'S CONSO
LE,AT THE ASTROGATION CONSOLE,AT THE COMBAT CONSOLE,AT THE COMMU
NICATIONS CONSOLE,IN THE TRANSPORTER ROOM,IN THE GYMNASIUM,IN SI
CK BAY,IN ENVIRONMENTAL CONTROL
185 DATAIN THE SCIENCE LAB,IN THE SHIP'S LIBRARY,IN THE SHIP'S S
TOREROOM,IN THE ARMORY,IN THE SHIP'S BRIG,IN ENTERPRISE'S HANGAR
BAY,IN THE AIRLOCK,IN MAIN ENGINE CONTROL,IN AUXILIARY ENGINE CO
NTROL,IN THE MAINTENANCE SHOP,IN THE GALILEO
190 DATALOST FOREVER IN A SANDSTORM,ON THE SANDY SURFACE OF TYCH
O IV,IN AN OASIS,AT THE ENTRANCE TO A BUILDING,IN THE TRANSPORTE
R ROOM OF A     ROMULAN BATTLE CRUISER,IN THE ROMULAN COMMANDER'
S       STATEROOM
195 DATAIN A LARGE ROOM,IN A CORRIDOR. THERE ARE STAIRS  LEADING
 UP AND DOWN,TOO LATE! THIS ISN'T A BRIG --  IT'S A TORTURE CELL
!  AFTER MANYHOURS YOU'RE FINALLY PUT OUT OF YOUR MISERY,IN A CO
RRIDOR. THERE ARE STAIRS  LEADING UP.
200 DATAIN THE ROMULAN SECURITY SECTION,IN THE ROMULAN ENGINE RO
OM,IN AN AIRLOCK,IN THE SHUTTLEBAY,IN A ROMULAN SHUTTLECRAFT
202 AT$="A TABLE AND AN OPEN VENTILATION  DUCT":AB$="A BENCH AND
 AN OPEN VENTILATION  DUCT"'6014
203 OD$="AN OPEN DOOR TO THE ":CD$="A CLOSED DOOR TO THE "'3777
210 READA$:FORI=1TO5:QS$(I)=A$:NEXT'2046
215 DATAA SIGN ON THE WALL
220 FORI=6TO28:QS$(I)="":NEXT'1781
225 FORI=29TO59:READQS$(I):NEXT'1737
230 DATAA TABLE,,SEVERAL CHAIRS AROUND A TABLE,,MANY BOOKS ON A
TABLE,NEARLY ANYTHING REQUIRED,MANY WEAPONS ON A TABLE,
235 DATATHE SHUTTLECRAFT GALILEO,,,A WORKBENCH,MANY TOOLS ON A W
ORKBENCH,THE ASTROGATION CONSOLE,,,,A SANDY DESERT,THOUSANDS OF
FLOWERS,A SIGN ON THE WALL,SEVERAL ROMULAN GUARDS ARMED     WITH
 BLASTERS
240 DATAMANY GUARDS WITH DRAWN BLASTERS,SEVERAL ARMED ROMULANS W
HO      BLAST YOU,AN ARMED ROMULAN GUARD,,,SEVERAL ROMULAN GUARD
S WITH       BLASTERS DRAWN
245 DATATHE ROMULAN HYPER-DRIVE ENGINES,,A ONE-MAN SHUTTLECRAFT,
A SIMPLE CONTROL PANEL
250 QS$(24)="  -- FIRE IMPULSE ENGINES --":QS$(25)="  -- ENGAGE
WARP DRIVE --":QS$(26)="  -- FIRE MAN PHASERS --"'6896
260 FORI=1TO11:READQO$(I):NEXT'1443
265 DATAVIALS OF VACCINE, A BATTERY-OPERATED LANTERN,A TRICORDER
,,,,,,,,
275 FORI=1TO30:READQV$(I):NEXT'1466
```

Listing continued

THE TOP–RATED COCO WORD PROCESSOR:

TELEWRITER-64

Colorware researched the word processors available for the Color Computer. We came to the very same conclusion that so many review articles have! Telewriter-64 is, by far, the superior word processor for the Color Computer.

Why is Telewriter so much better than the others? For one thing, it has overcome the 32x16 character display limitation of the Color Computer. No small feat, Telewriter accomplishes this by generating its own set of characters in software. You select 51x24, 64x24 or 85x24 character displays by merely issuing a format command. If you have ever used a word processing system, you know how important it is to be able to see a good portion of your text on the screen.

Telewriter-64 also generates true lower case characters. This is much preferable to the reverse characters that merely "represent" lower case letters in other co-co word processors.

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.

Disk $59.95
Cassette . $49.95

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.

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Give a Professional look to your project or product

- Designed especially for the Color Computer ROM slot.
- High quality 3 piece injection molded black plastic with spring-loaded door.
- Same size and specifications as Radio Shack ROMpak

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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.
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- Ideal for word processing and other serious CoCo use.

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

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QUALITY DISK DRIVE CABLES

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

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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***

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- 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."

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GHOST GOBBLER

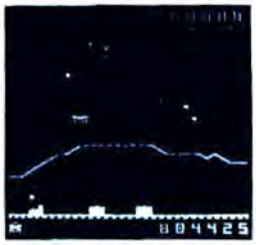
From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Tape: $21.95, Disk: $25.95

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

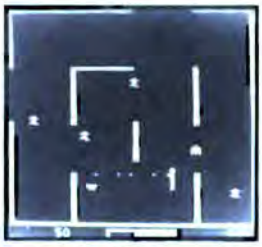


PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: $24.95, Disk: $27.95

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



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

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

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. Tape: $24.95

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 & 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 6ft. Extender Cord.

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ONLY
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A well proven joystick, the Atari is known for being rugged and reliable. It gives good response and is the standard among home video players. Now at 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"

THE BEST YOU CAN BUY

$34.95

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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Listing continued

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280 DATAREA,GET,MOV,LOO,PRE,PUS,SAY,JUM,PUL,INV,UNB,LIG,UNL,SCA,
GO ,PIC,OPE,CLO,WEA,REM,FIR,DRO,QUI,HEL,ENT,LOC,GIV,INS,DEA,ACT
290 FORI=1TO28:READQN$(I):NEXT'1480
295 DATAVACC,LANT,TRIC,MANU,COMM,SWIT,PHAS,SUIT,WREN,BLAS,DEVI,W
ALL,FLOW,TABL,BENC,DOOR,ENTE,COVE,LEVE,SURF,GUAR,SIGN,BUTT,DUCT,
SHUT,ENER,HANG,COOR
305 FORI=1TO11:READLO(I):NEXT'1447
310 DATA30,30,32,-1,-1,-1,-1,38,-1,-1,56
320 FORI=1TO59:FORJ=0TO3:READDM(I,J):NEXTJ,I'2476
325 DATA23,25,27,6,7,12,0,11,30,8,14,0,0,34,15,9,39,18,10,17,0,1
,135,0,0,70,2,136,0,71,137,3,0,4,72,138,5,0,73,0,28,2,11,11,29,1
2,12,2,32,14,13,0,3,33,14,13,4,16,15,35
330 DATA34,16,36,15,0,5,17,41,40,18,18,5,0,0,148,0,0,83,149,0,0,
84,150,0,0,0,85,0,0,24,1,0,0,0,25,23,24,0,26,1,25,0,0,27,1,26,0,
0,0,0,11,0,0,0,12,0,0,0,3,0
335 DATA0,32,0,0,0,0,13,31,0,0,0,14,0,0,16,0,0,15,0,0,16,0,0,0,0
,38,0,0,0,0,0,37,0,0,5,0,0,0,18,0,0,17,0,0,0,0,0,0,0,0,0,0,43,44
,45,46,44,45,47,48
340 DATA0,44,0,0,45,0,0,0,0,45,0,0,0,50,0,0,0,52,0,49,0,0,0,0,11
5,53,182,50,0,0,0,0,116,55,56,0,0,0,0,0,54,0,0,0,0,0,58,0,57,0,0
,59,0,0,0,0
345 GOSUB350:GOTO500'1038
350 PRINT:PRINT"  PRESS ANY KEY TO CONTINUE";'2380
355 A$=INKEY$:IFA$=""THEN355ELSERETURN'1978
500 CLS:PRINT@131,"WANT INSTRUCTIONS (Y/N)? ";:GOSUB355'3207
505 IFA$="N"THEN600ELSEIFA$<>"Y"THEN500'2381
510 CLS:PRINT:PRINT"IN RESPONSE TO AN EMERGENCY RE-  QUEST FOR M
EDICAL ASSISTANCE,   THE ENTERPRISE HAS ORBITED THE  CLASS M PLA
NET TYCHO IV TO      DELIVER VACCINE AGANST THE      DEADLY PARM
ELIAN FEVER."'12845
512 PRINT:PRINT"BECAUSE OF THE VACCINE'S MAG-    NETIC PROPERTIE
S, YOU AND DR.   MCCOY CANNOT TRANSPORT IT DOWN, BUT MUST DELIVE
R IT BY THE      SHUTTLECRAFT GALILEO."'10201
515 GOSUB350:CLS:PRINT:PRINT"TO ACCOMPLISH AN ACTION (SUCH AS TO
 READ A SIGN OR OPEN A DOOR), TYPE A VERB AND A NOUN SUCH AS":PR
INT:PRINT"   ";CHR$(34);"READ SIGN";CHR$(34);" OR ";CHR$(34);"OP
EN DOOR";CHR$(34)'12234
517 PRINT:PRINT"AND THEN PRESS THE <ENTER> KEY.":PRINT:PRINT:PRI
NT"IF THE COMPUTER DOESN'T UNDER-   STAND, TRY DIFFERENT WORDS."
'7152
520 GOSUB350:CLS:PRINT:PRINT"YOU CAN MOVE TO ANOTHER LOCATION WH
ICH IS NORTH, SOUTH, EAST,    WEST, UP OR DOWN FROM YOUR PRE- SE
NT LOCATION BY TYPING ONLY":PRINT" THE FIRST LETTER OF THE DIREC
-"'11855
522 PRINT" TION YOU WANT (N,E,S,W,U OR D). THEN PRESS THE <ENTER
> KEY."'4090
525 PRINT:PRINT:PRINT"    PRESS ANY KEY TO BEGIN":GOSUB355'2752
600 CLS:IFCL>59THENCL=CL-65:SOUND50,1'2193
602 IFCL=48THENVH=1'1208
605 IFCL=32THENSP=1:ELSEIFCL=37THENSP=0'2575
610 IFCL=39THENSC=1:ELSEIFCL=10ORCL=38THENSC=0'3158
615 IFCL=30ANDVH=0THENMC=1:ELSEIFCL>48THENMC=0'3107
620 IFCL=44ANDVH=1THEN935'1559
622 IFCL<19ORCL>22THENID=0ELSEID=1'2366
630 PRINT"YOU ";:IF(SP=1ANDCL<43)THENPRINT"& SPOCK ";'2847
635 IFMC=1THENPRINT"& MCCOY ";'1540
640 IFSC=1THENPRINT"& SCOTTY ";'1658
645 PRINT"ARE":PRINTQL$(CL)'1164
646 IFCL=53THEN3700'1064
655 IFCL=43THENPRINT"AND WANDER AROUND UNTIL YOU DIE OF THIRST":
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Listing continued

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GOTO3700'4454
665 AS=0:PRINT:PRINT"YOU SEE":IFCL<19ORCL>22THEN674'3036
670 IFID=1ANDLL=0THENPRINT"NOTHING. IT'S DANGEROUS TO MOVE  IN T
HE DARK":GOTO850:ELSEIFID=1THENPRINT"HANDHOLDS TO USE IN CLIMBIN
G":GOTO800'8577
674 IFCL=24ORCL=25ORCL=26THENPRINT"A BUTTON LABELLED":AS=1'3900
675 IFQS$(CL)<>""THENPRINTQS$(CL):AS=1'2308
680 IFCL=17THENAS=1:IFDE=1THENPRINTOD$;"NORTH":GOTO705:ELSEPRINT
CD$;"NORTH":GOTO705'4927
685 IFCL=38THENAS=1:IFDE=1THENPRINTOD$;"SOUTH":GOTO705:ELSEPRINT
CD$;"SOUTH":GOTO705'4951
690 IFCL=54THENAS=1:IFDR=1THENPRINTOD$;"WEST":GOTO705:ELSEPRINTC
D$;"WEST":GOTO705'4807
695 IFCL=57THENAS=1:IFDR=1THENPRINTOD$;"EAST":GOTO705:ELSEPRINTC
D$;"EAST"'4263
705 FORI=1TO11:IFLO(I)=CL THENPRINTQO$(I):AS=1:NEXTI:ELSENEXTI'3
557
715 IFCL=56ANDLO(11)=56THENPRINT"A CLOAKING DEVICE IS INSTALLED"
:IFCA=1THEN PRINT" AND ACTIVATED";'5918
716 IFCL=56ANDLO(11)ANDRG=1THENPRINT" AND IS WATCHED":PRINT" BY
AN ARMED GUARD."'4645
725 IFCL>5ORRO=0THEN750'1610
730 IFRO(CL)=1THENPRINT"AN ARMED ROMULAN GUARD":AS=1:GOTO800'378
7
732 IFRO(CL)=0THEN750'1290
735 CLS:PRINT:PRINT" TOO SLOW, CAPTAIN!"'2089
740 PRINT:PRINT" THE ROMULAN GUARD BLASTED YOU!": GOTO3700'3307
750 IFCL<>49THEN780:ELSELO(8)=57:QO$(8)="A SPACE SUIT"'3592
752 IFWS=1THENPRINT"YOUR SPACE SUIT IS REMOVED AND":WS=0'3679
755 HA=0:FORI=1TO11:IFLO(I)=0THENHA=1:I=11:NEXTI:ELSENEXTI'3756
760 IFHA=0THEN770ELSEPRINT"YOU ARE TOLD TO DROP ALL YOU ARE CARR
YING.":GOTO850'4817
765 CLS:PRINT:PRINT:PRINT"YOU DID NOT FOLLOW INSTRUCTIONS.":PRIN
T:PRINT"A ROMULAN WITH AN ITCHY TRIGGER  FINGER BLASTED YOU!":GO
TO3700'7872
770 PRINT:PRINT"YOU ARE TO BE TAKEN TO THE ROMU- LAN COMMANDER W
HO WILL DECIDE   YOUR FATE.":GOSUB350:CL=50:RC=1:GOTO600'7244
780 IFCL=51ORCL=55OR(CL=50ANDRC=2)THENPRINT"THERE ARE JUST TOO M
ANY.":PRINT"THEY OVERPOWER YOU AND TAKE YOU TO THE BRIG.":CL=53:
GOSUB350:GOTO600'9196
785 IFCL=50ANDRC=1THENPRINT:PRINT"THE ROMULAN COMMANDER SAYS -":
PRINT" WE FINALLY MEET, CAPTAIN KIRK!  SINCE THE FEDERATION AND
THE    ROMULAN EMPIRE ARE NOW AT WAR,  I HAVE SENT SOME ARMED GU
ARDS   TO CAPTURE THE ENTERPRISE.":ELSE790'14399
787 GOSUB350:CLS:PRINT:PRINT:PRINT" YOUR STARSHIP IS NOW MY WAR
    PRIZE AND YOUR CREW ARE MY      PRISONERS!"'6162
788 PRINT:PRINT" GUARD! TAKE THE CAPTAIN TO THE  BRIG FOR INTERR
OGATION.":PRINT:PRINT:GOSUB350:QL$(50)="IN A CORRIDOR":RC=2:CL=5
2:GOTO600'8011
790 IFAS=0THENPRINT" NOTHING"'1470
800 PRINT:PRINT"EXITS: ";:B=0:FORI=0TO3:A=DM(CL,I)'2818
805 IFA=0THEN840'788
810 IFA>127THENPRINT"DOWN ";:B=1:GOTO840'2208
815 IFA>63THENPRINT"UP ";:B=1:GOTO840'2017
820 IFI=0ANDA>0THENPRINT"NORTH ";:B=1:GOTO840'2671
825 IFI=1ANDA>0THENPRINT"EAST ";:B=1:GOTO840'2583
830 IFI=2ANDA>0THENPRINT"SOUTH ";:B=1:GOTO840'2691
835 IFI=3ANDA>0THENPRINT"WEST";:B=1'2077
840 NEXTI:IFB=0THENPRINT"NONE":ELSEPRINT'1828
850 PRINT:PRINT"COMMAND? ";:LINE INPUT A$'1693
855 SOUND190,1:IFA$=""THEN600'1353
856 IFCL=52ANDLEFT$(QS$(52),4)="AN A"THENIFLEFT$(A$,9)="JUMP GUA
R"THEN2210ELSE735'4861
857 IFRG=1ANDCL=56ANDLO(11)=56ANDCA=1THENIFLEFT$(A$,3)="FIR"THEN
3516ELSE735'4712
859 IFCL=49ANDHA=1THEN1000'1559
865 IFLEN(A$)>1THEN1000'1392
870 IFA$="D"THENB=128:GOTO880'1733
875 IFA$="U"THENB=64:ELSE885'1607
880 FORI=0TO3:IFDM(CL,I)>B THENCL=DM(CL,I)-B:I=4:NEXTI:GOTO600:E
LSENEXT:PRINT:GOTO925'5151
885 IFA$="N"THENB=0:GOTO905'1649
890 IFA$="E"THENB=1:GOTO905'1646
895 IFA$="S"THENB=2:GOTO905'1666
900 IFA$="W"THENB=3:GOTO905'1676
902 GOTO850'588
905 IFLL=0ANDID=1THENPRINT:PRINT"YOU FELL DOWN A HIDDEN SHAFT
 AND BROKE YOUR NECK!":GOTO3700'5660
910 IFLL=1THENLC=LC-1:IFLC=0THENLL=0'2618
915 A=DM(CL,B):IFA<1ORA>59THEN925'2215
920 CL=A:GOTO600'1044
925 SOUND50,1:GOTO600'1016
935 CLS:MC=0:PRINT:PRINT"SUDDENLY, FROM OUT OF NOWHERE,   HIGH-E
NERGY BEAMS STRIKE THE":IFGL=1THENPRINT" GALILEO AND IT EXPLODES
.":ELSEPRINT" GROUND ALL AROUND YOU..."'10024
936 B=1000:GOSUB2050:PRINT:PRINT"YOU TAKE COVER BEHIND A PILE OF
  ROCKS...":GOSUB2050'4814
937 PRINT:PRINT"THEN SUDDENLY, YOU'RE TRANSPOR-  TED UP FROM THE
 PLANET!":EDO=0:DE=0:GB=1:QS$(46)="THE CHARRED REMAINS OF THE
    GALILEO"'8874
940 PS=0:MC=0:RO=5:EDO=0:FORI=1TO5:RO(I)=1:NEXT:CL=49:GOSUB350:P
RINT:PRINT:GOSUB950:GOTO600'5842
950 PRINT:FORI=1TO20:PRINT"*";:FORJ=1TO25:NEXTJ,I:RETURN'2778
1000 A$=A$+"      ":V$=LEFT$(A$,3):N$="":FORI=3TOLEN(A$):IFMID$(A
$,I,1)=" "THENN$=MID$(A$,I+1,4):I=255:NEXTI:ELSENEXTI'7624
1001 IFV$="HEL"THEN3900'1326
1002 IFV$="INV"THEN2400'1341
1003 IFV$="QUI"THEN3700'1348
1005 NN=0:VN=0:FORI=1TO30:IFV$=QV$(I)THENVN=I:I=32:NEXTI:ELSENEX
TI'4396
1010 FORI=1TO28:IFN$=QN$(I)THENNN=I:I=32:NEXTI:ELSENEXTI:GOTO102
5'4046
1015 IFCL=49ANDHA=1THENIFV$="INV"THEN2400ELSEIFV$="DRO"THEN3600E
LSE735'4264
1016 IFCL=56ANDRG=1THENIF(V$="FIR"ANDN$="BLAS")THEN3516ELSE735'3
895
1017 IFCL>5THEN1020'1121
1018 IFRO(CL)=0THEN1020'1360
1019 IFV$="FIR"ANDLO(7)<>0THENPRINT"HE BLASTS YOU ON THE SPOT":G
OTO3700:ELSEIFV$="FIR"THEN3500:ELSE735'6246
1020 IFVN>0THEN ON VN GOTO 1500,1600,1700,4200,1910,1900,2100,22
00,2300,2400,2500,2600,2700,2800,2900,1600,3100,3200,3300,3400,3
500,3600,3705,3900,4000,4100,3000,2000,1800,4400'8918
1025 PRINT:PRINT"I CAN'T ";A$:GOTO850'1540
1027 PRINT:PRINT"I DON'T HAVE IT":GOTO850'1878
1030 PRINT:PRINT"I DON'T SEE ONE HERE":GOTO850'2203
1032 PRINT:PRINT"I ALREADY HAVE IT": GOTO 850'2113
1035 PRINT:PRINT"THE LANTERN BATTERIES ARE DEAD!":IFID=1THENPRIN
T"IT'S DANGEROUS TO MOVE":PRINT" IN THE DARK!":GOTO850:ELSEGOTO8
50'7213
1500 IFN$="SIGN"ANDCL<6THENPRINT:PRINT"IT SAYS --":PRINT"  DECK
";CL:PRINT"  ";LV$(CL):GOTO850'4924
1503 IFN$="SIGN"ANDCL=48THENPRINT:PRINT"IT SAYS --":PRINT" WELCO
ME TO THE":PRINT" TYCHO IV HOSPITAL":GOTO850'6124
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Listing continued

Listing continued

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1505 IFN$<>"TRIC"THEN1535'1582
1510 IFLO(3)=0THENPRINT"IT REGISTERS":ELSE1027'2587
1515 IFCL<43ANDRO>0THENPRINT" ";RO;"ROMULANS ON BOARD":GOTO850'3
826
1520 IFCL<43THENPRINT" ONLY THE SHIP'S CREW":GOTO850'3093
1525 IFCL<49THENPRINT" STRONG PLANT LIFE"'2429
1530 GOTO850'706
1535 IFN$<>"MANU"THEN1025'1605
1540 IFLO(4)<>0THEN1027'1206
1545 PRINT:IFCL=27THENPRINT"SHIP'S SENSORS ARE OPERATED":PRINT"
FROM THE SCIENCE OFFICER'S":PRINT" STATION":GOTO850'6441
1550 IFCL=24THENPRINT"THE BUTTON CONTROLS":PRINT" A FIRING SWITC
H":GOTO850'4184
1555 IFCL=28THENPRINT"TO ACTIVATE THE TRANSPORTER,":PRINT" SAY "
;CHR$(39);"ENERGIZE";CHR$(39):GOTO850'6028
1560 IFCL=31THENPRINT"A NETWORK OF VENTILATION DUCTS    RUNS THR
OUGHOUT DECKS 2-5.      THE BRIDGE HAS ITS OWN LIFE     SUPPORT
SYSTEMS.":GOTO850'8870
1565 IFCL=38THENPRINT"GIANT HANGARBAY DOORS PROTECT    AGAINST O
PEN SPACE.  THEY ARE   CONTROLLED BY A DEVICE ON THE   HANGARBAY
 WALL.":GOTO850'8764
1570 IFCL=40THENPRINT"EXPERIMENTAL DEVICES ARE TO BE  INSTALLED
AND TESTED HERE.":GOTO850'5379
1575 IFCL=25THENPRINT"NEVER ENGAGE WARP DRIVE WHILE     ORBITING
 A CLASS M PLANET.":GOTO850'5394
1580 IFLO(4)=0THENPRINT"THE MANUAL DOESN'T MENTION":PRINT"  ANYT
HING ABOUT THIS AREA.":GOTO850:ELSE1027'5881
1600 IFV$="PIC"THEN1615ELSEIFV$<>"GET"THEN1025'2626
1605 IFNN>11THEN1025'1007
1610 IFLO(NN)=0THEN1032'1197
1615 IFN$="FLOW"THEN2310'1256
1620 IFN$="DEVI"ANDCA=1THENCLS:PRINT:PRINT:PRINT"WHEN YOU PICKED
 UP THE ACTIVATED  CLOAKING DEVICE, YOU SUFFERED   FATAL RADIATI
ON BURNS.":GOTO3700:ELSEIFCL=56ANDN$="DEVI"THENQO$(11)="THE ROMU
LAN CLOAKING DEVICE"'13151
1625 IFLO(NN)=CL THENLO(NN)=0:GOTO600:ELSE1030'2706
1700 IFN$<>"LEVE"THEN1775'1522
1705 IFCL=37THENIFEDO=0THENEDO=1ELSEEDO=0'2723
1710 IFCL=58THENIFRDO=0THENRDO=1ELSERDO=0'2770
1715 PRINT:PRINT"THE HANGARBAY DOORS":PRINT" ARE NOW ";'2790
1720 IFCL=58THEN1745'1130
1725 IFEDO=1THENPRINT"OPEN":ELSEPRINT"CLOSED"'2341
1730 IFDE=1ANDEDO=1THEN1765'1696
1735 IFEDO=1ANDWS=0THEN1770'1729
1740 GOTO850'661
1745 IFRDO=1THENPRINT"OPEN":ELSEPRINT"CLOSED"'2374
1750 IFDR=1ANDRDO=1THEN1765'1742
1755 IFRDO=1ANDWS=0THEN1770'1762
1760 GOTO850'681
1765 PRINT:PRINT"UNFORTUNATELY, YOU LEFT THE AIR-  LOCK DOOR OPE
N. THE ";:IFCL<43THENPRINT"ENTERPRISE  IS DECOMPRESSED TO SPACE,
 AND   THE ENTIRE CREW DIES.":GOTO3700'10152
1767 PRINT"CRUISER IS  DECOMPRESSED TO SPACE. YOU ARE  BLOWN AWA
Y FROM THE SHIP AND    DIE WHEN YOUR OXYGEN RUNS OUT.":GOTO3700'
8054
1768 GOTO3700'734
1770 PRINT:PRINT"UNFORTUNATELY, YOU'RE NOT":PRINT" WEARING YOUR
SPACE SUIT AND     YOU DIE WHEN EXPOSED TO SPACE.":GOTO3700'7385
1775 IFN$="TABL"ORN$="BENC"THEN1777ELSE1025'2619
1777 IFCL=35ANDVO=0THENQS$(35)="A TABLE AND A CLOSED VENTILATION
 DUCT"'4657
1780 IFCL=31THENDM(31,2)=20:DM(20,0)=31:QS$(31)=AT$'3225
1782 IFCL=29THENDM(29,1)=19:DM(19,3)=29:QS$(29)=AT$'3273
1784 IFCL=40THENDM(40,1)=22:DM(22,3)=40:QS$(40)=AB$'3217
1786 IFCL=41THENDM(41,3)=22:DM(22,1)=41:QS$(41)=AB$'3223
1790 GOTO600'704
1800 IFN$<>"DEVI"THEN1025'1351
1805 IFLO(11)=CL THENPRINT:PRINT"THE CLOAKING DEVICE IS NOW":PRI
NT" DEACTIVATED.":CA=0:GOTO850:ELSE1030'5680
1900 IFN$="LEVE"THEN1705'1281
1905 IFN$="TABL"ORN$="BENC"THEN1780'2098
1910 IFN$<>"BUTT"THEN1025'1484
1915 IFCL<>24THEN1950'1240
1920 IFFS=0THENPRINT:PRINT"NOTHING HAPPENED":GOTO850'2868
1925 IFFS=1ANDLO(6)=-2THENCLS:PRINT:PRINT"YOU LEFT THE ORBIT OF
TYCHO IV   ON IMPULSE ENGINES ";'5824
1927 IFFS=1ANDLO(6)=-2AND(CA=0ORLO(11)<>40)THENPRINT"BUT THE":PR
INT" ROMULANS SEE YOU AND BLAST YOU  OUT OF THE SKY!":GOTO3700'7
976
1929 IFFS=1ANDLO(6)=-2ANDLO(11)=40ANDCA=1THENWG=1:PRINT"AND HAVE
":PRINT" CAPTURED THE ROMULAN CLOAKING   DEVICE INTACT!"'7583
1931 IFWG=1ANDDV=0THENPRINT:PRINT"BUT PARMELIAN FEVER SPREADS
   THROUGHOUT THE ENTERPRISE AND   ALL ABOARD DIE A HORRIBLE DEA
TH";:GOTO3700'8716
1933 IFWG=1ANDMC=0THENPRINT"BUT YOU LEFT DR. MCCOY STRANDED  ON
TYCHO IV.!":GOTO3705'5176
1935 IFWG=1ANDRO>0THENPRINT"HOWEVER, THERE ARE STILL SOME    ROM
ULANS HIDING SOMEWHERE ON    THE ENTERPRISE.":GOTO850'7447
1940 IFWG=1THENPRINT:PRINT"DR. MCCOY'S VACCINE WORKS AND    WIPE
S OUT THE PARMELIAN SPORES.":PRINT:PRINT"YOU HAVE SOLVED THIS AD
VENTURE!":GOTO3705'8670
1945 GOTO 850'643
1950 IFCL=25THENCLS:PRINT:PRINT:PRINT"YOU ENGAGED THE WARP DRIVE
 WHILE ORBITING A CLASS M PLANET, AND  EXPOSED THE PLANETS POPUL
ATION  TO LETHAL RADIATION LEVELS.":PRINT:PRINT" YOU ARE HEREBY
RELIEVED OF       COMMAND.":GOTO3700'13692
1955 IFCL<>26THEN1030'1271
1960 IFPL=1THEN1965ELSECLS:PRINT:PRINT"YOU DIDN'T LOCK ONTO A TA
RGET    BEFORE YOU FIRED PHASERS.":PRINT:IFRND(3)>1THENPRINT" LU
CKILY, YOUR SHOT WENT HARM-    LESSLY INTO DEEP SPACE.":GOTO850'
11464
1962 PRINT"UNFORTUNATELY, YOU JUST ZAPPED   THE HOSPITAL ON THE
PLANET'S    SURFACE!":GOTO3700'5828
1965 PRINT:PRINT"YOU ZAPPED ";PH$:PL=0:GOTO850'2542
2000 IFN$="DEVI"THEN2035'1374
2005 IFN$<>"SWIT"THEN1025'1587
2010 IFCL<>24THEN2025'1329
2015 IFFS=1THEN2030'1108
2020 IFLO(6)>0THEN1027:ELSEFS=1:LO(6)=-2:PRINT:PRINT"OK.":GOTO85
0'3794
2025 PRINT:PRINT"I CAN'T INSTALL IT HERE":GOTO850'2663
2030 PRINT:PRINT"IT'S ALREADY INSTALLED":GOTO850'2679
2035 IFLO(11)=0AND(CL=40ORCL=56ORCL=59)THENPRINT:PRINTQO$(11):PR
INT" IS SUCCESSFULLY INSTALLED IN":CD=1:LO(11)=CL:IFCL=40THENPRI
NT" THE ENTERPRISE":ELSEIFCL=56THENPRINT" THE ROMULAN CRUISER":E
LSEPRINT" THE SHUTTLECRAFT"'13430
2040 GOTO850'706
2050 FORI=1TOB:NEXTI:RETURN'1142
2100 IFN$="ENER"THEN2115'1220
2105 PRINT:PRINT"OK --  ";'860
2110 B=600:GOSUB2050:PRINTRIGHT$(A$,5,LEN(A$)-4):GOSUB2050:GOTO8
50'3788
2115 PRINT:PRINT"ARE YOU BEAMING":PRINT" UP (U) OR DOWN (D)?":GO
SUB355'3450
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Listing continued

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2120 IFA$="D"THEN2152'998
2125 IFA$<>"U"THEN2115'1198
2130 IFCL=28ANDMC=0ANDPS=0THENPRINT:PRINT"MCCOY IS STILL DOWN TH
ERE, BUT   I DON'T HAVE HIS COORDINATES.":GOTO850'6928
2135 IFCL=28ANDMC=0ANDCE=1THENGOSUB950:PRINT:PRINT"MCCOY IS SAFE
LY BEAMED ABOARD.":MC=1:GOTO850'5756
2140 IFCL>43ANDLO(5)<>0THENPRINT:PRINT"WITHOUT A COMMUNICATOR TO
 PRO-   VIDE COORDINATES, YOU CAN'T     BEAM UP.":GOTO850'7344
2145 IFCL>43ANDCL<49ANDLO(5)=0THENGOSUB2155:CL=28:SP=1:GOTO600'4
066
2150 PRINT"NOTHING WAS BEAMED ABOARD.":GOTO850'2573
2152 IFCL=28THENGOSUB2155:CL=46:GOTO600:ELSEPRINT:PRINT"I AM ALR
EADY ON THE PLANET'S     SURFACE.":GOTO850'6053
2155 GOSUB950:CLS:PRINT:IFLO(1)=0THENPRINT"THE MAGNETIC PROPERTI
ES OF THE   VACCINE ARE DESTROYED AND IT    IS USELESS.":LO(1)=3
0:B=2000:GOSUB2050:RETURN:ELSERETURN'9320
2160 CL=44:GOTO600'1048
2200 IFN$<>"GUAR"THEN1025'1503
2205 IFCL<>52THEN1030'1265
2210 PRINT:PRINT"OK.  YOU KNOCKED HIM OUT.":LO(10)=CL:QO$(10)="A
 ROMULAN BLASTER":QS$(52)="AN UNCONSCIOUS GUARD":B=1000:GOSUB205
0:GOTO600'8468
2300 IFN$="LEVE"THEN1705'1426
2305 IFN$<>"FLOW"THEN1025'1362
2310 PRINT:PRINT"THE FLOWER EMITS A YELLOW GAS...":B=1000:GOSUB2
050:PRINT"IT'S HARD TO BREATHE!":GOSUB2050:PRINT:PRINT"YOU CHOKE
 TO DEATH ON THE        POISON GAS.":GOTO3700'9480
2400 PRINT:PRINT"YOU'RE CARRYING:":A=0'1991
2405 FORI=1TO11:IFLO(I)=0THENPRINT" ";QO$(I):A=1:NEXTI:ELSENEXTI
'3421
2410 IFA=0THENPRINT" NOTHING"'1477
2415 GOTO850'571
2500 IFN$<>"COVE"ORCL<>35THEN1025'2328
2505 PRINT:IFVO=1THENPRINT"IT'S ALREADY OPEN":GOTO850'2971
2510 VO=1:DM(35,2)=21:DM(21,0)=35:PRINT"OK.":QS$(35)=AT$:B=700:G
OSUB2050:GOTO600'4902
2600 IFN$<>"LANT"THEN1025'1393
2605 IFLO(2)<>0THEN1027'1249
2610 IFLC<1THEN1035'933
2615 LL=1:PRINT:PRINT"OK.  THE LANTERN IS LIT.":GOTO850'2960
2700 IFN$<>"LANT"THEN1025'1493
2705 IFLO(2)<>0THEN1027'1349
2710 IFLC<1THENPRINT:PRINT"IT'S ALREADY OFF.":GOTO1035'2903
2715 LL=0:PRINT:PRINT"OK.  THE LANTERN IS OFF.":GOTO850'3045
2800 IFN$="SURF"ORN$="PLAN"THEN2805ELSE1025'2665
2805 IFCL<>23THENPRINT"I CAN'T DO THAT HERE":GOTO850'3147
2806 IFSP=0THENPRINT:PRINT"SPOCK ISN'T HERE TO OPERATE THE  CONT
ROLS.":GOTO850'4698
2810 PS=1:PRINT:PRINT"SPOCK SAYS --"'1963
2815 IFGB=1ANDMC=0THENPRINT" CAPTAIN, WE'VE GOT DR. MCCOY'S  COO
RDINATES.":GOTO850'5123
2820 PRINT" THE PLANET IS VERY ARID AND     MOST OF THE SURFACE
IS DESERT.  HOWEVER, A UNIQUE FORM OF PLANT LIFE DOES EXIST IN I
SOLATED     COLONIES.  THERE ARE NO OTHER   LIFE FORMS ON THE PL
ANET EXCEPT";'12733
2825 PRINT" FOR THE HUMANS IN THE OBSERVA-  TION OUTPOST.":GOTO8
50'3821
2900 IFN$<>"SHUT"THEN2915'1468
2905 IF(CL=37ORCL=46)ANDGB=0THENCL=42:GOTO600'2986
2910 IFCL=58THENCL=59:GOTO600'1770
2912 GOTO1025'601
2915 IFN$<>"ENTE"THEN2960'1459
2920 IFCL=59THEN2925ELSEIFCL=42THEN2930:ELSE1025'2625
2925 IFRDO=0THENPRINT:PRINT"THE ROMULAN SHUTTLECRAFT SHOOTS  STR
AIGHT AHEAD, SLAMS INTO THE  CLOSED HANGARBAY DOOR AND       EXP
LODES.":GOTO3700'8858
2930 CLS:EDO=0:DE=0:PRINT:PRINT"YOU'RE COMING UP FAST ON THE
 ENTERPRISE.":PRINT:B=1000:GOSUB2050'5773
2932 IFGB=0THEN2940'998
2935 IFCA=1THENPRINT"THE ROMULANS HAVE NOT YET DETEC-TED YOUR ES
CAPE.":ELSEPRINT" BUT THE SHUTTLE WAS DETECTED    AND BLOWN UP B
Y THE ROMULANS.":GOTO3700'9371
2940 PRINT:PRINT"COMMAND? ";:LINEINPUTA$:A$=A$+"          ":IFLE
FT$(A$,9)="RADIO ENT"THENEDO=1ELSEEDO=0'5669
2945 PRINT:IFEDO=0THENPRINT"YOU SLAMMED INTO THE CLOSED      HAN
GARBAY DOORS AND EXPLODED    BECAUSE YOU DID NOT RADIO AHEAD FOR
 LANDING CLEARANCE.":GOTO3700'9571
2950 RE=1:PRINT:PRINT"ROGER,CAPTAIN.":PRINT:PRINT"THE HANGARBAY
DOORS ARE OPEN     AND YOU ARE CLEARED TO LAND.":B=1500:GOSUB205
0:PRINT:PRINT"NICE TOUCHDOWN, CAPTAIN.":GOTO850'9996
2960 IFN$<>"SURF"THEN2975'1530
2962 IFCL<>42THENPRINT:PRINT"I CAN'T DO THAT UNLESS I'M IN    TH
E SHUTTLECRAFT GALILEO.":GOTO850'5722
2965 PRINT:IFCL=42ANDEDO=0THENPRINT"THE GALILEO SHOOTS STRAIGHT
FOR- WARD, SLAMS INTO THE CLOSED     HANGARBAY DOORS AND EXPLODE
S.":GOTO3700'8725
2970 QS$(46)=QS$(37):QS$(37)="A SHUTTLECRAFT SERVICE PLATFORM":C
LS:PRINT@96,"YOU PROCEED TO TYCHO IV, BUT FOR UNKNOWN REASONS, Y
OU TOUCH DOWN A KILOMETER FROM THE HOSPITAL   AND HAVE TO WALK."
:PRINT:CL=46:GL=1:EDO=0:DE=0:GOSUB350:GOTO600'15470
2975 IFN$<>"HANG"THEN1025'1496
2980 IFCL=42ORCL=59THEN2985ELSE1025'2114
2985 IFEDO=1ANDWS=0THEN1770'1704
2987 IFCL=59ANDRE=1THENCL=37:RE=0'2333
2990 IFCL=42THENCL=37'1337
2992 GOTO600'631
3000 IFN$<>"VACC"THEN1025'1520
3005 IFLO(1)<>0THEN1027'1393
3010 PRINT:IFCL<>48THENPRINT"WAIT UNTIL WE REACH THE HOSPITAL";:
GOTO850'4291
3015 PRINT"THE COLONY'S DOCTOR THANKS YOU   FOR THE PRECIOUS VAC
CINE.  THE  PARMELIAN FEVER CAN NOW BE      STOPPED.":B=1000:GOS
UB2050:PRINT:PRINT"YOU MUST NOW RETURN TO THE       ENTERPRISE."
:DV=1:LO(1)=-1:GOTO850'13321
3100 IFN$<>"DOOR"THEN1025'1388
3105 IFCL=17ORCL=38THENDE=1:DM(17,0)=38:DM(38,2)=17'3276
3110 IFCL=54ORCL=57THENDR=1:DM(54,3)=57:DM(57,1)=54'3302
3115 GOTO600'499
3200 IFN$<>"DOOR"THEN1025'1488
3205 IFCL=17ORCL=38THENDE=0:DM(17,0)=0:DM(38,2)=0'3260
3210 IFCL=54ORCL=57THENDR=0:DM(54,3)=0:DM(57,1)=0'3284
3215 GOTO600'599
3300 IFN$<>"SUIT"THEN1025'1605
3305 PRINT:IFLO(8)=-1THENPRINT"I ALREADY HAVE IT ON.":GOTO850'35
09
3310 IFLO(8)=0THENPRINT"OK.":LO(8)=-1:WS=1:GOTO850'3187
3315 IFLO(8)=CL THEN1027ELSE1030'1789
3400 IFN$<>"SUIT"THEN1025'1450
3405 PRINT:IFWS=0THENPRINT"I'M NOT WEARING IT.":GOTO850'2946
3410 PRINT"OK.":LO(8)=0:WS=0:GOTO850'2039
3500 IFN$<>"PHAS"THEN3515'1531
3502 IFLO(7)=0THENPRINT:PRINT"ZZZAPP!"'1929
3505 IFCL<6THENIFRO(CL)=1THENPRINT:PRINT"YOU GOT HIM!":RO(CL)=0:
RO=RO-1:GOTO850'4941
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Listing continued

Listing continued

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3510 IFSP=1THENPRINT"SPOCK SAYS --":PRINT" WHAT A WASTE OF PHASE
R CHARGE!":GOTO850:ELSEGOTO850'5428
3515 IFN$<>"BLAS"THEN1025'1530
3516 IFCL=56THENIFBL>0THENRG=0:PRINT:PRINT"YOU GOT HIM!":BL=0:GO
TO850:ELSECLS:PRINT:PRINT"YOUR BLASTER WAS EMPTY!":GOTO740'7164
3519 IFCL>5THEN3525'1085
3520 PRINT:IFRO(CL)=1THENIFLO(10)<>0ORBL<1THENPRINT"HE KILLS YOU
 ON THE SPOT.":GOTO3700:ELSEPRINT"YOU GOT HIM!":RO(CL)=0:RO=RO-1
'8053
3525 BL=0:PRINT:PRINT"ZZZAPP!":B=600:GOSUB2050:IFCL=52THENQS$(52
)="A DEAD GUARD":GOTO600'5252
3530 GOTO850'666
3600 PRINT:IFN$="VACC"ANDLO(1)=0THENPRINT"THE VIALS ARE SHATTERE
D AND THE  VACCINE IS LOST!":LO(1)=30:GOTO850'6430
3605 IFN$="DEVI"ANDLO(11)=0THENPRINT"THE CLOAKING DEVICE FELL AP
ART   WHEN YOU DROPPED IT!":LO(11)=-1:CA=1:CD=1:GOTO850'7575
3610 IFNN>11THEN1027'974
3611 IFLO(NN)=0THENLO(NN)=CL:ELSE1027'2124
3612 IFCL=49THENLO(NN)=-1'1565
3613 IFCL=49ANDNN=7THENLO(7)=35'1914
3615 GOTO600'489
3700 PRINT:PRINT" YOUR MISSION IS A FAILURE!"'2341
3705 PRINT:PRINT"THIS ADVENTURE IS OVER.":PRINT"DO YOU WANT TO T
RY AGAIN (Y/N)?":GOSUB355:IFA$="N"THENCLS:END:ELSEIFA$="Y"THENRU
N:ELSE3705'7668
3900 PRINT:IFCL=28ANDSP=0THENPRINT"YOU NEED SOMEONE TO OPERATE T
HE  CONTROLS"'4604
3905 IFSP=0THENPRINT"YOU'RE ON YOUR OWN, CAPTAIN!":GOTO850'3378
3910 PRINT"SPOCK SAYS --":IFCL=23THENPRINT" SHIP'S SENSORS CAN S
CAN THE     PLANET'S SURFACE.":GOTO850'5847
3915 IFCL=24THENPRINT" IT LOOKS LIKE THE FIRING SWITCH IS BROKEN
.":GOTO850'4413
3920 IFCL=34THENPRINT" I SEE ";:IFLO(5)=-1ANDLO(6)=-1THENQO$(5)=
"A COMMUNICATOR":QO$(6)="AN ELECTRICAL SWITCH":PRINTQO$(5):PRINT
" AND ";QO$(6):LO(5)=34:LO(6)=34:GOTO850:ELSEPRINT"ALL THE SHIP'
S STORES":GOTO850'12634
3925 IFCL=28THENPRINT" READY TO ENERGIZE, CAPTAIN.":GOTO850'3407
3930 IFCL=38ORCL=27ORCL=24ORCL=28ORCL=31ORCL=40ORCL=25THENPRINT"
 I SUGGEST WE CHECK THE SHIP'S   TECHNICAL MANUAL, CAPTAIN.":GOT
O850'8987
3935 IFCL=33THENPRINT" SEE WHAT'S ON THIS TABLE":GOTO850'3186
3940 IFRO>0THENPRINT" I SENSE DANGER, CAPTAIN.":GOTO850'3132
3945 PRINT" I HAVE NO SUGGESTIONS, CAPTAIN.":GOTO850'2975
4000 PRINT:IFN$="COOR"ANDPS=1ANDMC=0ANDCL=23THENCE=1:PRINT:PRINT
"SPOCK SAYS --":PRINT" COORDINATES ENTERED, CAPTAIN.":GOTO850'75
39
4005 IFN$="COOR"ANDCL=23THENPRINT"OK.":GOTO850'2659
4010 GOTO1025'679
4100 IFN$<>"PHAS"THEN1025'1360
4105 IFCL<23ORCL>27THEN1025'1552
4110 PRINT:PRINT"ONTO WHAT? (ONE WORD)":PRINT" ONTO ";:LINEINPUT
PH$'3110
4115 PL=1:PRINT:B=500:GOSUB2050:PRINT"CHEKHOV REPORTS --":PRINT"
 PHASERS LOCKED ON TARGET,      CAPTAIN.":GOTO850'6414
4200 PRINT:IFN$<>"DEVI"THEN4210'1648
4205 IFLO(11)=CL OR LO(11)=0THENPRINT"THE CLOAKING DEVICE":IFCA=
1THENPRINT" IS ACTIVATED":GOTO850:ELSEPRINT" IS NOT ACTIVATED":G
OTO850:ELSE1030'8260
4210 IFN$<>"SWIT"THEN4220'1497
4215 IFCL=24ANDFS=0THENPRINT"THE SWITCH IS BURNED OUT."GOTO850:E
LSEIFCL=25ORCL=26THEN4315:ELSEIFLO(6)=0THENPRINT" IT LOOKS LIKE
A NEW SWITCH.":ELSEIFLO(6)=CL THEN1027:ELSE1030'10518
4220 IFN$<>"LANT"THEN4235'1489
4225 IFLO(2)=CL OR LO(2)=0THENPRINT"THE LANTERN IS ";:IFLL=1THEN
PRINT"ON":ELSEPRINT"OFF"'4846
4230 IFLO(2)=0ORLO(2)=CL THENPRINT"THE BATTERIES WILL LAST":PRIN
T" ONLY";LC;"MORE MINUTES":GOTO850:ELSE1030'6384
4235 IFN$<>"BLAS"THEN4245'1492
4240 IFLO(10)<>0THEN1027ELSEPRINT:IFBL=1THENPRINT"IT HAS ONLY ON
E CHARGE LEFT":GOTO850:ELSEPRINT"IT IS EMPTY!":GOTO850'6745
4245 IFN$<>"TRIC"THEN4255'1519
4250 IFLO(3)=0THENPRINT"YEP!  IT'S THE LATEST MODEL!":GOTO850:EL
SEIFLO(3)=CL THEN1027ELSE1030'5271
4255 IFN$="MANU"THEN1545'1348
4260 IFN$<>"FLOW"THEN4270'1537
4265 IFCL=47THENPRINT"THEY'RE BLUE AND SMELL SWEET.":GOTO850:ELS
E1025'4032
4270 IFN$<>"TABL"THEN4285'1532
4273 IFCL=35ANDLO(7)=-1THENLO(7)=35:QO$(7)="A HAND PHASER":PRINT
"I SEE ";QO$(7):GOTO850'5379
4275 IFCL=33ANDLO(4)=-1THENLO(4)=33:QO$(4)="THE SHIP'S TECHNICAL
 MANUAL":PRINT"IT'S ";QO$(4);:GOTO850'6362
4277 IFCL=33ORCL=31ORCL=29THEN4315'2331
4280 IFCL=35THENPRINT"THERE ARE MANY PHASERS":GOTO850:ELSEIFCL=2
9THEN4315:ELSE1030'4795
4285 IFN$<>"BENC"THEN4295'1537
4290 IFCL=41ANDLO(9)=-1THENLO(9)=41:QO$(9)="A WRENCH":PRINT"A WR
ENCH AND OTHER TOOLS ARE ON  THE WORKBENCH.":GOTO850:ELSEIFCL=40
THEN4315:ELSE1030'9080
4295 IFN$<>"WALL"THEN4305'1563
4300 IFCL=37ORCL=58THENPRINT"I SEE A LEVER WHICH CONTROLS     TH
E HANGARBAY DOORS.":LV=1:GOTO850'6155
4301 IFCL=38THENPRINT"I SEE ";:IFMC=1THENQO$(8)="TWO SPACE SUITS
" ELSEQO$(8)="A SPACE SUIT"'5586
4302 IFCL=38THENPRINTQO$(8):GOTO850'1928
4304 GOTO4315'723
4305 IFN$<>"DUCT"THEN4315'1574
4310 IF(CL=29ANDDM(29,1)>0)OR(CL=31ANDDM(31,2)>0)OR(CL=35ANDDM(3
5,2)>0)OR(CL=40ANDDM(40,1)>0)OR(CL=41ANDDM(41,3)>0)THENIF(LL=1AN
DLO(2)=0)THENPRINT"THE DUCT RUNS VERTICALLY BETWEEN DECKS.":GOTO
850:ELSEPRINT"IT'S TOO DARK TO SEE IN THERE.":GOTO850'15682
4312 PRINT"THERE IS NO OPEN VENTILATION     DUCT HERE.":GOTO850'
3746
4315 PRINT"I SEE NOTHING OF INTEREST HERE.":GOTO850'3045
4400 IFN$<>"DEVI"THEN1025'1401
4405 IFLO(11)<>CL THEN1030'1433
4410 PRINT:IFCD=0THENPRINT"IT'S NOT INSTALLED YET!":B=1000:GOSUB
2050:PRINT:PRINT"LOOK OUT!":GOSUB2050:PRINT:PRINT"IT BLEW UP!":G
OTO3700'7097
4415 IFCL<42THENPRINT"THE ENTERPRISE":ELSEIFCL=59THENPRINT"THE S
HUTTLECRAFT":ELSEIFCL>48THENPRINT"THE ROMULAN CRUISER"'6947
4420 PRINT" NO LONGER APPEARS ON ANY         SENSORS.":CA=1:GOTO
850'3791
9999 END'192
63000 CL=PEEK(25)*256+PEEK(26):BN=0
63010 CLS:BN=BN+1:BT=0:PRINT" LINE","CHECKSUM":PRINT
63020 FORI=1TO10:CS=0:LN=PEEK(CL+2)*256+PEEK(CL+3)
63030 IFLN<63000THENPRINTLN,:NL=PEEK(CL)*256+PEEK(CL+1):ELSEI=11
:GOTO63060
63040 FORJ=CL+2TONL-1:IFPEEK(J)=58ANDPEEK(J+1)=131THENJ=NL:ELSEC
S=CS+PEEK(J)
63050 NEXTJ:PRINTCS:CL=NL:BT=BT+CS
63060 NEXTI:PRINT:PRINT"BLOCK";BN,BT:PRINT:IFLN>62999THENEND
63070 INPUT"PRESS ENTER TO CONTINUE";BT:GOTO63010
```

