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Screen above is unretouched photograph of ColorMote display. Disk Extended BASIC is not required.

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DIGRESSIONS

SHOULD YOU BE AFRAID OF BUYING MAIL ORDER?

I have a friend who, as a child, ordered a pet monkey from an ad in a comic book. Several weeks later the monkey arrived—dead. Of course, the ad didn’t say that the monkey was alive.

You can understand if I tell you my friend has bad feelings about shopping mail order. Perhaps you, too, have had bad experiences shopping by mail, and you hesitate to buy anything for your Color Computer unless you can get it at your local Radio Shack store.

Now, Radio Shack has some great stuff for the CoCo, but for every good product that Radio Shack sells, there are dozens of others a phone call or letter away. And much of the risk involved buying long distance can be reduced if you are aware of the laws and proper ordering etiquette. (This month we’ve published a short piece on p. 8 detailing your rights as a mail-order consumer and what to do if you think you are getting a raw deal. Please read it.)

The Color Computer “cottage industry,” or non-Radio Shack software and hardware vendors, has had an unusually good record in regard to the rest of the mail-order computer business. You just don’t hear stories of bogus companies taking people’s money and then disappearing in the Color Computer world.

If you have a problem with a mail-order vendor, it’s probably one of three types: The vendor advertised something that was not quite finished, and it isn’t brought to market at the promised date; your order “fell between the cracks” (vendors are human and sometimes lose track of things); or the vendor went out of business.

The first type is by far the most common, and this is true for the entire microcomputer support industry. Vendors advertise unfinished products because of the desire to beat out the competition. Many times, however, a product is advertised prematurely only because the vendor misjudged the lead time needed to get it out. Meanwhile, the buyer can write or get his money back.

The second type speaks for itself, and this problem is easily worked out between the buyer and the vendor. The third type of buyer/vendor problem is the most unfortunate: The vendor overestimated the market for his product and couldn’t make enough money to continue producing it. Luckily, this is the least-common type of problem.

Many of the CoCo vendors are enthusiasts like yourself. They have sincere interest in your getting the most out of their products. Many are willing to talk you through problems over the phone, and some offer upgrade services for free or at cost. A few even send out newsletters with tips and other newsworthy items.

Most of the vendors I’ve met are not out to make a killing off Color Computer users. They like what they are doing, and they get a big kick out of someone telling them, “Gee, I really liked your program.”

If you have a problem with a vendor, politely try to work it out. You’ll get satisfaction 99 percent of the time. If you are in the other 1 percent, let us know about it. Send us any correspondence you have and the problem’s history. We’ll do all we can to resolve the situation.

If you get exceptionally good service from a vendor, let’s hear about that, too. We’ll pass along your comments.

One more piece of advice: Don’t buy monkeys from ads in comic books.—M.N. ■
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Mail-Order Savvy

One of the ways HOT CoCo saves you money is through the many mail-order vendors for whom we run ads. By leafing through our pages, you can come up with some good deals on software and hardware.

Often, our readers have praised various vendors’ customer-service policies. Sometimes, though, that isn’t the case.

The Federal Trade Commission passed the Mail-Order Rule in 1975 to protect consumers from mail-order fraud. If you plan to order anything through the mail, you should know your rights.

If you’ve sent in payment, you must receive the merchandise when the vendor promised it.

If the vendor has not stated a specific delivery date, then he must ship your merchandise no later than 30 days after receiving your order. If you don’t get your purchase shortly after the 30 days, you can cancel your order and get your money back.

A vendor must notify you if he can’t meet the promised delivery date (or the 30-day limit). He must also tell you when he can ship the merchandise and give you the option of canceling your order for a full refund or agreeing to wait for the new shipping date. He must give you a free way to return your answer, as by a stamped card or envelope. However, if you don’t answer, it means you accept the shipping delay.

When you cancel a prepaid order (unless you paid via credit card), the vendor must mail you a refund within seven business days. If there is a refund delay, the company must obtain your express consent.

If you cancel a mail order charged on your credit card, the vendor must credit your account within one billing cycle after receipt of your request. This rule does not apply to certain purchases, such as the following: mail-order photo finishing, orders for seeds and plants, magazine subscriptions and other deliveries in a series (except for the initial shipment), C.O.D. orders, and credit orders when you do not pay before the company mails the merchandise. Also, the rule does not generally apply if you order an item by phone, perhaps when using a vendor’s toll-free 800 number.

So, if you have a problem, what should you do? First, contact the mail-order company. Be ready to give them all pertinent information, such as your order number, credit-card number, check number, order date, and the exact name you used when ordering. You’ll make solving potential problems much easier if you keep records of all this information from the beginning.

If you’ve contacted the company and still aren’t satisfied, contact the following organizations (and keep a record of each communication):

- Your local or state consumer protection office or Better Business Bureau.
- The consumer protection agency nearest to the vendor.
- Your local postmaster. Ask for the name and address of the appropriate postal inspector in charger.
- The book, magazine, or newspaper publisher that carried the advertisement. Publishers often try to resolve problems between readers and advertisers.

- The Direct Mail/Marketing Association, Mail-Order Action Line, 6 E. 43rd St., New York, NY 10017.
- The Federal Trade Commission, 6th St. and Pennsylvania Ave., Washington, DC 20580. The FTC doesn’t resolve individual disputes, but your information can help them establish policies to protect consumers in the future. ■

If Our Programs Don’t Work

Having trouble entering our listings from the magazine? Here are a few tips that might help.

First, we print all our Basic listings in the CoCo’s 32-column format. This means that each line should appear the same on the screen as it does in the magazine. If a line on your screen does not match the same line in the magazine, reread what you typed; you might have made an error.

Second, make sure the program is for your computer. Read the System Requirements box. The information in this box represents the minimum system configuration needed to run that particular program. Also, read the article thoroughly before typing in the program. Sometimes the article contains instructions vital to making the typed-in listing work. For instance, some CoCos will not accept the high-speed POKE (POKE 65495,0). The article for a program using this POKE will tell you to change those POKEs to 65494,0 if your computer will not work at the faster speed.

Some CoCos are sensitive to spacing in the program lines. Occasionally a computer will read a line such as FORR = $TOO incorrectly, interpreting the FOR not as a keyword, but as a variable. If you’ve removed spaces from a program listing to save space, and that program will not work, reinset those spaces.

If everything is okay so far, check the published listing with what you’ve typed. Common typing errors include confusing a zero with the letter O, a one with the letter I, or a colon with a semicolon. DATA statements are particularly tricky because of the long lists of numbers. Be very careful with these.

Assembly listings usually require an editor/assembler to enter them into your CoCo. The two most common editor/assemblers are Radio Shack’s EDTASM+ and The Micro Works’ SDS80C. An Assembly listing assembled using the SDS80C will probably not run under EDTASM+. You can hand-assemble Assembly listings using a short Basic listing such as that found on page 135 of the November 1983 HOT CoCo. Hand-assembly is a tedious task best left to more experienced users. If all the above fails, send us a printout or a detailed description of the problem you experience along with any error messages. We’ll try to work it out for you. We cannot help you if you have modified the original program in any way. ■

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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.

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TP-10 Thermal Printer. The affordable way to get program listings, text and data printouts. Prints non-color graphics, too. And TP-10's thermal operation is so quiet you'll hardly know it's there! Text mode prints 32 characters per line at 30 characters per second. A special repeat function makes graphics programming easier than ever! Uses 4⅛"-wide paper. Measures just 3 x 8 x 5".

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At $79.95, the HJL-57 is reasonably priced, but you can find other CoCo keyboards for a few dollars less. So, before you buy, we suggest that you compare.

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Compare Construction.
The HJL-57 has a rigidized aluminum baseplate for solid, no-flex mounting. Switch contacts are rated for 100 million cycles minimum, and covered by a spill-proof membrane.

Compare Performance.
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Feedback

Assembler Frustration

I enjoy the Assembly-language programs you publish and hope for more. However, I am continually frustrated by the differences between ED-TASM+ and other assemblers, such as SDS80C.

When you publish articles like "Smashout" (HOT CoCo, November 1983, p. 80), I wish you would explain how to assemble them on ED-TASM+, or at least let us know that the program requires an SDS80C assembler.

I would also appreciate an article explaining the differences and similarities among assemblers.

Joel A. Sherman
Watertown, CT

Sorry about our oversight. We try to be as specific as possible in our System Requirements box. Your article suggestion is a good one. We'll see what we can do. —eds.

Better Resolution

I built the monochrome monitor ("Monochrome Monitor Driver," HOT CoCo, July 1983, p. 36), which I find very satisfactory, but I would appreciate better resolution. How about publishing an article on building an 80-column card (if such a thing is possible), preferably internally connected so the ROM-pack port remains free for my Super Color Writer ROM pack.

Keep up the good work; I enjoy HOT CoCo.

David Elliot
Toronto, Ontario

Them Ol' PMODE 4 Blues

Many programmers seem to be using the PMODE 4 color artifacts lately, as does Radio Shack in Sands of Egypt. However, PMODE 4 does not work on TV sets in countries such as Australia and the UK that use the PAL TV system. This color artifact just results in black and white, or at best, blue and white.

Down here, games such as Donkey King and Space Shuttle are pale and colorless, but those such as Trapfall and Whirlybird Run that use different high-resolution color techniques work well.

I hope the programmers out there take note. I'd like to be able to see more of the color games on my CoCo.

Tony R. Davidson
Brisbane, Australia

Have You Hugged Your HOT CoCo Today?

I want to thank you for a great magazine—it's fantastic. My 15-year-old son and I have learned so much from each article.

Jeanne Raynor
Ford, WA

On-Line

Falcon Color-80

The Falcon Color-80 is a new 24-hour bulletin board system (BBS) in California. We're a CoCo board, but we welcome all computer users.

In addition to an electronic mail section, we have full upload and download capabilities. We welcome comments.

Craig, Keith, and Dan Daniel,
Sysops
Fairfield, CA
707-437-3663 (BBS)

CoCo Corner BBS

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Jim LeDoux, Sysop
Santa Barbara, CA
805-687-9400 (BBS)

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Eric Thred, Sysop
Blis, IL
312-597-8485 (BBS)
Dang It, Let’s Get It Right

The very chagrined staff of HOT CoCo would like to apologize to our reader’s for the inadvertent sneak preview of the February Elmer’s Arcade program listing in January. The correct listing, Dang It, appears below. (Sorry Richard, but Elmer made us do it.)

```
100 REM * DANG IT * TRS-80 EXTENDED COLOR BASIC
110 REM * ELMER’S ARCADE * JAN.
'84 * RICHARD RAMELLA
120 CLL
130 FOR A=1 TO 200
140 PRINT CHR$(34+RND(10));
150 B=RND(10)
160 IF B=5 THEN PRINT " DANG IT!" ;
"*"; SOUND RND(8)*13,1
170 NEXT A
180 FOR A=1 TO 500
190 NEXT A
200 CLL(8)
210 SC=0
220 E=30
230 GS=CHR$(128)
240 R=1024
250 FOR A=32 TO 62
260 POKE R+A,207
270 POKE R+A+448,207
280 IF A=32 OR A=62 THEN FOR X=A TO A+446 STEP 32: POKE R+X,207:
290 NEXT X
300 PRINT 0,"SCORE";STRINGS(25)
310 PRINT 24,"HIGH";STRINGS(3,191)+
CHR$(270);
320 PRINT 0,"SCORE";SC;
330 PRINT 0,"SCORE";SC;
340 PRINT 40,STRINGS(31,207);
350 NEXT A
360 END
370 FOR K=M TO 63 STEP -32
380 IF POKE (R+K-32) <>128 GOTO 390
390 NEXT T
400 FOR T=1 TO E
410 IF B<>1 THEN FOR C=506 TO 480
420 STEP -1 ELSE FOR C=480 TO 506
430 PRINT 0,C;PS;
450 PRINT C-31,JS;
460 FOR T=1 TO E
470 NEXT T
480 IF INKEYS<>("GAME OVER";
490 NEXT C
500 SC=SC-1
510 GOTO 510
520 M=30
530 PRINT 0,"GAME OVER";
540 FOR K=M TO 63 STEP -32
550 PRINT 0,K;HS;
560 IF PEER(R+K-32)<>128 GOTO 570
570 PRINT 0,K;GS;
580 NEXT K
590 L=A-143
600 IF K=415 THEN PRINT 0,K;HS:
"GOTO 300"
610 IF PEER(R+K-32)=L OR PEER(R+K-1)=L OR PEER(R+K+1)=L GOTO 658
620 SC=SC+1
630 SOUND RND(8)*13,1
640 GOTO 330
650 IF SC<>SG THEN SG=SC
660 PRINT 0,480,"GAME OVER";
670 SOUND 1,1
680 SOUND 100,1
690 IF INKEYS<>("GAME OVER";
700 GOTO 200
710 END
```

High Scores

<table>
<thead>
<tr>
<th>Name</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ray Gallantry</td>
<td>64,275</td>
</tr>
<tr>
<td>Dan Shargel</td>
<td>74,500</td>
</tr>
<tr>
<td>Doug Burke</td>
<td>14,700</td>
</tr>
<tr>
<td>Greg Burke</td>
<td>64,500</td>
</tr>
</tbody>
</table>

Help!

Ray Gallantry also needs to know how to get out of the maze and obtain a spell in Madness and the Minotaur and how to load the gun in Keys of the Wizard. Any suggestions?

M.A. Brickles
Allen Park, MI

Michael E. Nadeau
Peterborough, NH

Mark E. Reynolds
Bennington, NH

Life in the Fast Lane

I’m an avid game-player who loves car games. If anyone out there has written a good one, please send it in.

Scott March
6 Debra Cresent
Barrie, Ontario L4N 3T1

Coke and CoCo

Many of your advertisers are making a serious mistake when they show a computer or peripheral sitting with a cup of coffee beside it. A cup of liquid beside your machine is a disaster waiting to happen.

As a TV engineering supervisor, I work with electronic devices every day, and I’m well aware of the hazards presented by coffee, tea, or soda pop in a computer. Not only can they short out a unit that’s on, but they also contain acid that can eat into things like circuit-board traces and fragile little wires.

Spilled soda pop is worst of all, because it contains sugar and corn syrup and gets sticky when it dries. When you try to clean it, it just thins and then rethickens when it dries again, so you must soak, rinse, and wipe damaged components repeatedly. Some of the cleaning agents are very expensive, as is the labor cost.

So, don’t set liquid near your computer.

D. W. Hauer
Jackson, MI

Corrections:

re Colormania

The Colormania tutorial, HOT CoCo, January, p. 108, contains a mistake. The reference to Listing 2a (third column, second paragraph) should read Listing 2b. The next paragraph’s reference to Listing 2b, should read Listing 2a.

Also, in the February issue, p. 128, Doctor ASCII instructed our readers to type CSAVE "name", <start address>, <end address>, <EXEC address> in response to Claude L. Perry’s question. This should read CSAVEM "name", <start address>, <end address>, <EXEC address>.

Exeter, NH

I enjoy your magazine and am interested in bulletin boards and users’ groups. If anyone is interested in starting a users’ group, or knows of a bulletin board system in the Kingston/Exeter area, please let me know.

Fred Ahlberg
RFD 1
Kingston, NH 03848

Send your letters to Feedback, HOT CoCo, 80 Pine St., Peterborough, NH 03458.
1. What is an electronic spreadsheet, anyway?
Business people use spreadsheets to organize columns and rows of figures. DYNACALC simulates the operation of a spreadsheet without the mess of paper and pencil. Of course, corrections and changes are a snap. Changing any entered value causes the whole spreadsheet to be re-calculated based on the new constants. This means that you can play, 'what if?' to your heart's content.

2. Is DYNACALC just for accountants, then?
Not at all. DYNACALC can be used for just about any type of job. Not only numbers, but alphanumerical messages can be handled. Engineers and other technical users will love DYNACALC's sixteen-digit math and built-in scientific functions. You can build worksheets as large as 256 columns or 256 rows. There's even a built-in sort command, so you can use DYNACALC to manage small data bases — up to 256 records.

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That's a good question. Basically the answer is that DYNACALC will let your computer do just about anything you can imagine. Ask your friends who have VisiCalc™ or a similar program, just how useful an electronic spreadsheet program can be for all types of household, business, engineering, and scientific applications. Typical uses include financial planning and budgeting, sales records, bills of material, depreciation schedules, student grade records, job costing, income tax preparation, checkbook balancing, parts inventories, and payroll. But there is no limit to what YOU can do with DYNACALC.

4. Do I have to learn computer programming?
NO! DYNACALC is designed to be used by non-programmers, but even a Ph.D. in Computer Science can understand it. Even experienced programmers can get jobs done many times faster with DYNACALC, compared to conventional programming. Built-in HELP messages are provided for quick reference to operating instructions.

5. Do I have to modify my system to use DYNACALC?
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6. Will DYNACALC read my existing data files?
You bet! DYNACALC has a beautifully simple method of reading and writing data files, so you can communicate both ways with other programs on your system, such as the Text Editor, Text Processor, Sort/Merge, STYLOGRAPH™ word processor, RMS™ data base system, or other programs written in BASIC, C, PASCAL, FORTRAN, and so on.

7. How fast is DYNACALC?
Very. Except for a few seldom-used commands, DYNACALC is memory-resident, so there is little disk I/O to slow things down. The whole data array (worksheet) is in memory, so access to any point is instantaneous. DYNACALC is 100% 6809 machine code for blistering speed.

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Probably. You need a 6809 computer (32k minimum) with FLEX™, UniFLEX™, or OS-9™ operating system. You also need a decent CRT terminal, one with at least 80 characters per line, and direct cursor addressing. If your terminal isn't smart enough for DYNACALC, you probably need a new one anyway. The UniFLEX and OS-9 versions of DYNACALC allow you to mix different brands of terminal on the same system. There's also a special version of DYNACALC for Color Computers equipped with FLEX (Frank Hogg or Data-Comp versions).

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The FLEX versions are just $200 per copy; UniFLEX version $395; OS-9 version (works with LEVEL ONE or LEVEL TWO) $250. Orders outside North America add $7 per copy for postage. We encourage dealers to handle DYNACALC, since it's a product that sells instantly upon demonstration. Call or write on your company letterhead for more information.

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See your local DYNACALC dealer, or order directly from CSC at the address below. We accept telephone orders from 10 am to 6 pm, Monday through Friday. Call us at 314-576-5020. Your VISA or MasterCard is welcome. Please specify diskette size for FLEX or OS-9 versions. Software serial number is required for the UniFLEX version.

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Elmer was scribbling something in a Big Chief tablet as I quietly entered his arcade not long ago. I could tell he was in the throes of creative expression by the agonized look on his face.

"What are you doing, A History of The Penny Arcade?" I asked.

"Eep!" he yelped, pocketing a smidgen of a pencil and shoving the tablet under the counter.

"Come on, Elmer, let me see."

"What?"

"What you're writing. I'm a writer. Maybe I can help."

"It's nothing," he said, but I detected shy interest in his voice. It took less than a minute to coax out the Big Chief tablet. "It's just the first draft of a book for little kids," my arcanian friend protested hopefully as I read a lengthy poem called Tantrum.

"This isn't bad at all," I lied when I finished.

To understand how bad it really was, look at the first few lines...

There were three cranky robots: Kate, Ned, and Pete. Who worked in a loft Out on Cheesemaker Street. And under the floor Lived a mouse named Louise, Whose pleasure in life Was gathering up cheese...

It went on. And on and on. The rhyme got worse. To spare you torture and possible death by poetry, I'll simply tell the plot briefly.

The three robots threw a grand tantrum, which Elmer blamed on "a mindbending, spine-rending electrical surge." With the robots hopping all over the place, it was pretty tough for Louise to reach the cheese. In fact, she was in constant danger of being squished as she darted among metallic robot feet and arms in search of bits of de-Brie.

System Requirements
16K RAM
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And it is this part of the plot that gave me the idea for a computer game.

In time, Louise can stand the situation no more. She eats a magic morsel, which Elmer attempts to rhyme with tragic weasel (bring the smelling salts; I'm faint!).

And the little mouse becomes a giant. Robots Ned and Kate run away, but Pete is trapped in a closet, through the openings of which elephantine Louise tosses cheese bombs until all the robots promise never again to give her a hard time when she's gathering food.

The End (and thank goodness).

It was the second part of this story that gave me an idea for another computer game.

“Are you going to do with this... this... poem?” I asked Elmer.

“I thought I'd sell movie rights first.”

“Ever thought of making it into a video game?”

His face flushed. “Not for one moment!”

“Consider it, Elmer. Look at the merchandising boom of Pac-Man. If Louise becomes a star, maybe she could endorse Purina Rat Chow or something like that.”

“You're putting me on,” he said.

“Just let me give it a try.”

“I want a contract,” he said trustingly.

I put out my hand. “Elmer, a hand and a shaking of hands is all you need.”

I took the CoCo to Elmer's Arcade and set up the games for anyone with a nickel. Elmer and I made more than five bucks the first day!

Here’s how to play Cheese Louise:

Type RUN and tap the enter key. A title introduces the three robots. It’s the only part of Elmer's poem I could stand to use. When the timer comes on at the bottom left of the screen, the game begins. For each round the timer starts at 1,000 and is reduced to zero by 10s. You will see a yellow pixel, the cheese, and a blue pixel, Louise the mouse. Tap or hold down the four arrow keys to take Louise to the cheese. When the mouse contacts the cheese, you win the points shown on the timer.

There are, of course, some problems. On succeeding rounds of play, the cheese can be dropped at greater distances from the mouse. Also, the orange robots hop up and down, slowly but without warning. If a robot comes into contact with Louise, 250 points are lost. Also, at times it doesn't work to contact the cheese on a slanting approach. Example: The mouse is immediately northwest of the cheese, and taking it south can turn the cheese temporarily blue and lose points. Also, hitting a side of the room subtracts 250 points.

The game continues forever or until you score at least 10,000 points. Then Louise has all the nibble-chow she needs and you are declared The Big Cheese.”

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the printout, be as specific as possible in relating the error—line occurring, what happens, any clue at all. I surprise even myself with my ability to help in these cases.

However, I cannot attempt to debug a program which has been changed in any way from the version published.

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Lest that make me seem like a real sour apple, let me end by saying it is always a pleasure to hear from anyone with a question about programs I publish. Elmer's the sour apple, not me.
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How difficult is changing a TRS-80 Model I, III, or 4 Basic listing to use on a CoCo? It depends. Many Basic commands perform exactly the same on a CoCo as on the other Radio Shack computers. The other models use black-and-white monitors, so the primary differences between their programs and the Color Computer's involve the graphics commands. Another problem area is the conversion of keyboard PEEK's, but converting Assembly-language subroutines is not within our scope.

You don't need to rewrite programs command for command. You can rewrite SET graphics as CHR$ graphics. It is more important to have the final product function correctly than it is to be sure all commands are the same.

Whoever uses the program will be more impressed with how well it works than how closely the converted listing resembles the original. Most users probably won't even read the listing. There is no magic formula to convert software. I'll try to give some general guidelines for specific commands.

The PRINT command is exactly the same on any Radio Shack model, except that you must change the black-and-white (B&W) computer's LPRINT to PRINT#-2.

The CoCo's screen has 16 lines of 32 characters each. The B&W screen has 16 lines of 64 characters. A CoCo screen, therefore, cannot show as much information or writing at one time as a B&W screen. You must adjust PRINT lines to fit the smaller format by breaking one screen of printing down into two pages. The CoCo's small screen makes cutting words in half more difficult to avoid.

Program Listing 1 runs on B&W or a CoCo. On the CoCo, it splits words. Adjust for this by inserting enough spaces (Program Listing 2), or using two PRINT statements (Program Listing 3).

Following PRINT with a comma causes a B&W to print four columns, each 16 characters wide. Program

Listing 4 is an example. The program displays two 16-character-wide columns on a CoCo. PRINT TAB is usually used to center headings. The CoCo's center is 16 spaces from the left, while the B&W's is 32 spaces from the left. To center a title on a B&W, use Program Listing 5. Use Program Listing 6 for a CoCo. You can usually make the conversion by subtracting 16 from the PRINT TAB number.

Lowercase does not exist on the screen of some Model I's. Model III's have true lowercase. Sentences with lowercase look good on a Model III, but appear unsightly on the CoCo. Unless it's important, change all letters in sentences to uppercase.

PRINT@ positions on a B&W range from 0-1,023, with each line increasing by 64. PRINT@ on a CoCo goes from 0-511. Generally, to convert PRINT@, divide the position by two.

Fig. 1. The B&W's CHR$ and POKE Graphics Characters
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Turn your Color Computer into a graphic design center with the ease of a keystroke! MagiGraph makes it simple to create highly detailed figures up to and including an entire high-resolution screen. Designed for those with some experience in Basic and Assembly Language programming, MagiGraph includes lots of special features:

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- Executes in less time than Basic

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**CAVE HUNTER** — Experience vivid colors, bizarre sounds and eerie creatures as you wind your way through a cave maze in search of gold treasures. This exciting Hi-Res game by Mark Data Products requires 16K for cassette version. $24.95
The Model III has special characters available from CHR$(192) to CHR$(255), including Greek letters, card suits, people, and rockets. These are not built into the Color Computer.

Graphics conversions are a little more complicated. PRINT CHR$ and POKE graphics vary in size and design. Figure 1 shows the B&W’s characters for CHR$. Figure 2 displays characters available for a Color Computer. In Fig. 1 the dark areas are light on the screen, and in Fig. 2, dark areas are dark.

The B&Ws have a 3-by-2 pattern of SET positions within each character code. Color Basic’s character codes occupy a 2-by-2 pattern of SET positions.

Program Listing 7 for B&W and Program Listing 8 for the CoCo both draw the same space ship. There is no easy formula for converting. The B&W’s graphics are three spaces tall and, therefore, can print the ship as one string. Color Basic must use two strings to print the ship, since its CHR$ patterns, but you’ll also have trouble locating video memory. Video memory on the B&W ranges from 15,360-16,383, for a total of 1,024 video locations. Each is one PRINT@ position. Color Basic’s video is from 1,024-1,535, for a total of 512 locations.

Program Listing 9 makes the upper-left corner PRINT@ position on a B&W all white. Program Listing 10 makes the same corner buff on the CoCo.

Rather than devise a formula to convert, I usually watch the program on a B&W and then write a color program that has the same action. To change B&W video POKE positions to color, you can use my formula (Wood’s Equation?):

\[
\text{Color video POKE position} = (\text{B&W video POKE position}) \times 2 - 6656.
\]

Remember that the color screen is not contains many PRINT@ positions as B&W, nor does each PRINT@ position contain as many SET positions. Often in converting graphic programs it is necessary to simplify graphics due to the CoCo’s smaller number of video positions.

Another graphics command is SET. All Radio Shack computer screens start at 0,0 in the upper-left corner. The B&W’s lower-right corner has coordinates 127,47. The CoCo’s lower-right corner has coordinates 63,31. As a general rule, divide the X coordinate by two and the Y coordinate by 1.5.

Program Listing 11 draws a border around the B&W computer’s screen. Program Listing 12 does the same for a Color Computer. Remember that the CoCo’s SET command needs a third number representing the color to be used.

The POINT command on a B&W computer returns the value of -1 if a SET position is on, and zero if it is off. The CoCo’s POINT returns a zero if the SET position is black and the number (1-8) representing the color of a lighted position.

![Color Numbers](image)

**Color Numbers**

- Green = 0
- Yellow = 16
- Blue = 32
- Red = 48
- Buff = 64
- Cyan = 80
- Magenta = 96
- Orange = 112

![The Color Computer’s CHR$ and POKE Graphics Characters](image)

![The B&W Keyboard Matrix](image)

![The CoCo Keyboard Matrix](image)

![Color Video Locations](image)
The Basic Beat

You must write lines that PEEK at the keyboard to see if a key is pressed. Figure 3 is the B&W keyboard's matrix, and Fig. 4 shows the Color Computer's.

Program Listing 13 is a B&W computer line to convert to color. Use Fig. 3 to determine which key Listing 13 needs. The row and column representing 14337 and eight in Fig. 3 meet at C.

Figure 4 shows that pressing C on the CoCo keyboard results in memory location 341 containing 254. Thus, Program Listing 14 does for the CoCo what Listing 13 does for B&W. Sorry, there's no formula; you just need to know both machines.

When converting a program for color, you can add sound and joystick commands. Use whatever you have available to enhance the program.

And now, to change the topic. For those of you with Extended Color Basic, I'll look at semigraphics mode 8. This mode uses memory locations 1024-3071, so you need an Extended Color Basic machine with PCLEAR 1 or more graphics pages reserved or the video will overwrite your program.


To turn the screen black, lines 50-60 POKE a 128 into all video locations. If you don't like black, select another color from Fig. 5.

Figure 6 is the video map. There are 32 positions across and 64 positions down. Each position has a left and right block similar to CHR$ graphic's division into four cells. Figure 5 lists the numbers used to color these blocks. The left and right block cannot be different colors unless one of the colors is black.

Listing 15 displays each pattern on the screen. To display pattern 154 on the second row and three positions to the left, use the command POKE1058, 154.

Program Listing 16 is my semigraphics mode 8 rendition of a man driving a car. Basic's speed makes the ride a little jerky.

Next month: a final exam on the full-size CoCo and the graduation ceremony. Don't be late. ■

```
10 A=PEEK(65314)
20 POKE65314,(A AND 7)
30 POKE65476,0:POKE65475,1
40 POKE65472,0
50 FORA=1024TO3071
60 POKEA,A:GOTO88

Program Listing 11
```

```
10 CLS
20 FORX=0TO127
30 SET(X,0):SET(X,47)
40 NEXTX
50 FORY=0TO47
60 SET(Y,0):SET(127,Y)
70 NEXTY
80 GOTO88

Program Listing 12
```

```
10 A=PEEK(65314)
20 POKE65314,(A AND 7)
30 POKE65476,0:POKE65475,1
40 POKE65472,0
50 FORA=1024TO3071
60 POKEA,A:GOTO88
70 FORA=1024TO1370
80 POKEA+l,128:POKEA+2,149
90 POKEA+32,128:POKEA+33,143:POKEA+34,143:POKEA+35,143
100 POKEA+64,128:POKEA+65,133:POKEA+66,128:POKEA+67,138
110 FORT=1020TO1055
120 NEXTA
130 GOTO130

Program Listing 13
```

```
10 CLS
20 IF PEEK(14337)=8 THEN 30 ELSE 20
30 PRINT"FOUND CORRECT KEY"

Program Listing 14
```

```
10 CLS
20 IF PEEK(341)=254 THEN 30 ELSE 20
30 PRINT"FOUND CORRECT KEY"

Program Listing 15
```

```
10 A=PEEK(65314)
20 POKE65314,(A AND 7)
30 POKE65476,0:POKE65475,1
40 POKE65472,0
50 FORA=1024TO3071
60 POKEA,A:GOTO88
70 FORA=1024TO1370
80 POKEA+1,128:POKEA+2,149
90 POKEA+32,128:POKEA+33,143:POKEA+34,143:POKEA+35,143
100 POKEA+64,128:POKEA+65,133:POKEA+66,128:POKEA+67,138
110 FORT=1020TO1055
120 NEXTA
130 GOTO130

Program Listing 16
```
Rainbow Quest will take your child on a space adventure of the future. The planet Rainbow is a faraway land of ancient and mysterious cities, mazes, and puzzling events for young readers to discover. Rainbow Quest by Richard Ramella is a book-and-cassette adventure for the Radio Shack Color Computer. Children read and play along as Molly and Sam meet pirates, robots, and strange creatures as they make their way across the planet Rainbow. To reach their goal, they must survive on their own and face the challenges they meet along the way. Readers will help Molly and Sam find their way through dark and confusing mazes, solve word and number puzzles, and conquer invaders in arcade-style games.

Each obstacle they meet is a program, on the Rainbow Quest cassette, ready to load and run.

Rainbow Quest has 25 programs in all. Book and cassette are sold together in a protective storage binder with complete instructions. Each Rainbow Quest package for the Color Computer is $24.97.

To order Rainbow Quest, call toll-free for credit card orders, 1-800-258-5473. (In New Hampshire, call 924-9471.) Or mail your order with payment or complete credit card information to: Wayne Green Inc., Attn. Book Sales, Peterborough, NH 03458.


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Adventure in Wonderland
Prickly-Pear Software
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32K
$24.95, cassette $29.95, disk
by Beth Norman

You are in the east end of a hall. You see a three-legged glass table. On the table, you see a bottle labeled "Drink me," a scrumptious-looking cake, and a sharp key. You obediently open the bottle and sip. Suddenly, you feel all mimsy and begin to shrink. The Cheshire Cat warns that you will shrink down to nothing if you continue ...

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edited by Mark E. Reynolds

Prickly-Pear's new Adventure in Wonderland puts you in Lewis Carroll's magical land and lets you share what Alice found there. The booklet accompanying the game claims that it is the best text adventure available for the CoCo. That may just be true. (Did anyone ever claim to have the second-best?) It is certainly one of the biggest programs around; it very nearly fills a 32K computer.

The booklet also explains that the game has a vocabulary of hundreds of words, and responds to inputs of entire sentences. Sit up straight, don't abbreviate, and use proper punctuation when speaking with the inhabitants of Wonderland. After all, as the instructions say, "Don't they have schools where you come from?"

The program is never at a loss for words. Playing it reminds me of "talking" to Shrink, Eliza, or one of the other artificial-intelligence demonstration programs.

In the adventure, you play Alice, and follow the White Rabbit through a rabbit-hole in the TV screen. A slight variation from the original tale there—curiouser and curiouser. After falling through the hole, you find yourself in a long hall and at the beginning of your quest.

The Cheshire Cat, your constant companion, babbles incessantly and can keep you from making progress. This gets annoying, especially when you are on the verge of entering the White Rabbit's cottage or finding your way out of the Tulgey Wood. But be persistent; the puss eventually shuts up. Besides, some of the things he says might prove useful.

All the characters in Wonderland are great chatting partners. They often give you hints or puzzles to help you achieve your three goals: to become a queen, to capture the Snark, and to return home. For example, here is a typically informative Wonderland sign:

Seek it with thimbles
Seek it with care
Pursue it with forks and hope
Threaten its life with
A sharp double dare
Charm it with smiles and soap

Adventure in Wonderland has features taken from all three of Lewis
Carroll's beloved works: Alice in Wonderland, Through the Looking Glass, and The Hunting of the Snark. The game's characters are consistent with the originals. It's just plain fun to wander in the garden of talking flowers, and to meet with such old favorites as the Mock Turtle, the Gryphon, Tweedles Dee and Dum, the Duchess, the Caterpillar, and all the rest.

Speaking of wandering, Wonderland is seemingly endless—and not very logically laid out. It's helpful to draw a map, but you can't always take it too seriously.

One terrific feature: there are no deaths in Wonderland. Supposedly, there are always at least three ways out of any situation, no matter how perilous. Even after being swallowed by the Jabberwock (it happens to the best of us), you can still escape. A hint: take the Cheshire Cat's advice about whether crying ever helped anyone in Wonderland. The old cat sometimes comes through in the clutch.

The game probably won't be half as much fun if you're not familiar with the characters. The Prickly-Pear booklet (which is loaded with those charming John Tenniel woodcuts from the original books) mentions that folks who get really stumped just might want to go to a library and read some of Mr. Carroll's works. Nicely done.

Now for a confession: I have never completed the adventure. In fact, I have only reached one of the three goals. Every time I assemble most of the Snark-hunting tools, the Bandersnatch appears out of nowhere and takes some of them.

No matter. I've been having too much fun talking to Humpty Dumpty, the uffish sheep, and all the rest. Besides, you wouldn't want a 32K adventure to be a pushover, would you? My only regret is that there is no way to make a tape copy of a game in progress so you can pick up at the same point later.

Adventure in Wonderland is the best all-text game I've ever played on my CoCo: complex, complete, and funny. I recommend it highly.

---

**Statgraf V.1.0**
**Sugar Software**
2153 Leah Lane
Reynoldsburg, OH 43068
32K, Extended Color Basic
$24.95, cassette
$29.95, disk (same program on either medium)

by Scott L. Norman

Dennis Zaebst's Statgraf is a fine addition to the Color Computer's growing library of graphics-oriented mathematics programs. It performs linear regression analysis, a standard means of investigating possible relationships between measurable quantities, and produces graphics interpretations of the data and quantitative information tables to show the effect of your analysis.

Statgraf carries out many of the statistical computations used to see if one quantity (the dependent variable) can be meaningfully expressed in terms of another (the independent variable). It includes data-transformation routines to simplify any apparent functional dependences, and a graphing package that helps you see how the analysis is progressing.

Statgraf features several levels of menus. "Are you sure?" prompts give you a second chance before you do anything drastic. You can type in data as pairs of observations, or edit stored data files. The program can read data from tape or disk, and algebraically transform and sort it according to the independent variable.

The graphing routine can connect the data points or leave them isolated in a scatter diagram, and can display the regression line (the least-squares fit to the data) and the 95-percent confidence limits.

It is also possible to obtain both video and printed reports of several quantities of statistical interest, as well as a graphics display of residuals determined from the least-squares fit. Statgraf can plot many data sets on one graph, and save both the numerical data and the graphs themselves on tape or disk.

A word of caution: Although it is not difficult to use, Statgraf does have a few subtleties. The manual is packed with information, and you should read it carefully. What I first thought were bugs in the program turned out to be the results of my skimming through the documentation too quickly.

It was a pleasant surprise to find that my tape copy of Statgraf contained the routines for both tape and disk I/O. The program tests for a...
CoCo disk controller, and if it finds it, branches to the disk routines at the appropriate points. You can also copy the tape program to disk.

Statgraf does not include the screen-print driver necessary to print out statistics and line graphs. Instead, you are advised to use one of the commercial routines written in relocatable code. The documentation supplies the details of interfacing the two programs.

To use Statgraf, enter your data. The program sorts it and computes the various statistical measures. Then it prompts you to set up the graph.

You have a choice of a circle, a triangle, a square, a small point, or any uppercase letter as a plotting character to represent your data points. You are then asked to determine the maxima and minima for each variable and set the scales on the two axes accordingly.

Statgraf divides each axis into 10 parts and labels the alternate tick marks—points not explicitly covered in the documentation. Then you label the axes of the graph (numbers and uppercase letters only).

In the labeling option, you have complete freedom to place additional text anywhere on the graph, using a special full-screen editor; there is no guesswork involved in positioning the labels. The editing commands seem strange at first, but they are all covered in a Command Reference Chart at the back of the manual.

The Statistics menu asks for estimates of the slope and intercept of a straight line to which the program fits the data. Although there is value in using your best estimate if you have prior information about the data, you can enter any two numbers. The program calculates the slope and intercept of the regression line from the actual data.

It also computes the following quantities:
- the 95 percent and 99 percent confidence limits,
- the probability of significance for the two-sided t-test,
- the coefficient of correlation between x and y values, and
- the coefficients of determination and alienation.

If the coefficient of determination is too low, you might want to try a transformation of coordinates.

Statgraf’s transformations are cumulative. It is possible to continue to work with a transformed data set, adding a constant, taking logarithms, and so on.

It is also possible to interpolate an x value from the keyboard and have the program compute the corresponding value of y.

I appreciate the freedom to tinker that this program gives you. It is modestly priced, performs well, and encourages you to experiment. That is one of the things mathematical software is supposed to do. It’s not a package that you can use carelessly, but if you do exercise the proper skepticism about statistics, I highly recommend Statgraf.

Although Color Quick Reference Guide is a great idea, inexcusably shoddy proofreading spoils it. In my first reading, I found 39 major mistakes. Many of the examples gave SN errors when I tried them. Extra parentheses and spurious quotes abound. The JOYSTK subscript numbers are backwards. POS device numbers are wrong, and you find functions (INSTR and MKNS) listed as commands and some Color Basic statements (CLOADM) listed as Extended Color Basic only.

Three of the eight ROM addresses on page 19 are wrong and two (GIVABF and INTCNV) are missing. The illustration for PMODEs 2 and 3 on page 27 shows the graphics elements stacked vertically rather than horizontally, as they should be.

Things improve after page 27 as a reflection of the quality source material, the EDTASM+ manual. Pages 1–27, however, represent a mindless transcription of the worst editions of the early Color Computer manuals, complete with errors. It seems that no one familiar with the Color Computer read the final draft prior to printing.

After making the numerous corrections necessary, I have found myself using Color Quick Reference Guide often. You might be better off to buy the Nanos Reference Card if you don’t have disk or EDTASM+, but otherwise, despite its errors and problems, you should find this guide helpful.
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<thead>
<tr>
<th>Product</th>
<th>Weight</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS LP III, V</td>
<td>1 lb.</td>
<td>$5.85/ea.</td>
</tr>
<tr>
<td>RS LP VI, VIII</td>
<td></td>
<td>$7.00/ea.</td>
</tr>
<tr>
<td>RS DMP 400</td>
<td></td>
<td>$5.50/ea.</td>
</tr>
<tr>
<td>DIABLO Hytype I: M/S</td>
<td></td>
<td>4.50/ea.</td>
</tr>
<tr>
<td>OKIDATA 84</td>
<td></td>
<td>5.00/ea.</td>
</tr>
</tbody>
</table>

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A Picture Is Worth . . .
**Humbug (MC-10 version)**

*by* John S. Cullings

Sometimes it's a real pleasure to review a product of exceptional usefulness or value. Humbug, a machine-language monitor program for the MC-10, is just such a product. And, it includes a semidisassembler— a very useful addition.

Table 1 contains a list of MC6803 mnemonics and operation codes referenced in this review. Table 2 is a partial memory map of the MC-10.

A monitor program is most useful for machine-language program development. It lets you view any memory location and modify any read/write memory location. Most monitors let you display, fill, move, or execute blocks of memory, and they should also offer single-step operation of machine-language programs to simplify debugging.

Humbug contains all these monitor functions, plus many others. Features such as Find, Compare, Semidisassemble, Analyze, and Save to Tape make this program an exceptional value.

However, Humbug isn't written in position-independent code (because the MC6803 microprocessor doesn't have the appropriate instructions to make it easy to do so), so you can only load and execute the program at one address. Therefore, you get three different versions of Humbug so you can execute it in three different memory areas.

In MC-10 terms, Humbug is a large program. At 2,672 bytes, it leaves only about 500 bytes for another machine-language program. This could be a real problem for a 4K MC-10.

You might need to expand to 16K to develop or modify large programs. But you can overwrite (destroy) some of the less important Humbug functions to gain a little more working memory.

Humbug is easy to use. Its help command lists all function abbreviations.

---

### Table 1. MC6803 Op-Codes and Mnemonics

<table>
<thead>
<tr>
<th>Op-Code</th>
<th>Mnemonic</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>INX</td>
<td>increment X</td>
</tr>
<tr>
<td>20</td>
<td>BRA</td>
<td>branch always</td>
</tr>
<tr>
<td>26</td>
<td>BNE</td>
<td>branch if not equal</td>
</tr>
<tr>
<td>39</td>
<td>RTS</td>
<td>return from subr.</td>
</tr>
<tr>
<td>5A</td>
<td>DECB</td>
<td>decrement B</td>
</tr>
<tr>
<td>7D</td>
<td>TST</td>
<td>test memory byte</td>
</tr>
<tr>
<td>8C</td>
<td>CPX</td>
<td>compare X with #</td>
</tr>
<tr>
<td>BD</td>
<td>JSR</td>
<td>jump subroutine</td>
</tr>
<tr>
<td>C6</td>
<td>LDAB</td>
<td>load B with #</td>
</tr>
<tr>
<td>CE</td>
<td>LDX</td>
<td>load X with #</td>
</tr>
<tr>
<td>E7</td>
<td>STAB</td>
<td>store B (indexed)</td>
</tr>
<tr>
<td>FE</td>
<td>LDX</td>
<td>load X from memory</td>
</tr>
<tr>
<td>FF</td>
<td>STX</td>
<td>store X to memory</td>
</tr>
</tbody>
</table>

### Program Listing. Hex with ASCII Dump (Use only with the Humbug version at $4400.)

```
4481 2B FCB 2B + (after HUBBUG)
44DE 4BB5 FDB 4BB5 new AD address
4BB8 FF460B STX 460B save start addr
4BB9 2003 BRA +3 skip next commd
4BBF 7D45DA TST 45DA no operation
4BAC C604 LDAB #4 4 hex bytes
4BA4 FE4611 LDX 4611 memory pointer
4BA7 BD45CD JSX 45CD output 2 hex done?
4BAA 5A DECB no
4BAB 26FA BNE -6 memory pointer
4BAD FF4611 STX 4611 output a space
4BB0 BD45DA JSX 45DA output 2 hex
4BB3 C604 LDAB #4 4 hex bytes
4BB5 FE4611 LDX 4611 memory pointer
4BB8 BD45CD JSX 45CD output 2 hex done?
4BBB 5A DECB no
4BBC 26FA BNE -6 memory pointer
4BBE FF4611 STX 4611 go to ASCII dump
4BC1 200B BRA +0B
4BD1 7D45D6 TST 45D6 no operation
4BD4 BD45DA JSX 45DA output a space
4BD7 C608 LDAB #8 8 ASCII chars.
4BFC 2098 BRA -68 go to hex dump
```

*In MC-10 terms, Humbug is a large program.*
tions. It has error messages and a simple pause/print option, and you can set or examine up to four breakpoints for program debugging.

Humbug comes with a well-written manual that includes a fully documented source code of the program, but the comments are chopped off after 21 characters.

There are 13 useful machine-language subroutines that are documented and contained in a jump table at the beginning of the program. These subroutines can simplify the input and output of hexadecimal and text data. The addresses of these subroutines depend upon which of the Humbug versions you're using.

The Humbug manual is well done, but it lacks examples of many of its functions. A beginner could profit from more examples.

There are two things to remember when debugging a program. Once Humbug reaches a breakpoint, you must remove that point before continuing or single-stepping. And the register-examine (RE) command displays the A and B registers in reverse order, contrary to the example shown in the instruction manual. This makes viewing the D register more difficult because the 2 bytes are shown reversed. Overall, Humbug is a powerful machine-language monitor. You can correct any deficiencies because Star-Kits includes the commented source code. As an example of an improvement, I've included a short patch to the ASCII and hex dump option (see Program Listing).

For viewing large machine-language programs, like the Basic ROM, I prefer to dump both hex and ASCII code together. But Humbug only lets you choose one at a time. The Program Listing combines both the AD and HD commands into one command. The source-code listing helped make this modification simple.

<table>
<thead>
<tr>
<th>Addresses</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000-001F</td>
<td>MC6803 registers</td>
</tr>
<tr>
<td>0080-00FF</td>
<td>direct page CPU memory</td>
</tr>
<tr>
<td>4000-41FF</td>
<td>TV screen memory</td>
</tr>
<tr>
<td>4200-434F</td>
<td>system memory</td>
</tr>
<tr>
<td>4350-458F</td>
<td>Basic and user memory</td>
</tr>
<tr>
<td>4F90-4FFFF</td>
<td>stack memory (4K system)</td>
</tr>
<tr>
<td>5000-5FFF</td>
<td>additional 16K memory opt.</td>
</tr>
<tr>
<td>9000-BFFF</td>
<td>graphic and sound control</td>
</tr>
<tr>
<td>E000-FFFF</td>
<td>Basic ROM</td>
</tr>
<tr>
<td>FFDC-FFFD</td>
<td>Basic I/O pointer table</td>
</tr>
</tbody>
</table>

Table 2. MC-10 Memory Map

The addresses of these subroutines depend upon which of the Humbug versions you're using.

The Humbug manual is well done, but it lacks examples of many of its functions. A beginner could profit from more examples.

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Commtterm is a dumb-terminal program for the 16K CoCo or any MC-10. I looked at the MC-10 version, and found it a superb application for a machine with limited memory. This typical dumb-terminal program uses 1,279 bytes. It reads the incoming copy, puts it on the screen, sends out the keyboard data, and that's all. No bells, no whistles, just load the program, connect a modem, and you're on the air. The program is in machine language and runs via the CLOADM/EXEC commands that are in every MC-10, but not mentioned in the manual.

Bulletin-board operators and time-share services have pretty much standardized their data formats, and Commtterm's writers have chosen the setup format to match. I tried eight hobby bulletin boards, CompuServe, The Source, Telemail, and the IBM 38XX and DEC-VAX where I work. The program worked well with all systems.

The screen display is the usual 32-by-16 characters with no word-wrap, but you can't have everything in a 4K machine. (Most BBSs and large systems have a setup section to do word-wraps according to your specified screen width.)

The only setup choices are full or half duplex. Half duplex permits communication with a simple terminal, such as another MC-10. All the large systems now have echo to the user, permitting use of full duplex. You use the right arrow as the control key for sending control characters, and the usual shifted zero to switch to lowercase.

A terminal program is a good application for the MC-10, because at current sale prices, you could assemble a compact traveling kit at less than one-fourth the cost of a Model 100 or similar unit. The 4K MC-10 does not leave room for storage buffers or exotic features, but the simple Commtterm program is an ideal email message handler, and that is my main use for a portable terminal.

If you keep your email messages to memo size, you should find the MC-10/Commtterm package an effective and inexpensive link to a big system.

Although their ads say that Commtterm sells for $19.95, information in the package suggests that Star-Kits is using what could be called a pass-the-hat sales approach.

Instead of spending money on duplication, shipping, and advertising, the manufacturer urges you to copy the program and pass it out to your friends. Then you can each send in what you feel the tape is worth.

Or, you can send Star-Kits a blank cassette and a self-addressed envelope with three 20¢ stamps on it. They'll...
send you the program, three pages of instructions, extra instructions, and permission to copy Commterm and give it to others.

The program and the appeal for contributions both worked for me. After using my review copy for a few days, I decided to keep it and fired off a check. (I like to encourage good writers in the hope that they will write even better stuff in the future.)

The idea is sort of like passing the hat, and from reports I’ve seen, it may be cheaper for users and more profitable for authors than the usual method. It certainly seems to be a good way to market small, low-priced programs.

Commterm works well, and is useful software for every traveling MC-10 owner. I find the sales scheme interesting, and hope to see more programs offered this way in the future. I recommend the MC-10 version for any email user.

The main menu gives you 10 options: load data file; save data file to disk; retype, edit, insert, and delete data lines; print data to screen or printer; return to menu; and quit program. Since there is no directory command on this menu, you either must know the file name you want to load, or you must hit break and load your target disk to get its directory.

Once you have the file name, and you are sure it’s in ASCII format, be sure to type it in correctly or the program returns you to DOS Basic. If you get a disk error, the manual tells you to type GOTO 27 to reenter the program. This gives you a second menu of error types and possible actions. This second menu lets you see the target disk’s directory. With the file in the system, the rest of the commands are easy to handle, but having the documentation handy, though it has its deficiencies, is helpful.

Data Doctor is a good idea, but it is incomplete. The documentation lacks a good tutorial or a sample file on which to test the utility’s functions. It also has editorial errors: The documentation tells you to enter RUN‘‘DATADOC’’ to start the program. The actual file name is DATA/DR.

Another problem with Data Doctor is its price. It is not a machine-language program that enhances RS DOS. It does not reside with other programs; you must load it each time you want to use it. And it is limited to ASCII files, usually the alternative storage format in RS DOS because of its inefficient use of disk space. It does not stand up, price-wise, to other programs that have similar capabilities such as Telewriter and the Tool Box.

Also, this program and its documentation assume a degree of knowledge found in the hacker. Novice users might have trouble getting Data Doctor to work.

With its problems and poor documentation, Data Doctor is probably not your best choice. Save your money and wait for a better version of this program.

Data Doctor
Superior Graphics Software
Box 451
Canton, NC 28716
32K, disk
$49.95

by Leigh H. French, IV

Data Doctor lets you read and modify disk files saved in the ASCII format. It is written completely in Basic, and though configured for 32K, it will run on a 16K CoCo. Despite being menu driven, Data Doctor uses existing Radio Shack DOS commands with no machine-language enhancements as utilities.

The main menu gives you 10 options: load data file; save data file to disk; retype, edit, insert, and delete data lines; print data to screen or printer; return to menu; and quit program. Since there is no directory command on this menu, you either must

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"Data Doctor is not a machine-language program that enhances RS DOS."

---

Kraft Joystick
Kraft Systems
450 W. California Ave.
Vista, CA 92083
Kraft product no. 820-003 KJS-01T
$65 each

by Richard E. Esposito

After wearing out my second set of Radio Shack joysticks, I decided to consider some of the available alternatives. The Kraft stick was appealing because, unlike most other sticks, it uses potentiometers, as opposed to leaf switches, which only indicate direction. Leaf switches cause problems with software such as Radio Shack’s Project Nebula, which needs other information besides direction from the joystick.

The Kraft joystick does seem worth the money. It is sturdy, and (if you save your sales receipt) Kraft honors a one-year warranty against defects in manufacturing and materials. They use a high-quality cable that, on my machine, has helped cut down on some of the RFI.

The metal stick is unlikely to break off in normal use, and the fire button is of good quality. The potentiometers give very precise control, and as a result, I’ve scored considerably higher in many video games.
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Each Library program was carefully designed to be extremely easy to use. Built-in on-screen help tables are at your fingertips, as are menus of all kinds. Every effort is made to use logical, intuitive and easy-to-remember commands. The manuals have been thoughtfully prepared to cover every aspect of the program, and they have complete tutorials to get you going right away. We set the standard!

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State-of-the-Art graphics allow instant use of four display colors, and eight lowercase displays featuring descending lowercase letters. You can select from 51, 64 or 85 columns by 21 or 24 lines per screen, with wide or narrow characters in the 64 display. These screens provide a pleasant and relaxing way to perform your tasks, with as much text on the screen as is possible. Each program is easy to learn and a joy to use. We take pride in the stringent testing done to make these programs perform flawlessly. Every feature, every convenience, sleek, simple and elegant.

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All Library programs are compatible. Transfer and use of files between programs is easy and carefree. What’s better, when you have learned one program the others will come easy. And every program is the best of its kind available.

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Mini Disk Operating System
The Disk versions each have a Mini Disk Operating System which will masterfully handle from 1 to 4 drives. It offers smooth operation for such features as the ability to read a directory, display free space on the disk, kill files, save and automatically verify files, and load, rename and append files. Library programs simply do not have the limitations of BASIC.

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©1983 by Softlaw Corporation
VIP Writer™
(Formerly Super "Color" Writer II)
By Tim Nelson
RATED TOPS IN RAINBOW, HOT COCO,
AND COLOR COMPUTER MAGAZINE

The Official Dragon Microcomputer Word Processor

The most powerful and easy-to-use word processor is available in the showpiece and workhorse of the Library: The VIP Writer™. Because of its unique integrated superiority over all color computer word processors, it was selected by Dragon Data Ltd. of England and TANO in the U.S. to be the Official Word Processor for their line of Dragon microcomputers.

The result of two years of research, the VIP Writer™ offers every feature you could desire from a word processor. It is the most powerful, fastest, most dependable and most versatile. With the hi-res display, workspace and compatibility features built into the Library the Writer is the most used by every writer.

Nearly every feature and option possible to implement on the Color Computer. The design of the program is excellent; the programming is flawless . . . features for the professional, yet it is easy enough for newcomers to master. . . . Certainly one of the best word processors available for any computer . . . October 1983 "Rainbow".

"Word processing with VIP Writer is like driving a high-performance vehicle. . . . This feature of a package has more features than Telewriter, Easywriter (for the IBM PC), or Applewriter. . . . October 1983 "Hot CoCo."

The Writer will work with you and your printer to do things you always wanted to do. Every feature of your printer can be put to use, every character set, every graphics capability at any baud rate, EVEN PROPORTIONAL SPACING. All this with simplicity and elegance. You can even automatically print multiple copies.

Although all versions feature tape save and load, the disk version provides the Mini Disk Operating System common to the whole Library, plus disk file linking for continuous printing.