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BY JAMES J. BARBARELLO

REAL-WORLD APPLICATIONS— PART I, THE CMI

Have a capacitor of uncertain tolerance? Turn your CoCo into an inexpensive capacitance meter.

Popular opinion seems to say that the CoCo is only for playing games and such. Others have realized, however, that the CoCo is capable of many things—some of which would be difficult for most people to discover. For instance, did you realize that with the addition of a simple interface circuit, your CoCo could be transformed into a capacitance meter? Or how about a biofeedback monitor? In this first of two articles, I'll discuss the capacitance-meter interface (CMI), which, with associated software, will transform your CoCo into an accurate capacitance meter.

The three passive components used in most electronic circuits are resistors, capacitors, and inductors. For most of us, inductors (or coils) are seldom used. However, almost all hardware hobbyists own a volt/ohm meter (VOM) or digital volt-meter (DVM). With this low-cost device you can measure the exact value of a resistor.

But what about capacitors? There are capacitance meters, but they are expensive. Like me, you probably buy a capacitor and hope the actual value is close to that marked on the part.

Common resistors are available with 5-percent tolerances. For instance, if you have a 1,000-ohm, 5-percent resistor, you can be reasonably sure that its value will not be less than 950 ohms or greater than 1,050 ohms. On the other hand, low-cost capacitors have +80/−20-percent tolerances. That means that a 1 microfarad (μF) capacitor can be as low as 0.8 μF or as high as 1.8 μF. Since the actual value of a capacitor is usually critical to circuit performance, this wide variation can produce undesirable results.

In addition, capacitors possess a characteristic called dielectric absorption. Without going into the details, a poor dielectric absorption characteristic will result in the capacitor changing value after it is charged and discharged a number of times.

A capacitance meter can measure the actual value of a capacitor and determine if it has excessive dielectric absorption. The hardware involved and the process are simple. You charge the capacitor with a controlled current until it reaches a preset voltage level. When it reaches the preset level, you determine how long the process took and convert that time into a value in microfarads.

How can your CoCo assist in this process? First, you can send a signal to trigger the start of the charging (as you do when you CSAVE a program to tape). You can also sense a voltage level (as when you CLOAD a program from tape). And, of course, the CoCo can keep time extremely well. (It is, after all, crystal controlled.)

Finally, using a predefined formula, you can program your machine to convert the time to a capacitance value. But the CoCo can't readily provide the controlled current and sense a preset voltage level—not without a little help. That is where the CMI comes in.

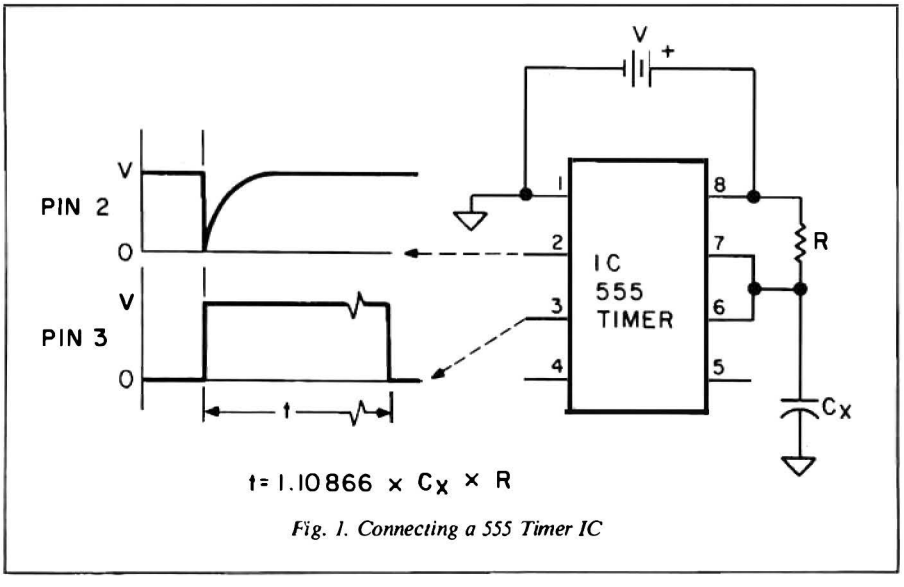

Fig. 1. Connecting a 555 Timer IC

Measuring Capacitance

If you connect a 555 timer IC, as shown in Fig. 1, and trigger it with a negative-going pulse, pin 3 will immediately rise to the supply voltage (V+). It will stay at V+ for a time equal to about R×C seconds (where

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R is in megohms and C is in microfarads). This time will not vary with changes in V+ and, if R is kept constant, will always be the same for a given capacitor.

So, if you can measure the time during which pin 3 stays at a positive voltage level, you can convert it directly into a capacitance value. But how do you trigger the IC, and how do you check the level of pin 3? This is where the CMI and the software come in. Take a look at the actual circuit.

The CMI Circuit

In the CMI schematic diagram (Fig. 2), notice that IC1 is a 555 timer IC connected like the one in Fig. 1. When a positive voltage greater than 0.7V is applied to J1, it turns on transistor Q1, shorting R2 to ground. This negative-going voltage change is applied directly to pin 2 of IC1 and starts the IC's timing cycle. During the timing cycle, pin 3 is at the V+ level.

The duration of IC1's output pulse depends on Cx (the unknown-value capacitor) and the value of timing resistors R3 or R4 (selected by rotary switch S1a). IC2 remains unaffected by the positive transition of IC1's output. But when voltage at pin 3 of IC1 returns to 0 volts, this negative transition passes through C1 and triggers IC2. As a result, IC2 produces a fixed-duration, positive-going pulse and provides it to J2.

A 9-volt battery provides power for the circuit. S1b provides power to the circuit when S1 is in position 1 or 2. It also disconnects the battery from the circuit when S1 is in the off position.

As a review, note that IC1's output pulse starts when a positive voltage is applied to J1. Also, the presence of a positive voltage at J2 tells you when IC1's output has ended. All the CoCo needs to do now is provide the positive voltage to J1 and count until it senses a positive voltage at J2.

The CMI Software

Before I discuss how the CoCo triggers and senses the CMI, I'll examine its counting task. To be an effective piece of instrumentation, the CoCo CMI should be able to measure capacitors in the picofarad (millionths of a microfarad) range. For example, assume you want to measure a 10-pF capacitor. Using range 1, the timing cycle would take about 10E6 × 10E-12 seconds (R3 = 10 megohms, or 10E6; C = 10 pF, or 10E-12). This calculates to 100E-6 or one ten-thousandth of a second.

Unfortunately, you cannot operate this quickly in Basic and still keep count. So you must resort to a machine-language subroutine to trigger, count, and sense. Program Listing 1 shows the subroutine that accomplishes this. Convert this subroutine into data values, place them in the Basic program, and POKE them into memory for use with Basic's USR function.

If you are not interested in how it works, you can skip to the next section.

Line 100 of Listing 1 defines its ORG (or origination) at 3F00H. The next command (ORCC #50H) sets the condition-code register's interrupt-request mask (IRQ) and fast interrupt-request mask (FIRQ) bits. In doing this, you disable all interrupt requests. You must accomplish this before you send out any

```
3F00                    00100          ORG     3F00H
3F00 1A   50            00200          ORCC    #50H
3F02 86   FF            00300          LDA     #255
3F04 B7   FF20          00400          STA     0FF20H
3F07 C6   08            00500          LDB     #8
3F09 5A                 00600 J1       DECB
3F0A 26   FD            00700          BNE     J1
3F0C 86   03            00800          LDA     #3
3F0E B7   FF20          00900          STA     0FF20H
3F11 1A   50            01000          ORCC    #50H
3F13 C6   01            01100          LDB     #1
3F15 8E   0000          01200          LDX     #0
3F18 86   FE            01300 CONT     LDA     #0FEH
3F1A BA   FF20          01400          ORA     0FF20H
3F1D 81   FE            01500          CMPA    #0FEH
3F1F 27   06            01600          BEQ     DONE
3F21 3A                 01700          ABX
3F22 8C   0000          01800          CMPX    #0
3F25 26   F1            01900          BNE     CONT
3F27 BF   3F30          02000 DONE     STX     3F30H
3F2A 39                 02100          RTS
          3F00          02200          END     3F00H

00000 TOTAL ERRORS

CONT      3F18
DONE      3F27
J1        3F09
```

Program Listing 1. Machine-Language Subroutine

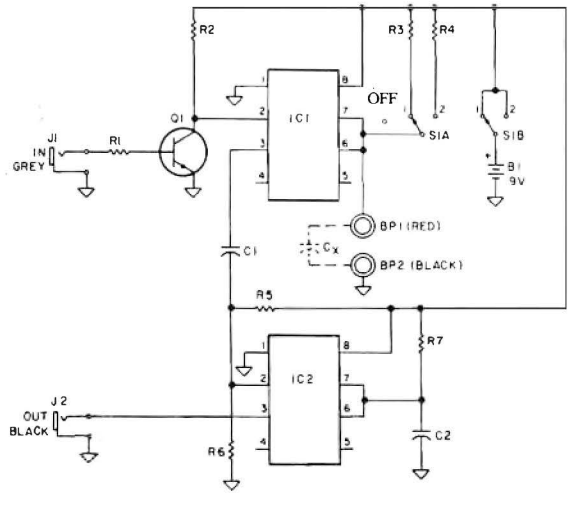

Fig. 2. CoCo CMI

Program Listing 2

```
 1 REM  **  COLOR CAP METER PROG.
 2 REM  **  NAME:CAPMETER
 3 REM  **  REV #2, 2 APR 1983
 4 REM  **  (C) 1983 J. BARBARELLO
 5 REM
10 CLS 5
   :CLEAR  200,&H3EFF
   :DEF USR = &H3F00
   :R(1) = 10
   :R(2) = 0.1
   :C(1) = 9
20 DATA 26,80,134,255,183,255,32,198,8,90,38,253,134,3
30 DATA 183,255,32,26,80,198,1,142,0,0,134,254,186,255
40 DATA 32,129,254,39,6,58,140,0,0,38,241,191,63,48,57
50 FOR  I = 16128 TO 16170
   :READ  M
   :POKE  I,M
   :NEXT I
60 REM ********************** UTILITY LOADED - PROGRAM BEG
    INS
70 REM ************************
80 CLS 0
   :AA$ = STRING$ (5,128) + "  " + STRING$ (16,128) + "  "+S
    TRING$ (7,160)
90 PRINT @5, STRING$ (20,32);
100 PRINT @32,;
   :FOR I = 1 TO 11
   :PRINT AA$;
   :NEXT
110 PRINT @389, STRING$ (20,32);
120 P = 39
   :P$ = "  CAPACITANCE   "
   :GO SUB  410
130 P = 71
   :P$ = "     METER      "
   :GO SUB  410
140 PRINT @103, STRING$ (16,255);
   :PRINT @135, CHR$ (255);
   :PRINT @150, CHR$ (255);
   :PRINT @167, STRING$ (16,255);
150 P = 233
   :P$ = " RANGE: 1 2 "
   :GO SUB  410
160 PRINT @241,"1";
   :RNG = 1
170 P = 328
   :P$ = "MEASURE"
   :GO SUB  410
180 P = 337
   :P$ = "READY"
   :GO SUB  410
   :PRINT @337,"R";
190 P = 136
   :P$ = " 00.000000 UF "
   :GO SUB  410
200 A$ = INKEY$
   IF  A$ = "" THEN  200
210 IF  A$ = "1" THEN  230
   :ELSE  IF  A$ = "2" THEN  240
   :ELSE  IF  A$ = "R" THEN  250
   :ELSE  IF  A$ = "M" THEN  270
220 GO TO  200
230 PRINT @241,"1";
   :POKE  1267,50
   :RNG = 1
   :GO TO  200
240 POKE  1265,49
   :PRINT @243,"2";
   :RNG = 2
   :GO TO  200
250 PRINT @337,"R";
   :POKE  1352,13
260 P = 136
   :P$ = " 00.000000 UF "
   :GO SUB  410
   :GO TO  200
270 PRINT @328,"M";
   :POKE  1361,18
280 X = USR (0)
   :M = PEEK (16176) * 256 + PEEK (16177)
   :POKE  16176,0
   :POKE 16177,0
290 IF  M < C(RNG) + 1 THEN  PRINT @136," OUT OF RANGE ";
   :GO TO  200
300 PRINT @136,;
   :PRINT USING " ##.###### UF ";(M - C(RNG)) / (450000 * R(
```

Listing continued

data. Next, load the A register with 255 decimal and send that value out to memory location 0FF20H.

Refer to page 7 of the TRS-80 *Color Computer Technical Reference Manual*. Note that memory locations FF20 through FF23 are actually PIA (peripheral interface adapter) U4. This device sends and receives data to and from the cassette recorder. By sending a value of 255 to U4, you generate a level of about 1 volt at the auxiliary (large grey) cassette plug.

You want to maintain this level for a short time so that the CMI can sense it. So, next you load the B register with the decimal value, 8. Then you decrement B until it reaches zero. This short delay maintains the level long enough for the CMI to sense it.

With this done, you reload the A register with decimal 3 and send it to U4. This returns the auxiliary level to its previous state. Now that you have finished sending data out, execute the command ORCC #50H again to restore the interrupts. Like an on/off switch, this command toggles the state of the interrupt flag bits.

"Before you return... check to see if index register X has been incremented past FFFFH to zero. This occurs if the timing cycle took too long, or if a fault in the CMI hardware never sent back a trigger pulse."

As in Basic, you must initialize your variable before you begin counting. First, load the B register with one (the count increment). Then load index register X (where the count will be stored) with zero. Count until the cassette's earphone plug sends a positive voltage level. Bit 0 of memory location FF20 is the cassette-data input.

Load the A register with 0FEH (254 decimal) and OR it with the contents of location 0FF20H. The program stores the results of this action in the A register. If bit 0 contains a one (not triggered), register A will contain 0FFH, and the comparison to 0FEH will not cause a branch to DONE. Instead, the

Listing continued

```
      RNG));
310 GO TO  200
400 REM ************************     POKE MESSAGE SUBROUTIN
    E          ************************
410 J = LEN (P$)
420 FOR I = 1 TO J
    :W = ASC ( MID$ (P$,I,1)) - 64
    :IF  W < 0 THEN  W = W + 64
430 POKE  P + I + 1023,W
    :NEXT
    :RETURN
```

ABX command adds the contents of the B register to index register X (incrementing it by one).

Before you return, however, check to see if index register X has been incremented past FFFFH to zero. This occurs if the timing cycle took too long, or if a fault in the CMI hardware never sent back a trigger pulse. If this happens, the process aborts and proceeds to DONE. Otherwise, it branches to CONT.

When the ORing of the A register and location FF20H produces FEH (bit 0 changed to "0" by the CMI's output), the CMPA #0FEH and BEQ DONE instructions cause execution to jump to DONE. Regardless of how you get to DONE, the program stores the contents of index register X in memory locations 3F30H (most-significant byte) and 3F31H (least-significant byte) before returning from this subroutine (RTS).

The Basic Program

Program Listing 2 shows the CMI Basic program. Line 10 first clears the screen to white (CLS5). It then clears 200 bytes of memory for string storage and reserves memory above 3EFFH (16127 decimal) for machine-language use. Then it defines the USR0 entry point as 3F00H (16128 decimal).

The remaining statements in line 10 require some discussion. If you look back at Fig. 1, you see the timing resistor for range 1 (R3) is 10 million ohms and the timing resistor for range 2 (R4) is 100,000 ohms. These are theoretical values, however, since the actual resistor installed in an individual unit can vary from these values by as much as 5 percent.

Measurement with precision components shows that on range 1, a 0.1 μF capacitor produces a count of 45009. Also, the intrinsic capacitance of the CMI produces a count of 9 (i.e., with no capacitor attached). On range 2, the intrinsic capacitance of the CMI is so small that it produces a count of zero (or no count).

Note that the value for variable R(1) is 10. This is the nominal value (in megohms) of the timing resistor for range 1. Similarly, R(2) is defined as 0.1 (or R4 = 100,000 ohms) for range 2. C(1) is defined as 9. It is the count obtained with no capacitor attached for range 1. Since range 2 produces no count, C(2) is not explicitly defined (since any variable not defined is implicitly zero).

The program will use these values later on to calculate the measured capacitance from the count supplied by the CMI. Assigning these variables allows them to be modified to the particular values of an individual CMI. For instance, if the measured value of R3 was 10.19 megohms and R4 was 0.0988 megohms (98,800 ohms), R(1) could be changed to 10.19 and R(2) to 0.0988. By doing this, the program achieves greater accuracy, since the calculation relates to the actual values of components on which the count relies.

Lines 20–40 contain DATA statements that hold the decimal values of the machine-language subroutine. Line 50 reads this data and then POKEs it into memory. Line 80 clears the screen to black and defines string AA$, which creates the sides of the capacitance-meter display. Line 90 draws the top of the meter, line 100 uses AA$ to draw the sides of the meter, and line 120 draws the bottom of the meter.

Lines 120 and 130 contain the first calls to a subroutine at line 410. This subroutine receives a string (P$) and a starting location (P) from the calling line. Line 410 calculates the length of the string to be displayed (J). The FOR...NEXT loop of line 420 uses the MID$ function to obtain the ASCII equivalent of each character in the string (W).

Line 420 subtracts the value of 64 from W so that line 430 can POKE the character into screen memory. When displayed this way, the character appears on a dark green background.

However, those characters with ASCII codes below 64 (space, numbers, etc.) will result in a W value less than zero, creating an error. So line 420 checks for that condition and, if found, adds back 64. Line 430 POKEs the string characters to the screen and, when done, returns execution to the calling line.

The screen display simulates a capacitance meter with a liquid-crystal display (LCD). Line 140 draws the orange border of the LCD. Line 150 calls our POKEing subroutine (line 410) and prints the RANGE: 1 2 selection legend. Since you begin in range 1, you want the 1 to be highlighted (on a normal green background). So line 160 prints a normal "1" in the proper position. Line 160 also sets the range identifier (RNG) to one, indicating that the routine has selected range 1.

Lines 170 and 180 use the POKEing subroutine to print the legends Measure and Ready. Line 180 also overprints the R in Ready, since the meter will initialize in the ready mode. Line 190 initializes the LCD to 00.000000 μF. Now that you have completed presentation of the meter, you can begin using it in line 200.

Line 200 is an INKEY$ scanning routine that causes execution to continue only when you've pressed a key on the keyboard. Then, the routine compares the key pressed to a 1, 2, R, or M. Pressing a 1 will branch execution to line 230, a 2 to line 240, an R to line 250, and an M to line 270. If you've pressed any other key, line 220 returns execution to line 200, where the scanning continues.

Line 230 highlights the 1 in the Range legend, displays the 2 in dark green (subdued), and sets RNG to one. It then returns execution to the keyscanning of line 200.

Line 240 performs a similar function, highlighting the 2, subduing the 1, and setting RNG to two. Thus, the range can be changed by simply pressing the 1 or 2 key.

Line 250 (R pressed) highlights the "R" in Ready and subdues the M in Measure. Line 260 then clears the LCD with an initializing display (00.000000 μF on a dark green background). This allows you to reset the meter to the Ready condition. Once this is done, execution returns to the keyscanning in line 200.

The meat of the program begins at line 270. Here, the routine highlights the M in Measure and subdues the R in Ready (indicating that the meter is now measuring).

Line 280 accesses the machine-language subroutine via the X=USR(0) command. The subroutine stores the most-significant byte (MSB) and least-significant byte (LSB) in memory locations 16176 and 16177. Line 280 retrieves these bytes and converts them to a decimal number that is assigned to the variable M. Finally, line 280 reinitializes memory locations 16176 and 16177 to zero.

"To measure, attach a capacitor to the CMI binding posts, set the CMI range switch to the same range selected on the meter, and press the M key."

If the capacitor being measured is too small or too large for the range you have selected, or if a fault has occurred (CMI not connected or power not applied), the program returns a count less than or equal to C(1). Therefore, line 290 checks M and, if it is less than C(1)+1, prints a highlighted "Out of Range" message in the LCD area, and then returns to the keyscanning of line 200. Otherwise, line 300 calculates the actual capacitance based on the count, R(RNG), C(RNG), and the constant 45000. The LCD then displays this calculated value. Then execution returns to the keyscanning of line 200.

When you run the program, the screen clears to white until the machine-language subroutine is loaded (the change to white screen lets you know that something is happening). Then the screen clears to black and displays the meter, initializing to range 1 and the ready state.

To change ranges, press the appropriate key (1 or 2). To measure, attach a capacitor to the CMI binding posts, set the CMI range switch to the same range selected on the meter, and press the M key. Once you've obtained the reading, press M again for another measurement, press 1 or 2 to change the range, or press R to clear the display and return to the ready state.

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Building the CMI

In order to control stray capacitances, you must use a printed circuit board (PCB). Figure 3 shows the CMI's PCB layout. Once you've made the PCB, you should mark it with transfer lettering or some other method before applying any components.

Begin applying the components to the PCB as shown in Fig. 4b, paying special attention to the orientation of IC1 and IC2. Next, mount the binding posts, phono jacks, and rotary switch on the PCB. Make the connections shown in Fig. 4a, using discarded leads from the resistors or short lengths of hookup wire. Also, connect battery clip B1 per Fig. 4a. Finally, mount a control knob on S1 and rotate it to the off position.

The PCB has been designed to replace the top cover of a Keystone #703 plastic case (available from sources such as Digikey Corp.). Tape a 9-volt battery in the case and snap B1 onto it. Secure the PCB to the case using four #4/40-by-½-inch machine screws.

Using the CMI

Type in, save, and then run the CMI program. When the screen displays the meter, remove the plugs from your cassette deck. Place the black plug into the CMI jack marked "black" and the large grey plug into the CMI jack marked "grey." Secure the capacitor to be measured to the binding posts. If the capacitor is polarized (i.e., an electrolytic capacitor with positive and negative leads), secure the positive lead to the red binding post and the negative lead to the black binding post. If the capacitor is not polarized (i.e., a disk capacitor), you may connect either lead to either binding post.

Place S1 on the CMI to position 1. The position of S1 and the Range selection must always agree, otherwise the screen will display a false capacitance value (since the program will be using the wrong R(RNG) and C(RNG) values). Now press the M key. After some time (determined by the range and the value of the capacitance), the LCD should display a value.

If the capacitor is too large or too small for the range selected (or if the CMI is not working properly), an "Out of Range" message will appear instead. To clear the display, press the R key. Alternately, you can press the M key to obtain another reading.

The CMI may produce slightly changing readings for the same capacitor (i.e.,

(Note: All resistors are ¼ watt, 5 percent. Capacitors are 10V or greater.)

R1, R2, R5, R6, R7	10,000 ohms
R3	10,000,000 ohms
R4	100,000 ohms
C1	0.01 μF
C2	0.1 μF
IC1, IC2	555 timer IC
Q1	2N2222A, PN2222A, or MPS2222A NPN silicon Xtr
J1, J2	1/8-inch phono jack
S1	2-pole, 6-position rotary switch
B1	9-volt battery clip
BP1	red 5-way binding post
BP2	black 5-way binding post

Miscellaneous: PC board, control knob, suitable case (optional).

Note: A kit containing all parts (less case) and the CMI program on cassette is available for $20 from the author. New Jersey residents add 5-percent sales tax.

Table 1. List of Materials

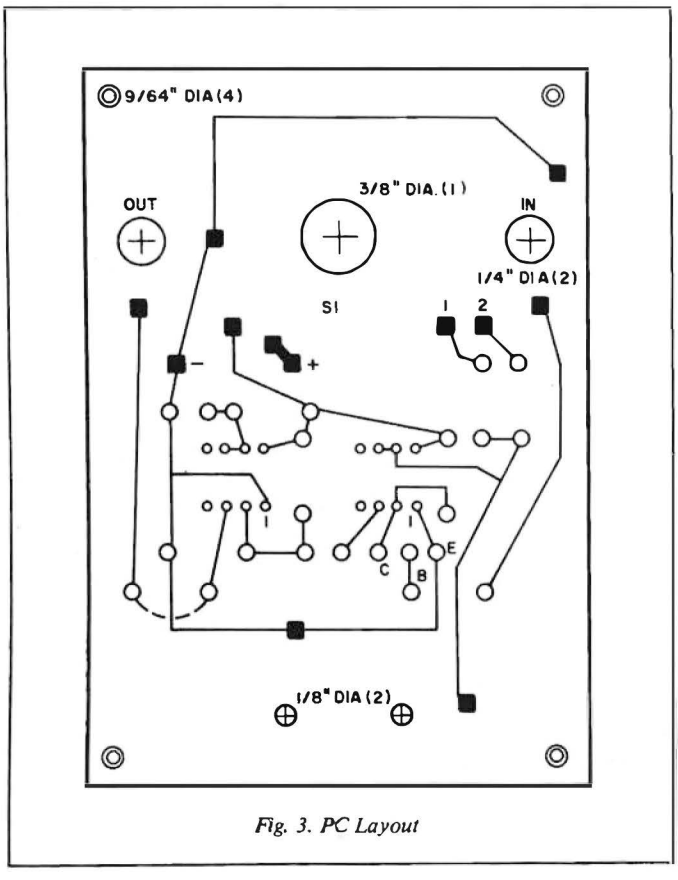

Fig. 3. PC Layout

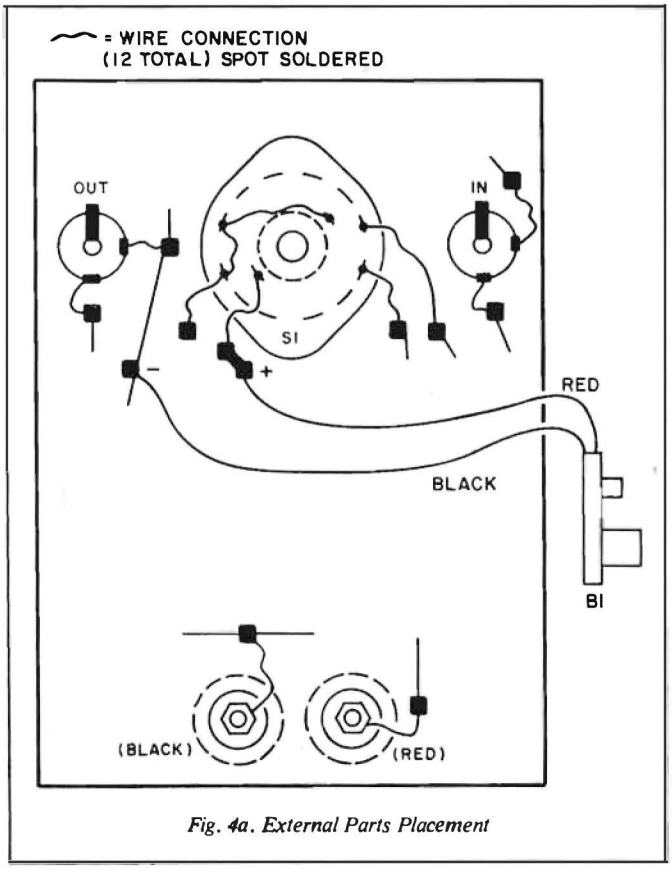

Fig. 4a. External Parts Placement

0.010456, 0.010449, 0.010453). This normal condition provides accurate results to at least three significant digits. With some capacitors, however, you may note that repeated remeasurements result in a continually drifting value. This is usually related to the dielectric-absorption characteristic mentioned earlier.

As the capacitor is repeatedly charged and discharged, it retains charge and drifts further and further from the originally measured value. A capacitor that never approaches a stable measurement should be a prime candidate for the wastebasket.

The CMI can measure capacitors with values of between 1 pF and 0.1 μF (100,000 pF) on range 1. On range 2, the CMI can measure between 0.1 and 15 μF. You should use any capacitor above 10 μF primarily for filtering. Such a capacitor is usually not a candidate for measurement.

However, if your application requires measuring capacitors greater than 15 μF, you can modify the CMI to accommodate them. Simply change the value of R4 from 100k ohms to 10k ohms to obtain a range of 1 to 150 μF in position 2. You should also change the value of R(2) to the measured value of R4 (i.e., 0.00976). Once you've changed this, you should save the modified program for use with the modified CMI.

You can easily modify the CMI program to accommodate tasks such as go/no-go testing and computer-aided design. In go/no-go testing, an acceptable range (go) is specified. Then the capacitor is measured. If it is not within that range, a no-go condition (reject) has occurred. For computer-aided design, you can measure the capacitor and use its actual value in subsequent programming to determine other circuit values (such as companion timing resistors and oscillator frequency).

Coming Up in Part II

In the next installment, I'll show you a completely different application that uses a very similar interface and machine-language subroutine. The application is biofeedback, a subject that elicits much interest.

I'll expand the machine-language subroutine to perform some screen manipulation. I'll also provide full details of the hardware construction and use. Until then, keep those soldering irons and keyboards warm! ■

Address correspondence to James J. Barbarello, RD #1, Box 241H, Tennent Road, Englishtown, NJ 07726.

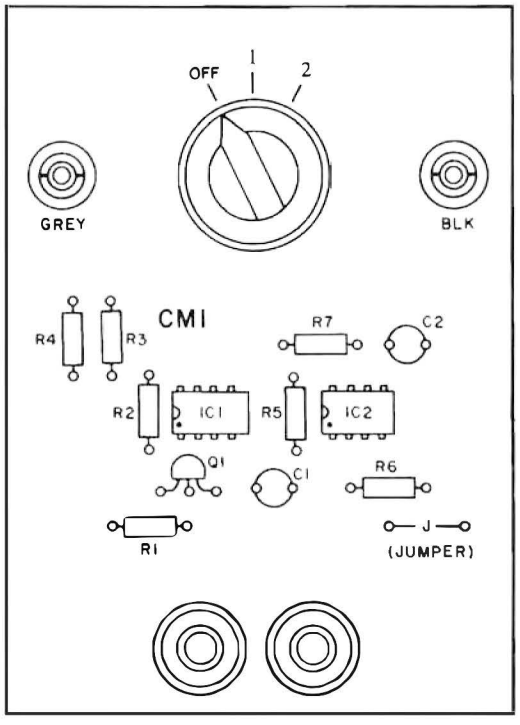

Fig. 4b. Components Placement

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BY KARL ANDREASSEN

COLOR CRYPTOLOGY— PART I

Enter the intriguing world of cryptology with this first in a series of fascinating articles.

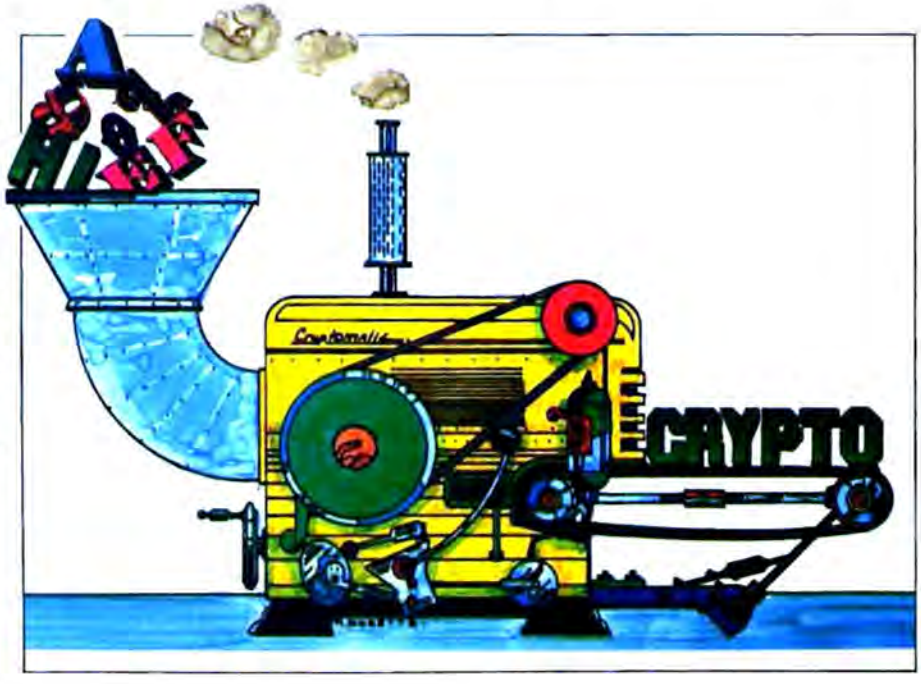
Making and breaking ciphers and codes has long been a fascinating hobby for individuals and a very serious business of nations. Merchants and corporations often use enciphered correspondence in their day-to-day business communications. Subscription television stations scramble their transmissions to prevent nonpaying viewers from enjoying the programming.

Most kids send cryptic notes to one another and many toys have been sold as "secret spy communicators." There are often as many cryptograms as crossword puzzles in popular publications, because cryptology has long had its gamesters as well as those who employ it for deadly serious business.

Until the coming of the personal computer, the only crypto machines were kept in "black rooms" in government bureaus. But now the friendly CoCo puts a crypto machine within easy reach of everyone.

Would you believe that this innocuous little electronic wizard, not much larger than a portable typewriter, has more crypto power within its chips than the biggest and most expensive crypto machines of only four decades ago? And what's more, it has potentials for encoding and encipherment far surpassing those of the past: The CoCo can employ color, graphics, and yes, even audio in the encryption process.

The ASCII code used by most computers is a form of cryptography. Likewise, the International Morse Code used for radio communication is a simple substitution cipher using periods and dashes as symbols. There is so much coded information in communi-



System Requirements

4K RAM
Color Basic

cations channels today that cryptanalysts, those who make a profession or serious hobby of breaking ciphers and codes, have all levels of practice material available to them.

The challenge and the enjoyment of cryptology lies in pitting one's wits against persons who attempt to hide a communication within a garment of systematically scrambled letters. Within the bounds of rules that have become common knowledge, a cryptogram, or cipher, is usually created by one of two methods: substitution or transposition.

In the first instance, the message maker substitutes carefully chosen letters from a cryptic alphabet (that bears some prearranged relationship to the standard ABC. . . Z alphabet) for plaintext (the crypto name for plain language) letters.

In the second case, the order of appearance of plaintext letters is rearranged according to some systematic plan. Occasionally, encoders can also employ combinations of the two forms.

Codes are a different matter. These can take many forms, such as selecting a page and paragraph from a well-known book and indicating a certain word in that paragraph. Codes require that the originator and receiver possess the key to the coded message.

I will concentrate on ciphers rather than codes, but I'll look into the color and graphics potential that the CoCo offers for secret codes later.

Note that, by common consent, most cryptologists refer to ciphertext (enciphered plaintext, often printed in groups of five letters) as "code groups," even though, strictly speaking, these comprise a cipher system rather than a code system.

The Color Computer enables you to explore some very interesting ciphers, and eventually a few codes, such as those used by lodges and brotherhoods.

Simple, direct substitution ciphers are relatively easy to break without foreknowledge of the cipher key. Plain language has been subjected to intensive scrutiny over the years, and the letter frequencies and combinations that occur in average communication are well known.

For instance, in one careful study of a particular text, the order of frequency of letters was found to be, from highest to lowest, as follows:

ETAONISRHLDCUPFMWYBGVKQXJZ

Thus, by counting the frequency of the different letters in a cryptogram, you develop a wedge by which to enter the "shell" of the message. If, for instance, you substitute E for the code letter that occurs most frequently, chances are perhaps 2 to 1 that you have chosen the original plaintext letter, although T is sometimes more frequent than E.

Now look for two-letter word pat-

Program Listing 1

```
10 CLS :CLEAR 1000 :PRINT "BASIC
  CRYPTOLOGY PROGRAM"
20 PRINT "BY KARL ANDREASSEN, 1983."
  :PRINT
```

Listing continued

Listing continued

```
30 PRINT "PROGRAM WILL IGNORE
  PUNCTUATION OTHER THAN THE PERIOD."
40 PRINT "ENTER EITHER PLAINTEXT OR A
  CRYPTOGRAM ORIGINATED BY THIS
  PROGRAM." :PRINT
50 PRINT "TOUCH <*> TO END INPUT
  BEFORE 500TH LETTER." :PRINT
60 INPUT "WILL PRINTER BE ON LINE
  <Y/N>";P$
70 IF P$<>"Y" AND P$<>"N" THEN 60
80 DIM A(100),A$(100),B$(500)
90 FOR X=65 TO 90
100 A(X)=155-X :NEXT X :CLS
110 PRINT "BEGIN KEYBOARD INPUT: "
  :PRINT
120 Z$=INKEY$ :IF Z$="" THEN 120
130 PRINT Z$;
140 IF Z$="*" THEN 210
150 A=ASC(Z$) :B=A(A)
160 X=X+1 :B$(X)=CHR$(B) :IF Z$=" "
  THEN B$(X)=" "
170 IF ASC(Z$)=13 THEN B$(X)="/"
180 IF X>499 THEN GOSUB 210:END
190 IF P$="Y" THEN GOSUB260
200 GOTO 120
210 PRINT :FOR X=1 TO 500
220 IF B$(X) ="/" THEN PRINT
  CHR$(13); :B$(X)=""
230 PRINT B$(X); :NEXT X
240 IF P$="Y" THEN PRINT#-2, CHR$(13)
  ELSE END
250 END
260 PRINT#-2, CHR$(A(A));
270 IF Z$=" " THEN PRINT#-2,
  CHR$(32);
280 IF Z$="." THEN PRINT#-2,
  CHR$(46);
290 IF ASC(Z$)=13 THEN PRINT#-2,
  CHR$(13)
300 RETURN
```

```
GSVIV ZIV ULFI ZMW HRCGB DZBH
LU XLMHGIFXGRMT XIBKGL XRKSVIH ZMW VEVIB
HRMTOV LMV LU GSVN RH FHVUFO
DRGSRM XVIGZRM IVHGIRXGREV YLFMWH

GSV LMOB KVIUVXG XRKSVI RH LMV
GSZG WVOZBH RGH NVHHZTV ULI ZOO
VBVH VCXVKG GSV ZWWIVHHVV

AQJMH EPVQ ABHT PE IPIPAB AFBMT
AVS LFFO CFTSJMBSJPM RVJFS SP BUPJC
SJOOJMH PSGFQ OKBMSFQT
```

Fig. 1. Three Practice Cryptograms

terns, and then three-letter patterns. These follow highly restricted patterns that are often dead giveaways. For instance, how many pairs of two-letter words with the same initial letter make sense in English? How about the combination, "it is?" There's at least one other: "at an."

The longer a cryptic message, the better chance you have of cracking its secret. From this you can derive a basic maxim in cryptographic circles: Keep your message short!

Cryptographic machines have been used as aids in encrypting and deciphering messages for centuries, but until the advent of the modern computer, these machines were all subject to severe limitations. On one of the simplest machines, the cryptographer switches keycaps on an ordinary typewriter and uses "hunt and peck" to type the message. If a touch-typist trained on the old QWERTY keyboard tries to use the new, streamlined Dvorak Simplified Keyboard, an example of simple substitution cipher appears.

Computers themselves are problems in cryptology, in that privacy of data is not only desirable in many cases, but essential. An important specialty field exists, in which programmers also trained in cryptology try to make and break "unbreakable" systems adaptable to computer data.

There is another maxim: So far no one has invented an unbreakable cipher. Yet you cannot deny the existence of one or two cryptograms that have yet to be broken. This being the case, of what use is cryptology?

The idea is to *delay* compromise of your message until long after its content has any immediate value to anyone. To accomplish this, while at the same time making your cryptogram very easy to read by those with whom you share the key, is a challenge worthy of the best minds.

Basic Encipherment

You can substitute one alphabet for another quite readily with a computer program that prints the encoded message on paper and displays the same message in plain language on the screen, with or without the resulting cryptogram. The displayed message is impermanent, of course, since it will be lost when you turn the computer off.

In Program Listing 1, I prepared the key alphabet array A(x) (line 100) by inverting the ASCII number order of the alphabet with the FOR...NEXT loop (lines 90–100). Line 120 picks up the

plain-language message from the keyboard (in the case of using the program for encipherment), and line 130 prints it on the screen.

Each plain language letter generates its reciprocal by employing the A(x) array in line 150. Line 260 then prints out the information.

With translation complete, lines 210–230 run the ciphertext on the screen for examination, directly below the plaintext for easy comparison. You can end each line with enter (a carriage return) to prevent breaking a word at a point other than its end space. The PRINT#-2 in line 240 returns the print head to the beginning of the next line after the message is complete.

You can compare the two alphabets letter for letter by entering the normal-language alphabet (ABC...Z) instead of a message. Both alphabets appear on screen, one above the other. Because the alphabets are reciprocal, you can use the program without alteration for creating an enciphered message and for deciphering a cryptogram produced by this program. Thus, you can send your cryptogram to a friend who reads *HOT CoCo*, with a hint to CLOAD this program for convenient future use. Each of you can communicate in relatively secure secrecy with beautiful, ready-made crypto machines.

You can make variations on the inverted alphabet by changing the input to the array (lines 90 and 100). This offers the beginning cryptologist a challenge in altering program lines. However, like changing a combination lock, you must remember the key alphabet. Unless you carefully construct a fully reciprocal alphabet, your addressee will not be able to decipher the message.

A note of caution: Do not backspace and strike over letters when entering your message. The array records each key touched, so strikeovers can produce a garbled message. One or two small errors will not usually be serious, but too many can make deciphering hopeless. If you make serious mistakes, just hit break and start over with RUN.

Another caution: Be sure to answer the prompt (line 60) with N if you are not using a printer, or the program may crash. CSAVE the program as soon as you have it correctly entered. Then you won't have to reenter the program if it crashes.

Figure 1 presents three practice cryptograms. One of them will not respond to this program, because it has been composed using a different cipherkey alphabet. No computer program yet devised can replace the mind of a sharp cryptanalyst. Practice your skill at cracking this one message on your own. You will be more ready for the crypto aids that will be along in future issues of *HOT CoCo*.

Next month I'll explore more of the art and technology of cryptology with and for the CoCo.

You letters and suggestions are welcome, but I can acknowledge them only as space permits. I'll excerpt letters that best enlarge upon the themes under discussion and give the author credit. If you have thoughts on developing challenging cryptograms using color and graphics integral to the message, do send them in.

Lines to explore? Did you know that deep in the Amazon jungle there is an ancient stone labyrinth, upon which a ruthless old pegleg pirate wrote strange cryptic directions on reaching the spot where he had buried a huge sea locker full of doubloons...and the left sides of the maze walls are always green, and the right sides are red—or is it vice versa...?■

Send correspondence to Karl Andreassen, 24750 Chianti Road, Cloverdale, CA 95425.