Professional features of particular note:

- Memory-Sense with BANK SWITCHING to fully utilize 64K, giving not just 24 or 30K, but up to 64K of workspace with the compact version and 50K with the disk version
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does not allow hi-res display in 32K
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(Formerly Super "Color" Terminal)
RATED BEST IN JANUARY 1984 "RAINBOW"
By Dan Nelson

From your home or office you can join the communication revolution. The VIP Terminal™ opens the world to you. You can monitor your investments with the Dow Jones Information Service, or broaden your horizons with The Source or Compuserve, bulletin boards, other computers, even the mainframe at work.

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(Tape does not allow hi-res displays in 16k)

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RAVED ABOUT IN THE APRIL 1983 "RAINBOW!"
By Tim Nelson

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In Canada distributed by Kelly Software Distributors, LTD.
MAIL ORDERS: $3.00 U.S. Shipping ($5.00 CANADA; $10.00 OVERSEAS). Personal checks allow 3 weeks.
All Disk Programs are also available on 3" Diskettes for the Amdek Color AMDISK-III Micro-Floppy Disk System for an additional $3.00 each.
You can adjust the stick so that it self-centers in only the X-direction, only the Y-direction, or both, or you can make it free-floating (the only mode available with the Radio Shack sticks). You can also fine tune the center position.

On the minus side, Kraft mounted the fire button on the top of the base, inserting a plastic plug into the button sockets on the back of the base. It would have been nice if they had supplied an additional fire button in this second socket.

The fine tuning of the center position has a tendency to require readjustment during play, and the setting of the self-centering mode is difficult at first. But if you’re an arcade gamer, you’ll like this stick. ■

Eds. note—Since this review was written, Radio Shack began carrying the Kraft joystick for $39.95 in their 1984 catalogue. They call it the Deluxe Joystick, part no. 26-3012. It does not have a button socket on the base.

---

by Richard E. Esposito

These five titles represent current offerings of Assembly-language books specifically for the Color Computer or the 6809.

William Barden has aimed his book at the CoCo and deals with Radio Shack's EDTASM+ ROM pack assembler throughout. His probably outsells the other books because TRS-80 Color Computer Assembly-Language Programming has a low price and Radio Shack distribution.

It, like the other books in this group, is geared toward the person with some computer knowledge. Barden writes with an easy style, but, even at that, it might be difficult for beginners.

Unique to this book is its discussion of VARPTR for passing information to and from Basic when writing programs that use both Basic and machine-language USR routines.

This book is not as comprehensive nor does it present the technical material with as much detail as does Lance Leventhal's book, but considering its price and the fact that it is written specifically for the CoCo, I rate it a best buy.

Assembly-Language Graphics for the TRS-80 Color Computer is also written specifically for the CoCo, but it deals with The Micro Works' monitor, CBUG, and their editor/assembler SDS80C ROM pack.

It has a number of good sample programs that use the CoCo's color graphics and sound capabilities. It also has a chapter on using Spectral Associates' EPROM programmer.

Don Inman includes a section on using the USR function to link your machine-language programs to Basic. This book covers graphics in more detail than William Barden's book does, hence its title.

If you are using The Micro Works' software, it is certainly worth the extra
New Games For Your CoCo.

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cost. The Assembly-language programs in this book could prove useful to those with other software as well.

On the negative side, at $14.95 per copy, I was surprised to see dot-matrix program listings with occasional corrections in pen. 

Programming the 6809 has the best introduction of this group, but it bogs down in detail. It is a good reference in that it devotes a page to each Assembly-language instruction.

This book offers more detail than do either of the previous two. Hardware hackers will like its discussions of I/O devices and I/O techniques. For the more advanced hobbyist, it has a good discussion of data structures. 6809 Assembly-Language Programming remains the 6809 "bible." The other books are not as comprehensive, nor do they approach the same level of detail.

Like Programming the 6809, this book has a page devoted to each instruction. However, Lance Leventhal has added graphics displays of data movement as a result of an instruction and its effect on the condition-code register. It also has extensive charts and tables that are unrivaled by the others, and a listing of the instruction set by addressing mode, mnemonic, and tables that are unrivaled by the others, and a listing of the instruction set by addressing mode, mnemonic op-code, and numeric op-code.

Leventhal's book will delight hardware and software hackers alike. If you have a question about the MC6809, look here first. This book is the most expensive in the group, but it is worth it. After reading any one of the other five books, you will still find this one interesting, and an invaluable reference.

The publishers of The MC6809 Cookbook have made an effort to keep the price low at the expense of some clarity. The detailed explanations of each instruction would be a much more effective reference tool if each started on a new page.

As texts, the other four books are better than this one. The MC6809 Cookbook is a reference book, but as such, it's not as worthwhile as the other two 6809 books.

Which one should you buy then? If you already have EDTASM+ or SDS80C, the first two books on the list might be best. But whichever you buy, 6809 Assembly-Language Programming is still an excellent reference, especially if you're using FLEX or OS-9 assemblers.

DMP-120 Printer
Tandy/Radio Shack
1400 One Tandy Center
Fort Worth, TX 76102
Catalog No. 26-1255
$499.95
by Brian H. Alsop

The DMP-120 printer appeared to be a real buy. It had all the features I wanted, including a low price, a 132-column printout, expanded and condensed fonts, upper- and lowercase characters, dot graphics, and speed. Since it has both serial and parallel ports, you can use it in either mode with a CoCo.

"Well, the DMP-120 is a new product, and new products sometimes have bugs. I did encounter some problems, but I appreciate Radio Shack's cooperation in dealing with the rough spots."

Well, the DMP-120 is a new product, and new products sometimes have bugs. I did encounter some problems, but I appreciate Radio Shack's cooperation in dealing with the rough spots.

The manual also neglects to explain how the dots of the print head are numbered (see Fig. 1). The discussion on control characters gives only a single sentence to the Color Computer: "If you have a Color Computer, read all LPRINTs as PRINT#-2."

Hardware

The electronics consist of a microprocessor, ROM, parallel interface, serial interface, and print-head drivers. Unfortunately, the CoCo and the DMP-120 are somewhat incompatible. In two instances, the printer drops characters because it has problems communicating with the CoCo.

Radio Shack calls this a timing problem and says that it also occurs with the Scripsit ROM pack. This problem appears to be connected with the serial interface. The Color Computer probably doesn't receive the handshake signal fast enough at times to tell it to stop sending characters.

I phoned Tandy, and was told to install an updated ROM kit. The new ROM and a POKE 151, 255 to add a one-second delay after a carriage return before printing the next character did the trick.

However, now the printer occasionally stops in the center of a line and waits—even though the computer is defaulted to 132 characters per line. Even with this glitch, though, the DMP-120 has worked satisfactorily ever since.

If you have this problem, Radio Shack will apparently fix it free of charge, regardless of warranty status. Tell them you have a timing problem and it will ring a bell. Be sure to try the POKE 151, 255 command first.

Another annoyance is that the serial-port jack and DIP option (serial/parallel, baud rate, carriage return option and test/normal) selector switches are located behind the machine and are both completely obscured by the paper being fed. The DMP-200 has a similar design.

I was never able to get the printer to friction-feed paper that worked in my old Teletype and normal typewriter. The DMP-120 advertises friction feed
as an option, although the manual doesn't specify what weight paper will work. The platen appears to be much too slick to ever work in the friction-feed mode. I did not try heavier Radio Shack roll paper, however.

Other than these complaints, though, I found the printer to be well constructed and well designed. The self-test feature and buffered bidirectional printing are real plusses.

### Software
One reason I bought a dot-matrix printer was to print out a graphics screen. I fired up my old Radio Shack Screen Dump program and it didn't work. It spit out a few dots and died. Radio Shack now admits that Screen Dump won't work with the DMP-120, but they say a fix is on the way.

To solve this problem, I wrote a short Basic program to print out a PMODE4 screen (see the Program Listing). I've provided two scales.

Figure 2 gives a sample printout of a flight-simulator program on scale = 1. The y-direction is expanded about 10 percent relative to the screen and somewhat exaggerates the CoCo's stretching of this direction. You can change line 30 of the program by a PRINT#-2,CHR$(27)CHR$(19) and get it to over-correct slightly in the opposite direction. As is, scale = 1 gives a picture that is 2.5 by 2.5 inches.

Figure 3 gives a 6-by-7-inch sample of the scale = 2 option. Here, the y-direction and x-direction are very faithful reproductions of the screen.

Both options are slow: It takes 10 minutes to print a full screen in scale = 1, and 20 minutes in scale = 2. Being so slow, it doesn't overheat the print head.

The manual gives conflicting guidance on this point. In one place it says to give the printer a 1-minute rest after 10 minutes of graphics printing. In another place, it says to give it a rest

---

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Reviewed in the April issue of Rainbow.

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Classical Computing, Inc.
P.O. Box 3318
Chapel Hill, NC 27515
after printing one-sixth of a page.

The graphics program I’ve included takes 10 minutes to print out 25 percent of a page. A machine-language code could do it many times faster. Thus, a programmer will have to count rows and pause after each one-sixth of a page. This evidently means it will take about six minutes to dump a single screen. This seems a bit long.

Now that the printer is working reliably, I have only one complaint in that I can’t use friction-fed roll paper. I like its low cost and the convenience of not having it sit on the table. All in all, though, I consider the DMP-120 worth the money.

**Program Listing. Screen Print Program**

```plaintext
10 POKE 151, 255
20 PRINT#-2, CHR$(27) CHR$(20)
30 PRINT#-2, CHR$(18)
40 INPUT"FROM X1 TO X2 (0-255) "; X1, X2
50 INPUT"FROM Y1 TO Y2 (0-192) "; Y1, Y2
60 INPUT"SCALE 10R 2" ; A$
70 IF A$="2" GOTO 170
80 CLS: SCREEN 1, 0: TIMER = 0
90 REH LOOP TO GET 7 ROWS
100 FOR J = Y1 TO Y2 STEP 7
110 FOR I = X1 TO X2: N = P.Point(I, J) + P.POINT(I, J + 1) * 2 + P.POINT(I, J + 2) * 4 + P.POINT(I, J + 3) * 8 + P.POINT(I, J + 4) * 16 + P.POINT(I, J + 5) * 32 + P.POINT(I, J + 6) * 64 + 128: PRINT#-2, CHR$(N); N = 0: NEXT
120 PRINT#-2
130 PRINT@25, J
140 NEXT J
150 PRINT TIMER / 3600
160 END
170 FOR I = X1 TO X2 STEP 7
180 FOR J = Y2 TO Y1 STEP -1: N = P.POINT(I, J) * 12 + P.POINT(I + 1, J) * 4 + P.POINT(I + 2, J) * 8 + P.POINT(I + 3, J) * 64 + 128: PRINT#-2, CHR$(N); CHR$(N); CHR$(N); CHR$(N): N = 0: NEXT: PRINT#-2
190 FOR J = Y2 TO Y1 STEP -1: N = P.POINT(I, J) * 64 + P.POINT(I + 1, J) * 32 + P.POINT(I + 2, J) * 8 + P.POINT(I + 3, J) * 4 + P.POINT(I + 4, J) * 2 + P.POINT(I + 5, J) * 128: PRINT#-2, CHR$(N); CHR$(N); CHR$(N); CHR$(N); CHR$(N); N = 0: NEXT: PRINT#-2
200 PRINT I
210 NEXT J
220 PRINT TIMER / 3600
230 END
```

**"The program locks out all keys, including break, that you don’t need to enter numbers or perform command functions."**

After entering a value, press the enter key to put the value into the calculation, and press the up/down arrows to position the cursor at the next factor. When you have entered all known factors, position the cursor at the factor to be calculated and press the @ key to perform the calculation.

The program locks out all keys, including break, that you don’t need to enter numbers or perform command functions. This makes it difficult to enter incorrect data.

Here is a sample calculation format:

**Time & Money**

*The Computer House*

**Box 1051**

**DuBois, PA 15801**

**16K, Extended Color Basic**

$19.95, cassette

$24.95, disk

by Robert P. Bussell

---

**Time & Money provides a convenient means to perform the following common financial calculations:**

- Compound Interest
- Sinking Funds
- Loans (ordinary annuity)
- Lease (annuity due)

You select each type from a main menu. Then you’ll see a format that contains a line for each of the factors to be entered. The cursor indicates the first of these.

You can enter a value for this factor or use the up- and down-arrow keys to move to another factor. You can enter a factor as the number to be used or as a simple expression, like 4*12. The program recognizes all math operators.

**Loans (ordinary annuity)**

<table>
<thead>
<tr>
<th>Initial Value</th>
<th>$7,772.41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest (Apr)</td>
<td>10.50</td>
</tr>
<tr>
<td>Pmts. Per Year</td>
<td>12.00</td>
</tr>
<tr>
<td>No. of Payments</td>
<td>48.00</td>
</tr>
<tr>
<td>Payment Amount</td>
<td>$199.00</td>
</tr>
<tr>
<td>Ending Balance</td>
<td>$-0.01</td>
</tr>
</tbody>
</table>

**Total Payments** | $9,552.00 |
**Total Interest** | $1,779.58 |
**Chg in Princ** | $-7,772.42 |

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car, given the interest rate of 10.5 percent for a period of four years and my monthly payment of $199.

If, after running this program, I want to know what the effect on my payment is if I spend $10,000, I move the cursor to the Initial Value and change it to $10,000. Then I place the cursor at the Payment Amount and press the @ key. The screen displays my new monthly payment.

A handy feature of this program is its ability to save the results of one calculation as an entry value for another type of calculation selected from the menu.

I use this program frequently. I wish, however, they had included a feature to let you save the tape version to disk.

The 16-page documentation pamphlet explains how to use the program and gives a typical, real-world situation as an example of how to use each calculation. Time & Money is well written and executes without a flaw.

In the first screen, 32 wolves come five at a time to the top of the screen and float to the ground via balloon. The piglet moves up and down in a basket, firing arrows at the balloons and dodging the acorns that the wolves throw.

Once in a while the pig gets a secret weapon in the form of a piece of meat that appears at the top of the screen. If he can get up and grab it and fire it into a cluster of wolves, they will let go of their balloons to catch it. Ah, the wages of greed.

Any wolves that make it safely to the ground run immediately across to a ladder and climb up to one of four platforms from which they can push the piglet out of his basket.

In the second screen, 40 wolves come five at a time to the bottom of the screen, grab two or three balloons, and attempt to float to the top. It takes several hits here to stop each wolf, and if seven of them reach the top of the screen, they line up to push a rock down on the hapless pig.

This is an excellent, fast-action game. The packaging is very impressive and contains a tape and a disk version of the game. DataSoft does this to make it easy when cassette users upgrade their systems to disk. I think that's a worthy idea.

Pooyan
DataSoft
9421 Winnetka Ave.
Chatsworth, CA 91311
32K, joysticks optional
$29.95, cassette and disk together

by Peter Paplaskas
HOT CoCo staff

If you thought the Three Little Pigs did away with the Big Bad Wolf, think again—now he's back with all his brothers in Pooyan, a considerably altered version of the old story.

In this machine-language game, you use a joystick or the up/down-arrow keys to raise or lower a piglet (pooyan means piglet in Chinese, so we're told) and fend off an aerial assault by wolves.
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DEALER INQUIRIES INVITED.

HOT CoCo March 1984 45
What's Disk?

One of the best things about the magnetic disk system as opposed to a cassette tape system is that it lets you store and access larger amounts of programs or data in a shorter period of time. Because it is so easy to save programs, you can be confident when tinkering with and improving them. If the new version malfunctions, the old version is still on the disk.

If you know how a disk stores information, you can use your system more efficiently. Here’s how to get the most out of your disk-based CoCo.

**DSK1$ and DSK0$**

Those of you who are used to other operating systems might get frustrated with the omission of file dating, until you realize it is compensated by two special commands. DSK1$ and DSK0$ (pronounced Disky and Disco) are unusual input/output commands that function similarly to the high-priced zapper utilities.

DSK0$, the output function of the pair, is so powerful it is actually dangerous to the information on the disk because it disregards the directory system that normally keeps files from being overwritten. It should be used only by those who possess both a clear understanding of what they want to do with it and a good back-up disk. DSK0$ is the only Basic command word that can clobber the directory.

The other command, DSK1$, is perfectly safe because it only inputs. But it is no less powerful. To DSK1$ there is no such thing as a protected disk. It allows you to position the drive head over, and read the information off, any part of the surface. With these commands the Color Computer disk system can be made to do just about anything any other system does and some things those others can’t. But using these commands requires a little knowledge of how information is physically arranged on the disk. Tracks, granules, and sectors are, in descending order of size, the divisions of the surface recognized by the system.

**Tracks and Sectors**

The track is an obvious physical division similar to the grooves of a phonograph record. In this case there are 35 concentric rings of information. Each track contains 4,608 bytes or roughly three typewritten pages of storage. Because the inner tracks are shorter, the information on them is squeezed together, but the programmer doesn’t need to know this. Track changing is the only operation that causes the magnetic head to move. The other divisions are accessed by the spinning of the disk.

A sector is a pie-slice shaped section. Here there are 18 such sections. The portion of track that falls in each sector is 256 bytes long. This is the standard chunk of data written or read by the head at once and is the portion addressed by DSK1$ and DSK0$.

For example, DSK1$ 0,7,11,A$,B$ would read from drive 0 the portion of track 7 which is in sector 11. It is a peculiarity of these commands that they divide the 256 bytes of information they...
handle into two string variables, which are both 128 bytes long. In this example, A$ would contain the first half of the sector and B$ the last.

**The Directory**

Now you have the tools to get information back and forth, but to make use of them you need to know how the directory works.

The directory is stored on track 17. This location makes sense because it is right in the middle so the head can swing to the first or last track in equal time. The actual directory entries take up sectors 3 to 11 in this track. There are eight on each of these nine sectors, making room for 72 entries. Each entry is 32 bytes long. The file name takes up the first 8 bytes of each entry. The routine below steps through each of the nine sectors and each of the eight entries in each sector and puts the file names into the variable NA$ in line 150.

```
100 FOR SE = 3 TO 11
110 DSKI$ = 0,17,SE,A$,B$
120 A$ = A$ + LEFT$(B$,11,1)$
200 FOR DE = 0 TO 7
210 PT = DE + 32
250 NA$ = MIDS(A$,PT + 1,8)
260 PRINT NA$
.
.
.
800 NEXT DE
900 NEXT SE
```

The outer portion of this double loop puts the 256 bytes of each sector into A$ and B$, which are then joined together as A$ in line 120. Because a Basic string variable can't hold all 256 bytes, the very last of B$ is truncated. The inner loop sequence is a pointer PT (line 210) that is used in a MIDS function to get the 8-character filename in line 250. (MIDS takes eight characters of A$ starting at the first byte after the pointer.)

The routine is a general-purpose skeleton. Changes can be made around line 250 that allow it to do different things. For instance, after the 8 bytes of the file name are 3 bytes for the extension. This might be obtained by adding EX = MIDS(A$,PT + 9,3) to line 250. It would be easy to add conditional statements to make the routine print only files with a certain extension such as: IF EX$ = "NEW" THEN PRINT NA$, EX$, or to kill all files of a certain extension, KK$ = NA$ + "" + EX$. IF EX$ = "OLD" THEN KILL KK$, or do other manipulations.

Users of the highly rated FLEX system might recognize a similarity to the CAT,--- (catalog by extension) or X--- (delete conditional on extension) utilities in the suggested modifications. You can approximate most of the other way around. This allows sophisticated file handling by Basic programs without ever having to go into a system mode or load a DOS.

The next 3 bytes in the directory entries (11, 12, and 13) are the file type, the ASCII flag, and a pointer to the beginning of the file in the disk storage area. Here is the entry format:

**Byte** | **Function**
---|---
0-7 | File Name
8-10 | Extension
11 | File Type
12 | ASCII Format Flag
13 | Points to Start Granule
14-15 | Ending Data
16-31 | Not Used

The last half of each entry (bytes 16-31) is blank. The owner's manual states that this space is reserved for future use. Some people use this area for expanded directory area, putting date-time or other information in with DSKO$.

---

**One of the very good features of Disk Extended Color Basic is that the operating system is contained in Basic instead of the other way around.**

---

FLEX commands. One of the very good features of Disk Extended Color Basic is that the operating system is contained in Basic instead of the other way around.
However, there are some advantages to having this information more directly attached to the file so it will never get lost if the file is renamed or copied. Then the routine can be set up and modified without having to worry about accidental zaps.

One solution that works well with Basic programs is to use the first line (line 0) of the program itself for identification. With DSKI$, you can get this directly off the disk without having to load or list the program. The place to look for the start of the saved program is specified by byte 13 of each directory entry. Byte 13 will be a number from 0 to 67. To use it, it is necessary to understand one more unit of disk space allocation.

Granules

The granule is a more artificial division than the track or the sector, and it lies between them in physical size. It is half of a track, which is equal to nine sectors, or 2,304 bytes. This is the minimum unit of storage normally allocated by the filing system. Adding just 1 byte to a program or file, which is exactly one granule long, causes the space reserved to double. Hence, a disk containing many short programs might have a lot of dead space.

The number in byte 13 of each directory entry is the identification of one of 68 possible granules (possible because 34 tracks are used for data and each track has two granules). But DSKO$ and DSKI$ need to know a track number and sector number, not a granule number.

Converting

All granules start on either sector 1 or sector 10. Track 0, sector 1, is the start of granule 0. Sector 10 of this track starts granule 1, and the first sector of the next track (track 1) is the beginning of granule 2. The conversion formula is that the track number equals half the granule number. The sector is 1 if the granule number is even, or 10 if the granule number is odd. If the granule is more than 33, the formula in the last two sentences applies, except that the track number is greater by one. Though this sounds convoluted, it is simple, except that the directory in track 17 is not counted as granules. This throws the sequence off for the higher tracks. The conversion is done in lines 410 and 420 of the Program Listing, Direct.

About Direct

This utility looks directly at the first part of programs on the disk in two phases. Phase 1 is the general-purpose, directory reader loop shown and explained above. Phase 2 calculates the beginning track and sector from the granule number in byte 13 of each entry.

DSKI$ is used here to get the first sector of the program or file into the variables C$ and D$ (line 440). D$ is string together with C$, and then a portion of it is printed out, either to the screen or the printer (line 580). Then it loops to the next entry. The program is no more complicated than that. The additional lines are mainly garbage filters because some files contain data, such as codes for carriage returns and backspaces, that might upset a printer.

Since screen space is limited, another trap prevents printing the line number of the first Basic line. Direct also reads the first sector of other types of files. Machine-language files usually look like gibberish, so a flag in line 380 blanks them out.

On the other hand, it is often informative to see ASCII and data files, so they are displayed even though they look strange. You can sometimes reconstruct long lost or forgotten data formats this way. Because of the peculiar way direct-access files are stored, a portion near the last of the file is seen.

Seeing Ghosts

Direct displays the ghosts of dead files. Killing a file merely places a zero in the first byte of the file name in the directory entry, allowing it to be written over later. If you accidentally kill a crucial file, it is possible to resurrect it by inserting a valid character in place of the zero, provided you haven't written over the old storage area. Very careful use of DSKO$ accomplishes this. Direct shows dead files just like live files except it displays a blank space for the first letter of the name.

The program prints an expanded directory containing the beginning of all the Basic programs on the disk to the screen, or it makes a printout. The default expansion length is set so each entry only takes up one line on the screen or on a 40-column printer. This provides a minimum of 18 more characters in addition to the eight-character file name and the three-character extension.

You have the option to change the length so you can view up to 256 characters of the files, or more with some changes to the program. The default values for expansion lengths are in line 30 and you can change them to fit different printers. With no DSKO$, it is perfectly safe to tinker with the routine.

If the first 18 characters of the first line of a Basic program are now part of the directory, it is helpful to adopt some kind of standard order for them. Otherwise, the directory will look confusing. I include in my first program line (line 0) an apostrophe or REM for remark, possibly followed by the date and the particular distinctive feature of that version of the program.

It seems best to put the name of the Basic program after all the other information because it is generally the same or similar to the file name. Fig. 2 is a sample expanded directory.

At the end of the routine is a prompt that asks you to exit or insert another disk. This way it takes only a few minutes to get a printout of the contents of a small library of disks. Once generated, you can tack the hardcopy to the wall or put it where it is visible at a glance. It sure beats having to go through a stack of disks loading and listing the programs to see what's in them.

Address correspondence to Philip McLaughlin, 510 Fort Worth Drive, Denton, TX 76201.
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You are a desperate possum trapped on a busy, three-lane highway, patrolled by cars, milk trucks, and tanks. Can you survive long enough to get home?

Possum Run is a high-resolution arcade-style game for the CoCo, loosely based on the game Frogger. It is fast because it uses machine-language routines. The hi-res graphics are detailed and a good example of artifacting colors in PMODE 4.

Make sure that you save several copies before running the program because a mistake in typing in the machine-language routines can result in a crash. If your computer does not work in the high-speed mode, then change line 4 to read: 4 PK = 65494. This fixes the speed for the entire program.

The first thing you see when you run Possum Run is a red or orange-red screen. If the screen is a bluish color, press reset and run the program until the screen is red. After a short pause, you are asked to pick your difficulty level.

Level 1 is next to impossible, while level 20 is a snap. A good starting level is 15. You begin game play at the chosen level. Use the right joystick to move your possum along the highway lanes and up and down each lane. The vehicles periodically move along the highway.

If you collide, your possum becomes a graphic splat and you lose him. Because of the machine-language routines, the screen is not limited to only one or two vehicles moving at the same time. Play at level 1 and you will see what I mean. There are usually six or seven vehicles per lane to make the game more challenging. At the top of the screen is a timer. If you survive long enough for the timer to run out, you are awarded a 1,000-point bonus and you continue at a level two notches higher.

Program Listing. Possum Run

```
0 CLS:CLEAR200,16000:PCLEAR4:D1
M1(16),A2(16),A3(14),A4(14),BU(8),GL(6)
4 PK=65495
B POKEPK,0
10 PMODE1,1:PCLS3:PMODE4,1:SCREEN
N1,1
15 GOSUB5000
20 GOSUB2000
25 CLS:PRINT"POSUM RUN":PRINT@264,"BY NICK BRADBURY":SCREEN
N1,1
30 GOSUB1000
40 R%=40:SC%=NB=4
80 GOSUB8000
82 CLS:POKE65494,0:SCREEN0,0:PRI
NT"ENTER DIFFICULTY LEVEL:""INPU
T"1=DIFFICULT,20=EASY":CS=IFCS
<JORCS:20THEN82ELSECS=CS-3
88 POKEPK,0
90 XI=2:Y=101:X2=2:Y2=101:X3=21
0:Y3=82:X4=210:Y4=11
92 ZX=108:ZY=103:GOSUB500
94 GOSUB8200
96 PLAY"30L55255":
98 PMODE4,1:SCREEN1,1
100 J0=JOYSTK(0):J1=JOYSTK(1)
104 IF J0=16THEN30ELSEIF J0=47THE
H325
106 IF J1=16THEN35ELSEIF J1=47THE
```

System Requirements

16K RAM
Extended Color Basic
Joystick

If you score a 1,000 point bonus, you are awarded a 1,000-point bonus and you continue at a level two notches higher.

Poor old possum headin' home—the car misses, the milk truck too! Watch out for that tank! Splat!
How It Works

I made the detailed graphics in Possum Run by first drawing the outline on graph paper. I transferred this into a DRAW statement. The windows, racing stripes, and other such frills were done by trial and error PSET, LINE, and PAINT commands. I saved all finished figures in a GET array.

Each machine-language routine scrolls a separate part of the screen. The mountain-scrolling routine moves the mountains to the left and wraps them around to the right. Two separate routines scroll the medians, and another moves the guard rail. This gives the effect of the possum moving toward its destination. The three other routines move the areas containing the cars, tanks, and milk trucks. Using this method, the overall speed remains the same if there are two or 200 cars on the screen.

32K users might want to relocate the machine-language routines (lines 500-5999) into upper RAM. This frees another 16K that can be used to add things such as on-screen scoring that doesn’t fit into 16K. Possum Run runs unchanged on 32K systems, but, to my knowledge, it does not run on disk systems without relocating the machine-language routines.

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GIVE YOUR DISK DRIVE A ONE-TRACK MIND

I/O error blues from a crashed disk? Speed your back-up copy procedure with this CoCo utility.

Anyone who owns a Radio Shack disk system knows the phrase I/O error too well—another crashed disk. But what can you do about it? Most people have back-ups of all their disks, so they reformat the blown disk and recopy from the back-up. For those of us who have only one drive, however, this is a slow process. In a normal Back-up procedure for a one-drive system it takes six changes of disk. There is a faster way to do this.

To solve the problem you need to know the Radio Shack disk operating system stores things on a disk. The disk is divided into 35 tracks numbered 0-34, and each of these tracks is divided into 18 sectors. The DOS uses one track as its directory track, and on it stores things like the names and types of programs (Basic, binary, data), how long the program is, and where it is stored on the disk.

Approximately 95 percent of all I/O errors come from a blown track 17. You can tell if you have a crashed track with this CoCo utility. It can repair the directory on the disk. Here is a listing of the utility:

```
50 ** MENU **
55 CLEAR350:DIM N$(64),T$(34),
EL$(34):CLS:PRINT604,":**PRINT:
PRINT 68 PRINT$69,":DIRECTORY DISK PROG:
RAM":PRINT$18,":VER.1.1":PRINT$1
37, "DENNIS ELFERT"
65 PRINT$192,"1. SAVE DIRECTORY TO D.D.":PRINT$224,"2. DISPLAY C:
ATALOG ON D.D":PRINT$256,"3. REP:
AIR DAMAGED DIRECTORY":PRINT$288
4,"4. ERASE DIRECTORY ON D.D":PRINT$3
20,"5. DISPLAY A DIRECTORY":PRINT$3
T8352,"6. END"
78 PRINT$416,":(D.D. REFERS TO DI
RECTORY DISK)");
75 PRINT$486,"INPUT 1,2,3,4,5,0
R 6";
80 A$=INKEYS:IF A$="":THEN80
85 A=VAL(A$):IF A<>0 OR A>6 THEN
55
87 IF A=6 THEN CLS:END
90 CLS:IF A=1 AND A<>6 THENPRINT
224,"INSERT DIRECTORY DISK & <EN
TER>":ELSE IF A=1 THENPRINT$225,"I
MPACT DISK TO LOAD DISK."
PRN
T8263,":AND PRFS< ENTER>
95 AS=INKEYS:IF A$="":THEN55 ELSE
SE IF ASC<CHR$(13) THEN 95 ELSE
ON A GOTO 105,205,305,405,505,60
0
100 ** SAVE DIRECTORY **
105 CLEAR 8000
110 T=0:X=0:Y=0:DIM D$(10),E$(10
),F$(35)
115 FOR X=2 TO 11
120 DSK$I 0,T,X,D$(Y ),E$(Y )
125 Y=Y+1
130 NEXT X
135 CLS:PRINT$224,"INSERT DIRECT:
ORY DISK & <ENTER>
140 AS=INKEYS:IF A$=CHR$(13) THEN
145 ELSE IF A$="":THEN55 ELSE 1
40
145 GOSUB 1000
150 FORX=1TO7:PRINT$105
155 F$(Y )="MIDS$(BS$(X),Z*15+2,1)
=F:ASC$(F$(Y ))
157 T=T+1
160 IF F<>255 THEN 170
165 S=2+1:NEXT$=Z:Z=NEXT$:
NEXTX:CLS:PR
1NT$225,"DISK FULL":FOR$=1 TO 65
0:NEXT$:GOTO55
170 CLS:PRINT$224,":NAME OF DISK"
:PRINT$266,"":"INPUTMS:IF LEN(M
S$)>12 THEN 170
175 IF LEN(MS$)>12 THEN 185
180 NMS=NMS$+":GOTO175
185 MIDS$(BS$(X),Z*15+2,1)="O":MID
S$(BS$(X),Z*15+3,12)=NMS
```

Program Listing: Directory Disk

```
190 GOSUB 2000:X=0:Y=0:FORX=2TO1
1
195 DSK$I 0,T,X,D$(Y ),E$(Y )=Y+1
1:NEXT$:GOTO55
200 ** DISPLAY CATALOG **
205 CLS:PRINT$4,":DIRECTORY DISK:
CATALOG"
210 GOSUB 3000
220 PRINT$416,"ENTER TO CONTIN
UE":PRINT$448:"<Q> TO QUIT"
225 AS=INKEYS:IF A$=CHR$(13) THEN
N 230 ELSE IF A$="":THEN55 ELSE 25
230 230
235 GOSUB$350
240 PRINT$416,"ENTER TO SEE A G
AIN"
245 PRINT$486,"<Q> TO QUIT"
250 AS=INKEYS:IF A$=CHR$(13) THEN
255 ELSE IF A$="":THEN55 ELSE 25
260 250
```

System Requirements

16K RAM  
Disk Basic  
One Disk Drive

54 HOT CoCo March 1984
Almost all disk commands use track 17 because track 17 is constantly being accessed. There are 35 tracks, but only one track is bad, so one disk backing up 34 other disks. To make a back-up of one of your disk's directories, you can have one disk backing up 34 other disks. With this program you can store up to 34 different track 17s on one disk, called the Directory Disk, since it stores only the directory tracks of other disks.

In this program 34 out of the 35 tracks hold directories while the remaining track, called the catalog, is for the program's own directory.

Once you have a bug-free program, run it. You will be greeted with the main menu of six options, each explained in detail below.

• Save Directory to D.D. (Directory Disk): Choose this when you want to make a back-up of one of your disk's directories. It tells you to insert the disk you want to back up. Once you have inserted the disk and pressed the enter key, the program copies the contents of track 17 into arrays D$ and E$.

With this program you can store up to 34 different track 17s on one disk, called the Directory Disk, since it stores only directory tracks of other disks.

name of the blown disk and enter its number. The program then loads into memory the directory track of the blown disk. Insert the damaged disk and it copies the directory track in memory on track 17 of the blown disk. You should now have a good disk.

• Erase Directory on D.D.: This mode is similar to Disk Basic's KILL command, and it erases unwanted directories on your Directory Disk to make that track available for storing others.

• Display a Directory: This prompts you to insert the Directory Disk that displays the list of saved directory tracks. From here you can request a display.

• End: Returns control to Basic. In all modes you can return to the main menu at any time by pressing Q.

I set the program up on a 32K machine, but it runs on a 16K machine if you first enter PMODE:POKE 25,14 POKE 3584,0; NEW <ENTER>. This frees the 6K grabbed by Basic for graphics.

Address correspondence to Dennis Elfert, 315 Richard Drive, Houma, LA 70360.
The Radio Shack Multi-Pak Interface (MPI) is the best peripheral to come along for the CoCo since disk drives. It is a great convenience to novice users, but more importantly to me, it allows for some interesting interfacing and programming projects. I’ve taken a look at what’s inside this wonderful device, and what follows are my findings plus instructions on how to add on/off and slot-selection LEDs to the MPI.

Strange POKEs

The software POKEs used for selecting a slot are given in the owner’s manual with an addenda sheet as:

- POKE 65407,0 Slot 1
- POKE 65407,17 Slot 2
- POKE 65407,34 Slot 3
- POKE 65407,51 Slot 4

Why do they look so odd? The numbers 0, 17, 34, and 51 written in binary or in hex are enlightening:

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Hex</th>
<th>Binary</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>00000000</td>
</tr>
<tr>
<td>17</td>
<td>11</td>
<td>00010001</td>
</tr>
<tr>
<td>34</td>
<td>22</td>
<td>00100010</td>
</tr>
<tr>
<td>51</td>
<td>33</td>
<td>00110011</td>
</tr>
</tbody>
</table>

See the pattern? There are four expansion slots and two separate counters. Unlike other expansion devices the CTS and SCS signals are individually switched in the MPI with a decoder circuit.

CTS is the cartridge-select signal used to select the address space $C000 through $FFEF ($C000, decimal 49152, is where most ROM packs begin). SCS is the spare-select signal selecting the address space $FF40 through $FF5F. Some internal investigation and testing with homemade peripherals showed that the CTS and SCS signals can be independently selected, and that an LED display of these selections would be a desirable feature on the MPI.

The simplest way to program these lines is by POKEing either address

<table>
<thead>
<tr>
<th>POKE VALUE into 65407 or 65439</th>
<th>CTS</th>
<th>SCS</th>
<th>* BOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
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<td>3</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>33</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
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<td>3</td>
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<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>50</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

* Indicates values given in the Radio Shack Owner’s Manual for POKEs. Manual shows address 65439 ($FF9F) with addenda sheet change to 65407 ($FF7F).

Note that you can add 4, 8, 64, or 128 to any of these POKEs and still get the same result.

Example: POKE 65407,255 would select both CTS and SCS for slot number 4, the same as using POKE 65407,51.

<table>
<thead>
<tr>
<th>Table 1. Slot Select Lines (CTS and SCS) Minimum Decimal POKE Values</th>
</tr>
</thead>
</table>
You can POKE other values, but these are redundant since the bits for 4, 8, 64, and 128 do nothing. For example, POKE 65407, 48 selects the CTS of slot 4 and the SCS of slot 1. You could get the same result with POKE 65407, 52, POKE 65407, 56, POKE 65407, 112, or POKE 65407, 176. You could also POKE these numbers into 65439 for the same result.

If you had the disk controller in slot 4 (as the owner's manual suggests) and another hardware device that used the SCS line in slot 1, you could use the Disk Basic ROM with your hardware device and switch back and forth from one hardware device to another. It works, and it is a great tool for hackers who want to save a couple of chips per hardware project that are typically needed for address decoding. Now you must add some indicator LEDs to let you know which slot-select lines are enabled.

The LED Project

When you open the MPI you void the warranty by breaking the seal over one of the four Phillips-head screws used to secure the lid. Inside is a near carbon copy of the CoCo power supply: +5V dc with pass-transistor, +12V dc regulator with heat-sink, and the –12V dc regulator without a heat-sink.

There is plenty of power here. There is also a socketed PAL (programmable array logic, 14L4CN, 20-pin DIP) device that is probably used to memory-map the MPI I/O to the CoCo expansion bus.

These interesting devices are quickly changing standard logic design practices. This one chip obviously makes the I/O implementation easy, even if it requires changes in memory address (such as 65407 or 65439). A service manual should describe the function of the PAL in more detail. There are of course buffers (74LS367's and LS245) with some other logic ICs, and a nice shield on the bottom side of the board, but you do not need to remove any of this to perform this add-on modification.

To indicate the CTS and SCS status of each slot you need to duplicate the action of the 74LS139 dual 2-to-4 line decoders/multiplexers circuit within the MPI (see Fig. 1). This is IC U13 and is located next to slot 1 (J1).

Place a separate 74LS139 on top of U13 (piggyback) with pins 1, 4, 5, 6, 7, 9, 10, 11, 12, 15, and 16 bent outward. You only need to solder pins 2, 3, 8, 13, and 14 of the add-on LS139 to U13. Pins 16 and 8 are the +5V dc and ground pins, respectively.

Use a short piece of small wire to connect pin 16 of the piggyback LS139 (not of U13) to the positive lead of the 100-microfarad capacitor C30 found between the J1 and J2 connectors. The +5V dc supply at pin 16 of U13 is from the CoCo and would not indicate whether the MPI power is on or off.

Be careful when soldering this wire to
To test your lamps, plug in the MPI to the CoCo. (Make sure all power is off.) Turn on the MPI and then the CoCo. The LEDs are powered by the MPI, so they act as the MPI power-on indicator. Due to the LS139 IC, there will always be one LED lit (and only one) in each column when the power is on. The LEDs next to the slot chosen by the front selector switch should both be on.

No matter what position the front slide switch is in, slot 4 is constantly the capacitor lead, since all around is ground and could easily short out the MPI +5V dc supply. Pins 2 and 3 of the LS139 ICs are used to select the slot for the SCS line, and pins 13 and 14 are used to select the slot for the CTS line.

Connect pins 1 and 15 on the piggyback IC to pin 8 (ground). This permanently enables the selection outputs used to power the LEDs (see Fig. 2).

To keep the case top and base easy to separate, I used a 16-pin DIP connector with about 18 inches of flat ribbon cable to reach from the LS139 to where the LEDs are on the case top. You can unplug the LEDs if desired or set the top next to the base in case you have to repair the MPI.

Solder an empty 16-pin DIP socket on top of the new LS139 (all 16 pins). Strictly a job for confident hackers, this requires a neat and careful assembly of the piggyback arrangement to avoid any troubles. If one of the LEDs does not light, this area is the first to search for questionable solder connections.

I drilled holes in the top of the case just large enough for the LEDs that I had on hand. Be sure to use eight LEDs that are alike. Usually the long lead of the LED is the anode (connect this to +5V dc). I positioned the LEDs so that a +5V dc bus could be made in a straight line between the two rows of four LEDs and used Super Glue to hold them in place. I recommend a drill press for a neat job, but LED sockets will probably cover up any accidents.

Finish the wiring as per the schematic, soldering the resistors directly to the flat cable and LED cathodes (short leads). I don’t recommend a board since it takes up too much space. There is a larger filter capacitor next to slot 3 and the power transformer is next to that. I had no problems placing the LEDs over the transformer area directly across from the slot numbers, but there is no room over the large capacitor for anything. Be sure to stay clear of this area. I used transfer labeling to mark which column of LEDs are for CTS and SCS.

To test your lamps, plug in the MPI to the CoCo. (Make sure all power is off.) Turn on the MPI and then the CoCo. The LEDs are powered by the MPI, so they act as the MPI power-on indicator. Due to the LS139 IC, there will always be one LED lit (and only one) in each column when the power is on. The LEDs next to the slot chosen by the front selector switch should both be on.

No matter what position the front slide switch is in, slot 4 is constantly

```
10 "REMOVE ALL PAKS FROM MULTI-PAK INTERFACE
20 A=65487: 'OR USE A=65439
30 FOR V=0 TO 255
40 POKE A,V
50 FOR D=1 TO 10:NEXTD; 'DELAY
60 NEXT V
```

Program Listing. POKE Combinations to Test LEDs
These parts may be purchased from Digi-Key Corporation, Highway 32 South, P.O. Box 677, Thief River Falls, MN 56701. 1-800-346-5144.

Table 2. Parts List

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-ended, 2-foot DIP jumper cable assembly with flat ribbon R114-24-ND</td>
<td>$2.46</td>
</tr>
<tr>
<td>Wide-angle LED T-1 3/4 NSL.6053</td>
<td>$2.20 /10</td>
</tr>
<tr>
<td>16-pin DIP socket (TIN) C8916</td>
<td>$0.16</td>
</tr>
<tr>
<td>Dual 2/4 decoder IC 74L.Si39N</td>
<td>$0.66</td>
</tr>
<tr>
<td>1/4-Watt carbon resistors 330Q</td>
<td>$0.50 /10</td>
</tr>
</tbody>
</table>

Total $5.98

selected if the CoCo power is off. This is why the owner’s manual suggests using slot 4 for the disk drive. With the CoCo and the Multi-Pak on, move the selector switch from 1 through 4 and verify that the LEDs switch on in pairs by slots 1 through 4 respectively. If they do not light, check your wiring, especially the soldering near the LS139. If they do not light in the correct order, check the wiring out of the flat ribbon to the LED resistors.

Next, POKE the values listed in Table 1 to see if all combinations work. If they do not, check for errors and verify that the number was correctly POKEd by PEEKing the same location. The Program Listing shows you all combinations (including the redundant POKEs) and makes an interesting display.

Do not try any of these tests with cartridges in the MPI since they may or may not become activated. Once you know the lights work, you can confidently insert your disk controller or other packs or accessories (turn all power off and wait for the LEDs to go off), and explore some real expansion capabilities. With the help of these LED slot-selection (and power-on) indicators, the Radio Shack Multi-Pak Interface opens a new world of computer interfacing and programming to CoCo users.

Address correspondence to John R. Kelty, 1440 N. 61st, Lincoln, NE 68505.
You have just finished typing in additions to your program; a new routine adds that important bell or whistle to make it outstanding. You run it, feeling it's a job well done, but the computer doesn't feel the same way. All it prints out is "FC ERROR IN 211."

After hours of debugging Basic programs, I decided to make the computer work a little harder and give me more information about the error. The Assembly-language routine in Program Listing 1 indicates where within a Basic line an error occurred. Then it enters the Extended Basic Edit routine automatically. You no longer need to type EDIT 211.

You need Extended Basic to use this routine, and Disk Basic works without modification. The code is position independent and can be located in any protected RAM location.

The computer's Basic interpreter uses a subroutine stored in RAM locations $9F to $AA to get characters from the Basic line, one at a time. When the interpreter discovers an error, locations $A6 and $A7 point to the last character in the Basic line that was read by the interpreter.

Basic lines are stored in tokenized form. All Basic commands are stored as 1- or 2-byte numbers called tokens. This saves space and makes program execution faster, but complicates the line reading for the operator.

In order for the error location to be useful it must point to the location in a Basic line in detokenized form. Fortunately, the routine beginning at $B7CB spells out the commands represented by tokens and puts the detokenized line in the buffer pointed to by the Y register. A zero represents the end of a Basic line. By putting a zero in the location where the error occurred, the detokenization routine stops at the error location. Lines 350–450 save the location pointer, put the original character back in the line, and continue detokenization.

Lines 490–580 print the line number and detokenized line just as Edit would, and then enter the Edit routine at $855C.

Your only problem now is how to get the Basic interpreter to jump to the new Error routine after it completes its own error-handling routine. The interpreter jumps to RAM locations $15E to $1A8 during various operations. The jump before Basic, which outputs a character to the screen (CHROUT $A282), is important since your new Edit routine should be run after the interpreter prints —ERROR IN—.

This jump can be used to check whether that statement is being output to the screen. ERROR IN is stored in locations $ABE1 to $ABEB of the Basic ROM. The CHROUT routine expects this location to be in the X register for output.

There is one bug in this method of adding the new Error routine. ERROR and IN are called by separate lines of the ROM Basic Error routine. In order to add the new routine after IN, only IN can be checked. When a Basic program is stopped by the break key, the address of IN is also used. You are put in the edit mode at the location in the program line last executed before you pressed break.

The CHROUT routine is checked by this jump before it has completed the screen output. By changing the return address used at the end of this ROM routine, the new Error routine will not be entered until CHROUT is finished. These return addresses are stored in a stack pointed to by the S register. While in the jump table they are three deep and, since each address is 2 bytes, inserting the new Error routine start address at...
The subroutine in lines 110–200 inserts the new jump into the jump table. This routine allows a jump already in error-handling routine. This takes more code but maintains compatibility with other machine-language routines using this jump. The subroutine even works code but maintains compatibility with non-Extended Basic, but is of no value because of the Extended Basic calls in the main program.

Program Listing 2 is a Basic program to load the machine-language routine without an editor/assembler. Lines 20 and 25 check the maximum memory in your computer and automatically clear the last 1K for the routine.

Debugging should be much easier. Not only do you know where the error is within the line, you are in the Edit routine with the cursor at the error. Use the Q command to exit the Edit mode if you do not want to make changes at this time. Q is the only Edit command that preserves the variable table if you need access to it for debugging purposes.

Address correspondence to Stephen Tichenal, 937 Montford, Cleveland Heights, OH 44121.

"After hours of debugging Basic programs, I decided to make the computer work a little harder…

The Assembly-language routine in Program Listing 1 indicates where within a Basic line an error occurred. Then it enters the Extended Basic Edit routine automatically. You no longer need to type Edit 211."
By Martin Tichborne

**WORDSEARCH**

No more scavenging the magazine racks hunting for word puzzles; now you can design them yourself with your CoCo. Computer Wordsearch is similar to an ordinary wordsearch puzzle, with the words placed in a grid vertically, horizontally, backwards, forwards, and diagonally (see Fig. 1). Filling the remaining spaces in the grid are random letters that hide the words and complete the wordsearch.

Choose a theme and challenge yourself. Now you can create your own Wordsearch puzzles.

Choose a theme and type words related to the theme into the computer. The words must be entered one at a time. See the words inserted, or challenge yourself and wait until the grid is filled to search.

The Basic version, Program Listing 1, is slow. There is a long delay between the time you enter your word and when the computer inserts it into the grid. Entering the last few words of your puzzle may take as long as 10 minutes or more for each word.

You stop the computer while it is searching by pressing the slash (/) key. When you finish your program type X and the computer completes the wordsearch.

The machine-language version, Program Listing 2, written with Tandy's EDTASM + cartridge, is much faster than Basic. Aside from the speed, this version has several advantages. Choose any matrix size from 1 by 1 to 31 by 16, the words are inserted in reverse lettering, and the computer prompts you to turn on the printer.

(Ed. note: Because of the length of the Assembly version of Wordsearch, we've omitted the op codes. You must assemble this program with Radio Shack's EDTASM +. Anyone wanting the Assembly listing with op codes can send a self-addressed, stamped envelope.

**System Requirements**

16K RAM
Extended Color Basic
Editor/Assembler
Printer

---

**Fig. 1. Sample Wordsearch Puzzle**

---

**EUROPEAN COUNTRIES**

| E | A | I | N | A | B | L | A | V | G | U | K | A | I | R | A | G | L | U | B |
| E | I | G | Y | J | I | J | U | I | C | E | R | W | A | L | E | S | L | I |
| N | E | M | A | N | P | V | D | N | A | L | T | O | C | S | F | Z | M | C |
| G | D | Z | W | V | T | N | A | Q | A | S | I | A | S | R | R | Y | V | J |
| L | X | U | R | B | A | M | U | L | U | L | W | I | W | U | A | M | X | Z | F |
| A | V | M | O | L | O | X | F | N | S | F | P | N | E | S | N | X | B | C | M |
| N | R | D | N | A | L | L | O | H | T | O | K | A | D | S | C | X | T | U | M |
| D | Y | I | G | E | T | K | Z | N | R | S | G | M | E | I | E | I | I | R |
| P | F | L | Q | R | V | W | A | X | I | G | F | U | N | A | G | G | R | I |
| W | D | N | A | L | E | C | I | X | A | A | I | R | Y | S | L | I | E | A | C |
| V | V | X | F | T | Z | E | R | Z | T | P | P | L | R | E | W | H | L | Y | W |
| D | U | I | Y | U | I | V | C | E | D | B | N | S | B | R | Q | Z | A | U | D |
| H | U | N | G | A | R | Y | F | E | D | P | O | L | A | N | D | G | H | V | J |
| C | Z | E | C | H | O | S | L | O | V | A | K | I | A | B | G | D | I | C |

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<td>NORWAY</td>
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<td></td>
</tr>
</tbody>
</table>

---

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to HOT CoCo, Pine St., Peterborough, NH 03458.

As this program needs more than one page of display, the origin is moved from 600 to 2000. To assemble in memory, follow this 10-step procedure (these instructions include the computer prompts # and * which need not be typed):

1. Insert EDTASM+ cartridge
2. Enter *Z
3. Enter #W
4. Enter #TF/ 600 2000
5. Enter #GC006
6. Ready the cassette at the start of the source-code version.
7. Enter *L
8. Enter Ready Cassette
9. Tape reads in.
10. + *A/IM/\AO

This will assemble the program to memory. It can be saved to tape using the following steps:

1. Enter *Z
2. Ready the cassette
3. Enter #P WS2 1000 3000 1000

When saved, you can reload from Basic by rewinding the tape and using CLOADM:EXEC or you can run it straight away by:

1. Enter #G 1000

Wordsearch puzzles on your CoCo are fun when you design them yourself. It's a challenge to invent a theme and choose the related words, and then to search for them.

Write Martin Tichborne c/o HOT CoCo, Pine St., Peterborough, NH 03458.

Program Listing 1. Wordsearch, Basic Version

REM WORD SEARCH PROGRAM
20 CLEAR 1000
40 DIM G$(80)
50 P=1
60 CLS
70 POKE 65494,0
80 PRINT"WORD SEARCH";
90 PRINT"COPYRIGHT (c)";C"
100 PRINT@294,"BY M.J. TICHBORNE"
110 GOSUB 1640
120 Z=0:Q=1
130 FOR I=1 TO 280
140 FS(I)="*
150 NEXT I
160 CLS:PRINT"INSTRUCTIONS":PRINT"YOU SELECT THE WORDS AND I WILL INSERT THEM FOR YOU":PRINT"WHEN YOU ARE FINISHED TYPE 'X' AND I WILL FILL THE GAPS IN"
190 PRINT"IF I TAKE TOO LONG FINDING A SPACE FOR YOUR WORD THEN HIT '/' AND I WILL GIVE YOU THE CHANCE TO TYPE A NEW WORD"
200 PRINT"HAPPY SEARCHING"
210 PRINT"HIT -ENTER- TO CONTINUE":INPUT G$;CLS
220 CLS
230 PRINT"IF YOU DO NOT WISH TO
SEE THE WORDS BEING INSERTED THEN TYPE '<D>' THEN ENTER BUT IF YOU DO JUST HIT <ENTER>":INPUT R
240 POKE 65495,0:REM--SPEED IT UP
250 J=6:CLS
260 FOR I=1 TO 280
270 PRINT@J,F$(I)
280 PRINT@J,F$(I)
290 IF F$(INT(J/32)*32+J-32)<2 THEN J=J+12
300 NEXT I
310 IF Z=100 THEN 1260
320 PRINT@444,"STRING(S)':"
330 PRINT@449,"WORD(S);Q:INPUT AS
340 IF A$="X"THEN G$(Q+1)=A$;Q="*
350 IF A$="*"THEN X$=A$Z=0
360 IF R=0 THEN 1200
370 POKE 65494,0
380 IF INKEYS="*"THEN 1610
390 POKE 65495,0
400 Z=0
410 GOTO 450
420 REM
430 IF Z<8 THEN 1170
440 GOTO 360
450 D=LET$(A$)
460 GOTO 900
470 JJ=0:ON C GOSUB 670,700,740,
780,800,820,840860
480 GOTO J,J+1 THEN 420
490 CS=A$\0
500 KK=0
510 IF P=1 THEN 1010
520 IF KK=1 THEN 560
530 IF F$(B+(J-1)*E))="*"THEN
540 IF F$(B+(J-1)*E))="":LEFT$(CS,1) THEN 1620
550 CS=RIGHT$(CS,D-J)
560 NEXT J
570 IF KK=1 THEN 420
580 CS=A$\0
590 FOR J=1 TO D
600 K=CS(J)=LEFT$(CS,1)
610 CS=RIGHT$(CS,D-J)
620 IF KK=1 THEN 420
630 POKE INT(K/10/V)*1029+K
640 POKE IN$(K/10/V)*1029+K
650 NEXT J
660 GOTO 320
670 E=0
680 GOSUB 880
690 RETURN
700 E=19
710 GOSUB 880
720 GOSUB 950
730 RETURN
740 E=1
750 GOSUB 880
760 GOSUB 970
770 RETURN
780 E=21
790 GOTO 710
800 E=20
810 GOTO 680
820 E=19
830 GOTO 710
840 E=1
850 GOTO 750
860 E=2
870 GOTO 710
880 S=INT(B/120)
890 T=INT((D-I)*E+1/20)
900 IF T+13 THEN 1630
910 IF T=0 THEN 1630
920 IF T=13 THEN 1630
930 IF S=0 THEN 1630
940 RETURN
950 IF ABS(S-T)<<D-1 THEN 1630
960 RETURN
970 IF ABS(S-T)<0 THEN 1630
980 RETURN
990 RETURN
1000 CS=RIGHT$(LEFT$(A$;H),1)
1010 FOR J=1 TO 50
1020 N=RAND(8)
1030 IF F$(N)<CS THEN 1680
1040 NEXT J
1050 B=N:GOTO 470
1060 ON C GOTO 1070,1100,1110,110,
20,1130,1140,1150,1160
1070 P=20
1080 B+N*(H-1)+N
1090 GOTO 470
1100 P=19:GOTO 1080
1110 P=1:GOTO 1080
1120 P=23:GOTO 1080
1130 P=20:GOTO 1080
1140 P=19:GOTO 1080
1150 P=1:GOTO 1080
1160 P=21:GOTO 1080
1170 C=RAND(8)
1180 Z=x+1
1190 GOTO 1080
1200 FOR I=1 TO 280
1210 IF F$(I)<"*"THEN 1230
1220 F$=CHR$(ASC(F$)+RND(26))
1230 NEXT I
1240 Z=x+1000
1250 GOTO 250
1260 POKE 65494,0
1270 PRINT@444"STRING(S)'"
1280 PRINT@449"HIT ENTER WHEN PRINT READY":INPUT A$
1290 PRINT+2,CHR$(30)
1300 PRINT@448"TYPE HEADING";I
1310 PRINT@446"BIG(B)OR SMALL(S)
1320 PRINT@448"LETTERS":INPUT A$
1330 PRINT+-2,TAB(30);B$"+
1340 PRINT+2
1350 PRINT+2
1360 IF A$="B"THEN PRINT+2,CHR$(5)(31):GOTO 1390
1370 IF A$="S"THEN PRINT+2,CHR$(5)(30):GOTO 1390
1380 GOTO 1320
1390 POKE 65495,0
1400 I=1
1410 IF A$="B"THEN C$="ELSE C"
1420 IF A$="B"THEN D$="ELSE DS
1430 IF K=1 THEN 20
1440 DS=DS+F$(I)+C$:I=I+1
1450 NEXT K
1460 POKE 65494,0
1470 PRINT+2,DS
1480 PRINT+2
1490 IF I<280 THEN 1410
1500 PRINT+2,CHR$(30)
1510 IF HH=1 THEN 1660
1520 FOR I=1 TO Q STEP 5
1530 PRINT+2,CHR$(15):TAB(15):GS(1)
+1):TAB(15):GS(1)+1):TAB(45):GS(1)
+3):TAB(60):GS(1)+4)
1540 PRINT+2,AX
1550 NEXT I
1560 PRINT+2,CHR$(30)
1570 GOSUB 1640
1580 PRINT+2,CHR$(30):NEXT COPY(C)NEW
1590 INPUT A$:IF A$="A"THEN 127
0 ELSE IF A$="N"THEN RUN
1600 END
1610 Q=0:1:GOSQ(0):GOTO 1620
1620 KK=1:GOTO 560
1630 J=1
1640 PLAY"yilT6;L6b618c4L4D0
2A;AL8;A;B;03;L8;C4;D14;E;E
C;A
1650 RETURN
1660 FOR I=1 TO Q STEP 5
1670 GOTO 1530