⌐See List of Advertisers on page 130

BY JOHN G. SKORA

INVERTED VIDEO MODIFICATION

Are you tired of your Color Computer's text video display? Wouldn't it be nice to have light characters on a dark background instead of the eye-fatiguing dark characters on a light background?

There are two methods to solve the problem. One method doesn't differentiate between upper- and lowercase characters: All are inverted to light characters on a dark background. The more difficult method inverts uppercase characters to light characters on a dark background and lowercase characters to dark characters on a light background, making it easy to distinguish between the two. Neither modification affects the computer's full-graphics modes of operation.

Reading the CoCo's text display can be tiring, but these modifications can soothe your eyes.

The Easy Method

The fastest and simplest modification requires you to lift only one pin of an integrated circuit (IC). Here's what to do:

1) Make sure that the computer is unplugged.
2) Turn it over and remove the screws holding the top on. (Doing so will void your warranty if it hasn't already expired.)
3) Carefully turn the computer back over and remove the top. Then look for the RF shield, which will be a large aluminum cover. Remove it by prying up its edges with a small screwdriver.
4) Look in the area just uncovered for IC U7. It has 40 pins, and it is an MC6847 (see Fig. 1).
5) Again using a small screwdriver or IC puller, carefully remove IC U7 by gently rocking it back and forth. Make sure it comes out evenly so that you do not bend any pins.
6) Take the removed IC and bend pin 32 90 degrees so that it points out from the IC (see Fig. 1).
7) Replace the IC by pushing it back in smoothly and evenly, making sure that all the pins except pin 32 enter the socket properly. Make sure that pin 1 is properly oriented.
8) Replace the RF shield and the computer cover.

You will probably have to adjust the brightness and contrast of your picture for the best readability, but otherwise your inverted video is ready for use.

The More Difficult Method

The second method involves a little more work, but the added benefit is inverted lowercase (the lowercase letters are dark) and normal uppercase. Here is how it is done:

1) Follow steps 1–7 in the directions above.
2) Find IC U29 and carefully remove it.
3) Bend pins 1, 2, and 3 on IC U29 at 90-degree angles.
4) Connect IC U29 pin 16 to IC U29 pin 3 with a small piece of insulated wire.
5) Connect IC U7 pin 2 to IC U29 pin 2 with another piece of wire.
6) Connect IC U29 pin 1 to IC U7 pin 32 with a third piece of wire.
7) Replace the RF shield and the computer cover.

This modification gives a complete inverted video. It will not affect full high-resolution graphics and can be easily reversed. You could also install a switch in the circuit for easy conversion from inverted to normal video. ■

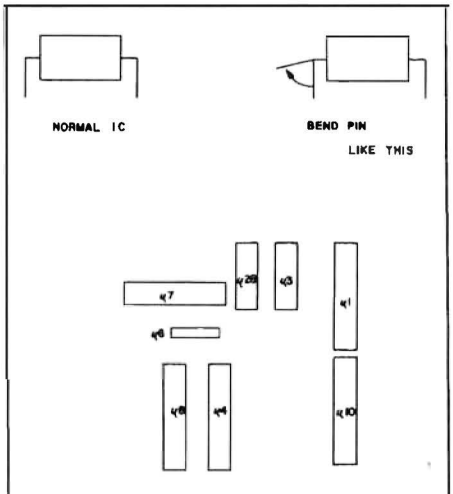


Fig. 1. CoCo Integrated Circuit Layout

System Requirements

Any Color Computer

Write John Skora at 55 Randall Road, Shoreham, NY 11786.

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BY WILLIAM MCARTHUR

LINKAGE EDITOR

Hooking up those Assembly subroutines to your Basic programs is easier with this nifty utility.

Shortly after I purchased the EDTASM+ cartridge for my Color Computer, I realized that there was a missing link(age) in my personal program development process. Linkage (Program Listing 3) is useful for linking a machine-language subroutine residing on an object (CLOADM) tape with a Basic program. The program may already reside on a source (CLOAD) tape or may be written around the machine-language subroutine. To illustrate the use of the linkage editor, let's look at the development process.

The Objective

Last summer, my son and I wrote Cantmiss (can't miss tie fighter), an arcade-type game program that illustrates the use of GET and PUT, graphics page flipping, and joystick manipulation of graphics screens.

I felt that a natural place to insert a slight speed-up in the program would be the lines shown in Program Listing 1. The variables XX and YY represent the horizontal and vertical coordinates of the upper left corner of the tie-fighter design. Lines 16 and 17 check the joystick and increment or decrement XX and YY, while ensuring that the image remains within the display screen. The variable PA represents the current graphics page and flip-flops between 1 and 5.

The objective was to replace lines 16–18 with a call to a machine-language subroutine.

The Machine-Language Subroutine

The machine-language subroutine appears as Program Listing 2. For efficiency, I decided to have the machine-language subroutine operate directly on the Basic program's variables XX, YY, and PA. The VARPTR function of Basic allows access of Basic variables, so the subroutine provides 2 bytes for the address of each variable. These locations in the subroutine are labeled XX, YY, and PA, and the subroutine assumes that the appropriate addresses reside therein at call time.

Things are complicated slightly because numeric variables in Extended Color Basic are stored as single-precision numbers in exponent-mantissa form. This means that you can't just add 4 to some byte of the stored value to increment the value by 4.

To see what I was dealing with, I printed a small table of selected numbers in their exponent-mantissa form. A few of the values follow:

Number	Stored Value
1	80 00 00 00 00
2	81 00 00 00 00
3	82 40 00 00 00
65	87 20 00 00 00
255	88 7F 00 00 00

The next step was to write a subroutine to convert a 2-byte exponent-mantissa value into a single-byte binary value. The routine that I wrote appears in Program Listing 2 as GETBYT and assumes that the D register contains the exponent-mantissa value and supplies the single-byte result in the B register. I used the in-memory assembly option of EDTASM+ to test this routine independently.

I then wrote the companion subrou-

```
16 IF JOYSTK(0)<32ANDXX>=6 THEN XX=XX-4ELSE IF XX<=210 THEN XX=X
X+4
17 IF JOYSTK(1)<32ANDYY>=6THENYY=YY-4ELSE IF YY<=160 THEN YY=YY+
4
18 IF PA=1 THEN PA=5 ELSE PA=1
```

Program Listing 1. Lines to Speed Up Program Listing 3

System Requirements

16K RAM
Extended Color Basic
Editor/Assembler

tine, GETWRD, which accepts a single-byte value in the B register and returns the exponent-mantissa value in the D register.

I discovered two things of note. First, the joystick pot value locations that I used are for the left joystick (not the right, as I expected), and I found that the up/down and left/right locations were the reverse of what I had expected. Second, when a single-byte value is greater than 127, I encountered a slight difficulty with the 2-byte value's complement representation, under which the number is interpreted as negative.

I used Program Listing 4 to test my routine. To prepare this program, however, I relied on the linkage editor.

The Linkage Editor

The linkage editor (Program Listing 3) assumes that the user has an object cassette (CLOADM) produced by EDTASM+ or some equivalent mechanism and that the user knows how many bytes there are in the machine code. The editor also assumes that the machine code will reside in memory at or above location &H3F00. This last assumption can be modified by changes to program lines 1 and 89, which should also be modified to allocate more or less string space.

In lines 1–5, the editor announces itself, asks you to get the object cassette ready, and causes the object cassette to be loaded into memory. In line 6, the user is told to rerun the editor, which automatically deletes lines 1–6, causing the program to stop.

Lines 10–41 are dummy DATA statements, which will ultimately represent the machine code. As is, there is space for 256 bytes of machine code; add more DATA statements if this is insufficient.

Line 89 is the actual beginning of the second pass of the editor. Lines 90 and 91 await the string representation of the starting address of the machine code and the length of the machine code, respectively. Line 100 readies the array D$ for the binary-to-hexadecimal conversion process.

Lines 148–164 capture the starting address of the machine code from memory locations 157–158 and establish the address in line 90. Lines 165–176 query the user for the byte count of the machine code (use the prefix &H when entering this value in hexadecimal) and establish the length in line 91.

Lines 180–300 capture the machine code in hexadecimal form, putting it into the DATA statements. The hexadecimal values are also displayed on

Program Listing 2. Machine-Language Subroutine

```
3F00                00010          ORG     $3F00
3F00 AD  9F A00A    00020 START    JSR     ($A00A)  SAMPLE JYSTKS
3F04 86  20         00030          LDA     #$20     UP/DOWN
3F06 B1  015D       00040          CMPA    $015D              <32?
3F09 2E  48         00050          BGT     DECYY    YEP!
3F0B EC  9F 3FA9    00060          LDD     (YY)     GET YY VALUE
3F0F BD  3F99       00070          JSR     GETBYT   CONV TO INTEGR
3F12 C5  80         00080          BITB    #$80     YY>127?
3F14 27  04         00090          BEQ     GOON1    NOPE!
3F16 C1  A0         00100          CMPB    #160     YY>160?
3F18 2E  09         00110          BGT     TRYXX    YEP!
3F1A CB  04         00120 GOON1    ADDB    #04      YY<--YY+4
3F1C BD  3F89       00130          JSR     GETWRD   CONV TO SINGLE
                                                    PRECISION
3F1F ED  9F 3FA9    00140          STD     (YY)     PUT BACK IN YY
3F23 86  20         00150 TRYXX    LDA     #$20     LEFT/RIGHT
3F25 B1  015C       00160          CMPA    $015C              <32?
3F28 2E  44         00170          BGT     DECXX    NOPE!
3F2A EC  9F 3FA7    00180          LDD     (XX)     GET XX VALUE
3F2E BD  3F99       00190          JSR     GETBYT   CONV TO INTEGR
3F31 C5  80         00200          BITB    #$80     XX>127?
3F33 27  04         00210          BEQ     GOON2    NOPE!
3F35 C1  D2         00220          CMPB    #210     XX>210?
3F37 2E  09         00230          BGT     DOPA     YEP!
3F39 CB  04         00240 GOON2    ADDB    #04      XX<--XX+4
3F3B BD  3F89       00250          JSR     GETWRD   CONV TO SINGLE
                                                    PRECISION
3F3E ED  9F 3FA7    00260          STD     (XX)     PUT BACK IN XX
3F42 EC  9F 3FAB    00270 DOPA     LDD     (PA)     GET PA VALUE
3F46 BD  3F99       00280          JSR     GETBYT   CONV TO INTEGR
3F49 C8  04         00290          EORB    #4       EXCHNG 5 WTH 1
3F4B BD  3F89       00300          JSR     GETWRD   CONV TO SINGLE
                                                    PRECISION
3F4E ED  9F 3FAB    00310          STD     (PA)     PUT BACK IN PA
3F52 39             00320          RTS              RET TO BAS DRV
3F53 EC  9F 3FA9    00330 DECYY    LDD     (YY)     GET YY VALUE
3F57 BD  3F99       00340          JSR     GETBYT   CONV TO INTEGR
3F5A C5  80         00350          BITB    #$80     YY>127?
3F5C 26  04         00360          BNE     GOON3    YEP!
3F5E C1  06         00370          CMPB    #6       YY<6?
3F60 2D  C1         00380          BLT     TRYXX    YEP!
3F62 C0  04         00390 GOON3    SUBB    #4       YY<--YY-4
3F64 BD  3F89       00400          JSR     GETWRD   CONV TO SINGLE
                                                    PRECISION
3F67 ED  9F 3FA9    00410          STD     (YY)     PUT BACK IN YY
3F6B 7E  3F23       00420          JMP     TRYXX    NOW CHECK XX
3F6E EC  9F 3FA7    00430 DECXX    LDD     (XX)     GET XX VALUE
3F72 BD  3F99       00440          JSR     GETBYT   CONV TO INTEGR
3F75 C5  80         00450          BITB    #$80     XX>127?
3F77 26  04         00460          BNE     GOON4    YEP!
3F79 C1  06         00470          CMPB    #6       XX<6?
3F7B 2D  C5         00480          BLT     DOPA     YEP!
3F7D C0  04         00490 GOON4    SUBB    #4       XX<--XX-4
3F7F BD  3F89       00500          JSR     GETWRD   CONV TO SINGLE
                                                    PRECISION
3F82 ED  9F 3FA7    00510          STD     (XX)     PUT BACK IN XX
3F86 7E  3F42       00520          JMP     DOPA     TAKE CAR OF PA
                    00521 **************************
                    00522 **  CONVERT TO SINGLE   **
                    00523 **       PRECISION      **
                    00524 **                      **
                    00525 ** INPUT:B HAS INTEGER **
                    00526 ** OUTPUT: D HAS REAL  **
                    00527 **                      **
                    00528 **************************
3F89 86  08         00530 GETWRD LDA     #$08     START WITH A=8
3F8B C5  80         00540 SHIFT2 BITB    #$80     IS HIGH-ORDER
                                                    BIT SET IN B?
3F8D 2D  05         00550          BLT     OUT2     YES, GET OUT
3F8F 58             00560          LSLB             SHFT B TO LFT
3F90 4A             00570          DECA             A<--A-1
3F91 7E  3F8B       00580          JMP     SHIFT2   KEEP ON SHFTN'
3F94 C4  7F         00590 OUT2     ANDB    #$7F     STRIP HI-ORDER
                                                    BIT
3F96 8A  80         00600          ORA     #$80     SET HI-ORDER
                                                    BIT OF EXP
3F98 39             00610          RTS              RET W/SINGLE
                                                    PRECISION
                    00611 **************************
                    00612 **                      **
                    00613 **  CONVERT TO INTEGER  **
                    00614 **                      **
                    00615 ** INPUT: D HAS REAL    **
                    00616 ** OUTPUT:B HAS INTEGER **
                    00617 **                      **
                    00618 **************************
3F99 84  7F         00620 GETBYT ANDA    #$7F     STRIP HI-ORDER
```

Listing continued

Listing continued

```
                                                    BIT OF EXP
3F9B CA  80       00630          ORB     #$80       SET HI-ORDER
                                                    BIT OF FRCTION
3F9D 81  08       00640 SHIFT1   CMPA    #$8        IS EXP=8?
3F9F 2C  05       00650          BGE     OUT1       YES, GET OUT
3FA1 54           00660          LSRB               SHFT B TO RGHT
3FA2 4C           00670          INCA               A<--A+1
3FA3 7E  3F9D     00680          JMP     SHIFT1     KEEP ON SHFTN'
3FA6 39           00690 OUT1     RTS                RET W/INTEGER
3FA7              00700 XX       RMB     $02        ADDRESS OF XX
                                                    IN BASIC DRIV
3FA9              00710 YY       RMB     $02        ADDRESS OF YY
                                                    IN BASIC DRIV
3FAB              00720 PA       RMB     $02        ADDRESS OF PA
                                                    IN BASIC DRIV
          0000    00730          END     START
00000 TOTAL ERRORS

DECXX    3F6E  | GOON1    3F1A  | OUT2     3F94  | TRYXX    3F23
DECYY    3F53  | GOON2    3F39  | PA       3FAB  | XX       3FA7
DOPA     3F42  | GOON3    3F62  | SHIFT1   3F9D  | YY       3FA9
GETBYT   3F99  | GOON4    3F7D  | SHIFT2   3F8B  |
GETWRD   3F89  | OUT1     3FA6  | START    3F00  |
```

Program Listing 3. The Linkage Editor

```
1 CLEAR 200,&H3F00
2 CLS:PRINT:PRINT TAB(9);"linkage editor":PRINT
3 PRINT TAB(3);"READY OBJECT CASSETTE"
4 PRINT TAB(3);"HIT <ENTER> WHEN READY":INPUT A$
5 CLOADM
6 CLS:PRINT"TYPE 'RUN' WHEN READY":DEL 1-6
10 DATA 00,00,00,00,00,00,00,00
11 DATA 00,00,00,00,00,00,00,00
12 DATA 00,00,00,00,00,00,00,00
13 DATA 00,00,00,00,00,00,00,00
```

Listing continued

the screen. Line 303 tells the user to proceed in the development process, and line 305 deletes the code of the linkage editor. The remainder becomes the kernel of the Basic driver program.

The Basic Driver

The Basic driver for the Cantmiss subroutine is shown as Program Listing 4. Lines 350–430 are the only lines that the linkage editor did not supply. Line 320 places the starting location of the machine code (assumed to be the entry point, by the way) into memory locations 157 and 158 so that entering EXEC calls the machine-language routine.

Lines 330–340 place the machine code into memory at run time. Line 345 deletes the DATA statements and the memory-loading logic to reduce the overhead. This line is optional if memory space is not a problem, but in the case of Cantmiss, it is an essential step.

Mission Accomplished

Program Listing 5 shows the finished product—the Cantmiss program linked with the machine-language subroutine. This program will not run with lines 330–450 in place, so they should not be

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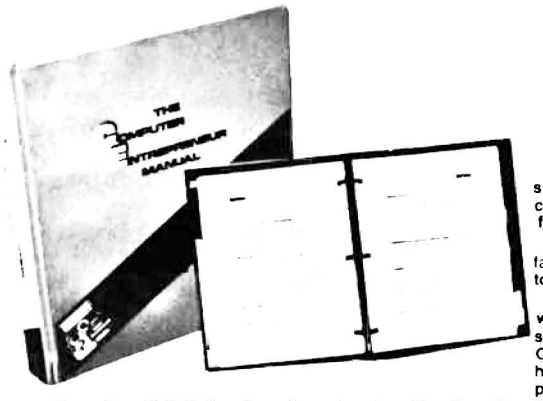

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considered part of the program. The first statement of line 250 calls the machine code.

I used EDTASM+ to merge the original Cantmiss renumbered to 100 and above and the result of the linkage editor. Both Basic programs were CSAVEd with the ,A option to be compatible with EDTASM+. The merge capabilities of EDTASM+ came as a pleasant surprise to me and provided the last step in the development of the revised Cantmiss program.

The scenario for Cantmiss is that the user has control of an enemy tie fighter that he can manipulate via the left joystick. The enemy ship continually fires its laser cannon at the user's base, but the base is invisible and invulnerable. At any time, the fire button on the joystick will blast the enemy out of space; an equally hapless enemy ship will replace the one just destroyed. ■

Address correspondence to William McArthur, Dept. of Mathematics and Computer Science, Shippensburg State College, Shippensburg, PA 17257.

Listing continued

```
 14 DATA 00,00,00,00,00,00,00,00
 15 DATA 00,00,00,00,00,00,00,00
 16 DATA 00,00,00,00,00,00,00,00
 17 DATA 00,00,00,00,00,00,00,00
 18 DATA 00,00,00,00,00,00,00,00
 19 DATA 00,00,00,00,00,00,00,00
 20 DATA 00,00,00,00,00,00,00,00
 21 DATA 00,00,00,00,00,00,00,00
 22 DATA 00,00,00,00,00,00,00,00
 23 DATA 00,00,00,00,00,00,00,00
 24 DATA 00,00,00,00,00,00,00,00
 25 DATA 00,00,00,00,00,00,00,00
 26 DATA 00,00,00,00,00,00,00,00
 27 DATA 00,00,00,00,00,00,00,00
 28 DATA 00,00,00,00,00,00,00,00
 29 DATA 00,00,00,00,00,00,00,00
 30 DATA 00,00,00,00,00,00,00,00
 31 DATA 00,00,00,00,00,00,00,00
 32 DATA 00,00,00,00,00,00,00,00
 33 DATA 00,00,00,00,00,00,00,00
 34 DATA 00,00,00,00,00,00,00,00
 35 DATA 00,00,00,00,00,00,00,00
 36 DATA 00,00,00,00,00,00,00,00
 37 DATA 00,00,00,00,00,00,00,00
 38 DATA 00,00,00,00,00,00,00,00
 39 DATA 00,00,00,00,00,00,00,00
 40 DATA 00,00,00,00,00,00,00,00
 41 DATA 00,00,00,00,00,00,00,00
 42 '*****************************
 43 '**                         **
 44 '**     LINKAGE EDITOR      **
 45 '**                         **
 46 '**  WRITTEN BY:            **
 47 '**   william g. mcarthur   **
 48 '**      NOVEMBER  1982     **
 49 '**                         **
 50 '*****************************
 89 CLEAR 200,&H3F00
 90 ST$="????"
 91 LN$="????"
100 DIM D$(16):D$(0)="0":D$(1)="1":D$(2)="2":D$(3)="3":D$(4)="4"
:D$(5)="5":D$(6)="6":D$(7)="7":D$(8)="8":D$(9)="9":D$(10)="A":D$
(11)="B":D$(12)="C":D$(13)="D":D$(14)="E":D$(15)="F"
110 CLS
120 PRINT
130 PRINT TAB(9);"linkage editor"
148 SS=VARPTR(ST$):SL=VARPTR(LN$)
150 SA=256*PEEK(SS+2)+PEEK(SS+3)
152 LA=256*PEEK(SL+2)+PEEK(SL+3)
154 XX=PEEK(157)
156 LL=INT(XX/16):RR=XX-16*LL
158 POKE SA,ASC(D$(LL)):POKE SA+1,ASC(D$(RR))
160 XX=PEEK(158)
162 LL=INT(XX/16):RR=XX-16*LL
164 POKE SA+2,ASC(D$(LL)):POKE SA+3,ASC(D$(RR))
165 INPUT"HOW MANY BYTES OF CODE";BY$:BY=VAL(BY$)
166 XX=INT(BY/256)
168 LL=INT(XX/16):RR=XX-16*LL
170 POKE LA,ASC(D$(LL)):POKE LA+1,ASC(D$(RR))
172 XX=BY-256*XX
174 LL=INT(XX/16):RR=XX-16*LL
176 POKE LA+2,ASC(D$(LL)):POKE LA+3,ASC(D$(RR))
180 AD=PEEK(25)*256+PEEK(24)-19
185 ST=VAL("&H"+ST$):EN=ST+VAL("&H"+LN$)
190 FOR I=ST TO EN STEP 8
200 FOR J=0 TO 7
210 XX=PEEK(I+J)
220 LL=INT(XX/16)
230 RR=XX-16*LL
240 POKE AD,ASC(D$(LL))
250 POKE AD+1,ASC(D$(RR))
260 PRINT @ 140,D$(LL);D$(RR);
270 AD=AD+3
280 NEXT J
290 AD=AD+6
300 NEXT I
303 CLS:PRINT"NOW COMPLETE BASIC DRIVER"
305 DEL 100-305
315 ST=VAL("&H"+ST$):EN=ST+VAL("&H"+LN$)
320 POKE 157,VAL("&H"+MID$(ST$,1,2)):POKE 158,VAL("&H"+MID$(ST$,
3,2))
330 FOR I=ST TO EN
335 CLS:PRINT"LOADING M/L"
340 READ A$:POKE I,VAL("&H"+A$):NEXT I
345 CLS:PRINT"TYPE 'RUN' WHEN READY":DEL 10-345
349 '*****************************
350 '*** START BASIC DRIVER HERE
351 '*****************************
352 'TO CALL ROUTINE, USE EXEC
```

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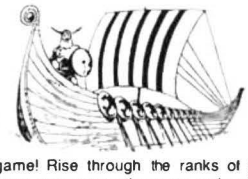

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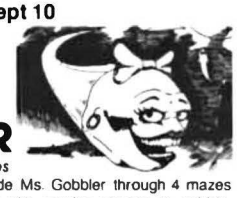

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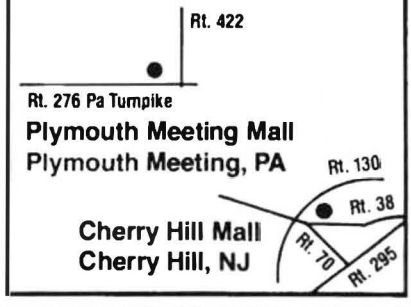

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Program Listing 4. Basic Driver for the Cantmiss Subroutine

```
10 DATA AD,9F,A0,0A,86,20,B1,01
11 DATA 5D,2E,48,EC,9F,3F,A9,BD
12 DATA 3F,99,C5,80,27,04,C1,A0
13 DATA 2E,09,CB,04,BD,3F,89,ED
14 DATA 9F,3F,A9,86,20,B1,01,5C
15 DATA 2E,44,EC,9F,3F,A7,BD,3F
16 DATA 99,C5,80,27,04,C1,D2,2E
17 DATA 09,CB,04,BD,3F,89,ED,9F
18 DATA 3F,A7,EC,9F,3F,AB,BD,3F
19 DATA 99,C8,04,BD,3F,89,ED,9F
20 DATA 3F,AB,39,EC,9F,3F,A9,BD
21 DATA 3F,99,C5,80,26,04,C1,06
22 DATA 2D,C1,C0,04,BD,3F,89,ED
23 DATA 9F,3F,A9,7E,3F,23,EC,9F
24 DATA 3F,A7,BD,3F,99,C5,80,26
25 DATA 04,C1,06,2D,C5,C0,04,BD
26 DATA 3F,89,ED,9F,3F,A7,7E,3F
27 DATA 42,86,08,C5,80,2D,05,58
28 DATA 4A,7E,3F,8B,C4,7F,8A,80
29 DATA 39,84,7F,CA,80,81,08,2C
30 DATA 05,54,4C,7E,3F,9D,39,FF
31 DATA FF,FF,FF,FF,FF,FF,FF,FF
32 DATA 00,00,00,00,00,00,00,00
33 DATA 00,00,00,00,00,00,00,00
34 DATA 00,00,00,00,00,00,00,00
35 DATA 00,00,00,00,00,00,00,00
36 DATA 00,00,00,00,00,00,00,00
37 DATA 00,00,00,00,00,00,00,00
38 DATA 00,00,00,00,00,00,00,00
39 DATA 00,00,00,00,00,00,00,00
40 DATA 00,00,00,00,00,00,00,00
41 DATA 00,00,00,00,00,00,00,00
42 '*****************************
43 '**                         **
44 '**     LINKAGE EDITOR      **
45 '**                         **
46 '**  WRITTEN BY:            **
47 '**   william g. mcarthur   **
48 '**      NOVEMBER  1982     **
49 '**                         **
50 '*****************************
89 CLEAR 200,&H3F00
90 ST$="3F00"
91 LN$="00AD"
315 ST=VAL("&H"+ST$):EN=ST+VAL("&H"+LN$)
320 POKE 157,VAL("&H"+MID$(ST$,1,2)):POKE 158,VAL("&H"+MID$(ST$,
3,2))
330 FOR I=ST TO EN
335 CLS:PRINT"LOADING M/L"
340 READ A$:POKE I,VAL("&H"+A$):NEXT I
345 CLS:PRINT"TYPE 'RUN' WHEN READY":DEL 10-345
350 XX=128:YY=94:PA=1
360 XA=VARPTR(XX):XB=INT(XA/256):XC=XA-256*XB:POKE &H3FA7,XB:POK
E &H3FA8,XC
370 XA=VARPTR(YY):XB=INT(XA/256):XC=XA-256*XB:POKE &H3FA9,XB:POK
E &H3FAA,XC
380 XA=VARPTR(PA):XB=INT(XA/256):XC=XA-256*XB:POKE &H3FAB,XB:POK
E &H3FAC,XC
```

Listing continued

Listing continued

```
390 CLS
400 PRINT "XX =";XX;" YY =";YY;" PA =";PA
410 EXEC
420 FOR I=1 TO 50:NEXT I
430 GOTO 400
```

Program Listing 5. Cantmiss Linked with the Machine-Language Subroutine

```
5 CLEAR 200,&H3F00:PCLEAR 8
10 DATA AD,9F,A0,0A,86,20,B1,01
11 DATA 5D,2E,48,EC,9F,3F,A9,BD
12 DATA 3F,99,C5,80,27,04,C1,A0
13 DATA 2E,09,CB,04,BD,3F,89,ED
14 DATA 9F,3F,A9,86,20,B1,01,5C
15 DATA 2E,44,EC,9F,3F,A7,BD,3F
16 DATA 99,C5,80,27,04,C1,D2,2E
17 DATA 09,CB,04,BD,3F,89,ED,9F
18 DATA 3F,A7,EC,9F,3F,AB,BD,3F
19 DATA 99,C8,04,BD,3F,89,ED,9F
20 DATA 3F,AB,39,EC,9F,3F,A9,BD
21 DATA 3F,99,C5,80,26,04,C1,06
22 DATA 2D,C1,C0,04,BD,3F,89,ED
23 DATA 9F,3F,A9,7E,3F,23,EC,9F
24 DATA 3F,A7,BD,3F,99,C5,80,26
25 DATA 04,C1,06,2D,C5,C0,04,BD
26 DATA 3F,89,ED,9F,3F,A7,7E,3F
27 DATA 42,86,08,C5,80,2D,05,58
28 DATA 4A,7E,3F,8B,C4,7F,8A,80
29 DATA 39,84,7F,CA,80,81,08,2C
30 DATA 05,54,4C,7E,3F,9D,39,FF
31 DATA FF,FF,FF,FF,FF,FF,FF,FF
33 ST$="3F00"
34 LN$="00AD"
35 ST=VAL("&H"+ST$):EN=ST+VAL("&H"+LN$)
36 POKE 157,VAL("&H"+MID$(ST$,1,2)):POKE 158,VAL("&H"+MID$(ST$,3
,2))
37 FOR I=ST TO EN
38 CLS:PRINT"LOADING M/L"
39 READ A$:POKE I,VAL("&H"+A$):NEXT I
40 CLS:PRINT"TYPE 'RUN' WHEN READY":DEL 5-40
41 XX=128:YY=94:PA=1
42 XA=VARPTR(XX):XB=INT(XA/256):XC=XA-256*XB:POKE &H3FA7,XB:POKE
 &H3FA8,XC
43 XA=VARPTR(YY):XB=INT(XA/256):XC=XA-256*XB:POKE &H3FA9,XB:POKE
 &H3FAA,XC
44 XA=VARPTR(PA):XB=INT(XA/256):XC=XA-256*XB:POKE &H3FAB,XB:POKE
 &H3FAC,XC
110 POKE 65495,0:XA=RND(-TIMER):DIM TY(16):DIM TZ(16):PMODE 3,1:
PCLS
120 A$="O1L250GBCADV10L200BCCGAA"
130 A$=A$+A$+"L100C"
140 B$="O5L150BACGGA"
150 DRAW"BM10,10D20R6U8R16D8R6U20L6D8L16U8L6"
160 PAINT (24,20),2,4
170 PAINT(12,12),3,4
180 CIRCLE(24,20),6
```

Listing continued

Listing continued

```
190 FORI=-1TO1:FORJ=-1TO1:PSET(24+I,20+J,6):NEXTJ,I
200 GET (10,10)-(40,30),TY,G
210 FOR I=1 TO 20:LINE(RND(31)+9,RND(21)+9)-(RND(31)+9,RND(21)+9
),,PSET:NEXT I:GET(10,10)-(40,30),T2,G
220 PCLS
230 SCREEN 1,1
250 EXEC:PMODE 3,PA:PCLS:PUT(XX,YY)-(XX+30,YY+20),TY,PSET:SCREEN
 1,1
260 IF RND(8)=1 THEN COLOR 6,5:SX=RND(256)-1:SY=RND(192)-1:LINE(
XX+14,YY+10)-(SX,SY),PSET:COLOR 8,5:PLAY B$
270 IF PEEK(65280)=125 OR PEEK(65280)=253 THEN 280 ELSE 250
280 LINE (128,191)-(XX+14,YY+10),PSET
290 PUT(XX,YY)-(XX+30,YY+20),T2,PRESET
300 POKE 65494,0:PLAY A$
310 PCLS:FOR I=1 TO 500:NEXT I
320 POKE 65495,0:GOTO 220
330 REM**********************
340 REM*                    *
350 REM*  CAN'T MISS FIGHTER *
360 REM*                    *
370 REM*  WILLIAM G. MCARTHUR *
380 REM*       (& SON)      *
390 REM*                    *
400 REM*     JULY  1982     *
410 REM*                    *
420 REM*  MACHINE CODE ADDED *
430 REM*    NOVEMBER 1982   *
440 REM*                    *
450 REM**********************
```


↙See List of Advertisers on page 130

BY TOMAS ROKICKI

GIVE YOUR COMPUTER SOME CHARACTER

One of the major problems with the Color Computer is its alphanumeric display. Sixteen lines of 32 characters each are just not enough for serious software development, even in Basic. Word processing is next to impossible with inverse video for lowercase. To correct these problems, I wrote a program that will generate the full ASCII character set on a high-resolution graphics screen.