END
Listing 2 continued

WORDSEARCH

01830 INJ JSR POLKEY POLE KEYBOARD
01840 CMPA #$4E =N
01850 BNE IN2A
01852 CLRA
01854 IN2A STA SMT
01855 JSR CLEAR I CLEAR PAGE 1
01860 LDY #$4E0
01860 LDY #5X0
01860 JSR STRING PRINT DEFINE COLUMNS
01860 JSR NEWLIN
01860 JSR CLLRIN
01860 JSR NUMB READ IN NUMBER
01860 LDD NUMB
01860 CPMD #$0
01860 JSR LIN NOT ZERO
01860 LS Y IN NOT 0
01860 CPMD #$1
01860 JSR INPUT GREATEST THAN 11
01860 JSR NEWLINE GO TO NEW LINE
01860 JSR TEXTX7
01860 JSR STRING PRINT DEFINE ROWS
01860 JSR NEWLIN
01860 JSR CLRIN
01860 JSR NUMB READ IN NUMBER
01860 LDD NUMB
01860 CPMD #$0
01860 JSR LIN NOT 0
01860 LS Y IN NOT 16
01860 CPMD #$16
01860 JSR LS 1S LESS THAN 16
01860 JSR IN4 JSR IN4 FREE CL
01860 JSR CLRLIN

INTRODUCTION

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Listing 2 continued
Listing 2 continued

01950 * 01960 NEWLIN STY TEMP 01970 STD TEMPl 01980 LDD TEMP 01990 ADD $0280 02000 CMPD #$5600 02010 BLT NWl 02020 LDD #$0400 RESET PAGE 02030 NWl ANDB #$5E0 02040 STD TEMPl 02050 LDD TEMP 02060 STD TEMPl 02070 RTS 02080 TEMP FDB $0000 02090 * 02100 BACKLI STY TEMP 02110 STD TEMPl 02120 LDD TEMP 02130 SUBD #$20 02140 CMPD #$400 BGE NWl 02150 LDD 1$5E0 02160 BRA NWl 02170 TEMP FDB $0000 02180 * 02190 * 02200 * 02210 * 02220 * 02230 * 02240 *CLEAR CURRENT LINE 02250 * 02260 CLR LIN JSR NEWLIN 02270 JSR BACKLI 02280 STD TEMPl 02290 LDD TEMP 02300 SUBA 1$20 02310 CMPA 1$20 BNE CLRl 02320 LDD TEMP 02330 JSR BACKLI 02340 RTS 02350 * 02360 * 02370 *MATRIX 600 -800 02380 * 02390 *MATRIX 600-800 02400 * 02410 *MATRIX STY TEMP 02420 STA CHANGE SET TO 2ND PAGE 02430 STA CHANGE SET TO 2ND PAGE 02440 LDD BLIST 02450 STD ALIST INITIALSE OUTPUT LIST 02460 LDA 1$20 02470 LSRA 02480 STA COL SAVE START COL. 02490 STA ROW SAVE START ROW 02500 LDA 1$10 02510 SUBA ROW+l 02520 LSRA 02530 STA ROW SAVE START ROW 02540 LDD 1$10 02550 LDD 1$10 02560 MTl STA ,Y+ CLE AR PAGE 2 CLEAR PAGE 2 02570 CMPY IP AGE2 02580 BLT MTl 02590 LDB ROW 02600 MUL 32*ROW DIF. 02610 ADDC COL 02620 ADDD PAGE2 START OF MATRIX 02630 EKG Y,D 02640 LDA ROW+l 02650 STA TEMPl 02660 MT3 LDA COL+l 02670 STA TEMPl 02680 LDB #2E PUT DOTS IN MATRIX 02690 MT4 STY ,Y+ 02700 DEC TEMPl 02710 BNE MT4 END OF ROW? 02720 LDD $20 02730 SUBB COL+l 02740 STD TEMPE NEXT ROW ADDRESS 02750 EKG Y,D 02760 ADDD TEMPE 02770 EKG Y,D 02780 DEC TEMPE 02790 BNE MT2 LAST row? 02800 MT2 LDD TEMP 02810 RTS 02820 TEMP2 FDB $0000 02830 * 02840 TEMP2 FDB $0000 02850 * 02860 * 02870 *INPUT THE WORD 02880 * 02890 WORD LDX TEXT6 02900 LDD #$5E9 02910 STD TEMPE 02920 WORDJ JSR CLEARl CLEAR PAGE 02930 STA SFFC Set TO PAGE 1 02940 LDD #$5E9 02950 JSR STRING 02960 JSR STRING 02970 WDN LDA #$AF 02980 STA 3 02990 JSR JSR POLKEY 03000 CMPA #$F6 03010 BSX 03020 CMPA #$15 03030 BSX 03040 BRQ DS LEFT ARROW

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Listing 2 continued

04100 LC5D JSR RAND
04110 ADBB #$07 8 DIRECTIONS!
04120 CBMP #3
04130 BLT LC6 B= 8.1.2 (-33, -32, -31)
04140 BNE LC5A
04150 LDB #3 B= +1 (-1)
04160 BRA LC6
04170 LC5A CBMP #7
04180 BNE LC5B
04190 LDB #2 B= -1 (-1)
04200 BRA LC6
04210 LC5B ADBB #86 B= 4,5,6 (31,32,33)
04220 *
04200 LC6 CLRFA
04200 SBD #33
04250 SSD X3 SAVE OFFSET
04260 LC6B AIX , -X
04270 CMPA #$26
04280 B8Q LC7 REACHED BEGINNING
04290 EXG D , Y
04300 SBD X3 ADD OFFSET
04310 SBD #4AEGE
04320 JSR BOXCHK
04330 BEQ LC6A NOT IN BOX
04340 LDA , Y GET CHAR
04350 CMPA #$2E DOR DOTT
04360 BEQ LC6B OK
04370 CMPA , X
04380 BEQ LC6B OK
04390 LC6A LDHX TEMP
04400 DEX X2
04410 DEC X2
04420 BNE LC5D RESET & CHANGE DIR.
04430 BRA LC4A CHOOSE ANOTHER LETTER
04440 *
04450 *
04460 LC7 EXG D , Y
04470 SUBD X3
04480 EXG D , Y
04490 LDA , LDA X4
04500 LC7A LDA , X +
04510 STA X2
04520 CMPA #$2A
04530 BEQ LC6B END FUNCTION (CURSOR)
04540 EXG D , Y
04550 ADDD X3 ADD OFFSET
04560 SBD #4AEGE
04570 JSR BOXCHK
04580 BEQ LC6A NOT IN BOX
04590 LDA , Y GET CHAR
04600 CMPA #$2E DOTT
04610 BEQ LC7A OK
04620 CMPA #$2C CHAR . EQUAL?
04630 BEQ LC7A OK
04640 BEQ LC6A NOT OK, CHOOSE ANOTHER DIR.
04650 X 3 FDB $0000
04660 *
04670 *
04680 LC8 LDA , -X
04690 CLRA
04700 STA X2
04710 LCBA LDA , -X
04720 CMPA #$2B
04730 BEQ LC9 FINISHED
04740 STT [ALIST]
04750 INX
04760 INX X2
04765 SUBA #$40
04770 STA X , Y
04780 EXG D , Y
04790 SUBD X3
04800 EXG D , Y
04810 STA LCA STORE CHAR S IN MATR I X
04812 LC9A LCA SW1
04814 BEQ LC9A
04816 JSR BOXKEY
04818 LC9A LDA , X +
04820 LC9C EXG D , Y
04822 ADDD X3
04824 EXG D , Y
04826 LDA X , Y
04828 CMPB #$2F CURSOR?
04830 BEQ PNT2 NOT DONE
04832 JSR BOXCHK
04834 BRA LC9C
04836 *
04840 LC9D LDY ALIST
04850 LDA , Y
04860 ANDA #1
04870 ADDD X2
04880 SUBD X3
04890 STA , Y +
04900 STT [ALIST]
04910 CLRA
04920 STT , Y +
04930 JSR CMY CLIST
04940 BEQSignUp
04950 BGE RANDOM
04960 RTS
04970 XE FDB $B0
04980 X FDB $B0
04990 RANDOM LDY #PAGE2
05000 STA CHANGE CHANGE TO PAGE 2
05010 RND LDA , Y +
05020 CMPA #$2E DOTT
05030 BNE RN2 NO

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Listing 2 continued
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See List of Advertisers on page 130
Do you have problems presenting text messages? Here are three techniques to change them. Almost any program can use them in some form. When written as subroutines, they require very little memory beyond that required for more conventional PRINT statements. However, the action they provide is worth the few bytes of memory.

Program Listing 1 demonstrates all three techniques for presenting text messages. The first scrolls each line of the message from the right border onto the screen. The next prints the message, letter by letter, across the screen. The third scrolls lines onto the bottom of the screen. It then shifts the entire video display up one line to make room for another line scrolled onto the now vacant screen bottom.

All three techniques use a Sound routine to enhance the effect. It provides a distinctive teletype sound every time a new letter appears on the screen. The sound also provides a slight delay to improve the viewing of each technique.

The program can be divided into five distinct sections. One occupies lines 400-420, and is the DATA statement section containing text messages to be printed. Another section, lines 10-35, controls the demonstration. The three remaining sections do the actual printing. Two of them are subroutines numbered in the 100s and 200s. The last section is numbered in the 300s.

The first two techniques are called from the control section as subroutines by line 30. Prior to calling these subroutines, line 25 establishes a new value for K that is used in the subroutines to control the print location.

The value for K can be any whole number from 0 to 511. This value represents a unique screen location starting at zero in the upper-leftmost position of the screen. They increase in value as one moves across the screen. Each screen row has 32 of these locations. There are 16 rows on the screen, hence 512 total screen locations.

Type and run the Listing below for a better understanding of this numbering system. The short program moves a black rectangle across the screen. As it moves, it displays the numeric value of the screen location occupied. To slow the sequence, increase the duration of the sound call in line 60.

The subroutines used to print the text only print one line each time they are called. The control section of the program determines the number of lines printed. Lines 20 and 35 accomplish this. By changing the value of K in line 20, the start location can be changed and the ending location is controlled by line 35. The number of lines printed is the difference between the value of K in line 20 and line 35.

Before looking at the two subroutines in detail, look at lines 400-420. Both subroutines start by reading a line of text from these statements. When it reads a DATA statement, the Color Computer ignores any blank spaces following a comma (or the keyword DATA). It continues to ignore spaces until it encounters a nonblank space. This character is considered the first character of the next data element.

To center text on the screen, take care in writing a DATA statement. Positioning cannot be done with blank spaces, but other characters suffice. For example, examine the first entry in DATA statement 410. The period immediately following the word DATA functions as a positioning character. Remove it and the word this is printed flush with the left screen border rather than indented three spaces as intended.

The subroutines use the LEFT$ function to select the proper character(s) to print. In the first technique, line 120 is used to print a substring of N$ that is 31-N characters long. Since the value of N starts at 31, and is reduced by one each time line 110 executes, the substring appears to grow in length by one character.
letter each time through the loop.

The print location is also changed during each loop by the equation \( K + N \) in line 120. The combination of these two actions produces the scrolling effect of the first technique.

The second subroutine also uses a substring of \( NS \), but this time the substring is always one letter long. The character that is \( N \) characters to the left of \( N \$ \) is used in the substring. As \( N \) increases each time through the loop, the sentence appears to print on the screen, one letter at a time, left to right.

The third display uses the same scrolling system as the first technique, and is seen in the subroutine call of line 310. Prior to calling the subroutine, line 300 causes printing to occur on the top of the screen (row beginning with screen location 480).

After the sentence has completely scrolled onto the screen, line 320 is executed, printing to the lower right screen location (i.e., 510), and causing a vertical scrolling of the entire video screen. This action occurs as a result of Color Basic's automatic screen-scroll function, which is very simple. The result is a clearing of the bottom screen row, that is now ready for another line of text.

The third technique is not called as a subroutine, so it must provide its own control. This is done by lines 330 and 340 that are used to limit printing to 12 lines of text. This is sufficient for the example presented, but by changing the values that are accepted, you can select a different number of lines.

Address correspondence to W.H. Barber, 978 Cherry St., Winnetka, IL 60093.
Here's a low-cost, versatile design that interfaces your Color Computer to the world around you. It allows for a cartridge port, buffers the address and data buses, and decodes 16+ addresses for select signals. This was designed originally to interface a scratch-built PROM-burner, thus the layout of S1 and S2, but you can use it for many purposes.

The circuit is connected to the computer via the cartridge port using 40-wire ribbon cable and connectors available from Radio Shack. I used aluminum duct tape on the ribbon cable to cut down on the RFI. The board is a prototype board available from Radio Shack, and the sockets are all wire-wrap.

The numbers on the left of the schematic are connector numbers from the computer. All lines marked Vcc are connected to the +5V power supply needed for the interface. The line marked +5 (9) comes from the computer and is used only to power the ROM pack. All grounds are tied together.

Address lines 0-15 are buffered by Z1, Z2, and Z3. These are 74LS367 tri-state buffers with their enable pins (1 and 15) tied to ground so they are always enabled. AB0-AB13 are wired to the ROM pack socket as shown. AB0-AB3 also go to Z9, a 74154, one of 16 decoders. Z3 also buffers the read/write signal and the spare device-select signal (more on this later).

The data bus comes in on lines 10-15 (Z4) and 16 and 17 (Z5). These are labeled DW (data write) as the flow of data is from left to right when Z4 and a portion of Z5 are enabled. The lines marked DR0-DR7 are data read signals and the flow of data is from right to left when a portion of Z5 and Z6 is enabled. The data lines to the ROM pack are connected to the computer side of the buffers. The data lines are also buffered DB0-DB7 and connected to S1, a 16-pin wire-wrap socket.

The SCS signal is a spare device signal that goes low when addresses FF40H-FF5FH are selected (65344-65375 decimal). This signal and the R/W signal go to Z7A, an OR gate. When both are low, Z4 and a portion of Z5 are enabled allowing the data to pass through the buffers from left to right (a write operation).

The R/W also goes to Z8A where it is inverted, and it and the SCS signal go to Z8B to form a read signal that enables part of Z5 and Z6. This allows the data to pass from right to left for a read operation, thus the data buffers are only enabled when an address from FF40H-FF5FH is selected.

Both the data read (DR) and the data write (DW) go to Z10A, an AND gate, so when either one goes low, Z9, the one-of-16 decoder, is enabled. A0-A3 also go to Z9. These four address lines are decoded and provide 16 select signals for controlling various peripherals.

As stated earlier S1 and S2 are 16-pin wire-wrap sockets and you can bring out any signals you need here. I brought out D0-D7, the DW and DR signal, the +5V from the interface...
These provide all the signals necessary for the first six select signals and AO-Al. The other pins of Sl and S2 bring out to burn EPROMs.

A +5V power supply is needed to power this. I used +5V at 3A and it has been more than adequate for my purposes. I mounted the power supply and circuit board in a small scratch-built wooden box along with some breadboard strips to test circuits on.

After wiring this and double checking everything, plug it into the computer. Turn the interface on first, and then the computer. If you turn the computer on and plug in your cartridge and proceed as you normally would. If you're using a cartridge like EDTASM+ this allows you to monitor your various I/O signals as you test your programs.

If everything is right, you should have a 255 printed on the screen. Pin 1 of Z9 and DR should go momentarily low. By applying highs and lows in various patterns to pins 1-8 of Sl and running the above routine, you should see the corresponding numbers printed on the screen.

Last of all, check and double check the wiring on the ROM-pack socket. An error here could destroy your cartridge. Then plug in your cartridge and proceed as you normally would. If you're using a cartridge like EDTASM+ this allows you to monitor your various I/O signals as you test your programs.

Address correspondence to Michael Kraft, 1830 E St., Merced, CA 95340.
The first “Colormanía” article (HOT CoCo, January 1984, p. 100) explored number systems, showed how CoCo machine language compares to Basic programming, and gave you enough rudimentary Assembly mnemonics to program a simple loop counter. If you are a beginner one major difficulty you probably encounter is the complexity of machine-language programming, so I explained some fundamentals before proceeding to the programming.

By now the dedicated Colormaniac probably has some type of editor/ assembler, has learned more of the 6809 instruction set, and is eager to proceed to more productive programming.

**System Requirements**

16K RAM

Color, Extended, or Disk Basic Editor/Assembler (optional)
This month's article concentrates on a high-speed machine-language graphics routine.

This graphics program draws a high-resolution screen with a rectangular yellow border on a red background and bounces a ball within the rectangle. It is a vehicle for discussing machine-language programming and the foundation for an arcade game (after the addition of paddles and scoring).

Before examining the program, you need to understand pages 252-266 of the Radio Shack manual, Getting Started with Color Basic. If you get lost in the initial graphics setup procedures, consult an expert.

Also, this article shows hex values prefixed by the standard dollar sign with decimal equivalents following in parentheses.

Program Listing 1 uses the highest-resolution, four-color mode, set up by lines 4-17. The CLR (clear) mnemonic is used here since writing anything to the screen clearing, but more selectively. Rather than using the entire screen, the border leaves a blank area at the top to display scores if you expand the routine into a complete game.

The pattern for yellow pixels is

```
0003 265B CC55FF LDD #0011010111111111 SET PATTERN
0010 265D E35F LDD #$FF GO LITE DOT
0011 265E FF5F LDD #$FF SAVE PATTERN
0012 265F 1700 A3 SW LDD BEEP \*SOUTHWEST
0013 2660 20E4 BRA C@ AND LOOP BACK
0014 2661 26E3 2702 BNE NW
0015 2662 56 RORB 0132 2730 49 ROLB,
0016 2663 2030 SW LDD BEEP \*NORTHWEST
0017 2664 27 02 BEQ A@ IF SO, CONTINUE
0018 2665 265A 1700 A3 SW LDD BEEP \*SOUTHEAST
0019 2666 20E4 BRA C@ AND LOOP BACK
001A 2667 3088 20 DC LDD 32,X DROP /
001B 2668 26D5 26E8 A6 89 008 0 D@ LDA 4*32 ,X
001C 2669 000F 26DA 89 008 LDA 32,X
001D 266A 000F 26DA 89 008 LDA 32,X
001E 266B 000F 26DA 89 008 LDA 32,X
001F 266C 000F 26DA 89 008 LDA 32,X
0020 266D 265A 1700 A3 SW LDD BEEP \*SOUTHWEST
0021 266E 20E4 BRA C@ AND LOOP BACK
```

This month's article concentrates on a high-speed machine-language graphics routine. The problem of value in address $FF22 (65314) is tricky though, since the least-significant bits should not be disturbed.

"... to make smooth diagonal moves, the ball shifts one pixel at a time right or left and one pixel up or down, depending on the direction desired."

Do this by getting the value in this byte (line 7), using AND to drop the high 5 bits (line 8), ORing in 5 new high bits (line 9), and putting the result back (line 10).

Once the screen initialization is completed, you have a 128-by-192-pixel screen controlled by $1800 (6,144) bytes of RAM. The value at RAM address $0E00 (3,584) controls the four pixels starting at the screen's top left corner.

The next $1F (31) bytes control the remainder of the top horizontal row, and so on, until the bottom right screen corner is controlled by $25FF (9,727). This corresponds to Basic graphics pages 1-4 in the disk CoCo, but causes no problems in the nondisk system.

Clear the screen in lines 18-22 by loading index register X with the address of the top left control pixel, loading accumulator A with the value for red, and looping across and down the screen until the bottom right pixel is reached.

The border is drawn by a process like the screen clearing, but more selectively. Rather than using the entire screen, the border leaves a blank area at the top to display scores if you expand the routine into a complete game.

The pattern for yellow pixels is
loaded into A (line 23) and X is initialized with the address of the top left corner of the border (line 24). Line 26 draws each byte of the left border while the OFFSET command in lines 30–34 draws the right border, mapped $1F (31) control bytes higher. Lines 30–34 then draw horizontal border lines.

The ball's position is initialized on the screen inside the top left corner of the border (line 35), and the fun begins. The DOTON subroutine (lines 145–151) draws the ball four pixels high by four pixels wide, and DOTOFF (lines 152–158) extinguishes it.

In order to make smooth diagonal moves, the ball shifts one pixel at a time right or left and one pixel up or down, depending on the direction desired. For the initial top left to bottom right movement, this occurs in a subroutine called Southeast, or SE. There are three corresponding subroutines for movement in other directions, labelled NE, SW, and NW. Figure 1 shows how movement to the right is accomplished in the SE section.

Double accumulator D (accumulators A and B concatenated) and index register X jointly control the dot's position. While X points to a screen location, D sets the pattern for eight pixels at that location. Initially, as shown in Fig. 1a, the first 8 bits of D are set at 01-01-01-01-01, making the first four pixels yellow.

The remaining 8 bits are 11-11-11-11, so the next four pixels are red. Formation of the dot's first layer occurs when this pattern is placed into memory (line 153) and the other three layers are drawn as the pattern is continually repeated $20 (32) bytes higher (lines 154–156).

The dot is shifted to the right in Fig. 1b, when the pattern is changed to...

---

"The Assembly source code for the bouncing ball can be assembled into memory and saved to tape or disk only if you have an editor/assembler."


This process continues through Fig. 1e, where the dot reaches the far right side of the 2 bytes controlled by the D accumulator. Figure 1f then shows how, by incrementing X by one (half the width of D) and restoring the pattern of Fig. 1b, the rightward movement continues.

Within the SE routine, the following things take place, in order:

- **Beep**—Make some noise.
- **Test**—See if the movement is about to encounter a border; if so, jump to the appropriate subroutine for another direction.
- **Off**—Extinguish the dot.
- **Shift**—Move the dot pattern one pixel down and one pixel to the right.
- **On**—Relight the dot in its new position.
- **Delay**—Enter a brief loop counter to smooth the motion, then loop back to Test and do it all again.

Don't let the strange-looking labels like A@ throw you; my assembler, the Micro Works' SDS80C, allows "local labels," single letters followed by @, which are valid only in a particular local area. The A@ in the SE section and the A@ in the NE section are two different labels, and any blank line in the source listing serves as a delimiter. If you enter this program with an assembler that does not allow local labels, you'll have to replace them with, for example, A-SE and A-NE.

The ORCC statement in line 49 needs explanation. This sets bit C in the condition code register, so that a "1" bit can be shifted into A with the RORA in line 50. This and the following lines 51–53 accomplish the shifting of bits within the D accumulator to move the dot.

The three other movement routines operate in essentially the same manner as SE, except that up becomes down or right becomes left, according to direction of movement.

Lines 163–169 use the Sound routine contained in ROM to generate the beep when the dot encounters a border. This is an example of the many routines in ROM that you can call. Here, you call the sound by loading $008C (140) with the desired frequency and the B accumulator with the desired duration, then transferring control to the ROM at $A951 (43345).

There's an RTS (return from subroutine) in ROM that transfers control back to your program after the sound is generated. While a Basic Sound command is limited to durations of 1–255, this routine uses a duration of zero (line 166). Try SOUND 100,0 in Basic and you'll get a function-call error. Stacking the X register upon entry and recovering it just before exiting from this routine is a necessity, since the sound-generating code contained in ROM changes X's value and crashes the whole program unless X is protected.

The Assembly source code for the bouncing ball can be assembled to memory and saved to tape or disk only if you have an editor/assembler. The entire routine is written in relocatable
or position-independent code, so the ORG $2600 statement <0001> can be altered and the program can reside wherever you desire, as long as the display memory $0E00-$25FF (3584-9727) is avoided.

If you have no editor/Assembler, the Basic driver (Program Listing 2) contains the same code. The driver version has been relocated to the high RAM addresses in the 16K system, but works in the 32K system as well.

Type in the driver and save it to tape or disk before it is run, since the graphics manipulation alters values in the same addresses occupied by the Basic driver program. Disk users might avoid the conflict by executing a PCLEAR 4 before entering the program, but it is a good practice to save before running.

Program Listing 3, Datasave, is a Basic routine that takes bytes of machine-language code from memory and creates Basic DATA strings with the same values. It creates either tape or disk files, with DATA lines starting with line 1000. Non-Extended Color Basic has no CSAEM command, but this program simulates one.

The only trick is to get Datasave and the machine-language program to reside in different memory areas so they won't destroy each other. Imagine that my bouncing ball routine is a commercial program called Ping-Pong, for which you paid $19.95, and that you want to protect your investment by making a back-up copy.

You must first determine the program's start, end, and EXEC addresses (the first and last RAM addresses occupied by the program), and the address to which control is transferred to start the program running. Start and EXEC addresses are the same in many machine-language programs, but not all. From examining the Assembly output (Listing 1), you know that Ping-Pong's start, end, and EXEC addresses are $2600 (9,728), $2797 (10,135) and $2600 (9,728), respectively.

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and the response is 10136. Since this is end +1, you know that the actual end address is 10135. Finally, you determine the EXEC address by typing:

```
PRINT 256*PEEK(487) + PEEK(488) <ENTER>
```

and find that the EXEC address is also 9728. If you have Extended Color BASIC you can now make a back-up tape

```
"You can add scoring and joystick controlled paddles..."
```

by inserting a blank cassette, pressing the play and record buttons, and observing the syntax for creating machine-language tapes, which is CSAVEM "file name", start address, end address, EXEC address, or: CSAVEM "PINGPONG", 9728, 10135, 9728 <ENTER>
or if you prefer hex, use:

```
CSA VEM "PINGPONG", &H2797, &H2600;
```

This also holds true for the disk-system user, but only if the program was loaded from tape. Machine-language programs loaded from disk contain start, end, and EXEC addresses on track 17 of the disk.