The full ASCII character set is now available for graphics displays on a high-resolution screen.

Advantages

Using this modification has several advantages. The most obvious is the availability of additional characters. Twenty-four lines of 42 characters each are sufficient for most Basic software development, and having that many makes developing Assembly-language programs much easier. The lowercase capability allows word-processing applications (although most word processors for the Color Computer already have a similar modification included).

The full ASCII character set is another advantage. This allows use of the Color Computer with professional operating systems such as FLEX or OS-9. It also enhances the terminal-emulation possibilities.

Because the characters are generated on a high-resolution character screen, mixed graphics and text are quite easy to implement in Basic and Assembly language. Adventure games using a technique similar to Apple's mixed mode become simple, and labeling graphs and graphics is tremendously simplified.

The modification is almost totally compatible with Basic. It is "transparent"—i.e., Basic talks to the screen just as before. Most machine-language routines that use Basic's input/output routines will also work quite well with this program.

The character set can be modified and expanded. I have defined the 96 ASCII characters, plus one cursor character, but you can modify each character individually and add up to 128 characters of your own.

The memory for the display screen can be located anywhere in memory. This program is ideal for 64K systems, in which the text screen can be moved into high memory. Also, the number of lines the program will display is continuously variable from 1 to 24 with a regular display and more than 24 with a 24-line window-type display. This allows hardware scrolling—make the display 64 lines long, and just move the window. Of course, once you hit the bottom, you must scroll, but only once. Instead of scrolling for each line, you end up scrolling for every (64–24) or 40 lines.

You can also develop graphics without switching back and forth between graphics and alpha displays. Just limit your graphics to the top five-sixths of the screen and use the bottom sixth as four alphanumeric lines. Then type the commands from Basic until the screen looks the way you want it to.

This software modification requires no hardware modification. It will work with black-and-white and color televisions. The code can be relocated in ROM, so if you have burned new ROMs for your system, you can place this routine in one of the high-memory ROMs.

The modification can also be loaded into a 16K, 32K, or 64K computer. The Program Listing is for a 32K machine. To relocate it, just change the origin and end addresses. The object code will be the same in any case.

Disadvantages

Along with the many advantages, the program has several disadvantages. First, most software will have to be modified to use this screen. The POS,

System Requirements

32K RAM (modifiable to 16K)
Editor/Assembler

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$30.95 DISK

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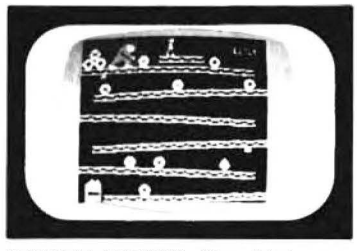

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32K Machine Language
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$29.95 disk

ARCADE ACTION - How high can you climb? Four full graphic screens. Exciting Sound - Realistic graphics. Never before has the color computer seen a game like this. Early reviews say: Just like the arcade - Simply outstanding!

NEW

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By KEN KALISH
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The "Pitfalls" in this game are many. Hidden treasures, jump over the pits, swing on the vine, watch out for alligators, beware of the scorpion. Another game for the Color Computer with the same high resolution graphics as "The King."

16K MACHINE LANGUAGE
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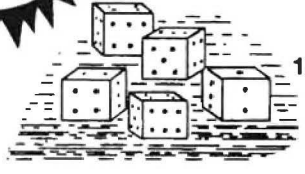
DISK $30.95

NEW

"YAAZEE"

(C) 1983

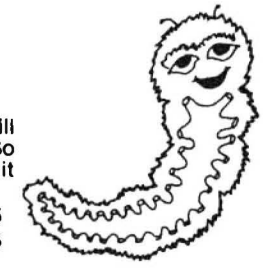


$19.95

16K MACHINE LANGUAGE
EXT. BASIC

Yaazee is a 2 player game using five dice to get the best poker hand. After game is loaded flashing digit below player number determines which player rolls dice at the start of the game.

KATERPILLAR ATTACK



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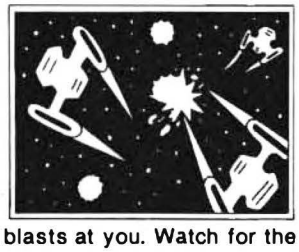

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Program Listing. Custom Character Generator

```
                        00100 ************************************************************
                        00110 *                                                          *
                        00120 *  THIS PROGRAM WILL ALLOW THE COLOR COMPUTER TO DISPLAY    *
                        00130 * 24 LINES OF 42 CHARACTERS WITH THE COMPLETE ASCII        *
                        00140 * CHARACTER SET, INCLUDING LOWER CASE.  IT USES A HIGH     *
                        00150 * RESOLUTION GRAPHICS SCREEN, AND WILL THEREFORE ALLOW    *
                        00160 * MIXED GRAPHICS AND TEXT.  PORTIONS OF A PAGE MAY ALSO   *
                        00170 * BE USED, AS IN THE APPLE MIXED TEXT/GRAPHICS MODE.      *
                        00180 * IT IS FULLY RELOCATEABLE SO IT CAN BE LOADED ANYWHERE   *
                        00190 * IN MEMORY AND USED ON 16K, 32K, OR EVEN 64K MACHINES.   *
                        00200 *                                                          *
                        00210 *  WRITTEN BY TOMAS ROKICKI  TEXAS A&M UNIVERSITY         *
                        00220 *          BOX 258  COLLEGE STATION, TX  77841            *
                        00230 *                                                          *
                        00240 ************************************************************
                        00250
           0000         00260 MSK      EQU     0               SOME STACK VARIABLES
           0001         00270 CMSK     EQU     1
           0168         00280 VECTR1   EQU     $168            THIS IS THE CHROUT VECTOR I CHANGE
           016B         00290 VECTR2   EQU     $16B            THIS IS THE CHRIN VECTOR I MODIFY
                        00300
00F3                    00310          ORG     $F3             FREE SPACE IN DIRECT PAGE
                        00320 *
                        00330 *  THESE BYTES MAY BE MODIFIED BY BASIC POKES TO EMULATE
                        00340 *  PRINT@ AND TAB.  A PEEK TO H WILL GIVE YOU THE CURRENT
                        00350 *  CURSOR POSITION.
                        00360 *
00F3                    00370 H        RMB     1               HORIZONTAL POSITION (0-41)
00F4                    00380 V        RMB     1               VERTICAL POSITION (0-23)
                        00390 *
                        00400 *  THESE CAN BE CHANGED BY THE USER TO POINT TO ANYWHERE
                        00410 *  IN DYNAMIC MEMORY.  CALL START2 IMMEDIATELY AFTER YOU
                        00420 *  CHANGE THEM, HOWEVER!!
                        00430 *
00F5                    00440 DSET     RMB     1               SAM INITIALIZATION VARIABLE
00F6                    00450 SBEG     RMB     2               START OF TEXT PAGE
00F8                    00460 SEND     RMB     2               END OF TEXT PAGE
7CAF                    00470          ORG     31919           FOR A 32K MACHINE.
7CAF CC   0600          00480 START    LDD     #$600           DEFAULT START OF PAGE
7CB2 97   F5            00490          STA     <DSET           INITIALIZE VARIABLES
7CB4 DD   F6            00500          STD     <SBEG
7CB6 8B   18            00510          ADDA    #24             24 LINES INITIALLY
7CB8 DD   F8            00520          STD     <SEND
7CBA 0F   F3            00530 START2   CLR     <H              THIS ALSO WORKS LIKE A
7CBC 0F   F4            00540          CLR     <V              BASIC CLS COMMAND.
7CBE CC   FFFF          00550          LDD     #$FFFF          FF IS GREEN.
7CC1 9E   F6            00560          LDX     <SBEG           SET UP INDEX REGS
7CC3 ED   81            00570 STLP1    STD     ,X++            AND CLEAR THE SCREEN
7CC5 ED   81            00580          STD     ,X++
7CC7 9C   F8            00590          CMPX    <SEND           DONE?
7CC9 25   F8            00600          BCS     STLP1           IF NOT, GO BACK AND DO MORE.
7CCB 30   8C 0A         00610          LEAX    <CHRIN,PCR      SET UP VECTORS
7CCE BF   016B          00620          STX     VECTR2
7CD1 30   8C 39         00630          LEAX    <CHROUT,PCR
7CD4 BF   0168          00640          STX     VECTR1
7CD7 39                 00650          RTS                     AND RETURN (THIS SHOULD BE SWI FOR ASSEMBLER.)
                        00660 *
                        00670 *  THIS ROUTINE WAITS FOR A CHARACTER
                        00680 *
7CD8 0D   6F            00690 CHRIN    TST      $6F            IS IT FROM KEYBOARD?
7CDA 27   03            00700          BEQ     CINCN1          IF SO, CALL OUR ROUTINE
7CDC 7E   8CF1          00710          JMP     $8CF1           OTHERWISE, CALL BASIC'S
7CDF 0F   70            00720 CINCN1   CLR     <$70
7CE1 34   14            00730          PSHS    B,X             SAVE REGISTERS
7CE3 CC   0100          00740          LDD     #$100           SET UP LOOPS
7CE6 34   06            00750          PSHS    D
7CE8 BD   A1C1          00760 CINLP1   JSR     $A1C1           CALL BASIC'S GETCHR ROUTINE
7CEB 26   12            00770          BNE     CINOUT          IF THERE WAS A CHARACTER, EXIT
7CED 6A   E4            00780          DEC     ,S              OTHERWISE DECREMENT COUNTER
7CEF 26   F7            00790          BNE     CINLP1          TRY AGAIN.
7CF1 63   61            00800          COM     1,S             CHECK IF BLOCK IS SET
7CF3 27   03            00810          BEQ     CINOFF          IF SO, TURN IT OFF
                        00820 *
                        00830 *  THIS $80 CAN BE CHANGED TO ANY CHARACTER.
                        00840 *
7CF5 86   80            00850          LDA     #$80            OTHERWISE, DISPLAY IT.
7CF7      8C            00860          FCB     $8C             A CMPX OP.  SHORTER THAN BRA.
7CF8 86   20            00870 CINOFF   LDA     #$20            GET SPACE
7CFA 17   00A7          00880          LBSR    SINGOU          AND DISPLAY SPACE/CURSOR
7CFD 20   E9            00890          BRA     CINLP1          GO BACK FOR MORE
7CFF A7   E4            00900 CINOUT   STA     ,S              SAVE CHARACTER WE GOT
7D01 86   20            00910          LDA     #$20            CLEAR CURSOR
7D03 17   009E          00920          LBSR    SINGOU
7D06 35   06            00930          PULS    D               GET CHARACTER AND CLEAN STACK
7D08 35   14            00940          PULS    B,X             GET REGISTERS
7D0A 32   62            00950          LEAS    2,S             REMOVE OLD RETURN ADDRESS
7D0C 39                 00960          RTS                     AND GO TO CALLER
                        00970 *
                        00980 *  THIS IS THE ACTUAL CHROUT ROUTINE
                        00990 *  IT CAN BE MODIFIED FOR STAND-ALONE
                        01000 *  OPERATION OR DISK BASIC
                        01010 *
7D0D 0D   6F            01020 CHROUT   TST     $6F             DISPLAY TO SCREEN?
7D0F 27   01            01030          BEQ     CHRPRT          IF SO, GO TO THIS ROUTINE
7D11 39                 01040          RTS                     OTHERWISE, EXIT
7D12 34   16            01050 CHRPRT   PSHS    D,X             SAVE D REGISTER
7D14 86   F0            01060          LDA     #$F0            SET UP SAM AND VDG
7D16 B7   FF22          01070          STA     $FF22
7D19 96   F5            01080          LDA     <DSET           GET ADDRESS TO SET SAM TO
7D1B 44                 01090          LSRA                    GET RID OF LEAST SIG BIT
7D1C 8A   80            01100          ORA     #$80            SET SIGN BIT TO END ROUTINE
```

Listing continued

✓See List of Advertisers on page 130

TAB, PRINT@, CLS, and comma delimiter will no longer work. These must be replaced by PEEKs and POKEs to the horizontal and vertical cursor positions and by an EXEC command for CLS.

In addition, the scrolling is slower, as is the actual character-display routine, because of the need to do bit manipulation. Legibility on low-quality monitors will also be poorer with this program than with Radio Shack's characters. The SET and RESET graphics will work, but will not be displayed without a SCREEN0 command.

The modification also requires system memory—about 849 bytes for the program and character table—so you must load it into the computer for each session.

A Simple Routine

The program itself is rather simple. The first portion, Start, sets up the display parameters to be on the first four graphics pages. It falls through to Start2, which clears the screen and homes the cursor. Start2 can be called as a CLS, and it must be called immediately after you modify SBEG or SEND.

The second part is the CHRIN routine. This routine is called from Basic whenever a character is needed. First, the routine checks to see if a character is requested from the keyboard or from some other device. If the keyboard is not specified, it goes back to the ROM. Otherwise, the routine displays a cursor and waits for a key press. As soon as a key is pressed, the routine clears the cursor and returns the character to the calling routine.

The third part of the program is the CHROUT routine. This routine takes the character passed in the A register and prints it to display memory. If the character is less than 32, this routine interprets it as a control character. It recognizes the backspace (8) and carriage return (13), but ignores all others. It then increments the cursor position and scrolls if necessary.

The SINGOU routine prints a character at the current cursor location. It is called by CHROUT to print the character and by CHRIN to flash the cursor. It puts the character in a cell that is 6 by 8 pixels. The entire first column is always cleared. The next five columns contain the data from the bit table, TBL2. SINGOU uses a quick, efficient, multiple-pixel clear/set routine.

The fifth part of the program is the actual character table. There are 5 bytes for each character. The first byte is the left column, and the most-significant bit of each byte is the top dot in the corresponding column. You can modify the existing characters or create your own using this information.

Basic Bytes

The program uses 9 bytes of the direct page that are not used by any Basic (including Disk Basic) program or the EDTASM + program pack. These bytes are in the $F3 (243) to $F9 (249) locations, which you will change to reconfigure this routine.

The first byte is H, the horizontal cursor position. It is at $F3 (243) and can be modified by the Basic POKE command to place the cursor anywhere on the screen. It can have values from 0–41. The next byte is V, the vertical cursor position. It is at $F4 (244) and can also be POKEd. Normally, it can vary from 0–23, but if you change the number of lines in text memory, it can vary from zero to the number of lines minus one.

The third byte is DSET, the SAM initialization byte. It is located at $F5 (245) and defaults to $06. This byte contains the most-significant byte of the address on which the 6K graphics page starts.

The SAM is initialized using this byte

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.)

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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.)

Listing continued

```
7D1E 8E   FFC6      01110          LDX     #$FFC6          GET ADDRESS OF FIRST REG
7D21 A7   1A        01120          STA     -6,X            INITIALIZE TO PMODE4:SCREEN1,(
7D23 A7   1D        01130          STA     -3,X
7D25 A7   1F        01140          STA     -1,X
7D27 44             01150 CPRTL1   LSRA                    AND START LOOPING.
7D28 27   0C        01160          BEQ     CPRCN1
7D2A 25   04        01170          BCS     CPRON           IF BIT SET, SAM BIT GOES ON
7D2C A7   81        01180          STA     ,X++            OTHERWISE, IT GOES OFF
7D2E 20   F7        01190          BRA     CPRTL1          BACK FOR MORE.
7D30 A7   01        01200 CPRON    STA     1,X             TURN ON REG
7D32 30   02        01210          LEAX    2,X
7D34 20   F1        01220          BRA     CPRTL1          BACK FOR MORE
7D36 A6   E4        01230 CPRCN1   LDA     ,S              GET CHARACTER FROM STACK
7D38 81   20        01240          CMPA    #$20            CHECK IF CONTROL CHARACTER
7D3A 25   49        01250          BCS     SPEC            IF SO, BRANCH
7D3C 8D   66        01260          BSR     SINGOU          OTHERWISE, CHROUT
7D3E DC   F3        01270          LDD     <H              INCREMENT THE HORIZONTAL POSITION
7D40 4C             01280          INCA
7D41 81   2A        01290          CMPA    #42             HAVE WE EXCEEDED THE MAX?
7D43 25   39        01300          BCS     UPDT            IF NOT, WE ARE OKAY
7D45 4F             01310 INJP     CLRA                    OTHERWISE, FIRST CHARACTER
7D46 97   89        01320          STA     $89
7D48 5C             01330          INCB                    ON NEXT LINE.
7D49 34   04        01340          PSHS    B               WAS THAT THE LAST LINE?
7D4B DB   F6        01350          ADDB    <SBEG           CHECK AGAINST SBEG AND SEND
7D4D D0   F8        01360          SUBB    <SEND
7D4F 35   04        01370          PULS    B               RESTORE B
7D51 25   2B        01380          BCS     UPDT            IF NOT, WE ARE OKAY
7D53 5A             01390          DECB                    OTHERWISE, WE HAVE TO SCROLL
7D54 34   66        01400          PSHS    D,Y,U           SAVE REGS
7D56 9E   F6        01410          LDX     <SBEG           X IS TO REGISTER
7D58 33   89 0100   01420          LEAU    $100,X          U IS FROM REGISTER
7D5C 20   0E        01430          BRA SLPCK               GO TO CHECK FIRST IN CASE 1 LINE
7D5E 37   26        01440 SLP1     PULU    D,Y             MOVE LOWER LINES UP
7D60 ED   81        01450          STD     ,X++
7D62 10AF 81        01460          STY     ,X++
7D65 37   26        01470          PULU    D,Y
7D67 ED   81        01480          STD     ,X++
7D69 10AF 81        01490          STY     ,X++
7D6C 1193 F8        01500 SLPCK    CMPU    <SEND           DONE?
7D6F 25   ED        01510          BCS     SLP1            IF NOT, CONTINUE
7D71 CC   FFFF      01520          LDD     #$FFFF          CLEAR BOTTOM LINE
7D74 ED   81        01530 SLP2     STD     ,X++
7D76 ED   81        01540          STD     ,X++
7D78 9C   F8        01550          CMPX    <SEND DONE?
7D7A 26   F8        01560          BNE     SLP2            CONTINUE IF NOT
7D7C 35   66        01570          PULS    D,Y,U           RESTORE REGS
7D7E DD   F3        01580 UPDT     STD     H               UPDATE POSITION
7D80 35   16        01590 EXITOU   PULS    D,X
7D82 32   62        01600          LEAS    2,S             DELETE THIS IF CALLED FROM OTHER PROGRAM
7D84 39             01610          RTS
7D85 81   0D        01620 SPEC     CMPA    #13             WAS IT A CARRIAGE RETURN?
7D87 26   04        01630          BNE     NXCK            IF NOT, CHECK MORE
7D89 D6   F4        01640          LDB     V               JUMP TO NEXT LINE
7D8B 20   B8        01650          BRA     INJP
7D8D 81   08        01660 NXCK     CMPA    #8              WAS IT A BACKSPACE?
7D8F 26   EF        01670          BNE     EXITOU          IF NOT, IGNORE
7D91 DC   F3        01680          LDD     H               BACKSPACE
7D93 4A             01690          DECA                    WRAP UP TO NEXT LINE?
7D94 2A   06        01700          BPL     OKAY            IF NOT, WE ARE OKAY
7D96 86   2A        01710          LDA     #42             OTHERWISE, LAST CHARACTER ON PREV LINE
7D98 4A             01720          DECA
7D99 5A             01730          DECB
7D9A 2B   E4        01740          BMI     EXITOU          IF WE ARE OFF SCREEN, IGNORE BACKSPACE
7D9C DD   F3        01750 OKAY     STD     H               UPDATE POSITION
7D9E 86   20        01760          LDA     #$20            OUTPUT A SPACE
7DA0 8D   02        01770          BSR     SINGOU
7DA2 20   DC        01780          BRA     EXITOU          AND LEAVE
                    01790 *
                    01800 *  THIS ROUTINE PRINTS A CHARACTER AT THE
                    01810 *  SPECIFIED POSITION
                    01820 *
7DA4 34   36        01830 SINGOU   PSHS    X,Y,D           SAVE REGISTERS
7DA6 34   06        01840          PSHS    D
7DA8 96   F3        01850          LDA     H               GET HORIZONTAL POSITION
7DAA C6   06        01860          LDB     #6              GET DOT WIDTH
7DAC 3D             01870          MUL                     FIND ACTUAL DOT POSITION
7DAD CB   02        01880          ADDB    #2              GIVE A SMALL LEFT MARGIN
7DAF 54             01890          LSRB                    DIVIDE BY EIGHT TO FIND BYTE NUMBER
7DB0 49             01900          ROLA
7DB1 54             01910          LSRB
7DB2 49             01920          ROLA
7DB3 54             01930          LSRB
7DB4 49             01940          ROLA
7DB5 A7   60        01950          STA     MSK,S
7DB7 96   F4        01960          LDA     V               GET VERTICAL POSITION
7DB9 9B   F6        01970          ADDA    <SBEG           ADD OFFSET
7DBB 1F   01        01980          TFR     D,X             INITIALIZE INDEX REGISTER
7DBD A6   60        01990          LDA     MSK,S           GET REMAINDER
7DBF 31   8C 51     02000          LEAY    <TBL1,PCR       GET START OF BIT TABLE
7DC2 A6   A6        02010          LDA     A,Y             GET BIT MASK
7DC4 A7   60        02020          STA     MSK,S           SET UP MASK VARIABLES
7DC6 43             02030          COMA
7DC7 A7   61        02040          STA     CMSK,S
7DC9 31   8C AF     02050          LEAY    <OF1,PCR        GET START OF CHARACTER TABLE
7DCC A6   62        02060          LDA     2,S             GET CHARACTER AGAIN
7DCE C6   05        02070          LDB     #5
7DD0 D7   89        02080          STB     $89
7DD2 3D             02090          MUL                     GET OFFSET INTO TABLE
7DD3 31   AB        02100          LEAY    D,Y             AND INITIALIZE THAT INDEX REGISTER
7DD5 CC   0806      02110          LDD     #$806           SET UP LOOPS
7DD8 34   06        02120          PSHS    D
7DDA 5F             02130          CLRB
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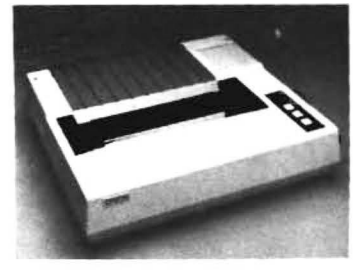

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```
7DDB 20 06      02140        BRA    LP1
7DDD 86 08      02150 LP2    LDA    #8              SET UP SECOND LOOP
7DDF A7 E4      02160        STA    ,S
7DE1 E6 A0      02170        LDB    ,Y+             GET COLUMN OF DOTS
7DE3 59         02180 LP1    ROLB                   GET DOT
7DE4 A6 84      02190        LDA    ,X              GET BYTE
7DE6 24 04      02200        BCC    ON              IF DOT IS SET, TURN IT ON IN BYTE
7DE8 A4 63      02210        ANDA   CMSK+2,S        OTHERWISE, TURN IT OFF
7DEA 20 02      02220        BRA    CONT1
7DEC AA 62      02230 ON     ORA    MSK+2,S         TURN IT ON
7DEE A7 84      02240 CONT1  STA    ,X              STORE BYTE
7DF0 30 88 20   02250        LEAX   32,X            GO TO NEXT DOT IN COLUMN
7DF3 6A E4      02260        DEC    ,S              AND DECREMENT COUNTER
7DF5 26 EC      02270        BNE    LP1             CONTINUE IF NOT DONE
7DF7 30 89 FF00 02280        LEAX   -256,X          FIX UP INDEX REGISTER
7DFB 6A 61      02290        DEC    1,S             DECREMENT OUTER COUNTER
7DFD 27 10      02300        BEQ    OUT1            IF DONE, EXIT
7DFF A6 62      02310        LDA    MSK+2,S         GET MASK
7E01 44         02320        LSRA                   SHIFT IT
7E02 24 04      02330        BCC    OKAY2           IF SAME BYTE, CONTINUE
7E04 30 01      02340        LEAX   1,X             INCREMENT INDEX REGISTER
7E06 86 80      02350        LDA    #$80            FIRST BIT IN BYTE
7E08 A7 62      02360 OKAY2  STA    MSK+2,S         UPDATE MASKS
7E0A 43         02370        COMA
7E0B A7 63      02380        STA    CMSK+2,S
7E0D 20 CE      02390        BRA    LP2             CONTINUE LOOP
7E0F 32 64      02400 OUT1   LEAS   4,S             CLEAN UP STACK
7E11 35 B6      02410        PULS   D,X,Y,PC        AND RETURN
7E13    8008    02420 TBL1   FDB    $8008
7E15    2002    02430        FDB    $2002
7E17    4004    02440        FDB    $4004
7E19    1001    02450        FDB    $1001
                02460 *
                02470 *  THIS IS THE START OF THE CHARACTER BIT
                02480 *  TABLE.  EACH CHARACTER TAKES FIVE BYTES
                02490 *  EACH IS A 5X8 DOT MATRIX.  THE FIRST BYTE
                02500 *  IS THE LEFTMOST COLUMN.  THE MOST SIGNIFICANT
                02510 *  BIT IS THE HIGHEST BIT IN A COLUMN
                02520 *  THIS TABLE CAN BE CHANGED, OR EVEN EXTENDED.
                02530 *
7E1B    0000    02540 TBL2   FDB    $0000           SPACE
        7D7B    02550 OF1    EQU    TBL2-$A0
7E1D    0000    02560        FDB    $0000
7E1F    00      02570        FCB    $00
7E20    0000    02580        FDB    $0000           !
7E22    FA00    02590        FDB    $FA00
7E24    00      02600        FCB    $00
7E25    00E0    02610        FDB    $00E0           "
7E27    00E0    02620        FDB    $00E0
7E29    00      02630        FCB    $00
7E2A    28FE    02640        FDB    $28FE           #
7E2C    00FE    02650        FDB    $00FE
7E2E    28      02660        FCB    $28
7E2F    2454    02670        FDB    $2454           $
7E31    D654    02680        FDB    $D654
7E33    48      02690        FCB    $48
7E34    C6C8    02700        FDB    $C6C8           %
7E36    1026    02710        FDB    $1026
7E38    C6      02720        FCB    $C6
7E39    6C92    02730        FDB    $6C92           &
7E3B    6A04    02740        FDB    $6A04
7E3D    0A      02750        FCB    $0A
7E3E    0000    02760        FDB    $0000           '
7E40    E0E0    02770        FDB    $E0E0
7E42    00      02780        FCB    $00
7E43    3844    02790        FDB    $3844           (
7E45    8200    02800        FDB    $8200
7E47    00      02810        FCB    $00
7E48    0000    02820        FDB    $0000           )
7E4A    8244    02830        FDB    $8244
7E4C    38      02840        FCB    $38
7E4D    1038    02850        FDB    $1038           *
7E4F    7C38    02860        FDB    $7C38
7E51    10      02870        FCB    $10
7E52    1010    02880        FDB    $1010           +
7E54    7C10    02890        FDB    $7C10
7E56    10      02900        FCB    $10
7E57    1A1C    02910        FDB    $1A1C           ,
7E59    0000    02920        FDB    $0000
7E5B    00      02930        FCB    $00
7E5C    1010    02940        FDB    $1010           -
7E5E    1010    02950        FDB    $1010
7E60    10      02960        FCB    $10
7E61    0606    02970        FDB    $0606           .
7E63    0000    02980        FDB    $0000
7E65    00      02990        FCB    $00
7E66    0608    03000        FDB    $0608           /
7E68    1020    03010        FDB    $1020
7E6A    C0      03020        FCB    $C0
7E6B    7C8A    03030        FDB    $7C8A           0
7E6D    92A2    03040        FDB    $92A2
7E6F    7C      03050        FCB    $7C
7E70    0042    03060        FDB    $0042           1
7E72    FE02    03070        FDB    $FE02
7E74    00      03080        FCB    $00
7E75    4E92    03090        FDB    $4E92           2
7E77    9292    03100        FDB    $9292
7E79    62      03110        FCB    $62
7E7A    4482    03120        FDB    $4482           3
7E7C    9292    03130        FDB    $9292
7E7E    6C      03140        FCB    $6C
7E7F    1030    03150        FDB    $1030           4
7E81    50FE    03160        FDB    $50FE
7E83    10      03170        FCB    $10

7E84    E4A2    03180        FDB    $E4A2           5
7E86    A2A2    03190        FDB    $A2A2
7E88    9C      03200        FCB    $9C
7E89    7C92    03210        FDB    $7C92           6
7E8B    9292    03220        FDB    $9292
7E8D    0C      03230        FCB    $0C
7E8E    8688    03240        FDB    $8688           7
7E90    90A0    03250        FDB    $90A0
7E92    C0      03260        FCB    $C0
7E93    6C92    03270        FDB    $6C92           8
7E95    9292    03280        FDB    $9292
7E97    6C      03290        FCB    $6C
7E98    6092    03300        FDB    $6092           9
7E9A    9292    03310        FDB    $9292
7E9C    7C      03320        FCB    $7C
7E9D    006C    03330        FDB    $006C           :
7E9F    6C00    03340        FDB    $6C00
7EA1    00      03350        FCB    $00
7EA2    00DA    03360        FDB    $00DA           ;
7EA4    DC00    03370        FDB    $DC00
7EA6    00      03380        FCB    $00
7EA7    1028    03390        FDB    $1028           <
7EA9    4482    03400        FDB    $4482
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↙518

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- External Terminal Program

Languages Available

Pascal, Fortran, RS Basic, RS Assembler, TSC Basic, TSC Assembler, Relocating Assembler, Macro Assembler, Mumps

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DATA-COMP's FLEX9 Conversion for the TRS-80C Color Computer was designed for the SERIOUS COMPUTER **USER**, with features like greatly increased Display Screens, WITH Lower Case Letters, so you can put a FULL Menu on ONE Screen, or see SEVERAL Paragraphs at the same time, with features like providing a FULL Keyboard so you have FULL Control of your Computer AND it's Programs NATURALLY, without needing a chart to see what Key Combination will give you what function, with USER ORIENTED functions to make using the Operating System natural, like having the Computer AUTOMATICALLY determine what type of Disk is being used in what type of Disk Drive and working accordingly, rather that you have to specify each and every thing for it, or like having the Computer work with the Printer you have been using all along without you having to tell the new Operating System what is there, etc.

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DATA-COMP ↙213

DATA-COMP has everything you need to make your TRS-80C Color Computer WORK for YOU; from Parts and Pieces to Full, Ready To Use SYSTEMS. DATA-COMP designs, sells, services, and SUPPORTS Computer SYSTEMS, not just Software. CALL DATA-COMP TODAY to make your Computer WORK FOR YOU!

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when purchased with Special General FLEX9 Sys	$49.95
when purchased without the General FLEX9 Sys	$59.95
Set of Eight 64K RAM Chips w Mod. Instructions	$59.95
Color Computer with 64K RAM and EXT. BASIC	$399.95

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7EAB  00      03410  FCB  $00
7EAC  2828    03420  FDB  $2828      =
7EAE  2828    03430  FDB  $2828
7EB0  28      03440  FCB  $28
7EB1  0082    03450  FDB  $0082      >
7EB3  4428    03460  FDB  $4428
7EB5  10      03470  FCB  $10
7EB6  4080    03480  FDB  $4080      ?
7EB8  9A60    03490  FDB  $9A60
7EBA  00      03500  FCB  $00
7EBB  4C92    03510  FDB  $4C92      @
7EBD  9A82    03520  FDB  $9A82
7EBF  7C      03530  FCB  $7C
7EC0  3E48    03540  FDB  $3E48      A
7EC2  8848    03550  FDB  $8848
7EC4  3E      03560  FCB  $3E
7EC5  82FE    03570  FDB  $82FE      B
7EC7  9292    03580  FDB  $9292
7EC9  6C      03590  FCB  $6C
7ECA  7C82    03600  FDB  $7C82      C
7ECC  8282    03610  FDB  $8282
7ECE  44      03620  FCB  $44
7ECF  82FE    03630  FDB  $82FE      D
7ED1  8282    03640  FDB  $8282
7ED3  7C      03650  FCB  $7C
7ED4  FE92    03660  FDB  $FE92      E
7ED6  9292    03670  FDB  $9292
7ED8  82      03680  FCB  $82
7ED9  FE90    03690  FDB  $FE90      F
7EDB  9090    03700  FDB  $9090
7EDD  80      03710  FCB  $80
7EDE  7C82    03720  FDB  $7C82      G
7EE0  8292    03730  FDB  $8292
7EE2  9E      03740  FCB  $9E
7EE3  FE10    03750  FDB  $FE10      H
7EE5  1010    03760  FDB  $1010
7EE7  FE      03770  FCB  $FE
7EE8  0082    03780  FDB  $0082      I
7EEA  FE82    03790  FDB  $FE82
7EEC  00      03800  FCB  $00
7EED  0C02    03810  FDB  $0C02      J
7EEF  0202    03820  FDB  $0202
7EF1  FC      03830  FCB  $FC
7EF2  FE10    03840  FDB  $FE10      K
7EF4  2844    03850  FDB  $2844
7EF6  82      03860  FCB  $82
7EF7  FE02    03870  FDB  $FE02      L
7EF9  0202    03880  FDB  $0202
7EFB  02      03890  FCB  $02
7EFC  FE40    03900  FDB  $FE40      M
7EFE  3040    03910  FDB  $3040
7F00  FE      03920  FCB  $FE
7F01  FE40    03930  FDB  $FE40      N
7F03  2010    03940  FDB  $2010
7F05  FE      03950  FCB  $FE
7F06  7C82    03960  FDB  $7C82      O
7F08  8282    03970  FDB  $8282
7F0A  7C      03980  FCB  $7C
7F0B  FE90    03990  FDB  $FE90      P
7F0D  9090    04000  FDB  $9090
7F0F  60      04010  FCB  $60
7F10  7C82    04020  FDB  $7C82      Q
7F12  8A84    04030  FDB  $8A84
7F14  7A      04040  FCB  $7A
7F15  FE90    04050  FDB  $FE90      R
7F17  9894    04060  FDB  $9894
7F19  62      04070  FCB  $62
7F1A  44A2    04080  FDB  $44A2      S
7F1C  928A    04090  FDB  $928A
7F1E  44      04100  FCB  $44
7F1F  8080    04110  FDB  $8080      T
7F21  FE80    04120  FDB  $FE80
7F23  80      04130  FCB  $80
7F24  FC02    04140  FDB  $FC02      U
7F26  0202    04150  FDB  $0202
7F28  FC      04160  FCB  $FC
7F29  E018    04170  FDB  $E018      V
7F2B  0618    04180  FDB  $0618
7F2D  E0      04190  FCB  $E0
7F2E  FE04    04200  FDB  $FE04      W
7F30  1804    04210  FDB  $1804
7F32  FE      04220  FCB  $FE
7F33  C628    04230  FDB  $C628      X
7F35  1028    04240  FDB  $1028
7F37  C6      04250  FCB  $C6
7F38  C020    04260  FDB  $C020      Y
7F3A  1E20    04270  FDB  $1E20
7F3C  C0      04280  FCB  $C0
7F3D  868A    04290  FDB  $868A      Z
7F3F  92A2    04300  FDB  $92A2
7F41  C2      04310  FCB  $C2
7F42  FE82    04320  FDB  $FE82      [
7F44  8200    04330  FDB  $8200
7F46  00      04340  FCB  $00
7F47  C020    04350  FDB  $C020      \
7F49  1008    04360  FDB  $1008
7F4B  06      04370  FCB  $06
7F4C  0000    04380  FDB  $0000      ]
7F4E  8282    04390  FDB  $8282
7F50  FE      04400  FCB  $FE
7F51  2040    04410  FDB  $2040      ^
7F53  8040    04420  FDB  $8040
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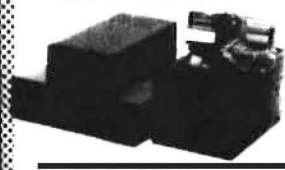

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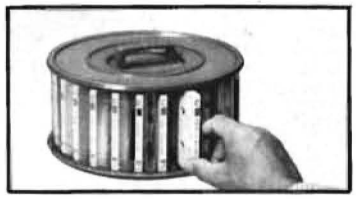

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every time the CHROUT routine is called. It must be even, as the SAM can only start graphics pages on a 512-byte boundary. It does not necessarily have to be the start of text, but can be the address of the graphics page you happen to be using.

The next 4 bytes are related. The first 2 bytes, SBEG, at $F6 (246) contain the beginning address of the place where text will be put. This must be on a 256-byte boundary. The next 2 bytes, SEND, at $F8 (248) contain the end address of the text screen. It, too, must be divisible by 256. The number of lines is defined as (SEND–SBEG)/256. The default for these is $600 for SBEG and $1E00 for SEND, or the beginning and end of the first four graphics pages.

Let me explain how to change these by giving you an example. Let's say that you want to write an adventure game in Basic. You want the screen to be split, with the top five-sixths graphics and the bottom sixth four lines of text. You want to use the Basic graphics, so the start of displayed memory would be $600.

Displaying the four lines of text on the bottom of the screen requires 4 * 256 bytes, or $400 bytes, with the end of the screen at $1E00. Therefore, the beginning of the text screen would have to be $1E00–$400, or $1A00. You would then set DSET to 6 (the most-significant byte of the address of the start of the graphics memory). You would set SEND to $1E00 (the end of graphics memory) and SBEG to $1A00 (the beginning of your new text screen). Then you would call Start2.

For example, the first line of your program might look like this:

```
10 PMODE4,1:PCLS:POKE245,6:
POKE246,26:POKE248,30:EXEC31930
```

It is very important that you call Start2 after you modify either SBEG or SEND. Otherwise, the CHROUT routine could crash the system. Also, notice that I did not have to clear the least-significant bytes of SEND or SBEG—they should always be cleared, anyway.

Installation

To install this program on your system, you can type it into the EDTASM+ program pack, assemble it, and save it on tape. You can also POKE the object code directly into memory using a monitor or Basic program. One such program might look like this:

```
10 CLEAR200,31918
20 FOR X = 31919 TO 32767
30 READ A$
40 POKE X, VAL("&H" + A$)
50 NEXT X
60 DATA CC, 06, 00, 97, F5,
DD, F6, 8B, 18, DD, F8...
```

I recommend that you save the Basic program after you type it in and before you run it. After saving the program, run it, and type EXEC 31919. You should immediately go into the new text mode. List your program on it, then print all 96 characters with FORX = 32TO127:PRINTCHR$(X);:NEXTX. Make sure they all look right, and modify them if necessary. Then save the routine to cassette with CSAVEM "CHROUT", 31919, 32767, 31919.

Whenever you want to use the modification, just type CLEAR200, 31918: CLOADM:EXEC and set up the cassette to load the program. Please note two things, however: Start2 is at 31930, and for a 16K machine, subtract 16384 from all addresses referencing the program.■

Write Tomas Rokicki at Box 244, Wolfe City, TX 75496.

Listing continued

```
7F56  0101  04440        FDB   $0101      UNDERSCORE
7F58  0101  04450        FDB   $0101
7F5A  01    04460        FCB   $01
7F5B  0080  04470        FDB   $0080      ACCENT
7F5D  4020  04480        FDB   $4020
7F5F  00    04490        FCB   $00
7F60  1C22  04500        FDB   $1C22      a
7F62  223C  04510        FDB   $223C
7F64  02    04520        FCB   $02
7F65  FE12  04530        FDB   $FE12      b
7F67  2222  04540        FDB   $2222
7F69  1C    04550        FCB   $1C
7F6A  1C22  04560        FDB   $1C22      c
7F6C  2222  04570        FDB   $2222
7F6E  04    04580        FCB   $04
7F6F  1C22  04590        FDB   $1C22      d
7F71  2212  04600        FDB   $2212
7F73  FE    04610        FCB   $FE
7F74  1C2A  04620        FDB   $1C2A      e
7F76  2A2A  04630        FDB   $2A2A
7F78  18    04640        FCB   $18
7F79  0010  04650        FDB   $0010      f
7F7B  7E90  04660        FDB   $7E90
7F7D  40    04670        FCB   $40
7F7E  1825  04680        FDB   $1825      g
7F80  2525  04690        FDB   $2525
7F82  1E    04700        FCB   $1E
7F83  FE20  04710        FDB   $FE20      h
7F85  201E  04720        FDB   $201E
7F87  00    04730        FCB   $00
7F88  0000  04740        FDB   $0000      i
7F8A  BE00  04750        FDB   $BE00
7F8C  00    04760        FCB   $00
7F8D  0402  04770        FDB   $0402      j
7F8F  22BC  04780        FDB   $22BC
7F91  00    04790        FCB   $00
7F92  FE08  04800        FDB   $FE08      k
7F94  1422  04810        FDB   $1422
7F96  00    04820        FCB   $00
7F97  0000  04830        FDB   $0000      l
7F99  FE00  04840        FDB   $FE00
7F9B  00    04850        FCB   $00
7F9C  1E20  04860        FDB   $1E20      m
7F9E  1E20  04870        FDB   $1E20
7FA0  1E    04880        FCB   $1E
7FA1  3E10  04890        FDB   $3E10      n
7FA3  2020  04900        FDB   $2020
7FA5  1E    04910        FCB   $1E
7FA6  1C22  04920        FDB   $1C22      o
7FA8  2222  04930        FDB   $2222
7FAA  1C    04940        FCB   $1C
7FAB  3F24  04950        FDB   $3F24      p
7FAD  2424  04960        FDB   $2424
7FAF  18    04970        FCB   $18
7FB0  1824  04980        FDB   $1824      q
7FB2  2424  04990        FDB   $2424
7FB4  3F    05000        FCB   $3F
7FB5  3E10  05010        FDB   $3E10      r
7FB7  2020  05020        FDB   $2020
7FB9  00    05030        FCB   $00
7FBA  122A  05040        FDB   $122A      s
7FBC  2A2A  05050        FDB   $2A2A
7FBE  04    05060        FCB   $04
7FBF  207C  05070        FDB   $207C      t
7FC1  2204  05080        FDB   $2204
7FC3  00    05090        FCB   $00
7FC4  3C02  05100        FDB   $3C02      u
7FC6  0204  05110        FDB   $0204
7FC8  3E    05120        FCB   $3E
7FC9  3804  05130        FDB   $3804      v
7FCB  0204  05140        FDB   $0204
7FCD  38    05150        FCB   $38
7FCE  3C02  05160        FDB   $3C02      w
7FD0  0C02  05170        FDB   $0C02
7FD2  3C    05180        FCB   $3C
7FD3  2224  05190        FDB   $2224      x
7FD5  3E12  05200        FDB   $3E12
7FD7  22    05210        FCB   $22
7FD8  3805  05220        FDB   $3805      y
7FDA  0505  05230        FDB   $0505
7FDC  3E    05240        FCB   $3E
7FDD  2226  05250        FDB   $2226      z
7FDF  2A32  05260        FDB   $2A32
7FE1  22    05270        FCB   $22
7FE2  106C  05280        FDB   $106C      LEFT BRACKET
7FE4  8282  05290        FDB   $8282
7FE6  00    05300        FCB   $00
7FE7  0000  05310        FDB   $0000      VERTICAL BAR
7FE9  FF00  05320        FDB   $FF00
7FEB  00    05330        FCB   $00
7FEC  0082  05340        FDB   $0082      RIGHT BRACKET
7FEE  826C  05350        FDB   $826C
7FF0  10    05360        FCB   $10
7FF1  3040  05370        FDB   $3040      TILDE
7FF3  2010  05380        FDB   $2010
7FF5  60    05390        FCB   $60
7FF6  AA55  05400        FDB   $AA55      RUBOUT
7FF8  AA55  05410        FDB   $AA55
7FFA  AA    05420        FCB   $AA
7FFB  FFFF  05430        FDB   $FFFF      CURSOR
7FFD  FFFF  05440        FDB   $FFFF
7FFF  FF    05450        FCB   $FF
      8000  05460  END    EQU   *
      7CAF  05470        END   31919
00000 TOTAL ERRORS
```

```
CHRIN   7CD8
CHROUT  7D0D
CHRPRT  7D12
CINCN1  7CDF
CINLP1  7CE8
CINOFF  7CF8
CINOUT  7CFF
CMSK    0001
CONT1   7DEE
CPRCN1  7D36
CPRON   7D30
CPRTL1  7D27
DSET    00F5
END     8000
EXITOU  7D80
H       00F3
INJP    7D45
LP1     7DE3
LP2     7DDD
MSK     0000
NXCK    7D8D
OF1     7D7B
OKAY    7D9C
OKAY2   7E08
ON      7DEC
OUT1    7E0F
SBEG    00F6
SEND    00F8
SINGOU  7DA4
SLP1    7D5E
SLP2    7D74
SLPCK   7D6C
SPEC    7D85
START   7CAF
START2  7CBA
STLP1   7CC3
TBL1    7E13
TBL2    7E1B
UPDT    7D7E
V       00F4
VECTR1  0168
VECTR2  016B
```


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The program employs high-resolution graphics. The DRAW command creates the white piano keys and the notes on the staff. The LINE command creates the staffs and the black keys.

The notes and the piano keys blink because they change from their original color (green), and back again. As a result, each note is always there, but it momentarily blends in with the background, giving the impression that both the note and the piano key are blinking.

The letters underneath the piano keyboard are not text; they have been drawn. If you would like to experiment drawing letters, they are on lines 200–220.

There are problems that arise in using the letter on a computer key to represent a note of the same name. For example, the C on the keyboard could represent a C note, but is that low, middle, or high C? And what do you do for C#?

As the most practical aid to piano students then, we assigned variables to each note in order to have the fingering on the computer keyboard correspond as closely as possible to the fingering on the piano keyboard. Therefore, ignore the letters and numbers on the computer keys and imagine they are piano keys. Table 1 lists each note and its corresponding computer key. ■

Address correspondence to Eddie and Daniel Caggiani, RFD #2, Box 164J, Peterborough, NH 03458.

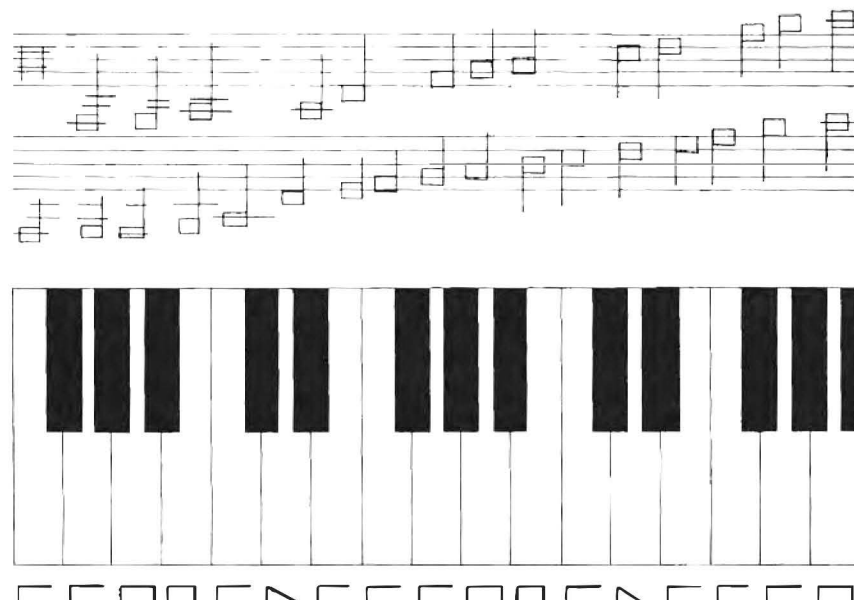

Figure 1. The Piano Keyboard

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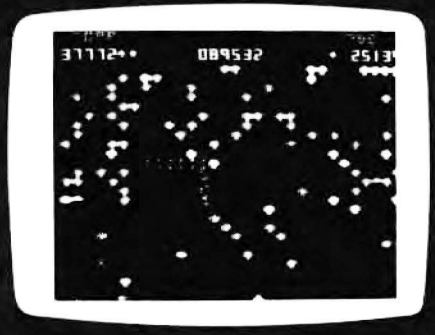

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Variable (Computer Key)	Note
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2	F#
W	G
3	G#
E	A
4	A#
R	B
T	C
5	C#
Y	D
6	D#
U	E
I	F
7	F#
O	G
8	G#
P	A
9	A#
A	B
S	C
0	C#
D	D
:	D#
F	E
G	F
-	F#
H	G
left arrow key	G#
J	A
right arrow key	A#

Table 1. Keyboard Chart

Lines 10-60 are REM statements giving credit to the programmers.
Line 70 sets up into the graphics mode.
Lines 80-110 set up the piano display.
Lines 120-130 create the staff, using the LINE command.
Lines 140-160 draw the white notes on the bottom staff.
Lines 170-190 draw the sharp sign on the top staff and the black notes.
Lines 200-220 place the letters underneath the piano keyboard.
Lines 230-540 set up the manual controls using INKEY$. These lines contain the sound of the note and the command to make each note blink.
Line 550 sounds the note. If you want to change the duration of the note, simply edit this line. To lengthen the sound of the note, increase the last number in the line; to shorten it, decrease the number.
Line 560 returns to line 230 so you can choose another note.

Table 2. Program Operations

Program Listing. Melody Master

```
10 ':::::::::::::::::::::::::::
20 ':     MELODY-MASTER       :
30 ':                BY;      :
40 ':           DANIEL & EDDIE:
50 ':              CAGGIANI    :
60 ':::::::::::::::::::::::::::
70 PMODE 3,1:PCLS :SCREEN1,1
80 LINE(0,120)-(255,120),PSET:LI
NE(0,177)-(255,177),PSET
90 DRAW"BM0,120;D57;R15;U57;R15;
D57;R15;U57;R15;D57;R16;U57;R15;
D57;R15;U57;R15;D57;R15;U57;R15;
D57;R15;U57;R15;D57;R15;U57;R15;
D57;R15;U57;R15;D57;R15;U57"
100 LINE(11,120)-(17,156),PSET,B
F:LINE(26,120)-(33,156),PSET,BF:
LINE(43,120)-(48,156),PSET,BF:LI
NE(72,120)-(78,156),PSET,BF:LINE
(88,120)-(94,156),PSET,BF:LINE(1
16,120)-(123,156),PSET,BF:LINE(1
33,120)-(139,156),PSET,BF:LINE(1
49,120)-(155,156),PSET,BF
110 LINE(179,120)-(184,156),PSET
,BF:LINE(194,120)-(200,156),PSET
,BF:LINE(223,120)-(229,156),PSET
,BF:LINE(237,120)-(243,156),PSET
,BF:LINE(251,120)-(255,156),PSET
,BF
120 COLOR 3,4
130 LINE(0,85)-(255,85),PSET:LIN
E(0,65)-(255,65),PSET:LINE(0,70)
-(255,70),PSET:LINE(0,75)-(255,7
5),PSET:LINE(0,80)-(255,80),PSET
:LINE(0,35)-(255,35),PSET:LINE(0
,25)-(255,25),PSET:LINE(0,45)-(2
55,45),PSET:LINE(0,40)-(255,40),
PSET:LINE(0,30)-(255,30),PSET
140 DRAW"C6;BM8,92;D16;L4;U4;R4;
BM5,95;R6;BM5,99;R6;BM2,106;R10"
:DRAW"BM23,87;D16;L4;U4;R4;BM20,
92;R6;BM20,95;R6":DRAW"BM38,83;D
16;L4;U4;R4;BM35,91;R6;BM33,97;R
10":DRAW"BM53,80;D16;L4;U4;R4;BM
50,90;R6":DRAW"BM68,77;D16;L4;U4
;R4;BM63,91;R10"
150 DRAW"C6;BM83,74;D16;L4;U4;R4
":DRAW"BM98,71;D16;L4;U4;R4":DRA
W"BM113,69;D16;L4;U4;R4":DRAW"BM
128,66;D16;L4;U4;R4":DRAW"BM143,
63;D16;L4;U4;R4":DRAW"BM154,87;U
10;R4;U4;L4;D4":DRAW"BM169,84;U1
0;R4;U4;L4;D4":DRAW"BM184,82;U10
;R4;U4;L4;D4"
160 DRAW"C6;BM199,79;U10;R4;U4;L
4;D4":DRAW"BM214,77;U10;R4;U4;L4
;D4":DRAW"BM229,74;U10;R4;U4;L4;
D4":DRAW"BM244,71;U10;R4;U4;L4;D
4;BM241,59;R9"
170 LINE(2,31)-(2,40),PSET:LINE(
1,33)-(9,33),PSET:LINE(7,31)-(7,
40),PSET:LINE(1,38)-(9,38),PSET:
DRAW"BM14,47;D17;L4;U4;R4;BM12,5
1;R6;BM12,54;R6;BM8,62;R10":DRAW
"BM30,45;D17;L4;U4;R4;BM28,49;R6
;BM28,53;R6"
180 DRAW"BM46,43;D17;L4;U4;R4;BM
44,49;R6;BM40,58;R10":DRAW"BM76,
37;D17;L4;U4;R4;BM71,52;R10":DRA
W"BM92,33;D17;L4;U4;R4":DRAW"BM1
22,30;D15;L4;U4;R4":DRAW"BM138,2
7;D15;L4;U4;R4":DRAW"BM157,24;D1
5;L4;U4;R4":DRAW"BM184,49;U14;R4
;U4;L4;D4"
190 DRAW"BM197,46;U14;R4;U4;L4;D
4":DRAW"BM217,43;U16;R4;U4;L4;D4
":DRAW"BM232,40;U16;R4;U4;L4;D4"
```

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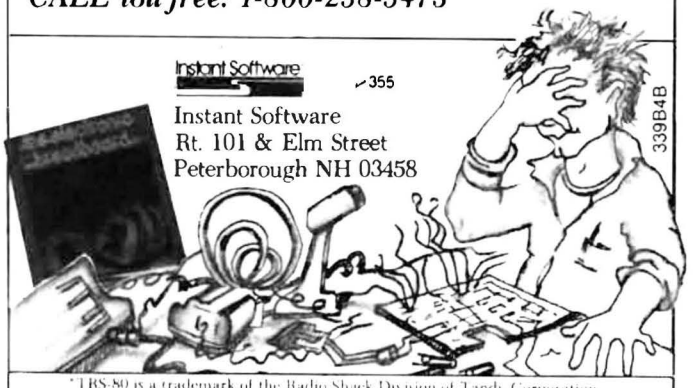

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```
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200 DRAW"C3;BM5,182;D7;U7;R4;L4;
D3;R4":DRAW"BM19,182;D7;R6;U3;L2
;BM19,182;R6":DRAW"BM35,182;D7;U
7;R6;D7;U3;L4":DRAW"BM50,182;D7;
R6;U4;L6;U3;R5;D4;L5":DRAW"BM72,
182;L5;D7;R5":DRAW"BM82,182;D7;R
2;E4;H4;L1"
210 DRAW"BM102,182;L5;D3;R4;L4;D
4;R5":DRAW"BM117,182;L5;D3;R4;L4
;D4":DRAW"BM127,182;D7;R6;U3;L2;
BM127,182;R6":DRAW"BM142,182;D7;
U7;R6;D7;U3;L4":DRAW"BM157,182;D
7;R6;U4;L6;U3;R4;D4;L5":DRAW"BM1
77,182;L5;D7;R5"
220 DRAW"BM187,182;D7;R2;E4;H4;L
1":DRAW"BM208,182;L5;D3;R4;L4;D4
;R5":DRAW"BM223,182;L5;D3;R4;L4;
D4":DRAW"BM237,182;L5;D7;R6;U3;L
2":DRAW"BM248,182;D7;U7;R6;D6;U3
;R5;D4;U3;L5"
230 A$=INKEY$:T=255
240 IF A$=""THEN 230
250 IF A$="Q"THEN DRAW"C5;BM0,12
0;D57;R15;U21":T=5      :DRAW"C4
;BM0,120;D57;R15;U21":DRAW"C5;BM
8,92;D16;L4;U4;R4;BM5,95;R6;BM5,
99;R6;BM2,106;R10":DRAW"C6;BM8,9
2;D16;L4;U4;R4;BM5,95;R6;BM5,99;
R6;BM2,106;R10"
260 IF A$="W"THEN DRAW"C5;BM15,1
56;D21;R15;U21":T=32:DRAW"C4;BM1
5,156;D21;R15;U21":DRAW"C5;BM23,
87;D16;L4;U4;R4;BM20,92;R6;BM20,
95;R6":DRAW"C6;BM23,87;D16;L4;U
4;R4;BM20,92;R6;BM20,95;R6"
270 IF A$="E"THEN DRAW"C5;BM30,1
56;D21;R15;U21":T=58:DRAW"C4;BM3
0,156;D21;R15;U21":DRAW"C5;BM38,
83;D16;L4;U4;R4;BM35,91;R6;BM33,
97;R10":DRAW"C6;BM38,83;D16;L4;U
4;R4;BM35,91;R6;BM33,97;R10"
280 IF A$="R"THEN DRAW"C5;BM45,1
56;D21;R15;U57":T=78:DRAW"C4;BM4
5,156;D21;R15;U57":DRAW"C5;BM53,
80;D16;L4;U4;R4;BM50,90;R6":DRAW
"C6;BM53,80;D16;L4;U4;R4;BM50,90
;R6"
290 IF A$="T"THEN DRAW"C5;BM60,1
20;D57;R15;U20":T=89:DRAW"C4;BM6
0,120;D57;R16;U20":DRAW"C5;BM68,
77;D16;L4;U4;R4;BM63,91;R10":DRA
W"C6;BM68,77;D16;L4;U4;R4;BM63,9
1;R10"
300 IF A$="Y"THEN DRAW"C5;BM76,1
77;    R15;U21":T=108:DRAW"C4;BM
76,177;R15;U21":DRAW"C5;BM83,74;
D16;L4;U4;R4":DRAW"C6;BM83,74;D1
6;L4;U4;R4"
310 IF A$="U"THEN DRAW"C5;BM91,1
56;D21;R15;U57":T=125:DRAW"C4;BM
91,156;D21;R15;U57":DRAW"C5;BM98
,71;D16;L4;U4;R4":DRAW"C6;BM98,7
1;D16;L4;U4;R4"
320 IF A$="I"THEN DRAW"C5;BM106,
120;D57;R15;U21"  :T=133:DRAW"C4
;BM106,120;D57;R15;U21":DRAW"C5;
BM113,69;D16;L4;U4;R4":DRAW"C6;B
M113,69;D16;L4;U4;R4"
330 IF A$="O"THEN DRAW"C5;BM121,
156;D21;R15;U21":T=147:DRAW"C4;B
M121,156;D21;R15;U21":DRAW"C5;BM
128,66;D16;L4;U4;R4":DRAW"C6;BM1
28,66;D16;L4;U4;R4"
340 IF A$="P"THEN DRAW"C5;BM136,
156;D21;R15;U21":T=159:DRAW"C4;B
M136,156;D21;R15;U21":DRAW"C5;BM
143,63;D16;L4;U4;R4":DRAW"C6;BM1
43,63;D16;L4;U4;R4"
350 IF A$="A"THEN DRAW"C5;BM151,
156;D21;R15;U57":T=170:DRAW"C4;B
M151,156;D21;R15;U57":DRAW"C5;BM
154,87;U10;R4;U4;L4;D4":DRAW"C6;
BM154,87;U10;R4;U4;L4;D4"
360 IF A$="S"THEN DRAW"C5;BM166,
120;D57;R15;U21":T=176:DRAW"C4;B
M166,120;D57;R15;U21":DRAW"C5;BM
169,84;U10;R4;U4;L4;D4":DRAW"C6;
BM169,84;U10;R4;U4;L4;D4"
370 IF A$="D"THEN DRAW"C5;BM181,
156;D21;R15;U21":T=185:DRAW"C4;B
M181,156;D21;R15;U21":DRAW"C5;BM
184,82;U10;R4;U4;L4;D4":DRAW"C6;
BM184,82;U10;R4;U4;L4;D4"
380 IF A$="F"THEN DRAW"C5;BM196,
156;D21;R15;U57":T=193:DRAW"C4;B
M196,156;D21;R15;U57":DRAW"C5;BM
199,79;U10;R4;U4;L4;D4":DRAW"C6;
BM199,79;U10;R4;U4;L4;D4"
390 IF A$="G"THEN DRAW"C5;BM211,
120;D57;R15;U21":T=197:DRAW"C4;B
M211,120;D57;R15;U21":DRAW"C5;BM
214,77;U10;R4;U4;L4;D4":DRAW"C6;
BM214,77;U10;R4;U4;L4;D4"
400 IF A$="H"THEN DRAW"C5;BM226,
156;D21;R15;U21":T=204:DRAW"C4;B
M226,156;D21;R15;U21":DRAW"C5;BM
229,74;U10;R4;U4;L4;D4":DRAW"C6;
BM229,74;U10;R4;U4;L4;D4"
410 IF A$="J"THEN DRAW"C5;BM241,
156;D21;R15;U21":T=210:DRAW"C4;B
M241,156;D21;R15;U21":DRAW"C5;BM
244,71;U10;R4;U4;L4;D4;BM241,59;
R9":DRAW"C6; BM244,71;U10;R4;U4;
L4;D4;BM241,59;R9"
420 IF A$="2" THEN DRAW"C5;BM13,
122;D33;R3;U33":T=19:DRAW"C4;BM1
3,122;D33;R3;U33":DRAW"C5;BM14,4
7;D17;L4;U4;R4;BM12,51;R6;BM12,5
4;R6;BM8,62;R10":DRAW"C6;BM14,47
;D17;L4;U4;R4;BM12,51;R6;BM12,54
;R6;BM8,62;R10"
430 IF A$="3"THEN DRAW"C5;BM30,1
22;D33;R3;U33":T=45:DRAW"C4;BM30
```

Listing continued

Listing continued

```
,122;D33;R3;U33":DRAW"C5;BM30,45
;D17;L4;U4;R4;BM28,49;R6;BM28,53
;R6":DRAW"C6;BM30,45;D17;L4;U4;R
5;BM28,49;R6;BM28,53;R6"
440 IF A$="4"THEN DRAW"C5;BM45,1
22;D33;R3;U33":T=69:DRAW"C4;BM45
,122;D33;R3;U33":DRAW"C5;BM46,43
;D17;L4;U4;R4;BM44,49;R6;BM40,58
;R10":DRAW"C6;BM46,43;D17;L4;U4;
R4;BM44,49;R6;BM40,58;R10"
450 IF A$="5"THEN DRAW"C5;BM75,1
22;D33;R3;U33":T=99:DRAW"C4;BM75
,122;D33;R3;U33":DRAW"C5;BM76,37
;D17;L4;U4;R4;BM71,52;R10":DRAW"
C6;BM76,37;D17;L4;U4;R4;BM71,52;
R10"
460 IF A$="6"THEN DRAW"C5;BM90,1
22;D33;R3;U33":T=117:DRAW"C4;BM9
0,122;D33;R3;U33":DRAW"C5;BM92,3
3;D17;L4;U4;R4":DRAW"C6;BM92,33;
D17;L4;U4;R4"
470 IF A$="7"THEN DRAW"C5;BM120,
122;D33;R3;U33":T=140:DRAW"C4;BM
120,122;D33;R3;U33":DRAW"C5;BM12
2,30;D15;L4;U4;R4":DRAW"C6;BM122
,30;D15;L4;U4;R4"
480 IF A$="8"THEN DRAW"C5;BM135,
122;D33;R3;U33":T=153:DRAW"C4;BM
135,122;D33;R3;U33":DRAW"C5;BM13
8,27;D14;L4;U4;R4":DRAW"C6;BM138
,27;D15;L4;U4;R4"
490 IF A$="9"THEN DRAW"C5;BM150,
122;D33;R3;U33":T=165:DRAW"C4;BM
150,122;D33;R3;U33":DRAW"C5;BM15
7,24;D15;L4;U4;R4":DRAW"C6;BM157
,24;D15;L4;U4;R4"
500 IF A$="0"THEN DRAW"C5;BM180,
122;D33;R3;U33":T=180:DRAW"C4;BM
180,122;D33;R3;U33":DRAW"C5;BM18
5,50;U15;R4;U4;L4;D4":DRAW"C6;BM
185,50;U15;R4;U4;L4;D4"
510 IF A$=":"THEN DRAW"C5;BM195,
122;D33;R3;U33":T=189:DRAW"C4;BM
195,122;D33;R3;U33":DRAW"C5;BM19
7,46;U14;R4;U4;L4;D4":DRAW"C6;BM
197,46;U14;;R4;U4;L4;D4"
520 IF A$="-"THEN DRAW"C5;BM225,
122;D33;R3;U33":T=200:DRAW"C4;BM
225,122;D33;R3;U33":DRAW"C5;BM21
7,43;U16;R4;U4;L4;D4":DRAW"C6;BM
217,43;U16;R4;U4;L4;D4"
530 IF A$=CHR$(8)THEN DRAW"C5;BM
240,122;D33;R3;U33":T=207:DRAW"C
4;BM240,122;D33;R3;U33":DRAW"C5;
BM232,40;U16;R4;U4;L4;D4":DRAW"C
6;BM232,40;U16;R4;U4;L4;D4"
540 IF A$=CHR$(9)THEN DRAW"C5;BM
253,122;D33;R2;U33":T=213:DRAW"C
4;BM253,122;D33;R2;U33":DRAW"C5;
BM247,37;U16;R4;U4;L4;D4;BM244,1
9;R10":DRAW"C6;BM247,37;U16;R4;U
4;L4;D4;BM244,19;R10"
550 SOUNDT,2
560 GOTO 230
```


See List of Advertisers on page 130

BY PETER H. STOLOFF

BSEARCH

I wrote BSearch as an aid for locating character strings and Basic commands in long programs. All too often I would have to make a change in a program but couldn't remember the line number.