If you have only non-Extended Basic (no CSAVEM command) or for any other reason you want to make a back-up in Basic driver form, you can use Datasave to create the driver, but, as mentioned above, avoid address conflicts. Remember also that PingPong is written in position-independent code, meaning that it can be relocated to any available RAM address and still function properly. How do you determine if there is a memory conflict, and whether it is necessary to relocate the machine-language routine?

The easiest way is to load Datasave, protect the memory in which the machine-language routine resides, and see what happens. The syntax is CLEAR n, h, where n determines the number of bytes to be reserved for string storage and h specifies the highest address that can be used by Basic. If no CLEAR command is used, then upon power-up the CoCo reserves 200 bytes for strings...
and allows Basic to use everything up to and including the highest available RAM address.

Since you know that Ping-Pong starts at $2600 (9728), you might try loading Datasave and executing a CLEAR200,9727, telling the CoCo not to let Basic use anything up to and including the highest available address. This simplifies things since you can assume that the CLEAR statement left enough RAM to do the job.

Although the CLEAR statement set aside 200 bytes for string storage, it was an ?OM error. If no ?OM error occurs at this point you can assume that you haven't left enough RAM to do the job.

In either case, the first sign that you haven't left enough RAM to do the job is an ?OM error. If no ?OM error occurs at this point you can assume that you haven't left enough RAM to do the job. In one case, the first sign that you haven't left enough RAM to do the job is an ?OM error. If no ?OM error occurs at this point you can assume that you haven't left enough RAM to do the job.

Once you determine the offset value of $1868 (6248), find the new start and EXEC addresses by adding the offset to the original values:

$2600 + $1868 = $3E68

($2600 + $1868 = (15976))

If the original start and EXEC addresses differ, you use the same addition process to determine a new EXEC address.

At this point enter a CLEAR 200,15975 statement. This limits Basic to use of RAM up to the last address below the new machine-language start location. You can then offset load the machine-language program with the command: CLOADM "PINGPONG",6248.

Now you can load and run Datasave. Prompts ask for the machine-language routine's start and end addresses and for the driver file name. Do not use a file-name extension if writing the driver file.

Once the driver has been written to tape or disk, it consists only of DATA statements, and you must add memory protection, a FOR...NEXT loop to read the data and POKE it into memory, and the EXECUTE command, as shown in Listing 3, lines 10-40, respectively. Also, it is written in ASCII format and can be loaded and resaved in Basic format to speed future loading.

You can add scoring and joystick-controlled paddles to make this a complete Ping-Pong game. You have only four directions of movement here. Should a finished product provide for "English," so that the ball's speed and angle off the paddle depend on which part of the paddle is contacted? I can answer this and other important questions in a future "Colormania," but meanwhile you might want to work on it yourself.

Address correspondence to Mark Silverblatt, HHC, 93d Signal BDE, Box 181, APO, New York 09279.
If you're in the same financial boat that I am (the Titanic), then you probably have a few dental and medical bills that become a headache at tax time. You have to figure the amount you paid and the amount your insurance covers because Uncle Sam wants you to be as accurate as possible. He doesn't want you to pay too much tax, right?

I've written two programs that allow you to keep track of medical and dental bills by entering the bills into the program as data and saving them to tape. When you receive reimbursement from the insurance company, you can load the data from tape and then enter the payment received. The computer will match the insurance payments to the original bills and, upon command, will print a summary for you.

The summaries will total the data for you and show each medical or dental service as well as the total cost of services, total paid by insurance and total cost to you (employee). In addition, a cross-hatch (#) will appear in the column to the right of the insurance payment for any entry that does not have a matching claim entered. This helps to spot the services that you might want to investigate.

The programs require Extended Color Basic because of the PRINT USING and LINE INPUT statements. You can delete USING and LINE for use with Color Basic.

Before entering either program, type:

POKE 25,6:NEW (enter)

to clear maximum memory. If you have 32K, this won't be necessary. This leaves you with zero graphics pages. Type in either program, but leave out the REMs. You will have more memory for data storage. If you have a 32K machine, you can combine both listings as one program—more about that later. The variables are compatible so you won't have to worry.

You can leave off the printer routines if you don't have a printer to save even more memory. The amount of memory used by the program depends upon the amount of data entered. If you enter long statements or names, you will use more memory. It is best to use initials instead of names and numbers for the date whenever possible. Because of the small screen format, data printed on the screen in both programs is in an abbreviated format. The printer data will be the same as the data you entered.

The major difference between these two programs is the way they summarize data. They use similar routines to match data, but the dental program (Listing 1) only does it when you request a summary and answer the prompt with a 3. This means you must ask for a summary before you ask for a printout or your results will show all zeros. This requires more action by the operator, but saves a lot of memory.

The medical program (Listing 2) is much more sophisticated. It does its own summary during the print routine, and therefore does not require a summary before printing. It also has an editor that allows the user to change any

---

**System Requirements**

16K RAM

Extended Color Basic

(Color Basic with minor changes)
entry. This is a handy feature when the insurance company makes a mistake and has to send you another check. You can edit the data in the dental program but you must stop the program execution to do so; I'll explain this later.

Both programs require that you load data from cassette (if you need to) before you make any keyboard entries. If you don't, you will overwrite your keyboard entries and they will be lost. You can, however, reenter them if you want. Both programs will warn you if you try this and an operator input is required to override the warning.

The dental program is much shorter because it contains only the basics for entering, saving, matching, and summarizing the data.

If you end the program prematurely, don't worry. Just type CONT and press enter. The program will take you back to the menu without any loss of data.

### Printer Control Codes

I have included printer control codes in both programs. If you don't have a Line Printer VII, you must adjust the

---

**Program Listing 1. Dental Expenses**

```plaintext
170 CLS:PRINT:CLEAR 1000
180 P1$=STRINGS(32,"%") ; P2$=CHR$(10): P3$=CHR$(31): P4$=CHR$(30)
190 DIM D$(20), D1$(20), I$(20), I1$(20), A(20), Al(20), A2(20)
200 PRINT"TAB(9)""DENTAL PROGRAM"
210 PRINT"BY DENNIS H. WEIDE"
220 PRINT"COPYRIGHT 1982"
230 FOR X=1 TO 550
240 NEXT X
250 GOTO 1510
260 IF P=1 THEN 280
270 IF P=2 THEN 650
280 CLS
290 IF N7=1 GOTO 580
300 N7 =1
310 ' ENTER DENTAL VISITS
320 ' Enter number of visits
330 ' ;N1
340 ' ;N1
350 ' ;N1
360 INPUT"ENTER NUMBER OF VISITS ";N1
370 CLS:FF=0:ZQ=1
380 PRINTTAB(9)"DENTAL VISITS"
390 GOSUB 1420
400 FOR X=N3+1 TO N1+N3
410 PRINT@11,""";LINEINPUT D$(X)
420 PRINT@12,""";LINEINPUT I$(X)
430 PRINT@13,""";INPUT A(X)
440 I1=I1+32; I2=I2+32; I3=I3+32
450 NEXT X
460 FOR X=N3+1 TO N1+N3
470 T1=T1+A(X)
480 NEXT X
490 PRINTPRINTTAB(5)"TOTAL CHAR
GES ";
500 PRINTUSING"$####.##";T1
510 PRINTPRINT:N3=N3+N1
520 GOTO 630
```

---

530 ' ERROR ROUTINE
540 ' 550 ' 560 ' 570 ' 580 PRINTPRINT
590 PRINTTAB(4)"YOU CANNOT REENT ER DATA"
600 PRINTPRINTPRINT
610 INPUT"PRESS <ENTER> TO CO NTINUE";X
620 GOTO 1510
630 INPUT"PRESS <ENTER> TO CO NTINUE";I4:GOTO 1510
640 END
650 CLS
660 IF N8=1 THEN 580
670 N8=1
680 ' 690 ' 700 ' ENTER INSURANCE CLAIMS
710 ' 720 ' 730 INPUT"ENTER NUMBER OF CLAIMS ";N2
740 CLS:PRINTTAB(6)"INSURANCE PA YMENTS"
750 ZO=1:FF=0:GOSUB 1420
760 FOR X=N4+1 TO N2+N4
770 PRINT@11,""";LINEINPUT D$(X)
780 PRINT@12,""";LINEINPUT I$(X)
790 PRINT@13,""";INPUT A(X)
800 I1=I1+32; I2=I2+32; I3=I3+32
810 NEXT X
820 FOR X=N4+1 TO N2+N4
830 T2=T2+AI(X):NEXT X
840 PRINTPRINTUSING"TOTAL INSUR ANCE REC'D $####.##";T2
850 PRINTPRINT:N4=N4+N2
860 INPUT" PRESS <ENTER> TO CO NTINUE";I4:GOTO 1510
```

Listing continued
codes to work for your printer. The following codes are for the Line Printer VII.

CHR$(10) = \text{Line feed with carriage return}
CHR$(30) = \text{Standard print (normal condition)}
CHR$(31) = \text{Double-wide print}
STRING$(5, 10) = \text{Five line feeds with carriage return (can be replaced with CHR$(12) for form feed)}
STRING$(80, "") = \text{for 80-column printer (change to column width of your printer)}

If your codes are different from these, just change the CHR$ values in line 180 in the dental program and lines 220 and 230 in the medical program to the proper values for your printer.

"Try a few practice entries so that you become familiar with how the program works. Error routines prevent any mistakes that could result in the loss of data."

Making Entries
It's very simple to make entries in either program. When you run the program, the main menu will appear. Just type the number of the function you want and press the enter key. Try a few practice entries so that you become familiar with how the program works. Error routines prevent any mistakes that could result in the loss of data.

If for any reason you must edit an entry in the medical program, return to the main menu and select the editor routine. Another menu will be displayed. Make your choice from this menu and enter the old data requested. You will be asked to enter the new data (follow the prompts). When you press the enter key, you overwrite the old data with the new data. If you make a mistake when editing, just edit the error again.

"ListinR continued"

870 ' 1260 NEXT
880 ' 1270 ' 1280'
900 ' 1290 ' PRINT RESULTS ON SCREEN
910 ' 1300 '
920 ' 1310 '
930 '
940 '
be edited. Then you must stop program execution. Do this by pressing the break key or entering a 7 if the main menu is displayed. Then use the following table to determine the data variable that must be changed.

**Dental Variables**

- Dental Visit Date = D$(X)
- Dental Visit Name = I$(X)
- Dental Visit Amount = A(X)
- Insurance Payment Date = DI$(X)
- Insurance Payment Name = 11$(X)
- Insurance Payment Amount = A1(X)

(Where X = line in Dental Expense Summary)

Let's look at an example. Suppose the data sample has an error in line 5. Here's line 5:

- JAN 24 DEBBIE $18.72 $9.00 $9.72

It shows an insurance payment of $9. That was the original amount paid by the insurance company. After inquiring about the claim, I received another check for $9.72. The total the insurance company paid on this claim then was $18.72. You now know that the error is on line 5 of the insurance payment. Enter the following:

```
A1(5) = 18.72:CONT
```

This will change the insurance payment amount and restart the program. Press the enter key one more time to get an illegal entry warning. The program will return to the main menu or the point at which you pressed the break key. You can now ask for a summary and verify that the data is now correct.

**For 32K Machines**

If you have 32K, you can combine the two programs and keep your medical and dental records separate while using only one program. First, type in the first program and save it to tape. Then clear the memory by typing NEW and pressing the enter key. Now type in the second program. After the second program has been entered, type:

```
PRINT PEEK(25),PEEK(26) (enter)
```

to locate the program pointers. Write down the values on the screen for later use. Now type:
POKE 25,PEEK(27):POKE 26,PEEK(28) – 2
(enter).

This will set the pointers to the end of the previous program so that the next program will not overwrite it.

Now you can load the program you saved on tape and renumber it starting with a line number higher than the last line number of the previous program.

Type:

POKE 25,X: POKE 26,Y (enter)

(where X and Y are the values of addresses 25 and 26 seen earlier) to set the program pointers back to the beginning of the previous program. Save a copy of both programs on tape in case you make an error while trying to load them back to back.

You can add a menu and combine the printer routines as well as the data saves and loads. I used the Basic Line Moer program by Jack Aker in the July 1982 issue of Color Computer News.

When in doubt about what to enter in either program, simply press the enter key. The error routines will prevent any mistakes that might lead to loss of data.

In the dental program, pressing enter without a page number during a summary will return you to the main menu. Now you can load the program you saved on tape and renumber it starting with a line number higher than the last line number of the previous program.

Type:

You can add a menu and combine the printer routines as well as the data saves and loads. I used the Basic Line Moer program by Jack Aker in the July 1982 issue of Color Computer News.

These two programs have saved me a lot of headaches over the last two years and have helped keep an accurate record of medical and dental expenses. I think you will find them quite useful.

Address correspondence to Dennis Weide, 14201 Marquette N.E., Albuquerque, NM 87123.

Listing continued

2270 'SAVE DATA TO CASSETTE
2280 '
2290 '
2300 CLS:PRINT PL$;
2310 PRINT"TAB(11) "SAVE DATA":PRINT PL$;
2320 PRINT"PRINTTAB(7) "1. LOAD DATA TAPE"
2330 PRINT"PRINTTAB(7) "2. PRESS RECORD & PLAY"
2340 PRINT"PRINTTAB(7) "3. PRESS ENTER"
2350 LINEINPUT ZZ$;
2360 CLS:PRINT:PRINT:PRINT:PRINT PL$;
2370 PRINTTAB(6) "YOU ARE SAVING DATA":PRINT PL$;
2380 OPEN"O",-1, "NEW"
2390 PRINT#-1,N3
2400 PRINT#-1,N4
2410 FOR X=1 TO N3
2420 PRINT#-1,IS(X)
2430 PRINT#-1,DS(X)
2440 PRINT#-1,A(X)
2450 PRINT#-1,D1S(X)
2460 PRINT#-1,11S(X)
2470 PRINT#-1,A1(X)
2480 NEXT X
2490 CLOSE#-1
2500 GOTO 1510
2510 '
2520 '
2530 'ERROR ROUTINE
2540 '
2550 '
2560 CLS:PRINT PL$:PRINT:PRINT DATA ALREADY LOADED":PRINT
2570 PRINTTAB(6) "DATA ALREADY LOADED":PRINT
2580 PRINTTAB(2) "DO YOU WANT TO RELOAD? (Y/N)";
2590 FOR II=1 TO 10:SOUND 100,3: NEXT
2600 LINE INPUT KK$;
2610 IF KK$="Y" THEN 2040 ELSE 1
2620 '
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See List of Advertisers on page 130

HOT CoCo March 1984 85
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Whether you're using cassette or disk, we have the right systems software for you. Not games, but serious software for putting your computer to work.

WORD PROCESSING SOFTWARE

SPELL 'N FIX finds and fixes your spelling and typographical errors. Cassette or disk versions cost just $69.29 with a 20,000 word dictionary. FLEX version $178.58. 75,000 word optional dictionary costs $50 additional.

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STAR-DOS provides the power of a big DOS with the simplicity of standard R/S disk format. $49.90 for 16K-64K systems.

STAR-FLEX is a full implementation of FLEX™ (a trademark of Technical Systems Consultants Inc.) for the Color Computer. $225 includes text editor, macro assembler, and HUMBUG debugger program.

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HUMBUG is the famous 6809 monitor/debugger adapted to the CoCo. $39.95 for 16K or 32K disk or tape systems. $59.95 for 64K systems using STAR-DOS or FLEX. $29.95 for the MC-10.

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STAR-KITS

PO BOX 209-H
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---432---

Program Listing 2. Medical Expenses

170 DIMENSION ARRAYS &
180 SET PRINTER CODES
190
200
210 CLS:CLEAR 1000
220 P1$=CHR$(10):P2$=CHR$(30):P3$=CHR$(31):P4$=STRING$(5,10)
230 P5$=STRING$(32,"#"):P6$=STRING$(80,"-""):P7$=STRING$(100,"-")
240 DIM AV(27),AM(27)
250 DIM PJ$(27),MP(27)
260 DIM DP$(27),PM(27)
270 DIM IP(27),DT(27)
280 DIM PT(27),MV(27)
290 DIM DV$(27),PV(27)
300
310
320 TITLE PAGE
330
340
350 PRINT@101,"MEDICAL EXPENSE PROGRAM"
360 PRINT@167,"BY DENNIS H. WEIDEN"
370 PRINT:PRINTTAB(13)"(C)1982"
380 PRINT
390 PRINTTAB(5)"":INPUT"WANT IN
400 IF W$="Y" THEN GOSUB 2090
410
420
430 PROGRAM MENU
440
450
460 CLS:T=6
470 PRINTTAB(4)"MEDICAL EXPENSE INDEX"
480 PRINT:PRINTTAB(2)"1.ENTRY-MEDICAL VISITS"
490 PRINTTAB(2)"2.ENTRY-MEDICAL PURCHASES"
500 PRINTTAB(2)"3.ENTRY-INSURANCE PAYMENTS"

Listing continued
510 PRINTTAB(2) "4.SUMMARY-MEDICAL VISITS"
520 PRINTTAB(2) "5.SUMMARY-MEDICAL PURCHASES"
530 PRINTTAB(2) "6.SUMMARY-INSURANCE PAYMENTS"
540 PRINTTAB(2) "7.SUMMARY-TOTAL COST"
550 PRINTTAB(2) "8.MEDICAL EDITOR PROGRAM"
560 PRINTTAB(2) "9.LOAD DATA FROM CASSETTE"
570 PRINTTAB(2) "10.SAVE DATA TO CASSETTE"
580 PRINTTAB(2) "11.HARDCOPY FROM PRINTER"
590 PRINTTAB(2) "12.END PROGRAM"
600 PRINT "ENTER ONE OF THE ABOVE" ; INPUT X
610 ON X GOTO 680, 820, 970, 1090, 1320, 1540, 1800, 2220, 2690, 2930, 3230, 3940
620 GOSUB 19A0 : GOTO 460
630 I
640 I
650 ' ENTRY-MEDICAL VISITS
660 '
670 '
680 CLS: MV=MV+1
690 PRINT: LINE INPUT "ENTER PATIENT NAME" ; P1$(MV)
700 PRINT: LINE INPUT "ENTER DATE OF VISIT" ; DV$(MV) : PRINT
710 PRINT: "ENTER NATURE OF VISIT (35 CHAR)"
720 LINE INPUT MV$(MV)
730 PRINT: "ENTER AMOUNT OF VISIT" ; AV(MV)
740 GOSUB 4010
750 ON X GOTO 680, 460
760 GOSUB 19A0: GOTO 740
770 '
780 '
790 ' ENTRY-MEDICINE PURCHASES
800 ' 810 '
820 CLS: MP=MP+1
830 PRINT: LINE INPUT "ENTER PATIENT NAME" ; INS$(MP)
840 LINE INPUT "ENTER DATE OF PURCHASE" ; DP$(MP)
850 PRINT: "ENTER PRESCRIPTION" ; PS$(MP)
860 PRINT
870 PRINT "ENTER AMOUNT OF PURCHASE" ; AM(MP)
880 AM(MP)=AM(MP)+(AM(MP)*.04)
890 GOSUB 4010
900 ON X GOTO 820, 460
910 GOSUB 19A0: GOTO 890
920 '
930 '
940 ' ENTRY-INSURANCE PAYMENTS
950 '
960 ' 970 CLS: IP=IP+1
980 PRINT: "ENTER PATIENT NAME" ; POS$(IP)
990 PRINT: "ENTER DATE OF VISIT" ; DTS$(IP)
1000 PRINT: "ENTER AMOUNT OF PAYMENT" ; PT(IP)
1010 GOSUB 4010
1020 ON X GOTO 970, 460
1030 GOSUB 19A0: GOTO 1010
1040 ' 1050 '
1060 ' SUMMARY-MEDICAL VISITS
1070 '
1080 '
1090 B1=1:B2=9
1100 CLS
1110 PRINTTAB(2) "1982 MEDICAL VISITS SUMMARY"
1120 PRINT: "DATE NAME AMOUNT DIAGNOSIS"
1130 PRINT P5$'
1140 GOSUB 1260: FOR X=B1 TO B2: GOSUB 1170: NEXT X: GOSUB 1220
1150 IF MV<=B2 THEN 460
1170 IF AV(X)<1 THEN 1210
1180 PRINT@A1, DV$(X) ; PRINT@A2, L
1190 PRINT@A3, USING "$###.###" ; AV(X) ; PRINT@A4, LEFT$(MV$(X), 12)
1210 RETURN
1220 AT=0: FOR X=1 TO 27: AT=AT+AV(X): NEXT
1230 PRINT@423, "TOTAL COST =" ; PRINT USING "$###.###" ; AT
1240 PRINT@448, "" ; LINE INPUT "PRESS <ENTER> TO CONTINUE" ; QWS
1250 CLS: RETURN
1270 '
1280 ' 1290 ' SUMMARY-MEDICAL PURCHASES
1300 '
1310 '
1320 B1=1:B2=9
1330 CLS: FOR Z=1 TO 50: NEXT
1340 PRINTTAB(1) "1982 MEDICINE PURCHASE SUMMARY"
1350 PRINT: "DATE NAME AMOUNT PRESCRIPTION"
1360 PRINT P5$
1370 GOSUB 1260: FOR X=B1 TO B2: GOSUB 1410: NEXT: GOSUB 1340
1380 IF MP<=B2 THEN 460
1400 IF AM(X)<1 THEN 1440
1410 PRINT@A1, DP$(X) ; PRINT@A2, L
...
Listing continued

ET$T INS(X),3); 1420 PRINT@A3,USING"$###.###";AM(X):;PRINT@A4,LEFT$(PNS(X),12); 1430 A1=A1+32:A2=A2+32:A3=A3+32:A4=A4+32 1440 RETURN 1460 AT=0:FOR X=1 TO 27:AT=AT+AM(X):NEXT X 1470 GOSUB 1240 1480 RETURN 1490 ' 1500 ' 1510 ' SUMMARY-INSURANCE PAYMENT 1520 ' 1530 ' 1540 B1=1:B2=9:DD=0 1550 CLS:PRINTTAB(1)"1982 MEDICAL INSURANCE SUMMARY" 1560 PRINT:PRINT"DATE NAME AMOUNT INSURED COST" 1570 PRINT P5$: 1580 A1=128:A2=133:A3=137:A4=145:A5=153 1590 FOR X=1 TO B2:DD=0 1600 IF AV(X)<1 THEN 1710 1610 PRINT@A1,DVS(X);PRINT@A2,LEFT$(PIS(X),3); 1620 PRINT@A3,USING"$###.###";AV(X) 1630 FOR Y=1 TO 27 1640 IF DVS(X)=DTS(Y) AND PIS(X)=POS(Y) THEN 1650 1660 DD=1:PRINT@A4,USING"$###.###";PT(Y) 1670 PRINT@A5,USING"$###.###";AV(X)-PT(Y) 1680 NEXT Y 1690 IF DD=0 THEN PRINT@A4,USING"$###.###";0:PRINT@A5,USING"$###.###";AV(X) 1700 A1=A1+32:A2=A2+32:A3=A3+32:A4=A4+32:A5=A5+32 1710 NEXT X 1720 GOSUB 1240 1730 IF IP<=B2 THEN 460 1740 B1=B1+9:B2=B2+9:GOTO 1550 1750 ' 1760 ' 1770 ' SUMMARY-TOTAL COST 1780 ' 1790 ' 1800 CLS 1810 TP=0:TI=0:TV=0 1820 FOR X=1 TO 27 1830 TP=TP+AM(X):TV=TV+AV(X):TI=TI+PT(X):NEXT X 1840 PRINT P5$:PRINTTAB(7)"TOTAL MEDICAL COST";PRINT P5$: 1850 PRINT:PRINTUSING"COST OF SERVICES $####.###";TV 1860 PRINT:PRINTUSING"COST OF PRESCRIPTION $####.###";TP 1870 PRINT:PRINT"MEDICAL PAYMENTS $####.###";TI 1880 PRINT:PRINT"COST TO EMPLOYEE $####.###";TV+TP-TI 1890 PRINT:PRINTGOSUB 1240;GOTO 460 1900 ' 1910 ' 1920 ' ERROR ROUTINES 1930 ' 1940 ' 1950 CLS:PRINT P5$:PRINTTAB(7)"YOU MUST LOAD TAPE" 1960 PRINTTAB(6)"BEFORE MAKING ENTRIES";PRINT 1970 PRINT P5$:GOSUB 1240;GOTO 460 1980 FOR X=1 TO 10:CLS 1990 FOR T=1 TO 50:NEXT T 2000 PRINT@233,"ILLEGAL ENTRY";SOUND 100,1 2010 FOR Y=1 TO 50:NEXT Y:X:CLS:RETURN 2020 PRINTDVS(X)" PI$(X),AV(X)";RETURN 2030 PRINT:PRINT"PRESS <ENTER> TO CONTINUE";INPUT ZZ:RETURN 2040 ' 2050 ' 2060 ' PROGRAM INSTRUCTIONS 2070 ' 2080 ' 2090 CLS:PRINTTAB(9)"INSTRUCTION S";PRINT 2100 PRINT"1. LOAD DATA FROM CASSETTE FIRST" 2110 PRINT"2. ENTER PATIENTS NAME" 2120 PRINT:PRINT"3. ENTER DATE USING 4 DIGITS" 2130 PRINT:PRINT"4. ENTER DATE A MONTH/DAY" 2140 PRINT:PRINT"5. ENTER AMOUNT WITHOUT $" 2150 PRINT:PRINT"6. FOLLOW OTHER INSTRUCTIONS" 2160 PRINT:GOSUB 1240;RETURN 2170 ' 2180 ' 2190 ' MEDICAL EDITOR 2200 ' 2210 ' 2220 CLS:PRINT P5$:PRINTTAB(9)"PROGRAM EDITOR";PRINT P5$: 2230 PRINT:PRINTTAB(4)"1. EDIT MEDICAL VISIT" 2240 PRINT:PRINTTAB(4)"2. EDIT MEDICAL PURCHASE" 2250 PRINT:PRINTTAB(4)"3. EDIT IN INSURANCE PAYMENT" 2260 PRINT:PRINTTAB(4)"4. EXIT EDITOR PROGRAM" 2270 PRINT:PRINT'INPUT" ENTER ONE OF THE ABOVE";QW
N 1950 ELSE 2710
2710 CLS:PRINT P5$;
2720 PRINTTAB(6) "YOU ARE LOADING DATA":PRINT P5$;
2730 PRINT:PRINTTAB(7) "1. LOAD DATA TAPE"
2740 PRINT:PRINTTAB(7) "2. PRESS PLAY ONLY"
2750 PRINT:PRINTTAB(7) "3. PRESS ENTER"
2760 LINE INPUT ZZ$
2770 CLS:PRINT:PRINT:PRINT P5$;
2780 PRINTTAB(6) "YOUR DATA ALREADY READ IN"
2790 OPEN "I",-1,"NEW"
2800 INPUT#-1,MV,MP,IP
2810 FOR X=1 TO MV
2820 INPUT#-1,DS$(X),DS$(X),AV(X)
2830 FOR X=1 TO MP
2840 INPUT#-1,DS$(X),PS$(X),AM(X)
2850 FOR X=1 TO IP
2860 INPUT#-1,DS$(X),PS$(X),AM(X)
2870 CLOSE#-1:ZQ=1:GOTO 460
2880 1
2890 1
2900 1 SAVE DATA TO CASSETTE
2910 1
2920 1
2930 N=3=N+1
2940 N=N+1
2950 CLS:PRINT P5$;
2960 PRINTTAB(11) "SAVE DATA":PRINT P5$;
2970 PRINTTAB(7) "1. LOAD DATA TAPE"
2980 PRINTTAB(7) "2. PRESS RECORD & PLAY"
2990 PRINTTAB(7) "3. PRESS ENTER"
3000 LINE INPUT ZZ$
3010 CLS:PRINT:PRINT:PRINT P5$;
3020 PRINTTAB(6) "YOU ARE SAVING DATA":PRINT P5$;
3030 PRINTTAB(6) "DATA ALREADY READ"
3040 PRINT:PRINT:PRINT P5$;
3050 PRINTTAB(9) "NO DATA MATCH"
3060 PRINT:PRINT:PRINT P5$;
3070 PRINT:PRINT:PRINT P5$:
3080 PRINTTAB(9) "DATA ALREADY READ"
3090 PRINT:PRINT:PRINT P5$:
3100 PRINT:PRINT:PRINT P5$;
3110 PRINT:PRINT:PRINT P5$;
3120 PRINT:PRINT:PRINT P5$;
3130 PRINT:PRINT:PRINT P5$;
3140 PRINT:PRINT:PRINT P5$:
3150 PRINT:PRINT:PRINT P5$:
3160 PRINT:PRINT:PRINT P5$:
3170 PRINT:PRINT:PRINT P5$:
3180 PRINT:PRINT:PRINT P5$:
3190 PRINT:PRINT:PRINT P5$:
3200 PRINT:PRINT:PRINT P5$:
3210 PRINT:PRINT:PRINT P5$:
3220 PRINT:PRINT:PRINT P5$:
3230 PRINT:PRINT:PRINT P5$:
3240 PRINT:PRINT:PRINT P5$:
3250 PRINT:PRINT:PRINT P5$:
3260 PRINT:PRINT:PRINT P5$:
3270 PRINT:PRINT:PRINT P5$:
3280 PRINT:PRINT:PRINT P5$:
3290 PRINT:PRINT:PRINT P5$:
3300 PRINT:PRINT:PRINT P5$:
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3560 PRINT:PRINT:PRINT P5$:
3570 PRINT:PRINT:PRINT P5$:
3580 PRINT:PRINT:PRINT P5$:
3590 PRINT:PRINT:PRINT P5$:
3600 PRINT:PRINT:PRINT P5$:
3610 PRINT:PRINT:PRINT P5$:
3620 PRINT:PRINT:PRINT P5$:
3630 PRINT:PRINT:PRINT P5$:
3640 PRINT:PRINT:PRINT P5$:
3650 PRINT:PRINT:PRINT P5$:
3660 PRINT:PRINT:PRINT P5$:
3670 PRINT:PRINT:PRINT P5$:
3680 PRINT:PRINT:PRINT P5$:
3690 IF ZQ=1 THEN 3120
3700 IF MV>0 OR MP>0 OR IP>0 THEN
RELOAD? (Y/N) ;
3150 FOR II=1 TO 10 : SOUND 100,3 :
NEXT
3160 LINE INPUT KK$ 
3170 IF KK$="Y" THEN 2710 ELSE 4 60
3180 ' HARD COPY FROM PRINTER
3190
3200 ' HARD COPY FROM PRINTER
3210 PRINTER
3220 PRINTER
3230 CLS : PRINT : PRINT
3240 PRINT#-2,TAB(8) "MEDICAL EXP
3250 PRINT#-2,STRING$(40,"#") ;P1$ 
3260 PRINT#-2,TAB(8) "MEDICAL EXP
3270 PRINT#-2,STRING$(40,"#") ;P1$ 
3280 PRINT#-2,TAB(8) "MEDICAL EXP
3290 PRINT#-2,TAB(9) "SUMMARY OF
3300 PRINT#-2,P1$;P2$;GOSUB 4020 
3310 PRINT#-2,TAB(55) "DIAGNOSIS"
3320 PRINT#-2,P6$ 
3330 FOR X=1 TO MV
3340 PRINT#-2,TAB(5);DVS$(X);TAB( 
3350 PRINT#-2,TAB(31)""
3360 PRINT#-2,USING"$####.####";AV (X);
3370 PRINT#-2,TAB(45);LEFT$(MV$( 
3380 NEXT X
3390 AT=0: FOR X=1 TO 27
3400 AT=AT+AV(X): NEXT X
3410 PRINT#-2,P6$ 
3420 GOSUB 4040 
3430 PRINT#-2,P4$ 
3440 PRINT#-2,P3$;TAB(10) "SUMMARY OF PURCHASES"
3450 PRINT#-2,P2$;P1$:GOSUB 4020 
3460 PRINT#-2,TAB(55) "MEDICINE PURCHASE"
3470 PRINT#-2,P6$ 
3480 FOR X=1 TO MP
3490 PRINT#-2,TAB(5);DPS$(X);TAB( 
3500 PRINT#-2,TAB(31)"
3510 PRINT#-2,USING"$####.####";AM (X);
3520 PRINT#-2,TAB(45);LEFT$(PS$( 
3530 NEXT X
3540 AT=0: FOR X=1 TO 27: AT=AT+AM (X): NEXT X: MC=AT
3550 PRINT#-2,P6$ 
3560 GOSUB 4040 
3570 PRINT#-2,P4$ 
3580 PRINT#-2,P3$;TAB(10) "SUMMARY OF INSURANCE"
3590 PRINT#-2,P2$;P1$:GOSUB 4020 
3600 PRINT#-2,TAB(45) "INSURANCE
3610 PRINT#-2,TAB(63) "EMPLOYEE COST"
3620 PRINT#-2,P6$ 
3630 AT=0:CT=0: EC=0
3640 FOR X=1 TO MV:Z=0
3650 PRINT#-2,TAB(5);DVS$(X);TAB( 
3660 PRINT#-2,TAB(31)""::PRINT#- 
3670 AT=AT+AV(X)
3680 FOR Y=1 TO IP
3690 IF DVS$(X)=DT$(Y) AND PT$(X) 
3700 Z=1: PRINT#-2,TAB(47) 
3710 PRINT#-2,TAB(64) ""::PRINT#- 
3720 CT=CT+PT(Y): EC=EC+(AV(X)-PT (Y))
3730 NEXT Y
3740 IF Z=1 THEN 3790 ELSE 3750 
3750 PRINT#-2,TAB(47) 
3760 PRINT#-2,USING"$####.####";0; 
3770 PRINT#-2,TAB(56)""::PRINT#- 
3780 PRINT#-2,TAB(64) 
3790 NEXT X
3800 PRINT#-2,P6$ 
3810 GOSUB 4040 
3820 PRINT#-2,TAB(47) 
3830 PRINT#-2,TAB(64) 
3840 PRINT#-2,P3$;STRINGS(2,10) 
3850 PRINT#-2,TAB(5) "TOTAL MEDICAL COST";
3860 PRINT#-2,TAB(24) 
3870 PRINT#-2,P2$;P4$ 
3880 GOTO 460 
3890 ' 3890 
3900 ' 3900 ' 3910 ' END PROGRAM
3920 ' 3930 ' 3940 CLS : PRINT"PROGRAM STOPPED"
3950 STOP:GOTO 460 
3960 ' 3970 ' 3980 ' SUBROUTINES
3990 ' 4000 ' 4010 PRINT:INPUT"1=ENTRY 2=INDEX 
4020 PRINT#-2,TAB(5) "DATE";TAB(1 
4030 PRINT#-2,TAB(32) "CHARGE";R 
4040 PRINT#-2,TAB(10) "TOTAL";TAB 
4050 PRINT#-2,USING"$####.####";AT ;:RETURN
It's a jungle out there, but the latest news on the Color Computer grapevine is that, above the swirling mists of confusion, more and more people are discovering the Rainbow.

Now in its third year, the Rainbow has become the standard by which all other Color Computer magazines are compared. And no wonder! The Rainbow towers above the crowd, now offering more than 300 pages each month, including more than two dozen type-in-and-run program listings, a host of articles and in excess of 30 hardware and software product reviews.

We lead the pack in Color Computer publications and are devoted exclusively to the TRS-80 Color, TDP-100 and Dragon-32. We made our climb to the top by continually offering the best and the most by such well-known authors and innovators as Bob Albrecht and Don Inman, and games from top programmers like Chris Latham, Fred Scerbo and John Fraysse. The Rainbow offers the most in entertainment and education, home uses, technical details and hardware projects, tutorials, utilities, graphics and special features like Rainbow Scoreboard and our new CoCo Clubs section.

For only $28 a year, you get the keys to all the secrets locked in your CoCo! Are you searching through the jungle of claims and clamor? Climb above it all. Look up. Find the Rainbow.
You don’t have to be a programmer to bring out your artistic creativity with the CoCo's graphics. Type in the Program Listing, Color Computer Artist, and you can design a graphics screen or copy an existing one.

This program takes advantage of most of the computer’s graphics commands such as LINE, CIRCLE, PAINT, GET, and PUT.

Color Computer Artist has 29 commands to draw pictures. You won’t need to memorize all of them since you can list them by hitting the ? key. The first command set is for movement. The arrows move the cursor up, down, left, and right. Q, W, A, and S move the cursor at angles.

You can change the distance the cursor moves by hitting D followed by a number zero through nine for the number of dots the cursor moves. A zero is equal to a distance of 10 dots.

To place a dot on the screen, push the space bar. To draw a line, push L and the program draws a line from the last dot set to the cursor position.

To change the color you draw with, push C followed by a number one through eight for the color you want. To draw a circle, hit the space bar where you want the edge of the circle, then hit 0 where you want the center. If you want to draw a box, hit the space bar for one corner of the box, then hit the B for the opposite corner. If you push the hyphen, the program draws a line wherever you move the cursor without having to hit L. To return to normal mode hit the period key.

If you want to use the joysticks push J, and use both joysticks to move the cursor around the screen. The right joystick moves the cursor across the entire screen. The left joystick moves 63 dots horizontally or vertically and can be used for more exact movement. To return to keyboard movement, push K.

To clear the screen push the clear key twice. This avoids accidentally clearing the screen. To paint in an area, locate the cursor over the area you want to paint, push P followed by the number of the color you want to use, and the number of the border color.

To GET an image from the screen, push enter at the upper left corner of the image, and push G at the lower right corner. To PUT the image back on the screen push R as in replace (since the P is used for paint) where you want the upper left corner to be.

If you want to change modes, push M followed by a number zero through four. When you want to change color sets, push N to switch between color set zero and color set one. To change graphic pages, push ‘ ‘ to advance one page, and ‘ ” to go back one page.

When you want to save a drawing or load one in, push F. A menu appears and asks if you want to save a picture.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X, Y</td>
<td>location of cursor</td>
</tr>
<tr>
<td>X1, Y1</td>
<td>location of last dot drawn</td>
</tr>
<tr>
<td>C</td>
<td>color</td>
</tr>
<tr>
<td>D</td>
<td>distance cursor moves</td>
</tr>
<tr>
<td>PG</td>
<td>graphics page being used</td>
</tr>
<tr>
<td>CS</td>
<td>color set</td>
</tr>
<tr>
<td>MD</td>
<td>graphics mode being used</td>
</tr>
<tr>
<td>MP</td>
<td>maximum pages that can be used</td>
</tr>
<tr>
<td>P(n)</td>
<td>for storing with GET</td>
</tr>
<tr>
<td>A, B</td>
<td>temporary variables</td>
</tr>
<tr>
<td>IS</td>
<td>used with INKEYS</td>
</tr>
<tr>
<td>I</td>
<td>location of IS in C$</td>
</tr>
<tr>
<td>X2, Y2</td>
<td>size of image stored with GET</td>
</tr>
<tr>
<td>J</td>
<td>flag, 1 = joystick mode, 0 = keyboard mode</td>
</tr>
<tr>
<td>M</td>
<td>flag, 1 = continuous line mode, 0 = normal mode</td>
</tr>
<tr>
<td>CS</td>
<td>string of commands</td>
</tr>
<tr>
<td>P</td>
<td>keeps track of the color at the cursor location</td>
</tr>
</tbody>
</table>

Table 1. Variable List

System Requirements
16K RAM
Extended Color Basic
CU*BER
32K Mach. Lang.
$27.95 TAPE
$30.95 DISK
Approaches the excitement and challenges of any Video Arcade. The hazards of CU*BER are many. Help CU*BER change the colors on the pyramid while avoiding many of the dangers always present. Vipers, the Nurd, the Dork, bonus points all add up to another exciting release from Tom Mix Software.

DEVIL ASSAULT
16K Machine Language
$27.95 TAPE
$30.95 DISK
Devil Assault is a multi-level multi-screen game in which bird-like creatures, robots and the devil himself assault your home base which you must defend.

"THE FROG"
***ARCADE ACTION***
This one will give you hours of exciting play... Cross the busy highway to the safety of the median and rest awhile before you set out across the swollen river teaming with hidden hazards. Outstanding sound and graphics.

16K MACHINE LANGUAGE
TAPE $27.95
DISK $30.95

BUZZARD BAIT
By RUGBY CIRCLE
32K Machine Language
$27.95 TAPE $30.95 DISK
We've done it again! You thought the King was great? wait till you see this!! Outstanding high resolution graphics, tremendous sound make this "Joust" type game a must for your software collection. As you fly from cloud to cloud you will enjoy sky high excitement dealing with the challenges presented to you by this newest release by Tom Mix Software.

“TRAPFALL”
By KEN KALISH
***ARCADE ACTION***
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."

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load in a picture, or exit the program.

If you want to copy pictures onto the screen, an easy way to do it is to use a sheet of clear plastic. First trace the picture onto the plastic, then tape the plastic onto the screen and copy the outline.

Before you run or save the program, make sure the first line of the program is exactly the same as shown in the listing. Then, type PCLEAR4:POKE7690,10;POKE7691,8:POKE7692,9:POKE7697,12:POKE7698,13. This alters line 10 of the program by replacing all the asterisks in C$. C$ contains all the commands, some of which cannot be entered from the keyboard and need to be POKE'd in. This change is permanent and will be saved with the program.

How the Program Works
To parse the commands efficiently the program takes advantage of the INSTR and the ON GOTO commands. When a key is pushed, it is searched for in C$, which contains all the commands, using INSTR. The INSTR command returns a number 0-29 where a zero means the key pushed was not found in C$ and is an invalid command. If any other number is returned, the ON GOTO statement directs the program to the proper routine for the key pushed. To save space the program uses a subroutine at line 1000, which waits for a key to be pressed and stores it in I$. Then wherever the program needs to wait for a key I put a GOSUB 1000.

Now you can impress your friends with fancy graphics on your Color Computer. If you get frustrated trying to make recognizable scenery, try making abstract art.

Address correspondence to Eric Einem, 16985 Timber Ridge Drive, Granada Hills, CA 91344.

Program Listing, Color Computer Artist

10 C$="***QAS** LCPOS-JKFBGRM"

20 IFJ=1ANDM=1:THENX=INT(JOYSTK(0)+JOYSTK(2)*3.05):Y=INT(JOYSTK(1)+JOYSTK(3)*2.04):LINE(X,Y)-(A,B)

250 IFM=1THENLINE(X,Y)-(X+A*Y+B)

260 PSET

270 MOVECURSORTONEWPOSITION

280 CLEARSCREEN******

290 GO SUB 1000

300 IF ASC(I$)=12 THENPCLS:GOTO60

310 STOREPOINTFORGET****

320 PSET(X,Y):X1=X:Y1=Y:GOTO60

330 SETPOINT*****

340 PSET(X,Y):X1=X:Y1=Y:GOTO60

350 DRAWLINE*******

360 LINE(X,Y)-(X1,X2):PSET(X1-X2,Y1-Y2):GOTO60

370 CHANGECOLOR******

380 GOSUB1000

390 IFVAL(I$)=0:GOSUB1000:GOSUB1000

400 CLEARSCREEN******

410 PAINT******

420 GOSUB1000

430 VAL(I$)=0:GOSUB1000

Listing continued
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This helpful utility lets you list your Basic programs byte by byte along with line numbers.

This means that if you remove or change credits, the rest of the memory locations shift to close the gaps, putting all such POKEs within the program in the wrong places. K-Bug

This helps for Basic programs, called K-Bug (Program Listing 1), lists each line of a program and corresponding byte in memory. K-Bug interprets control codes and displays meaning for each memory location as well as the Basic line number. (See Fig. 1.) This is useful in changing a variable in a subroutine with a POKE to avoid duplicating lines of code.

You can also use it to add a measure of security to a program. For example, you can insert lines in a program that prevent it from working. The first character of these bogus lines can then be POKEd with an apostrophe to make comment lines, thus ignored when the program runs.

To further complicate things, try PEEKing values from credits and POKEing those values into the program at crucial places. The resulting Basic program is no longer relocatable.
makes it easy to find the appropriate memory locations to POKE.

K-Bug is in two parts. The loader (Program Listing 2) creates the data file for the control codes and needs to be run only once. K-Bug is saved in ASCII to merge with the program to be listed. It starts with line 10000, so to avoid conflicts be sure that Basic program line numbers are less than 10000.

After merging, type RUN 10000. Options let you start listing at the beginning of a program, at a particular address, or at a specified line number (the slowest option).