Therefore, to find the line that had to be changed, I would list the program a few lines at a time until I found what I was looking for. This process seemed to take forever.

Now, I can call this routine and tell it what character sequence I'm looking for. If the sequence is found, the screen displays the first line in the Basic program containing the characters. Not only does it display what I've been searching for, but it does so in the edit mode, thus allowing me to make any necessary changes.

Failing to locate the string results in a "not found" message. Subsequent calls to BSearch with an empty target string will continue the search for the previously defined string, beginning on the next line of the program.

Another unique feature of the program is the use of a wild-card feature, which can be used in specifying the target string. Let's say you want to find all occurrences of the word "their," but your typing was inconsistent. Sometimes you typed it "thier," and at other times, "their." Specifying the target as "th!!r" will search for the sequence "th" followed by any two characters and then the character "r."

Are you often searching for strings in long programs? Here's a program that will end the quest.

BSearch will also locate Basic statements. Basic commands are tokenized (encoded as 1- or 2-byte ASCII characters) before they are stored. Thus, a search for the character string, PRINT X, would fail because PRINT is stored as an ASCII 87 (hexadecimal).

My approach to the search for tokenized values was to tokenize the target string if the first character is a lowercase b. Therefore, when using the routine to search for Basic commands, don't forget to begin the expression of the target string with b.

When I developed the program, I wanted the search process to be initiated by pressing a key not normally used to enter data. I selected the down arrow for this purpose, but in order to use it, I had to change the way Basic handles input from the keyboard.

Basic's keyboard-scan routine uses an interrupt vector to tell it where to go during this process. BSearch alters this vector. Instead of returning to Basic after scanning the keyboard, program control is passed to the BSearch routine. This is accomplished by the RAM hook used in the first few lines of the program.

Program lines 200–230 store the address of the BSearch routine in the memory locations normally used to vector Basic back from the keyboard scan. The original address is preserved for BSearch to return to Basic.

Notice that this routine overwrites itself by placing a RETURN ($39) at the first location of the program after it has completed the initialization process. Attempts at reinitialization will simply result in a return to the calling program.

When the program scans the keyboard and detects a keypress, it passes control to the location labeled START in BSearch. Here it checks the A register, which will contain the ASCII code corresponding to the key pressed, for a down arrow ($0A). If the key pressed is not $0A, you return to Basic via the interrupt vector; otherwise, you begin the search process.

This process begins with the display of a prompt for the target string. The LINEINPUT routine located at $A390 is used for entering the string into a

System Requirements

16K RAM
Extended Color Basic
Editor/Assembler (optional)

✓See List of Advertisers on page 130

buffer beginning at memory location $2DD.

If the buffer is empty as the result of entering an empty string, this first location will contain a zero. The program uses this zero to indicate that the previously entered target string is to be used again. On the other hand, if the buffer is not empty, BSearch will copy its contents into BSearch's own buffer, labeled TGT.

Before the search begins, the program compares the first character in the target string to $62, lowercase b. If it finds b there, the program tokenizes the buffer's contents using the procedure shown in program lines 590–650. It uses the subroutine, beginning at location $B829 in the Basic ROM, for this purpose.

You are now ready to step through the Basic program in search of the target string. The section of the program labeled NEW performs this. Basic stores its pointer to the first line of the Basic code in location $19. The first 2 bytes in each program line are pointers to the next line, providing a map for searching through the entire program. (If the pointers contain zeros, you've reached the end of the Basic program.)

BSearch stores the pointers as the variable THISX, which it then uses as a reentry point for the next line of Basic code, if the one you're on does not contain the target. Subsequent calls to BSearch following a successful match will resume the search at the next Basic line to which THISX points.

Lines 780–890 give the byte-for-byte comparison of the target string with the Basic code. To make the comparisons, the program initializes the pointer to the beginning of the target buffer when you start the search and when the character patterns do not match.

If the characters do match, the program checks the next character in the target buffer against the next in the Basic line, and so on, until it reaches either the end of the buffer or the end of the Basic line. Reaching the end of the buffer means that you have a match; reaching the end of the Basic line indicates that you do not.

If you reach the end of the last Basic line, the entire search has failed to come up with a match. If this happens, the program prints a status message and then clears Basic's input buffer before returning to Basic.

The string search program is written in 6809 Assembly language, using position-independent code. This means that it can be relocated anywhere in memory not used for other things.

Program Listing 1

```
                        00100 ********************************
                        00110 *
                        00120 *       BSEARCH
                        00130 *
                        00140 ** REPETITIVE STRING SEARCH
                        00150 ** WITHIN BASIC LINES
                        00160 *
                        00170 **  PETER H. STOLOFF    **
                        00180 ********************************
0000 12                 00190 INIT    NOP             PLACE HOLDER
0001 BE   016B          00200         LDX     $16B    RAM HOOK
0004 AF   8D 000D       00210         STX     RTSV,PCR        PRESERVE RETURN
0008 30   8D 001E       00220         LEAX    START,PCR
000C BF   016B          00230         STX     $16B            NEW ENTRY FOR ROM ROUTI
NE
000F 86   39            00240         LDA     #$39    RTS INSTR
0011 A7   8C EC         00250         STA     INIT,PCR        PREVENT REINITIALIZATIO
N
0014 39                 00260         RTS             BACK TO BASIC
0015      0000          00270 RTSV    FDB     0       JMP LOC
0017 9E   02DD          00280 ERROR   LDX     ##2DD   BASIC INPUT BUFFER
001A 86   20            00290         LDA     #$20    SPACE
001C 6D   84            00300 CBUF    TST     ,X      END DATA?
001E 27   04            00310         BEQ     BVEC
0020 A7   80            00320         STA     ,X+     REPLACE WITH SPACE
0022 20   F8            00330         BRA     CBUF
0024 6E   9D FFED       00340 BVEC    JMP     [RTSV,PCR]      BACK TO BASIC
0028      0000          00350 BVEC1   FDB     0       OLD VECTOR
002A 81   0A            00360 START   CMPA    #$0A    DOWN ARROW?
002C 26   F6            00370         BNE     BVEC    TO BASIC
                        00380 *******BEGIN BSEARCH******
002E 30   8D 009D       00390 SEARCH  LEAX    MSG,PCR POINT TO MSG AREA
0032 A6   80            00400 MTOP    LDA     ,X+     GET CHR
0034 27   17            00410         BEQ     GETLN   END MSG
0036 BD   A30A          00420         JSR     $A30A   PRINT CHR
0039 20   F7            00430         BRA     MTOP    DO ANOTHER
003B DE   19            00440 AGAIN   LDU     $19     BEGIN LAST LN SEARCH
003D 27   40            00450 A1      BEQ     NEW     TOO FAR
003F 10AE 42            00460         LDY     2,U     LINE #
0042 33   D4            00470         LEAU    [,U]    UPDATE POINTER
0044 10AC 8D 0084       00480         CMPY    BOLD,PCR        OLD LN
0049 2C   36            00490         BGE     OLDSTR PAST IT. OK
004B 20   F0            00500         BRA     A1
004D 0F   6F            00510 GETLN   CLR     $6F     SELECT SCREEN
004F BD   A390          00520         JSR     $A390   LINEINPUT
0052 7D   02DD          00530         TST     $2DD    BEGIN BUFFER
0055 27   E4            00540         BEQ     AGAIN   EMPTY, USE OLD STRING
0057 8E   02DD          00550         LDX     ##2DD   LN BUFFER
005A A6   84            00560         LDA     ,X      FIRST CHAR
005C 81   62            00570         CMPA    #'b     CODE FOR TOKENIZE
005E 26   15            00580         BNE     CPY     DON'T BOTHER
0060 109E A6            00590         LDY     <$A6    SAVE BASIC'S NXT CHR PTR
0063 34   20            00600         PSHS    Y
0065 33   8D 0079       00610         LEAU    TGT,PCR OUTPUT AREA
0069 30   01            00620         LEAX    1,X     INPUT PAST b
006B BD   B829          00630         JSR     $B829   TOKENIZE
006E 35   20            00640         PULS    Y
0070 109F A6            00650         STY     <$A6    RESTORE
0073 20   0A            00660         BRA     NEW
0075 31   8D 0069       00670 CPY     LEAY    TGT,PCR POINT TO TARGET STR
0079 A6   80            00680 C1      LDA     ,X+
007B A7   A0            00690         STA     ,Y+     SAVE COPY
007D 26   FA            00700         BNE     C1
007F DE   19            00710 NEW     LDU     $19     START BASIC
0081 C6   21            00720 OLDSTR  LDB     #'!     DON'T CARE CHR
0083 30   40            00730 TOP     LEAX    0,U     RETRIEVE NEXT LN PTR
0085 27   35            00740         BEQ     FAIL    END BASIC
0087 AF   8D 0040       00750         STX     THISX,PCR       SAVE FOR EDIT
008B 33   94            00760         LEAU    [,X]    POINTER TO NEXT BASIC LN
008D 30   04            00770         LEAX    4,X     PAST POINTER
008F 31   8D 004F       00780 BEGLB   LEAY    TGT,PCR BEGIN LINE BUFFER
0093 6D   A4            00790 LOOP    TST     ,Y      ALL MATCHED
0095 27   12            00800         BEQ     FOUND
0097 A6   80            00810         LDA     ,X+     GET NXT BASIC BYTE
0099 27   E8            00820         BEQ     TOP     EOL
009B A1   A0            00830         CMPA    ,Y+     CMP BASIC WITH STR CHR
009D 26   F0            00840         BNE     BEGLB   NO, RESET STR PTR
009F E1   A4            00850 LOOP2   CMPB    ,Y      MATCH, CHK NXT FOR DON'T CARE
00A1 26   F0            00860         BNE     LOOP
00A3 30   01            00870         LEAX    1,X     YES, GO PAST IT
00A5 31   21            00880         LEAY    1,Y
00A7 20   F6            00890         BRA     LOOP2
00A9 86   01            00900 FOUND   LDA     #1
00AB 97   D8            00910         STA     $D8
00AD AE   8D 001A       00920         LDX     THISX,PCR       LINE POINTER
00B1 EC   02            00930         LDD     2,X     BASIC LN
00B3 DD   2B            00940         STD     <$2B    ALL FOR EDIT
00B5 ED   8D 0014       00950         STD     BOLD,PCR        SAVE LAST LINE #
00B9 7E   8543          00960 GOEDIT  JMP     $8543   GOEDIT
00BC 30   8D 0017       00970 FAIL    LEAX    FMSG,PCR
00C0 A6   80            00980 FTOP    LDA     ,X+
00C2 1027 FF51          00990         LBEQ    ERROR   BACK TO BASIC
00C6 BD   A30A          01000         JSR     $A30A   OUTPUT CHAR
00C9 20   F5            01010         BRA     FTOP
00CB                    01020 THISX   RMB     2
00CD                    01030 BOLD    RMB     2
00CF      54            01040 MSG     FCC     "TARGET "
          41
          52
          47
          45
          54
          20
00D6      00            01050         FCB     0
00D7      4E            01060 FMSG    FCC     "NOT FOUND"
          4F
          54
          20
          46
          4F
          55
```

Listing continued

If you have an assembler, you can type in the source code. For those of you who do not have an assembler, or would rather enter the object code directly, use the hexadecimal object code shown in the second and third columns of Program Listing 1.

You can also use the short program show in Program Listing 2 to POKE the program into memory and CSAVEM.

The DATA statement is a concatenation, or stringing together, of the complete machine code, with XX appended as an end-data flag.

The symbols nn should be replaced by a number corresponding to the starting location in memory where you want to store the program. If you have a 16K machine, you could use a value of 15902 for nn to place the routine at the top of memory, or 32285 if you have a 32K machine.

To initialize the program, type EXEC nn. Be sure to save the program before you run it as the initialization process alters the code. ■

Address correspondence to Peter H. Stoloff, 9203 Custer Terrace, Adelphi, MD 20783.

Listing continued

```
              4E
              44
    00E0      0D        01070          FCB     $0D
    00E1      00        01080          FCB     0
    00E2                01090 TGT      RMB     $FF
              0000      01100          END
00000 TOTAL ERRORS

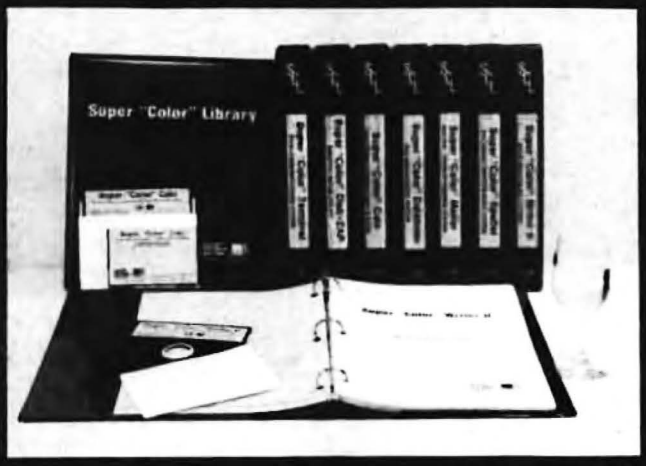
A1        003D
AGAIN     003B
BEGLB     008F
BOLD      00CD
BVEC      0024
BVEC1     0028
C1        0079
CBUF      001C
CPY       0075
ERROR     0017
FAIL      00BC
FMSG      00D7
FOUND     00A9
FTOP      00C0
GETLN     004D
GOEDIT    00B9
INIT      0000
LOOP      0093
LOOP2     009F
MSG       00CF
MTOP      0032
NEW       007F
OLDSTR    0081
RTSV      0015
SEARCH    002E
START     002A
TGT       00E2
THISX     00CB
TOP       0083
```

```
10 L=nn 'WHERE nn IS DESIRED LOAD ADDRESS OF BSEARCH
20 READ A$:FOR I=1 TO LEN(A$) STEP 2:T$=MID$(A$,I,2):IF T$="XX"T
HEN30ELSE POKE L,VAL("&H"+T$):L=L+1:NEXT:GOTO 20
30 CSAVEM"BSEARCH",nn,L,nn
40 DATA12BE016BAF8D0000D ... 0D00XX
```

Program Listing 2

Super "Color" Library™

For the TRS-80 Color and TDP System 100 Personal Computers



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!

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Super "Color" Writer II™

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

VERSION 3.0 By Tim Nelson

THE INTELLIGENT WORD PROCESSOR

The **Super "Color" Writer II** is for those who desire the best. It is the most powerful, fastest, most dependable and versatile word processor available for the Color Computer, from 16 to 64K. The **Super "Color" Writer II** has features for the most demanding professional, yet it is easy enough for newcomers to master.

Of course the **Super "Color" Writer II** has all the features you would expect from the highest quality word processor, such as a clear, crisp and readable professional display with your choice of display colors, 9 display formats; standard 32x16 & 51-64-85x21 &24 with real lowercase descenders, full 4-way cursor control, sophisticated edit commands, the ability to edit any BASIC program or ASCII textfile, seven delete functions, locate and change, wild card locate, a real block move & copy, word wrap-around, programmable tabs, display memory used and left, non-breakable space, multiple headers and footers, dynamic text formatting, comprehensive format parameters, use with ANY printer at any baud rate from 110 to 9600 baud, automatic justification, automatic pagination, automatic centering, automatic flush right, underlining, superscripts, subscripts, pause print, single-sheet pause, optionally print comments, append text files, available in a ROMPAK cartridge for maximum work space, but that's only half of the story. No other program can even begin to compare in features with the **Super "Color" Writer II.**

Check These Exclusive Features

MEMORY-SENSE adjusts to computer's memory (16-64K) for maximum work space; TYPE-AHEAD, TYPAMATIC KEY REPEAT and KEY BEEP for the pros, 3 PROGRAMMABLE FUNCTIONS; AUTO PHRASE INSERT, COLUMN CREATION, TEXT FILE LINKING, HELP MENU; A TRUE EDITING WINDOW IN ALL 9 DISPLAY MODES; TRUE FORMAT WINDOW to display line lengths up to 255 characters, with horizontal and vertical scrolling to replicate the printed page including centered lines, headers, footers, page breaks, page numbers, margins, giving a perfect printed document every time. Also makes hyphenation a snap; **TRUE AUTOMATIC JUSTIFICATION** for neat, even left and right hand margins; Ability to use CHARACTER CODES for printing special characters available with your printer; freedom to embed as many PRINTER CONTROL CODES as desired anywhere in the text, **EVEN WITHIN JUSTIFIED TEXT;** 90-plus page tutorial manual.

ADDITIONAL DISK FEATURES: Read a directory, Display free granules, Save with Automatic Verification, Load and Append ASCII files, and BASIC programs, Kill files, and Link files from disk for continuous printing. 54K bytes of workspace available with a 64 K system. Only the best offers all of these features.

TAPE $69.95 **ROMPAK $89.95** **DISK $99.95**

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ELECTRONIC SPREADSHEET By Kevin Herrboldt

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By Tim Nelson

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Version 3.0 By Dan Nelson

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FEATURES: MEMORY-SENSE to adjust to computer's memory (16-64K) for maximum work space; Selectively print data at baud rates from 110 to 9600 * 54K of data storage with 64K disk system. 128 character ASCII keyboard * Automatic graphics mode * Word mode (word wrap) for unbroken words * Send & receive **Super "Color" Writer II, Database & Calc** files, ASCII files, Machine Language & BASIC programs * Set communications baud rate from 110 to 9600. Duplex: Half/Full/Echo. Word length: 5, 6, 7 or 8. Parity: Odd, Even or None. Stop Bits: 1-9 * Local linefeeds to screen * Save and load ASCII files, Machine Code & BASIC programs * Unique CLONE feature for copying any tape * Lower case masking * 10 Keystroke Multiplier (MACRO) buffers to perform repetitive pre-entry log-on tasks and send short messages * Programmable prompt or delay for send next line * Selectable character trapping * Files compatible with other Library programs.

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✓See List of Advertisers on page 130

BY STEPHEN C. HEDGES

DON'T BE LISTLESS

If convenience and speed appeal to you, you will want to check out this simple list program.

Color Basic includes the usual LIST command to list all or part of a program. If you want to look through a reasonably long program, however, this command is inconvenient to use. You must enter statements such as LIST 70–145 to get a section of a program, then guess what range of line numbers to specify for the next section. If you guess too small a range, the display will not be anywhere near full. If you guess too large a range, the display will scroll past part of your program.

I like to begin modular sections of my programs with line numbers ending in 00 to help clarify the program's structure. Since these modules are not uniform in length, I get nonuniform use of line numbers when I try to list programs.

If I had a printer, I could simply LLIST the program and use the printout. Since I don't have a printer, I wrote a simple utility program that displays a program a screenful at a time. (See the Program Listing.) As an option, it also scrolls through the program one program line at a time as you press the spacebar.

Program Operation

First, you must save the program to be listed to cassette using the ASCII format (CSAVE "name" ,A). The program asks you to enter the program name (line 40) and offers a choice of advancing the display one line or one page at a time (line 50). Line 110 opens a file to input the program (line 130) as strings of data and display them on the screen.

The cassette input routine in Color Basic reads in a block of data (the saved program) into a buffer, then extracts the data one line at a time as required by the list program, which displays it on the screen. The display is then stationary for a second while the program reads in the next data block. This makes it easy to use the shift @ keys to halt the program, leaving the first block of data on the screen. Pressing any key displays the next block of data. In this way, it is possible to skip over large sections of a program to get to a particular section of interest.

The program is particularly helpful when, tired and bleary-eyed, you are trying to proofread a listing you have just keyed in from a magazine article. ■

Address correspondence to Stephen C. Hedges, 111 Thomas Ave., Rochester, NY 14617.

System Requirements

4K RAM
Color Basic

```
10 'LIST1:  TO LIST A PROGRAM      SAVED USING CSAVE,A FORMAT
20 'BY S. C. HEDGES  12/10/82
30 CLS:PRINT"POSITION TAPE AT START OF       PROGRAM TO BE LISTE
D.  PROGRAM  MUST HAVE BEEN SAVED USING      CSAVE" ",A.":PRINT:
PRINT:CLEAR 1000
40 INPUT"WHAT IS PROGRAM NAME";N$
50 PRINT:PRINT:INPUT"DO YOU WANT TO ADVANCE PROGRAM  LISTING BY
                    1.  1 PAGE (SCREEN) AT A TIME,OR2.  1 PROGR
AM LINE AT A TIME?   ENTER 1 OR 2";A
60 CLS:ON A GOTO 70,80:GOTO50
70 PRINT"TO PAUSE IN LISTING, HOLD DOWN  SHIFT AND @; PRESS ANY
KEY TO   RESUME LISTING":GOTO90
80 PRINT"PRESS SPACEBAR TO ADVANCE TO    NEXT LINE"
90 INPUT"READY";R$
100 CLS:PRINT"SEARCHING TAPE FOR "N$
110 PRINT:PRINT:PRINT:OPEN"I",#-1,N$
120 IF EOF(-1) GOTO160
130 INPUT#-1,L$:PRINTL$
140 ONA GOTO120,150
150 A$=INKEY$:IFA$=""THEN150:ELSE120
160 CLOSE#-1
```

Program Listing

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!)
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$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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BY RICHARD ESPOSITO AND RALPH RAMHOFF

DISK UTILITIES

Converting your CoCo from cassettes to disks can be frustrating if you don't heed the authors' advice.

When I purchased my disk drives, I was determined to eliminate the clutter of cassettes and ROM packs and put everything on floppy disks, or so I thought.

Assuming you have disk-compatible software, Program Listing 1, Directory Sort, allows you to alphabetize the disk directory so that whenever you type DIR, the listing will come out in alphabetical order.

As stated in the Disk Basic manual, disk drives are random-access devices. Consequently, the disk operating system must be aware of where data resides on a disk. This information is called the disk directory and is located on each disk in sectors 3 to 11 of track 17. It can consist of up to 68 file entries. The format of each file entry is as follows:

- bytes 0–7: file name in ASCII ($00 in high-order byte if not used, $FF if no other entries are used);
- bytes 8–10: file extension in ASCII;
- byte 11: file type;
- byte 12: ASCII flag;
- byte 13: number of first granule;
- bytes 14–15: number of bytes in use in the last sector of the file; and
- bytes 16–31: unused, reserved for future use.

More detailed information is available in Chapter 11 of the Disk Basic manual. Disk Basic allows I/O on a sector-by-sector basis using the DSKI$ and DSKO$ commands. This is the only way to access the disk directory from Basic. Listing 1 reads the disk directory, separates it into individual file entries, sorts these entries, and then rebuilds a new sorted file directory.

Save Listing 1 to disk by typing SAVE "DIR-SORT". To use it, do the following:

1. Insert disk containing the above program.
2. Type RUN "DIR-SORT".
3. Insert the disk to be processed when the program requests drive number.

Be sure that you have a back-up copy of the subject disk. A simple typing error when keying in the above program can lead to destruction of a disk's directory when it is run, effectively wiping out the disk.

```
10 CLEAR 7000:DIM A$(19),B$(85),F$(85),G(85,2),F(85,4)
20 FOR I=2 TO 11:DSKI$ 0,17,I,A$(I-2),A$(I+8):NEXT
30 FOR I=0 TO 67:G(I,0)=ASC(MID$(A$(0),I+1,1)):NEXT
40 FOR I=0TO85:B$(I)=STRING$(32,CHR$(&HFF)):NEXT
50 FOR I=1TO9:FORK=0TO1:FORJ=0TO3:B$((I-1)*8+J+K*4)=MID$(A$(I+K*
10),J*32+1,32):NEXTJ,K,I
60 FOR I=0TO70:IF LEFT$(B$(I),1)=CHR$(0) THEN B$(I)=STRING$(32,2
55)
70 NEXT
75 PRINT"SORTING DIRECTORY FOR DRIVE 0."
80 FOR I=0TO84:FORJ=I+1TO85:IF B$(I)>B$(J) THEN D$=B$(I):B$(I)=B
$(J):B$(J)=D$
90 NEXT J,I
100 FOR I=1TO9:A$(I)="":A$(I+10)="":FOR J=0TO3:A$(I)=A$(I)+B$((I
-1)*8+J):A$(I+10)=A$(I+10)+B$((I-1)*8+J+4):NEXT J,I
110 FOR I=0TO9:DSKO$ 0,17,I+2,A$(I),A$(I+10):NEXT
200 FOR I=0TO85:FORJ=0TO3:F(I,J)=ASC(MID$(B$(I),12+J,1)):NEXTJ:F
$(I)=LEFT$(B$(I),11):NEXTI
210 FOR I=0TO85:F$(I)=LEFT$(F$(I),8)+" "+RIGHT$(F$(I),3):NEXT
```

Program Listing 1. Directory Sort

Directory Print

Program Listing 2, Directory Print,

```
10 INPUT"DISK NAME";N$
20 PRINT#-2,CHR$(27)+CHR$(14)+N$+CHR$(27)+CHR$(15)
30 POKE150,41:POKE&H6F,&HFE:DIR
40 PRINT#-2,FREE(0);" GRANULES FREE"
```

Program Listing 2. Directory Print

System Requirements

16K RAM
Disk Basic
Editor/Assembler (optional)
Printer (optional)

```
          ORG     $2000           START AT 16K BOUNDARY
START     EQU     $0600           NEW START ADDRESS
FROM      EQU     START+$2000     CURRENT START ADDRESS
END       EQU     $5FF0           CURRENT END ADDRESS
EXEC      EQU     $0600           NEW EXEC ADDRESS
SCRBEG    EQU     $0400           START OF SCREEN
SCREND    EQU     $0600           END OF SCREEN + 1
BEGIN     CLRA                    TURN OFF DRIVE MOTOR
          STA     $FF40
          LDA     #$34            KILL DISK
          STA     $FF03
          LDX     #SCRBEG         CLEAR SCREEN
          LDA     #$80
CLS       STA     ,X+
          CMPX    #SCREND
          BLT     CLS
          LDX     #FROM
          LDY     #START
MOVE      LDA     ,X+             BLOCK MOVE
          STA     ,Y+
          CMPX    #END
          BLT     MOVE
          CLR     $71
          JMP     EXEC
          END     BEGIN
```

Program Listing 3. Tapefix

Program Listing 4. Program to Append Tapefix

```
10 GOTO480
20 CLS
30 PRINT@0,STRING$(32,"*")
40 PRINT@32,"*"+STRING$(30," ")+"*"
50 PRINT@64,"* MACHINE LANGUAGE CASSETTE TO *"
60 PRINT@96,"*          DISK UTILITY          *"
70 PRINT@128,"*    COPR 1982 BY                *"
80 PRINT@160,"*         RICHARD E. ESPOSITO    *"
90 PRINT@192,"*         & RALPH RAMHOFF        *"
100 PRINT@224,"*          <<  32K RAM  >>       *"
110 PRINT@256,"*       DISK COLOR BASIC 1.0     *"
120 PRINT@288,"*"+STRING$(30," ")+"*"
130 PRINT@320,STRING$(32,"*")
140 PRINT"IS TAPE READY?"
150 A$=INKEY$:IF A$="" THEN 150
160 IF LEFT$(A$,1)<>"Y" THEN PRINT"READY THE TAPE, THEN RUN AGAI
N":END
170 INPUT"NAME OF TAPE-FILE CONTAINING PROGRAM";F$
180 IF LEN(F$)>8 THEN PRINT"too big":GOTO 170
190 CLOADMF$,&H2000
200 SL=PEEK(487)*256+PEEK(488)
210 EN=PEEK(126)*256+PEEK(127)-1
220 EX=PEEK(157)*256+PEEK(158)-&H2000
230 NN=EN+42: XX=EN+1
240 FORI=EN+1 TO NN
250 READX$: X=VAL("&H"+X$)
260 POKEI,X
270 NEXTI
280 ST=SL+&H2000
290 S1=INT(SL/256): S2=SL-S1*256
```

Listing continued

allows you to get a printout of the directory. It is a lot easier than trying to hit the shifted @ key as the screen quickly scrolls by in an attempt to read the upper portion of it. As a bonus, you also get the number of free granules. The POKE150,41 in line 30 sets the baud rate to 1,200. If your printer uses a different rate, this should be modified. If you don't have an LP VIII, eliminate or modify line 20.

Tapefix

There are some machine-language programs that will not load properly when using Disk Basic. These are generally those programs that start before address $0E00. An adaptation of the following machine-language program in most cases allows you to load and execute those programs without modifying the original code. The following machine-language program does the trick by disabling the disk drives, clearing screen memory, then block-moving the offset-loaded code to its original location before execution.

Since not all programs are of the same length nor lie in the same address range, Program Listing 3, Tapefix, must be customized for each program. In particular, the START, END, and EXEC addresses must be changed as well as the relocation of the above code.

To eliminate this tedious examination procedure, I constructed the Basic Program Listing 4, which reads the offending program from tape and then appends the previously cited machine-language patch to allow the program to run from disk.

The program is self-prompting throughout. It asks for the name of the tape file and after it patches it, asks for the name of the file as it is to be put on disk. The program is nondestructive, so it can be run over and over again without hitting reset or dropping power.

Romfix

The biggest problem confronting the disk user is that the contacts on disk cartridges are subject to corrosion. When you remove the cartridge and then plug it in later, unless you get it back in the exact same position or clean the contacts with a rubber eraser, you risk wiping out a disk with the loss of whatever is on it.

Since cleaning the contacts requires opening the cartridge to get to the top set, there had to be a better way: Don't unplug the disk cartridge. But what do you do with a drawer full of ROM cartridges?

The machine-language Program List-

Listing continued

```
300 N7=EN+27:POKEN7,S1: N8=EN+28:POKEN8,S2
310 EL=EN-&H2000
320 S3=INT(ST/256): S4=ST-S3*256
330 POKEEN+23,S3: POKEEN+24,S4
340 E3=INT(EN/256): E4=EN-E3*256
350 POKEEN+34,E3: POKEEN+35,E4
360 X1=INT(EX/256): X2=EX-X1*256
370 POKEEN+41,X1: POKEEN+42,X2
380 INPUT"NAME OF FILE ON DISK";F$
390 IF LEN(F$)>8 THEN PRINT"too big":GOTO380
400 SAVEMF$,ST,NN,XX
410 SOUND125,3:PRINT"READY":END
420 DATA4F,B7,FF,40,86,34,B7,FF
430 DATA03,8E,04,00,86,80,A7,80
440 DATA8C,06,00,2D,F9,8E,26,00
450 DATA10,8E,06,00,A6,80,A7,A0
460 DATA8C,47,10,2D,F7,0F,71,7E
470 DATA18,38
480 PCLEAR1:GOTO20
```

Program Listing 5. Romfix

```
BLKMOV EQU $AC20     BLOCK MOVE ROUTINE IN BASIC
NEWEND EQU $41       ****************************
OLDEND EQU $43       * ADDRESSES FOR ARGUMENTS  *
NEWSTR EQU $45       * USED BY BLOCK MOVE ROUT. *
OLDSTR EQU $47       ****************************
       ORG $3F9A     ADDRESS OF ROMDSK ROUTINE
START  CLR $71       FORCE A HARD START
EXT64K ORCC #$50     ****************************
       LDX #$8000    *       COPY BASIC         *
LOOP   LDA ,X        *          TO              *
       STA $FFDF     *         RAM              *
       STA ,X+       *          IN              *
       STA $FFDE     *         64K              *
       CMPX #$C000   *         RAM              *
       BNE LOOP      *         MODE             *
       STA $FFDF     ****************************
BASFIX LDA #$7E      *                          *
       STA $A051     *        PATCHES           *
       LDD #$A072    *          TO              *
       STD $A052     *         BASIC            *
       LDD #$8E9F    *          ROM             *
       STD $A084     *          TO              *
       LDD #$FE7E    *        PREVENT           *
       STD $A086     *        CURSOR            *
       LDD #$A093    *      APPEARANCE,         *
       STD $A088     *      RESERVE 40K RAM,    *
       CLR $8000     *    KILL EXTENDED BASIC,  *
       CLR $71       *     KILL DISK BASIC,     *
       LDA #$7E      *    FIX RESET BUTTON SO   *
       STA $A0CB     *  IT RESTORES DISK BASIC, *
       LDD #ROMBAK   *   THEN JUMPS TO ROMBAK   *
```

Listing continued

ing 5, Romfix, allows you to save almost all of your ROM cartridge programs to disk on a 64K RAM machine. I could not get Microtext (The Microworks) to run off disk, but I was successful with the others that I had on hand.

Listing 5 patches the Color Basic 1.1 ROM code, eliminating Disk and Extended Basic. It gives the programs 40K of contiguous RAM below Basic as well as the RAM space above Basic for the program itself. Some programs will run even better due to the extra RAM space than in their native ROMs.

"Disk drives are random-access devices."

Program Listing 6, which has the above machine-language program embedded in it, incorporates the necessary modifications to accommodate different-sized ROMs with the ROM code that is read from tape. It eliminates the bother of customizing a machine-language program for each individual ROM pack that you might own. After you have successfully typed in Listing 6, you can lock up your ROM packs forever.

Romfix Operating Instructions

Save the ROM pack code to tape. The safest technique is to put a piece of tape over the cartridge-select land of the ROM cartridge. The cartridge-select land is the outer land alongside the shorter land, which supplies the cartridge with power. Plug in the ROM cartridge with the machine turned off. Now power up and type: CSAVEM "<name>",&HC000,<end address>, &HC000.

Find the end address by looking for a repetition of the code sequence that started at $C000 with some ROM packs or a succession of $7Es with others. This can be done using a machine-language monitor or Program Listing 7 with the ROM pack installed, but disabled with tape.

Load and run the Basic/machine-language combination Romfix (Listing 6). You will be prompted as to when you should load the previously prepared tapes and destination disk. ■

Write Richard Esposito at the University of Baltimore, Baltimore, MD 21201; write Ralph Ramhoff at 5015-1 Green Mountain Circle, Columbia, MD 21044.

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✓296

Just for your TRS-80® COLOR TDP System 100 Dragon-32 MC-10

Listing continued

```
                STD $A0CC     *                              *
                JMP $A027     ****************************
          ROMBAK LDD #$C000   PUT ROM CODE BACK AT $C000
                STA NEWSTR
                LDD #$DFFF    ($CFFF FOR 4K, $EFFF FOR 12K)
                STD NEWEND
                LDD #$4000
                STD OLDSTR
                LDD #$5FFF    ($4FFF FOR 4K, $6FFF FOR 12K)
                STD OLDEND
                JSR BLKMOV
                ANDCC #$AF
                JMP $C000
                END START
```

```
10 FOR I=&H3F9A TO &H3FFE
20 READ A$
30 POKE I,VAL("&H"+A$)
40 NEXT I
50 DATA 0F,71,1A,50,8E,80,00,A6,84,B7,FF,DF,A7,80
60 DATA B7,FF,DE,8C,C0,00,26,F1,B7,FF,DF,86,7E,B7
70 DATA A0,51,CC,A0,72,FD,A0,52,CC,8E,9F,FD,A0,84
80 DATA CC,FE,7E,FD,A0,86,CC,A0,93,FD,A0,88,7F,80
90 DATA 00,0F,71,86,7E,B7,A0,CB,CC,3F,E3,FD,A0,CC
100 DATA 7E,A0,27,CC,C0,00,97,45,CC,DF,FF,DD,41,CC
110 DATA 40,00,DD,47,CC,5F,FF,DD,43,BD,AC,20,1C,AF
120 DATA 7E,C0,00
130 CLS
140 PRINT@0,STRING$(32,"*")
150 PRINT@32,"*"+STRING$(30," ")+"*"
160 PRINT@64,"* ROMPACK TO DISK UTILITY V1.1 *"
170 PRINT@96,"*"+STRING$(30," ")+"*"
180 PRINT@128,"*   COPR 1982 BY                *"
190 PRINT@160,"*         RICHARD E. ESPOSITO   *"
200 PRINT@192,"*                               *"
210 PRINT@224,"*          << 64K RAM >>        *"
220 PRINT@256,"*    DISK COLOR BASIC 1.0       *"
230 PRINT@288,"*"+STRING$(30," ")+"*"
240 PRINT@320,STRING$(32,"*")
250 PRINT"IS ROMPACK CODE SAVED TO TAPE"
260 A$=INKEY$:IF A$="" THEN 260
270 IF LEFT$(A$,1)<>"Y" THEN PRINT"DROP POWER, THEN UNPLUG DISC
CARTRIDGE & SAVE ROM CODE":END
280 INPUT"NAME OF TAPE-FILE CONTAINING ROM CODE";F$
290 IF LEN(F$)>8 THEN PRINT"too big":GOTO 280
300 CLOADMF$,&H8000
310 E=PEEK(126)*256+PEEK(127)-1
320 EH=INT(E/256):EL=E-EH*256
330 POKE&H3FF3,EH:POKE&H3FF4,EL
340 FH=EH+&H80
350 POKE&H3FE9,FH:POKE&H3FEA,EL
360 INPUT"NAME OF FILE ON DISK";F$
370 IF LEN(F$)>8 THEN PRINT"too big":GOTO360
380 SAVEMF$,&H3F9A,E,&H3F9A
390 SOUND125,3:PRINT"READY"
```

Program Listing 6. Basic Listing with Romfix Incorporated

```
10 A=PEEK(&HC000): B=PEEK(&HC001):C=PEEK(&HC002): D=PEEK(&HC003)
: E=PEEK(&HC004): F=PEEK(&HC005)
20 FOR I=&HC400 TO &HF400 STEP &H400
30 IF PEEK(I)=A AND PEEK(I+1)=B AND PEEK(I+2)=C AND PEEK(I+3)=D
AND PEEK(I+4)=E AND PEEK(I+5)=F OR PEEK(I)=126 AND PEEK(I+1)=126
 AND PEEK(I+2)=126 AND PEEK(I+3)=126 AND PEEK(I+4)=126 AND PEEK(
I+5)=126 THEN PRINT HEX$(I-1):END
40 NEXT
```

Program Listing 7. Basic Program to Find End Address

See List of Advertisers on page 130

PRODUCT NEWS

edited by Mark E. Reynolds

The information used in the Product News section is supplied through manufacturers' press releases. *HOT CoCo* has not tested or reviewed these products and cannot guarantee any manufacturer's claim.

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The CMJ-IF is a multi-function subsystem for the TRS-80 Color Computer and the TDP-100. It plugs into the cartridge port and provides a speech synthesizer, two parallel ports, 4K or 8K of EPROM/ROM space, two counter timers, a serial communications port, and an extender port.

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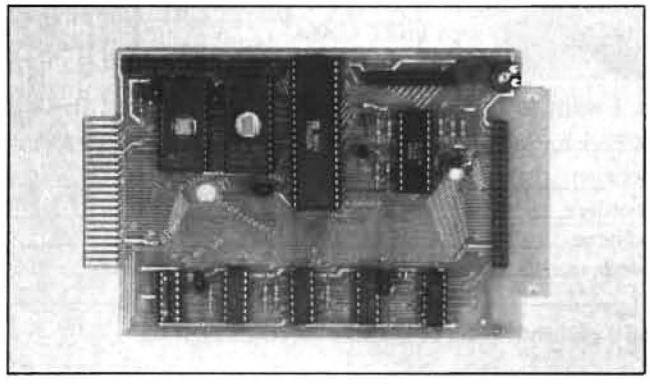

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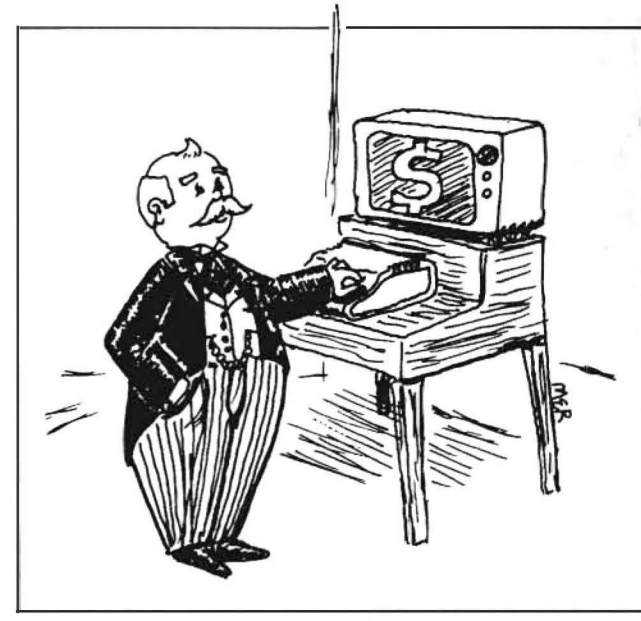

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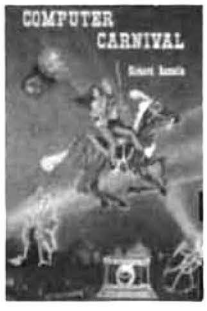

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Reader Service ✓551

Mind Those CoCo Disks

Disk Minder is a utility package for the CoCo disk drive. It allows you to find the load and execute addresses and length of machine-language programs and create an alternate directory that you can reinstall if the master directory bombs, or if you accidentally kill a program.

You can also analyze the directory to find out which granules are allocated to each file. The program can generate a free-space map that shows how the granules are being used, and which are not being used.

With Disk Minder you can kill selected files with a wildcard for either the file name or extension, list a file to the screen or printer, generate a cursor-controlled menu of all the files on disk that can scroll through the list, and run any of them with a single keystroke. Two-disk-drive owners can combine files from one disk to another.

Disk Minder sells for $24.95. All of its commands offer printout options where applicable. For more information, contact Derringer Software, P.O. Box 5300, Florence, SC 29502, 803-655-5676.

Reader Service ✓558

Create Data Files Of Directories

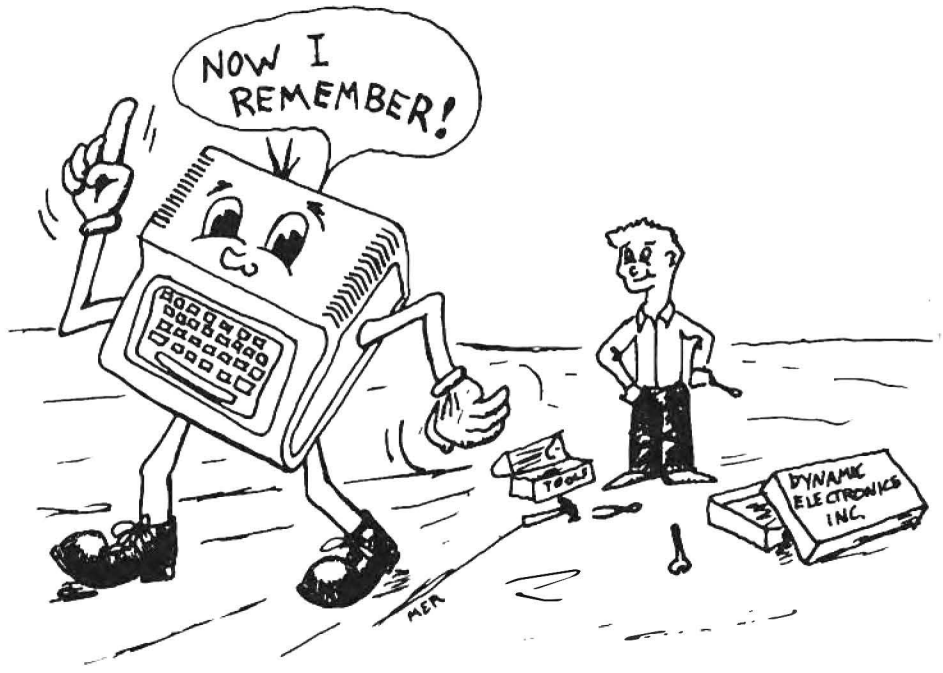
Pro-Color-Dir is an application program for use with Pro-Color-File (version 1.0 or 2.0) that will create a data file of directories.

You load the disks, and Pro-Color-Dir reads the directory and then stores the disk identification, file name, extension, file type, allocation of granules and sectors, and sectors used in a data file. It adds subsequent disk directories at the end of the file.

Pro-Color-File then accesses the data file and generates alphabetized reports of all the files. You can easily store 1,000 file names on one disk.

Pro-Color-Dir sells for $24.95 from Derringer Software, P.O. Box 5300, Florence, SC 29502, 803-665-5676.

Reader Service ✓557



Communicate With Other Systems

Super "Color" Terminal version 3.0 is a communications program for the Color Computer and TDP-100. You can use it to communicate with all popular information services, such as Dow Jones, CompuServe, The Source, and local BBSes and clubs. You can also communicate with other microcomputers, including CoCos, Apples, and IBM PCs, via RS-232 or direct.

Communications with this program are effortless, whether downloading or uploading. The Super "Color" Terminal also creates files totally compatible with other programs in the Super "Color" Library.

This program will work on a 16K CoCo, but it works best on a 64K machine. The ROM-pack version offers a full 61K of buffer space in a 64K computer. Up to 51.5K is available with a disk system, and 53K with a tape system.

The Super "Color" Terminal also offers a choice of eight high-resolution displays, with real lowercase descenders. It supports automatic color-graphics communications so you can receive pictures from bulletin boards and information systems. Other features include lowercase masking, selectable character trapping, and programmable upload prompts.

The Super "Color" Terminal is an integrated and adaptable system, capable of communicating with any system at baud rates from 110–9600. It supports disk and cassette I/O to save and load ASCII files, machine code and Basic programs, and allows you to print the buffer contents.

The program sells for $49.95 on tape, $59.95 on ROM pack, and $69.95 on disk (manual only, $10) from Nelson Software Systems, 9072 Lyndale Ave. S., Minneapolis, MN 55420, 612-881-2777.

Reader Service ✓561

Super "Color" Terminal

Disk Drive Kit

The Color Disk Drive Kit increases the CoCo's capacity to store and access programs and large amounts of data. It plugs into the cartridge port to give you

156,672 characters of storage per disk.

The drive kit is compatible with Radio Shack software and hardware. It includes a 5¼-inch double-density, 40-track floppy disk drive, a cable, a plug-in program cartridge, one blank 5¼-inch disk, a reference manual, and operator's instructions. The included cable allows you to use up to two drives per system. An optional cable allows you to use up to four.

The kit requires Extended Color Basic and costs $399 from American Small Business Computers Inc., 118 South Mill St., Pryor, OK 74361, 918-825-4844.

Reader Service ✓555

Printer/Modem Switcher

Saturn Electronics has introduced a printer/modem switcher that includes several features. It doesn't require batteries or power, nor does it need extra cables or adapters. It comes assembled and tested and lets you easily switch between your printer and modem.

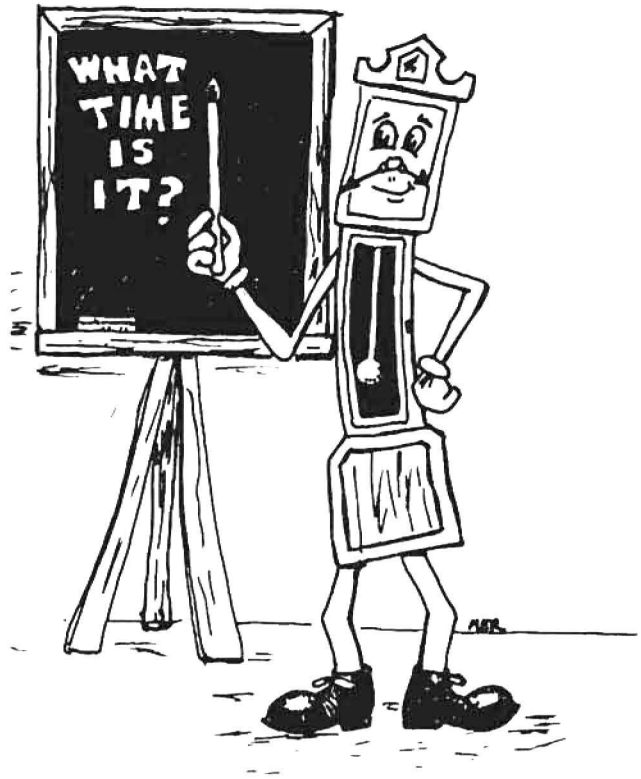
The unit automatically checks the RS-232 port and gives visual indication. It also adds three RS-232 ports to your CoCo.

The printer/modem switcher comes with a two-year warranty and sells for $29.95 from Saturn Electronics Co. Inc., 57-61 Cloverdale Blvd., Bayside, NY 11364, 212-423-4626.

Reader Service ✓553

Save ROM Packs To Cassette

Lessen the danger of using ROM packs by using ROMBACK2, a utility program designed to allow a 64K CoCo to produce cassette copies of ROM packs. ROMBACK2 also provides the start, end, and execute address of the tape so that you can transfer it to disk, using the SAVEM command.



ROMBACK2 checks the size of the ROM pack, block moves the data to low RAM, and then tacks on a special loader program. It executes this loader program first whenever you execute a ROMBACK tape or disk file.

It boots the cartridge data and a copy of the ROM Basic interpreter into high RAM, and then initializes the computer to emulate its state at the time of a jump on power up to a real cartridge. It then creates the cartridge data.

You can produce tapes on a 32K machine with ROMBACK2, but you must run them on a 64K. The program will not copy some code-protected ROM packs.

ROMBACK2 comes on cassette and sells for $20 from Cheshire Cat Software, 1529 Addison St., Berkeley, CA 94703.

Reader Service ✓563

A Game and Two Other Programs

Crystal Software has developed three new programs for the CoCo and the TDP-100.

● Spelling Bee is a one- or two-player game in which spellers try to find the letters that make up a word hidden in a flower.

The game comes with a file of 260 words, and you can create your own word files and save them on tape. There are three variations of play and two skill levels.

Spelling Bee is for ages seven to adult and requires Extended Color Basic. It is available on cassette for $15.95.

● Time Teacher displays a traditional and a digital clock. Students convert the time displayed on the traditional clock to digital time.

The program contains six skill levels that increase automatically as children successfully complete the exercises. It also keeps a detailed progress report for each student and can display it at any time on the screen or printer.

Time Teacher is written for children ages 5–11. It requires Extended Color Basic and is available on tape for $15.95.

● Traffic is a machine-language, arcade-type game in which you must forge your way across a congested highway by dodging traffic. You might reach a point at which you must cross 12 lanes of traffic, and the level of difficulty increases automatically.

Traffic requires at least 16K but does not require joysticks. It is available on a cassette that contains both Color Basic and Extended Color Basic versions of the game for $10.95.

You can get all three programs for $36. For more information on these cassettes, contact Crystal Software, 6591 Dawsey Road, Rock Creek, OH 44084.

Reader Service ✓554

A Cassette Magazine on Disk

Chromasette Magazine, the cassette magazine for the Color Computer, is now available on disk as well. Each month it brings you six to eight programs, including tutorials, utilities, and games.

You can buy any issue since July 1981 on tape and disk. The programs will be the same on either medium, but the ones on disk might be modified for 32K disk systems.

There will also be a menu program on each disk to take care of the initial memory allocation for each program, making it easy to run programs without worrying about the CLEAR and PCLEAR values.

Single copies of back issues sell for $6 on tape or

$11 on disk. A year's subscription (12 issues) is $50 on tape and $95 on disk. A subscription for six months (six issues) is $30 on tape and $55 on disk. For more information, contact *Chromasette Magazine*, P.O. Box 1087, Santa Barbara, CA 93102, 805-963-1066.

Reader Service ✓560

Old McDonald's Vowels

Old McDonald's Farm is a drill program on the long and short vowels.

The screen displays a barnyard scene, and the tape contains recorded audio messages so children will hear someone saying the vowel sounds and exemplary words. These words are printed on the screen and used in a sentence. A flashing pig appears when students make an error, but they get to find a mystery animal in the barn when they answer all cues correctly.

The program sells for $14.95 (plus $2 postage) and includes a manual that discusses the objectives of the drill, some sample items, operating hints, and suggestions for using the program. For more information, contact Teksym Corporation, 14504 Country Road 15, Minneapolis, MN 55441, 612-473-1225.

Reader Service ✓556

Beyond Words

Beyond Words is a series of language arts programs for a 32K, Extended Color Basic CoCo. There is a cassette for each of three skill levels—grades 3–5, grades 6–8, and grades 9–12.

All three levels include a spelling test in which the student must indicate the correct spelling from two choices, and a synonym/antonym test in which he must decide if different word pairs are similar or opposite in meaning. Beyond Words I includes a section on abbreviations and contractions, Beyond Words II contains a section on homonyms, and Beyond Words III tests language reasoning with verb analogies that ask the student to consider relationships between related word pairs.

Each cassette sells for $19.95, plus $1 postage, and is available from Computer Island, 227 Hampton Green, Staten Island, NY 10312, 212-948-2748.

Reader Service ✓564

The GMX 6809 CPU III

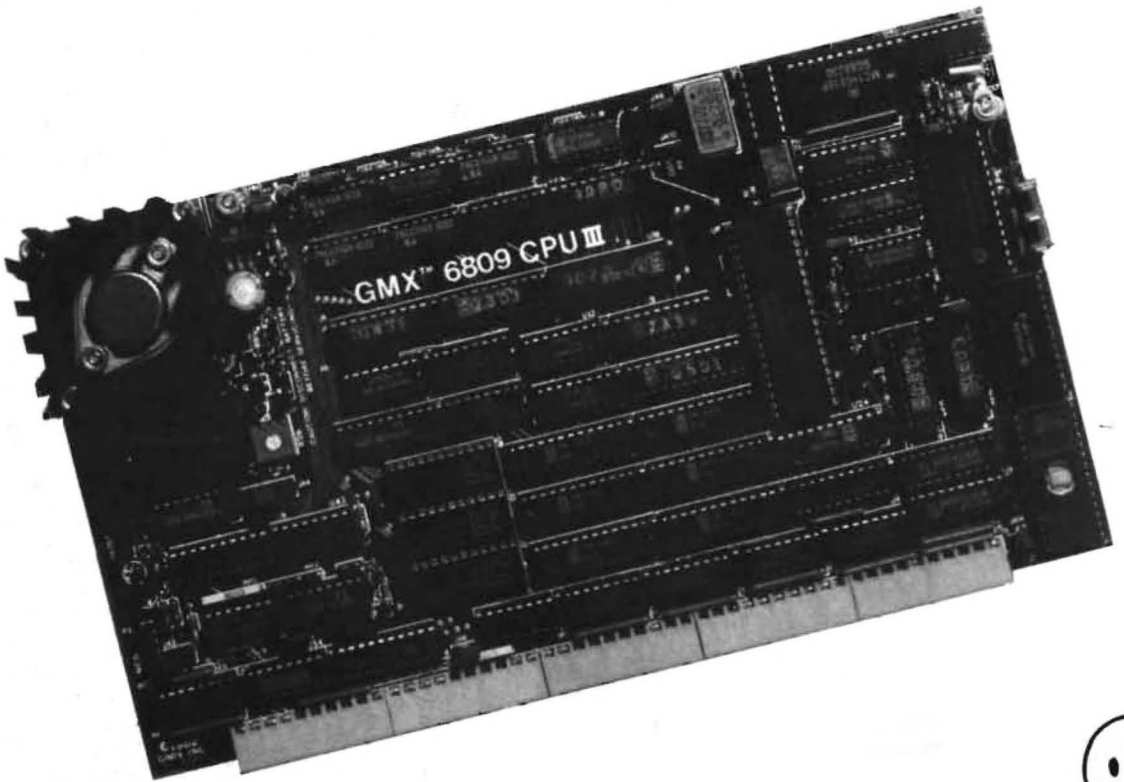
The GIMIX 6809 CPU III board is an advanced design, specifically intended for use with multi-user, multi-tasking operating systems.

Built on a multi-layer circuit board and utilizing high-speed, high-density logic, the GMX CPU III enhances the performance of the 2MHz. 68B09 by providing such features as 1 byte/microsecond DMA block transfers from memory to memory or between memory and I/O devices, and advanced memory management with 2K segments and segment attributes. The board automatically arbitrates DMA contention between the on board DMA and external DMA devices such as disk controllers. The 2K memory segments allow more efficient memory usage. The segment attributes allow the trapping of out-of-range memory references, write protection, and a hardware single step function for software debugging.

The board prevents the execution of certain illegal instructions from crashing the system by monitoring interrupts to the 6809 and its response to them. If the processor does not respond to an interrupt within 128 clock cycles the board resets the 6809 and asserts a special reset vector. The system can then close down the offending task and resume normal operation. This also limits the length of time that interrupts can remain masked by a user, preventing users from keeping the system from task switching and servicing other users.

To further protect the system, the CPU board supports separate user and system "states" with automatic switching to the system state in response to interrupts and system (SWI) calls. Certain functions and memory areas can only be accessed in the system state, preventing unauthorized accesses.

The GMX CPU III also includes a full function time-of-day clock with year and automatic leap year/daylight savings time correction, and a 2K scratchpad RAM; both with battery back-up. To provide precision timing functions, a 6840 PTM with a separate 500 KHz. precision (.0025%) time base oscillator is included. The oscillator is easily user replaceable to provide other time base frequencies (750 KHz. maximum). The single EPROM socket will accept 2K, 4K or 8K EPROMS, with a maximum of 4K mapped into the system address space at any one time. Software switching is implemented by selecting the upper or lower half of an 8K EPROM under hardware or software control.



OS-9 GMX III Operating System

OS-9 GMX III is an enhanced OS-9 Level II that takes full advantage of the features of the GMX CPU III. As a result, the system is faster, more memory efficient, and a more secure multi-user, multi-tasking operating system than the original OS-9 GIMIX II, while retaining complete software compatibility. Throughput is enhanced by the memory to memory DMA and the automatic task switching, while the memory attributes and illegal instruction trapping protect the system and individual users from each other. Sharable system modules in RAM are write protected to prevent tampering. Memory mapping in 2K segments and the ability to load modules in non-contiguous RAM provide more efficient memory utilization. Each task can be allocated a full 64K of RAM, with no operating system overhead in the tasks address space.

UniFLEX for the GMX 6809 CPU III and Intelligent I/O boards is in development.

GMX INC 1337 West 37th Place • Chicago, Illinois 60609 • (312) 927-5510 • TWX 910-221-4055

Wake up your CoCo

Do you really care what this ad says, or are you just looking at the girl?

If you bought your CoCo just to play games, then read no further because we're going to show you how to unleash the power that's in your CoCo. It's a little known fact that the CoCo is one of the fastest computers around and with the right software can do everything that any other computer can do, only better and faster. The key, of course, is good software! Without it, all you can do is play games with your CoCo.

Because of the power in the CoCo, it was possible for us to bring the FLEX operating system over to the CoCo, which we did over a year and a half ago, with FHL Color FLEX. Since then, FHL has become the largest supplier of software for the FLEX operating system and the CoCo in the world!! We have over 100 applications for the CoCo and they are all high level software packages that have been used for years on much larger computer systems running the FLEX operating system! These applications range from languages, utilities and software development tools to word processing, data base management and business applications.

We have thousands of CoCo users running our FHL Color FLEX and all of the software compatible with it. These users range from hobbyists to businessmen, schools, universities, accountants, secretaries, and even NASA. The uses for FLEX seem endless!

And, of course, we fully support our FHL Color FLEX!!!

Software is not the only way we enhance the CoCo. We have everything from complete systems to memory chips. We also have one of the best expansion systems for the CoCo available. It's called "THE SOLUTION", and can be seen in the center of the picture, between the CoCo and the disk drive.

If you want to know more about the power of your Color Computer and the possibilities open to you as a user, send $3.00 for our latest catalog! (The cost of which may be applied toward your first order.)

SPECIAL: FHL Color FLEX now $69.95 plus $3.50 shipping and handling.

FHL FRANK HOGG LABORATORY

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