```
MEM VAL LINE MEANING
2605 158 10000 CLS
2606 51 10000 3
2607 58 10000 :
2608 149 10000 CLEAR
2609 50 10000 2
260A 48 10000 0
260B 48 10000 0
260C 48 10000 0
260D 58 10000 :
260E 135 10000 PRINT
260F 64 10000 @
2610 51 10000 3
2611 52 10000 4
2612 44 10000 :
2613 34 10000 :
2614 67 10000 C
2615 79 10000 O
2616 76 10000 L
```

Fig. 1. Sample K-Bug Output

The tape version is similar. Disk I/O commands need to be changed to tape, and merging K-Bug with a program is more involved.

"You can also use it to add a measure of security to a program. For example, you can insert lines in a program that prevent it from working."

Address correspondence to Ken Wuelzer, 752 West Main, Moore, OK 73160.

ASCII to merge with the program to be listed. It starts with line 10000, so to avoid conflicts be sure that Basic program line numbers are less than 10000.

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ASCII to merge with the program to be listed. It starts with line 10000, so to avoid conflicts be sure that Basic program line numbers are less than 10000.

After merging, type RUN 10000. Options let you start listing at the beginning of a program, at a particular address, or at a specified line number (the slowest option).
You're about to go where no man or woman—not even Sally Ride—has gone before: Mars. But beware of the meteorites; they'll destroy you in a flash. And don't run out of fuel or you'll plummet to the Martian surface and crash.

Your mission is to stay alive and land safely on Mars' Blue Base, located in a crater 10,000 feet below, and moving east to west as the planet rotates beneath you. Remember, you must land before you run out of fuel.

If you're a hotshot space jock who laughs at danger and craves adventure, see how long you can remain in space. Dodge those meteorites and enjoy the view of Earth far off in the distance.

If you land, crash, or are hit by a meteorite, a flight timer tells you how long you flew. See if you can set a record for staying in orbit. And if you get homesick, or chicken out, you can abort your mission and head for home. To avoid a crash, be sure to land in the soft, blue Pacific Ocean and not on the hard green line.

**System Requirements**

4K RAM
Color or Micro Color (MC-10) Basic

---

What's it like on Mars? Do they have any good restaurants there? Find out in this 4K game.

---

**Notes**

*Table 1. Program Notes*
continents. Navigation is very critical.

Your controls are keys 1-8. They fire your landing rockets. The higher the
push the left-arrow key to refire your
surface, leaving orange bits of your heat
shield trailing behind you. If you fly too
fast and plunge even more rapidly to the
floor, you might crash into a crater rim.

You can make the program shorter
by eliminating the instructions. Just de­lete
lines 1-95 and lines 999-2018. Mars
Lander Simulator also operates on the
MC-10, with the following changes. De­lete lines 1-95 and lines 1000-2018.
Change line 430 to read IF H=63 THEN
440. Change line 370 to read IF V=25
and A=0 THEN 810. Add line 100 to
read CLEAR200. Add line 435 to read
GOTO 450.

Address correspondence to Robert
A. Mauro, 257 Center Lane, Levoit­
ton, NY 11756.
December's Old Wizard's star contest was a close race, and many readers sent in correct solutions. I had no idea so many people would crack the cryptogram, especially since I hadn't given a hint of how to proceed. There are some sharp readers out there.

Glenn Reed of Houston, TX took first place, followed by Donald L. McGarry of Centerport, NY in second and Michael R. Hughey of Lafayette, IN, in third.

Many letters came in from Canada four or five days after the bulk of those from the U.S., indicating a problem with using the earliest postmark as the only determiner of first solutions. Some people get their HOT CoCo before others do. I'll try to come up with something better next time.

Learn the Old Wizard's secret and other non-alphabetic ways to create your own secret messages.

The Secret

The Program Listing created the star message. Figure 1 shows the star-field alphabet: Read the stars and spaces beneath the plaintext letters vertically. The five-unit star/space combinations allowed for more than enough substitutes for each letter in the 26-letter alphabet. The cell configurations were arbitrary.

While the approach to analysis from a cold start may have taken a number of paths, one viable beginning is to count the lines and see how many different groups of lines are possible. Since there...
are 15, the only factors are 3, 5, 15, and linear.

If all 15 lines were involved serially, the linear path from left to right would have been the most logical first investigation, suggesting a count of stars and the linear path from left to right would following the progression from left to right, by the second line you run into a most disconcerting series of spaces without stars, ruling out likelihood of the linear path.

Three characters per cell will not provide full coverage for the alphabet. Five characters per cell is the obvious choice, therefore, because 15 would be very wasteful.

"Your CoCo can handle numerals as strings, or read them into an array as integers. It can add, subtract, or treat them algebraically."

If you look at the entire star field, you will notice that a few lines contain more stars strung side by side than do the balance of lines, some of which carry many sequential spaces. The general line format creates a pattern suggestive of three sets of five lines, containing as it does a thrice-repeated rhythmic pattern.

Divide the field with vertical lines separating the individual groups of five characters. You're getting warm. Draw horizontal lines beneath each set of five star lines. Note the vertical sets of five star/space patterns, and observe that some patterns are repeated.

Convert these patterns into letters that you can enter into one of your crypto-helper programs. If I suspected that this was a cryptogram within a cryptogram, I would assign letters alphabetically to each unique cell as it appears in the message, and then treat the resultant cryptogram as though it had never been presented symbolically.

Lines 260-290 of Listing 1 reveal the cipher alphabet as string data. Study this symbol-alphabet: Many different alphabets are possible by changing the placement of stars and spaces.

This particular star field has a plaintext message that is fairly easy to identify from the repetitions and combinations of symbols. You can be easily misled by such an assumption, how-

ever, if the author transposes his plaintext letters before he enciphers them as star cells. Figure 2 reveals the answer to the Wizard's message.

My sincere thanks to all who entered, and congratulations to the winners. Further, I am delighted that so many of you were able to decipher the message. There are some keenly analytical minds out there.

Figure 3 gives the answers to the other five December cryptograms.

Using Numerals to Encipher

After studying the method of the star message, you should easily see that you can also use numerals to represent letters. The decimal series consists of ten characters, 0-9. Standing alone, they can represent but 10 letters. In pairs, they offer a potential total of 99—virtually four times the number required to represent a 26-letter alphabet. You can select 26 combinations as mixed singles and pairs, although the absence of certain combinations can alert a cryptanalyst to a probable alphabet.

The CoCo's ASCII keyboard code uses numerals 65-90 to represent the uppercase (capital) letters of the alphabet. As a result, a numerical alphabet already exists throughout the computer world. But you probably want your numerical alphabet to be just a bit more cryptic than standard ASCII code.

As a first step, compose a look-up table of digital pairs:

```
# A B C D E F G H I J K L M
0 1 2 3 4 5 6 7 8 9 0 1 2 3
1 2 3 4 5 6 7 8 9 0 2 3 4 5
N O P Q R S T U V W X Y Z
4 5 6 7 8 9 0 1 2 3 4 5 6 7 8
6 7 8 9 0 3 4 5 6 7 8 9 0
```

To compose a message using this numerical alphabet, we simply read down from each letter:

```
NUMERICAL
46 15 35 56 80 90 34 12 24 01
CIPHERS
34 90 68 89 56 80 93
HAVE THEIR
89 12 26 56 01 04 89 56 90 80 01
NUMBERS
46 15 35 23 56 80 93
```

This method uses two symbols for each letter, plus a space between pairs. (A space has the value of a character. Spaces occur in English text far more often than does even the most frequent letter, E.) This points up an important axiom: To use space and time economically sometimes means you can't use ciphertext characters that are much longer than their plaintext equivalents.

Therefore, reduce the spacing, and consequently the message length, by creating six-numeral groups that still give your confidant a manageable message, as in this example:

```
461535 568090 341224 349068 895680 938912
```

You could use five-numeral groups as easily, adding one more level of difficulty for an unauthorized receiver. Further, now that the message is in the familiar five- or six-block code form, you could superencipher it quite easily, making it much more difficult to unscramble.

To superencipher is to subject the encrypted message to yet a second or third standard method of encryption.

---

**Fig. 1. The Star-Spangled Alphabet**

**Fig. 2. The Old Wizard's Star Message in Translation**
For instance, an understanding between sender and receiver could include swapping the first and last code groups, second and tenth, third and ninth, and so on, leaving the center group intact in the case of an odd number of groups. This creates no problem for the intended receiver, but does make cracking the cipher more difficult for others.

Your CoCo can handle numerals as strings, or read them into an array as integers. It can add, subtract, or treat them algebraically. Such ease of manipulation makes them almost ideal for computer-encrypted communication.

Later I'll look at octal, hex, and binary arithmetic for their cryptography potential. Binary applications are particularly useful, since you can use ROM chips to encrypt computer files and outputs for security.

I have received some very interesting programs from some of you lately. If you will use your growing crypto and programming skills to create a straight-forward program using the above six-numeral format to encipher plaintext, I will feature the best one in a later article.

I also must add that, due to the growing number of articles that need a space in HOT CoCo, we're going to run Colorful Cryptology every other month, instead of monthly as we have been. So, I'll see you in May.

Write to Karl Andreassen at 24750 Chianti Road, Cloverdale, CA 95425.

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In this fifth installment of Mark Goodwin's dissection of the Color Basic ROM, he reveals what lies at memory addresses A000 to A754. Routines that reside in this area include Color Basic initialization, keyboard, ROM pack, input and output, CSAVE and CLOAD, and device—eds.

Address correspondence to Mark Goodwin, Star Route 79, Box 103, Orland, ME 04472.

<table>
<thead>
<tr>
<th>A000-A00D System Routines</th>
<th>A03C-A03D</th>
<th>Clear control register A (PIA2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A000-A001</td>
<td>Address of keyboard input routine</td>
<td>A03E-A03F</td>
</tr>
<tr>
<td>A002-A003</td>
<td>Address of character output routine</td>
<td>A040</td>
</tr>
<tr>
<td>A004-A005</td>
<td>Address of cassette on routine</td>
<td>A041-A042</td>
</tr>
<tr>
<td>A006-A007</td>
<td>Address of cassette block in routine</td>
<td>A043-A044</td>
</tr>
<tr>
<td>A008-A009</td>
<td>Address of cassette block out routine</td>
<td>A045-A046</td>
</tr>
<tr>
<td>A00A-A00B</td>
<td>Address of joystick in routine</td>
<td>A047-A048</td>
</tr>
<tr>
<td>A00C-A00D</td>
<td>Address of write cassette leader routine</td>
<td>A049-A04A</td>
</tr>
<tr>
<td>A00E-A026 Color Basic Initialization Routine</td>
<td>A04B-A04C</td>
<td>Set the video control register for the SG4 graphics mode</td>
</tr>
<tr>
<td>A00E-A011</td>
<td>Initialize the stack pointer</td>
<td>A04D-A04E</td>
</tr>
<tr>
<td>A012-A013</td>
<td>A = PIA initialization value</td>
<td>A04F-A050</td>
</tr>
<tr>
<td>A014-A016</td>
<td>Turn on the ROM-pack FIRQ</td>
<td>A051-A053</td>
</tr>
<tr>
<td>A017-A018</td>
<td>A = RESET flag</td>
<td>A054-A055</td>
</tr>
<tr>
<td>A019-A01A</td>
<td>Coldstart?</td>
<td>A056-A057</td>
</tr>
<tr>
<td>A01B-A01C</td>
<td>Jump if it's a coldstart</td>
<td>A058</td>
</tr>
<tr>
<td>A01D-A01E</td>
<td>X = RESET address</td>
<td>A059-A05A</td>
</tr>
<tr>
<td>A01F-A020</td>
<td>A = RESET value</td>
<td>A05B-A05D</td>
</tr>
<tr>
<td>A021-A022</td>
<td>RESET value = 12?</td>
<td>A05E-A05F</td>
</tr>
<tr>
<td>A023-A024</td>
<td>Jump if no RESET</td>
<td>A060-A061</td>
</tr>
<tr>
<td>A025-A026</td>
<td>Jump to the RESET address</td>
<td>A062-A063</td>
</tr>
<tr>
<td>A027-A073 Hardware Initialization Routine</td>
<td>A064-A065</td>
<td>4K RAMs?</td>
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A077-A078 Clear the memory location
A079-A07A Bump the memory pointer
A07B-A07C Loop till the Basic Communications Area has been cleared
A07D-A07F Clear the screen
A080-A081 Clear the start of the Basic program area minus one
A082-A083 Save the start of the Basic program area pointer
A084-A085 A = Memory value
A086 Invert the memory value
A087-A088 Store the inverted memory value
A089-A08A Valid memory location?
A08B-A08C Jump if it's not a valid memory location
A08D-A08E Bump the memory pointer
A08F-A090 Restore the memory value
A091-A092 Loop until the top of RAM has been located
A093-A094 Save the top of RAM pointer
A095-A096 Save the start of the reserved-memory pointer
A097-A098 Save the next available location in string-space pointer
A099-A09C Adjust the memory pointer for the start of the string space
A09D-A09E Save the start of the string-space pointer
A09F-A0A0 Set the stack pointer to the start of the string space
A0A1-A0A3 X = ROM area pointer
A0A4-A0A6 U = Destination address pointer
A0A7-A0A8 B = number of bytes to move
A0A9-A0AA Do block move
A0AC-A0AE U = Destination address pointer
A0AF-A0B0 B = number of bytes to move
A0B1-A0B3 Do block move
A0B4-A0B5 Adjust the memory pointer
A0B6-A0B7 Save the memory pointer
A0B8-A0B9 Save the memory pointer
A0BA-A0BC X = Extended Color Basic links pointer
A0BD-A0BF D = RTS op-code and number of bytes to set
A0C0-A0C1 Save a RTS op-code
A0C2 All links set?
A0C3-A0C4 Loop until all the links have been set
A0C5-A0C7 Save a RTS op-code
A0CA-A0CA Do NEW
A0CB-A0CD X = Extended Color Basic test value
A0CE-A0D0 Extended Color Basic?
A0D1-A0D4 Jump if Extended Color Basic exists
A0D5-A0D6 Enable the interrupts
A0D7-A0D9 X = Color Basic 1.1 message pointer
A0DA-A0DC Display the message
A0DD-A0DF X = RESET address
A0E0-A0E1 Save the RESET address
A0E2-A0E3 A = RESET flag
A0E4-A0E5 Save the RESET flag
A0E6-A0E7 Jump to the command mode

**A0E8-A0F5 Warn-Start Routine**
A0E8 NOP for RESET
A0E9-A0EA Set the current device to the video display
A0EB-A0ED Reset the Basic pointers
A0EE-A0EF Enable the interrupts
A0F0-A0F2 Clear the screen
A0F3-A0F5 Jump to the command mode

**A0F6-A10C ROM-Pack Routine**
A0F6-A0F8 ROM pack?
A0F9-A0FA Jump if a ROM pack exists
A0FB Return
A0FC-A101 Delay
A102-A104 Y = return address
A105-A107 Do hardware initialization
A108-A109 Clear the RESET flag
A10A-A10C Jump to the ROM pack

**A10D-A146 Area Downloaded to RAM**

**A147-A170 Color Basic 1.1 Message**

**A171-A175 Keyboard Routine**
A171-A172 Scan the keyboard
A173-A174 Clear bit 7 of the key pressed
A175 Return

**A176-A198 Input Routine**
A176-A178 Call the Extended Color Basic link
A179-A17A Flag not end of file
A17B-A17C Current device = keyboard?
A17D-A17E Jump if the current device is the keyboard
A17F-A180 Any bytes left in cassette buffer?
A181-A182 Jump if there are bytes left in the cassette buffer
A183-A184 Flag end of file
A185 Return
A186-A187 Save the registers
A188-A189 X = next byte in the cassette-buffer pointer
A18A-A18B Get a byte from the cassette buffer
A18C-A18D Save the byte on the stack
A18E-A18F Save the new cassette-buffer pointer
A190-A191 Decrement the number of bytes left in the cassette buffer
A192-A193 Jump if there are any bytes left in the cassette buffer
A194-A196 Read the next cassette block
A197-A198 Get the registers and return

**A199-A1B0 Blink-the-Cursor Routine**
A199-A19A Blink the cursor?
A19B-A19C Jump if no blink
A19D-A19E B = new counter value
A19F-A1A0 Save the new counter counter
A1A1-A1A2 X = Cursor location
A1A3-A1A4 A = Cursor character
A1A5-A1A6 Bump the cursor's color value
A1A7-A1A8 Mask the cursor character
A1A9-A1A A Display the new cursor character
A1AB-A1AD X = delay value
A1AE-A1B0 Delay and return

**A1B1-A1C0 Keyboard Routine**
A1B1-A1B2 Save the registers
A1B3-A1B4 Blink the cursor
A1B5-A1B6 Scan the keyboard
A1B7-A1B8 Loop until a key is pressed
A1B9-A1BA B = space
A1BB-A1BE Display the space at the cursor location
A1BF-A1C0 Get the registers and return

**A1C1-A1C7 Keyboard Routine**
A1C1-A1C2 Save the registers
A1C3-A1C4 Scan the keyboard
A1C5 Set the flags for the keyboard value
A1C6-A1C7 Get the registers and return

**A1C8-A26C Keyboard-Driven Routine**
A1C8-A1CA U = PIA1 pointer
A1CB-A1CD X = keyboard work-area pointer
A1CE A = 0 and clear carry
A1CF A = FF
A1D0-A1D1 Make a 3-byte hole on the stack
A1D2-A1D3 Send the first column output value

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Listing continued

A1D4-A1D5 Ignore
A1D5 Set carry
A1D6-A1D7 Shift the column output
A1D8-A1D9 Jump if no key pressed
A1DA-A1DB Bump the column number
A1DC-A1DD Get the row value
A1DE-A1DF Save the row value
A1E0-A1E1 Mask it for the same as the last key pressed
A1E2-A1E3 Mask it for the same as the last key pressed
A1E4-A1E5 B = row value
A1E6-A1E7 Save the new keyboard work-area value
A1E8 Same as the last key pressed?
A1E9-A1EA Loop if it's the same as the last key pressed
A1EB-A1EC B = column output value
A1ED-A1EE Save the column output value
A1EF-A1F0 B = start value
A1F1-A1F2 Bump it for a row
A1F3 Adjusted for the row?
A1F4-A1F5 Loop until it's adjusted for the row
A1F6-A1F7 Adjust it for the column
A1F8-A1F9 Jump if the @ key was pressed
A1FA-A1FB Nonalphabetic?
A1FC-A1FD Jump if it's nonalphabetic
A1FE-A1FF Make it ASCII
A200-A201 Shift?
A202-A203 Jump if the shift key was pressed
A204-A206 Uppercase only?
A207-A208 Jump if uppercase only
A209-A20A Make it lowercasc
A20B-A20C Save the ASCII value
A20D-A20E X = delay value
A210-A212 Delay
A213-A214 B = column output value
A215-A216 Get the row value
A217 Bounce?
A218-A219 Jump if bounce
A21A-A21B B = column output value
A21C-A21D Get the row value
A21E-A21F Another key pressed?
A220-A221 A = ASCII value
A222-A223 Jump if another key was pressed
A224-A225 Shift 0?
A226-A227 Jump if it isn't shift 0
A228-A22A Invert the shift-0 flag
A22B Zero the ASCII value
A22C-A22D Clean up the stack and return
A22E-A22F A = column-output value
A230-A231 Send the column output
A232-A233 A = row value
A234-A235 Mask it for the shift key
A236 Return
A237-A238 Send the column output
A239-A23A A = row value
A23B-A23C Mask the row value
A23D-A23E Last column?
A23F-A240 Jump if it isn't the last column
A241-A242 Mask the row value
A243 Return
A244-A245 B = @ value
A246-A248 X = table pointer
A249-A24A Up arrow to 0?
A24B-A24C Jump to a 0 if it's an up arrow
A24D-A24F X = table pointer
A250-A251 Enter to @?
A252-A253 Jump if it's an enter to an @
A254-A255 Shift?
A256-A257 Less than a semicolon?
A258-A259 Jump if it's less than a semicolon
A25A-A25B Invert the shift value
Listing continued

A25C  Shift?
A25D–A25E Jump if no shift
A25F–A260 Adjust it for shift
A261–A262 Jump
A263  B = table offset
A264–A265 Shift?
A266–A267 Jump if no shift
A268  Bump the table offset
A269–A26A B = ASCII value
A26B–A26C Jump

A26D Nothing Here

A26E–A281 Keyboard Lookup Table
A26E  Up arrow: SE
A26F  Shifted up arrow: SF
A270  Down arrow: OA
A271  Shifted down arrow: SB
A272  Left arrow: 08
A273  Shifted left arrow: lS
A274  Right arrow: 09
A275  Shifted right arrow: SD
A276  Space: 20
A277  Shifted space: 20
A278  Zero: 30
A279  Shifted zero: 12
A27A  Enter: OD
A27B  Shifted enter: OD
A27C  Clear: OC
A27D  Shifted clear: SC
A27E  Break: 03
A27F  Shifted break: 03
A280  @: 40
A281  Shifted @: 13

A282–A2BE Output Routine
A282–A284 Call the Extended Color Basic link
A285–A286 Save B
A287–A288 B = current device flag
A289  Set the flags for the current device
A28A–A28B Get B
A28C–A28D Jump if it's the printer
A28E–A28F Jump if it's the video display
A290–A291 Save the registers
A292–A293 B = OPEN/CLOSE flag
A294  OPEN""'
A295–A296 Jump if it's OPEN""'
A297–A298 B = Length of the data block
A299  Bump it
A29A–A29B Jump if the buffer isn’t full
A29C–A29D Write the data block
A29E–A29F X = next available buffer-location pointer
A2A0–A2A1 Save the character in the buffer
A2A2–A2A3 Save the new buffer pointer
A2A4–A2A5 Bump the length of the data block
A2A6–A2A7 Get the registers and return
A2A8–A2A9 B = block type
A2AA–A2AB Save the block type
A2AC–A2AE X = buffer pointer
A2AF–A2B0 Save the buffer pointer
A2B1–A2B2 B = 0
A2B3–A2B4 Save it as the block length
A2B5–A2B6 Save the registers
A2B7–A2B9 Write the block
A2BA–A2BB Get the registers
A2BC–A2BE Go reset the buffer values

Listing continued
A2BF–A2F4 Printer-Driver Routine

A2BF–A2C0 Save the registers
A2C1–A2C2 Disable the interrupts
A2C3–A2C4 Send a start bit
A2C5 B = RS-232 value
A2C6–A2C7 Send a start bit
A2C8–A2C9 B = number of bits to send
A2CA–A2CB Save the bit counter
A2CC B = starting RS-232 value
A2CD Put the next bit into carry
A2CE Move the bit from carry to B
A2CF Put it into bit 1
A2D0–A2D1 Send the bit
A2D2–A2D3 Get the bit counter
A2D4 All bits sent?
A2D5–A2D6 Loop until all of the bits have been sent
A2D7–A2D8 Send a stop bit
A2D9–A2DA Get CC and A
A2DB–A2DC Was a carriage return just sent?
A2DD–A2DE Jump if a carriage return was sent
A2DF–A2E0 Bump the current carriage position
A2E1–A2E2 B = carriage position
A2E3–A2E4 End of the line?
A2E5–A2E6 Jump if it isn’t the end of the line
A2E7–A2E8 Carriage position = 0
A2E9–A2EC Delay for the carriage return
A2ED–A2EF B = printer status
A2F0 Printer ready?
A2F1–A2F2 Loop until the printer is ready
A2F3–A2F4 Get the registers and return

A2F5–A2FA Nothing Here

A2FB–A309 RS-232 Output Routine

A2FB–A2FC B = RS-232 value
A2FD–A2FF Send the value to the RS-232
A300–A301 Delay for the baud rate
A302–A303 X = baud rate delay value
A304–A306 Ignore
A305–A306 X = carriage-return delay value
A307–A309 Delay and return

A30A–A35E Video-Driver Routine

A30A–A30B Save the registers
A30C–A30D X = current cursor position
A30E–A30F Backspace?
A310–A311 Jump if it’s not a backspace
A312–A314 Cursor position = start of video memory?
A315–A316 Jump if the cursor position is equal to the start of video memory
A317–A318 A = space
A319–A31A Display a space at the last cursor position
A31B–A31C Jump
A31D–A31E Carriage return?
A31F–A320 Jump if it’s not a carriage return
A321–A322 X = current cursor position
A323–A324 A = space
A325–A326 Display a space at the cursor location
A327–A328 D = updated cursor position
A329–A32A Mask B for the cursor line position
A32B–A32C Loop until the start of the next line has been reached
A32D–A32E Jump
A32F–A330 Control code?
A331–A332 Jump if it’s a control code
A333 Graphic character?
A334–A335 Jump if it’s a graphic character
A336–A337 Less than an A?

A338–A339 Jump if it’s less than an A
A33A–A33B Uppercase?
A33C–A33D Jump if it’s uppercase
A33E–A33F Mask the character
A340–A341 Invert the character
A342–A343 Display the character at the cursor location
A344–A345 Save the new cursor position
A346–A348 End of video memory reached?
A349–A34A Jump if the end of video memory hasn’t been reached
A34B–A34D X = start of video memory
A34E–A350 D = two characters from the next line
A351–A352 Move the characters up a line
A353–A355 Scroll done?
A356–A357 Loop until the scroll is done
A358–A359 B = space
A35A–A35C Blank the last line
A35D–A35E Get the registers and return

A35F–A38C Output Routine

A35F–A361 Call the Extended Color Basic link
A362–A363 Save the registers
A364–A365 Clear the cassette flag
A366–A367 A = current device number
A368–A369 Jump if it’s the video display
A36A Cassette?
A36B–A36C Jump if it’s the cassette
A36D–A36E X = comma field width and the last comma field
A36F–A370 D = printer width and the carriage position
A371–A372 Jump
A373–A374 B = LSB of the current cursor position
A375–A376 Mask it for the cursor line position
A377–A379 X = comma field width and the last comma field
A37A–A37B A = line length
A37C–A37D Save the comma field width and the last comma field
A37E–A37F Save the line position
A380–A381 Save the line length
A382–A383 Get the registers and return
A384–A385 Flag the cassette
A386–A388 X = comma field width and the last comma field
A389 Line length = 0
A38A Line position = 0
A38B–A38C Jump

A38D–A3EC Input Routine

A38D–A38F Clear the screen
A390–A392 Call the Extended Color Basic link
A393–A394 Flag no key pressed
A395–A397 X = start of the input buffer
A398–A399 B = length of the input
A39A–A39C Get a character from the current device
A39D–A39E End of file?
A39F–A3A0 Jump if it’s the end of the file
A3A1–A3A2 Current device = keyboard?
A3A3–A3A4 Jump if it isn’t the keyboard
A3A5–A3A6 Clear key?
A3A7–A3A8 Jump if it’s a clear key
A3A9–A3AA Backspace?
A3AB–A3AC Jump if it isn’t a backspace
A3AD Decrement the length of the input
A3AE–A3AF Jump if the buffer is empty
A3B0–A3B1 Decrement the input-buffer pointer
A3B2–A3B3 Jump
A3B4–A3B5 Shift left arrow?
A3B6–A3B7 Jump if it isn’t a shift left arrow
A3B8 Decrement the length of the input
A3B9–A3BA Jump if the buffer is empty
A3BB–A3BC A = backspace
A3BD–A3BF Erase the last character

Listing continued
LISTING CONTINUED

A3C0-A3C1 Loop until all the input has been erased
A3C2-A3C3 Break key?
A3C4-A3C5 Set carry to signal break key
A3C6-A3C7 Jump if it's a break key
A3C8-A3C9 Enter key?
A3CA-A3CB Jump if it isn't an enter key
A3CC Clear carry to signal no break key
A3CD-A3CE Save the flags
A3CF-A3D1 Do a carriage return
A3D2-A3D3 Flag the end of the input
A3D4-A3D6 X = start of the input minus one
A3D7-A3D8 Get the flags and return
A3D9-A3DA Control code?
A3DB-A3DC Jump if it’s a control code
A3DD-A3DE Graphic character?
A3E1-A3E2 Buffer full?
A3E3-A3E4 Jump if the buffer is full
A3E5-A3E6 Save the character in the buffer
A3E7 Bump the length of the input
A3E8-A3EA Display the character
A3EB-A3EC Jump

A3ED-A415 Device Routine
A3ED-A3EF Call the Extended Color Basic link
A3F0-A3F1 A = current device number
A3F2-A3F3 Jump if it's the video display
A3F4 Printer?
A3F5-A3F6 Jump if it's the printer
A3F7-A3F8 A = OPEN/CLOSE flag
A3F9-A3FA Jump if a file is OPEN
A3FB-A3FC B = NO error code
A3FD-A3FF Display the message
A400 A = OPEN"I"
A401-A402 Jump if OPEN"I"
A403-A405 Display FM error message
A406-A408 Call the Extended Color Basic link
A409-A40A A = current device number
A40B Cassette?
A40C-A40D Jump if it isn’t the cassette
A40E-A40F A = OPEN/CLOSE flag
A410-A411 NO error if CLOSE
A412 OPEN"I"?
A413-A414 Display FM error message if OPEN"I"
A415 Return

A416-A425 Color Basic CLOSE Command
A416-A417 Jump if it’s the end of the Basic statement
A418-A41A Evaluate the device number
A41B-A41C CLOSE the file
A41D-A41E Get the next Basic character
A41F-A420 Jump if it’s the end of the Basic statement
A421-A423 Check the syntax
A424-A425 Loop until all the files have been CLOSED

A426-A44B Device Routine
A426-A428 Call the Extended Color Basic link
A429-A42A A = cassette device number
A42B-A42C Current device = cassette
A42D-A42F Call the Extended Color Basic link
A430-A431 A = current device number
A432-A433 Current device = video display
A434 Was the current device the cassette?
A435-A436 Jump if the current device wasn’t the cassette
A437-A438 A = OPEN/CLOSE flag
A439-A43A OPEN"O"?
A43B-A43C Jump if it’s not OPEN"O"
A43D-A43E A = number of bytes in the cassette buffer
A43F-A440 Jump if the buffer is empty
A441-A443 Write the remaining bytes
A444-A448 Write an EOF block
A449-A44A Flag CLOSE
A44B Return

A44C-A497 Color Basic CSAVE Command
A44C-A44E Evaluate the file name
A44F-A450 Get the next Basic character
A451-A452 Jump if it’s the end of the Basic statement
A453-A455 Check the syntax
A456-A457 B = syntax check character
A458-A45A Check the syntax
A45B-A45C Return if not ASCII
A45D Zero A
A45E-A460 Write the file header
A461-A462 A = cassette device number
A463-A464 Current device = cassette
A465 Zero A
A466-A468 Join the LIST code
A469 Zero A
A46A-A46B Zero X
A46C-A46E Write the file header
A46F-A470 Flag CLOSE
A471-A472 Flag data block
A473-A475 Write the leader
A476-A477 X = start of the Basic-program-area pointer
A478-A479 Save it as the cassette-buffer pointer
A47A-A47B A = block length
A47C-A47D Save the block length
A47E-A47F D = end of the Basic-program-area pointer
A480-A481 Figure the number of bytes left to write
A482-A483 Jump if done
A484-A487 Greater than FF bytes left?
A488-A489 Jump if greater than FF bytes left to write
A48A-A48B Save the block length
A48C-A48E Write a data block
A48F-A490 Loop until done
A491-A492 Flag EOF block
A493-A494 Block length = 0
A495-A497 Write the EOF block, turn off the cassette, and return

A498-A53D Color Basic CLOAD Command
A498-A499 Flag CLOSE
A49A-A49B CLOADM?
A49C-A49D Jump if CLOADM
A49E-A49F Clean up the stack
A4A0-A4A2 Evaluate the file name
A4A3-A4A5 Locate the file
A4A6-A4A8 Binary file?
A4A9-A4AA Jump if it's a binary file
A4AB-A4AD Basic file?
A4AE-A4AF Jump if it's not a Basic file
A4B0-A4B2 Do NEW
A4B3-A4B4 A = cassette device number
A4B5-A4B6 Current device = cassette
A4B7-A4BB Flag OPEN"I"
A4B9-A4BB Read a block
A4BC-A4BE Join the command-mode code
A4BF-A4C1 Call the Extended Color Basic link
A4C2-A4C4 Do CLOSE
A4C5-A4C7 Jump to the command mode
A4C8-A4CA Basic file?
A4CB-A4CC Jump if it's a Basic file
A4CD-A4CF Display FM error message
A4D0-A4D2 Do NEW
A4D3-A4D5 Read the leader
A4D6-A4D7 X = start of the Basic-program-area pointer

Listing continued
Listing continued

A4D8-A4D9  Save it as the cassette-buffer pointer
A4DA-A4DB  D = cassette-buffer pointer
A4DC  Bump the MSB of the cassette-buffer pointer
A4DD-A4DF  Do memory check
A4E0-A4E2  Read a block
A4E3-A4E4  Jump if IO error
A4E5-A4E6  A = block type
A4E7-A4E8  Jump if it's a file-header block
A4E9-A4EA  Loop if it's a data block
A4EB-A4EC  Save the cassette-buffer pointer as the end of the Basic-program-area pointer
A4ED-A4EE  Turn off the cassette
A4EF-A4F1  X = OK message pointer
A4F2-A4F4  Display the message
A4F5-A4F7  Jump
A4F8-A4FA  Do NEW
A4FB-A4FD  Display IO error message
A4FE-A4FF  Bump the ESP to the next character
A500-A501  Evaluate the file name
A502-A504  Locate the file
A505-A506  X = default offset
A507-A508  End of the Basic statement?
A509-A50A  Jump if it's the end of the Basic statement
A50B-A50D  Check the syntax
A50E-A510  X = offset
A511-A513  A = file type
A514-A515  Machine-language program?
A516-A517  Jump if it isn't a machine-language program
A518-A51A  D = EXEC address
A51B-A51C  U = adjusted EXEC address
A51D-A51E  Save the EXEC address
A51F-A521  Is the file ASCII?
A522-A523  Jump if it's ASCII
A524-A526  D = starting address
A527-A528  X = adjusted starting address
A529-A52A  Save it as the cassette-buffer pointer
A52B-A52D  Read the leader
A52E-A530  Read a block
A531-A532  Jump if IO error
A533-A534  Save the new cassette-buffer pointer
A535-A536  Set the flags for the block type
A537-A538  Jump if it's a file-header block
A539-A53A  Loop if it's a data block
A53B-A53D  Turn off the cassette and return

A53E-A548 Color Basic EXEC Command
A53E-A53F  Jump if it's the end of the Basic statement
A540-A542  X = EXEC address
A543-A544  Save the EXEC address
A545-A548  Jump to the EXEC address

A549-A553 Device Routine
A549-A54B  Call the Extended Color Basic link
A54C-A54D  A = current device number
A54E  Cassette?
A54F-A550  Jump if it's the cassette
A551-A553  Jump

A554-A563 Video Routine
A554-A556  D = @ location
A557-A559  @ location > 01FF?
A55A-A55D  FC error if the @ location > 01FF
A55E-A560  D = new cursor position
A561-A562  Save the new cursor position
A563  Return

A564-A577 Color Basic INKEY$ Command
A564-A565  A = last key pressed
A566-A567  Jump if a key was pressed
A568-A56A  Scan the keyboard
A56B-A56C  Last key pressed = 0
A56D-A56E  Save the value of the key pressed
A56F-A572  Join the CHR$ code if a key has been pressed
A573-A574  String length flag = 0
A575-A577  Reset the string pointers

A578-A581 Evaluate-File-Name Routine
A578-A57A  X = start of the file-name buffer
A57B-A57C  File-name length = 0
A57D-A57E  A = space
A57F-A580  Save a space in the buffer
A581-A583  Buffer filled with spaces?
A584-A585  Loop until the buffer has been filled with spaces
A586-A587  End of the Basic statement?
A588-A589  Jump if it's the end of the Basic statement
A58A-A58C  Build a string entry
A58D-A58F  X = string address and B = string length
A590-A592  U = start of the file-name buffer
A593-A594  File-name length = string length
A595-A596  Jump if the file name is a null string
A597-A599  Ignore
A598-A599  B = number of bytes to move
A59A-A59B  Get a character to be moved
A59C-A59D  Move it
A59E  Block move done?
A59F-A5A0  Loop until the block move is done
A5A1  Return

A5A2-A5C4 Device Routine
A5A2-A5A4  Check the syntax
A5A5-A5A6  Character = #?
A5A7-A5A8  Jump if it's a #
A5A9-A5AA  Jump if it's the video display
A5AB-A5AD  Evaluate the expression
A5AE-A5B0  D = device number
A5B1  B = adjusted device number
A5B2-A5B3  Device number out of range?
A5B4-A5B5  Jump if the device number is out of range
A5B6  B = adjusted device number
A5B7-A5B8  Save the current device number
A5B9-A5BB  Call the Extended Color Basic link
A5BC-A5BD  Jump if it's the video display
A5BE-A5BF  Jump if the device number is positive
A5C0-A5C1  Device number < - 2?
A5C2-A5C3  Jump if the device number < - 2
A5C4  Return

A5C5-A5CD Cassette Routine
A5C5-A5C6  Evaluate the file name
A5C7-A5C8  End of the Basic statement?
A5C9-A5CA  Jump if it's the end of the Basic statement
A5CB-A5CD  Display SN error message

A5CE-A5EB Color Basic EOF Command
A5CE-A5D0  Call the Extended Color Basic link
A5D1-A5D2  A = current device number
A5D3-A5D4  Save the current device number
A5D5-A5D6  Set the new device number
A5D7-A5D9  Check the device number
A5DA  Zero B
A5DB-A5DC  A = current device number
A5DD-A5DE  Jump if it's the video display
A5DF-A5E0  Cassette?
A5E1-A5E2  Jump if it isn't the cassette
A5E3  B = - 1
A5E4-A5E5  Get the old device number

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Listing continued

A5E6-A5E7  Reset the current device number
A5E8  D = true/false value
A5E9-A5EB  Save it as the current result

A5EC-A5F5  Color Basic SKIPF Command
A5EC-A5ED  Evaluate the file name
A5EE-A5EF  Locate the file
A5F0-A5F2  Read a block
A5F3-A5F4  Jump if IO error
A5F5  Return

A5F6-A580  Color Basic OPEN Command
A5F6-A5F8  Call the Extended Color Basic link
A5F9-A5FB  Evaluate the expression
A5FC-A5FE  Get the "O" or the "1"
A5FF-A5F0  Save the "O" or the "1"
A5F1-A5F2  Evaluate the device number
A5F3-A5F4  Check the syntax
A5F5-A5F6  Evaluate the file name
A5F7-A5F8  A = current device number
A5F9-A5FA  Current device = video display
A5FB-A5FC  Get the "O" or the "1"
A5FD-A5FE  OPEN"I"?
A5FF-A5F0  Jump if OPEN"I"
A5F1-A5F2  OPEN"O"?
A5F3-A5F4  Jump if it's the video display
A5F5-A5F6  B = FM error code
A5F7-A5F8  Ignore
A5F9-A5FA  Ignore
A5FB-A5FC  Ignore
A5FD-A5FE  B = AO error code
A5FF-A5F0  Return

A600-A605  Check the syntax
A606-A607  Evaluate the file name
A608-A609  A = current device number
A60A-A60B  Current device = video display
A60C-A60D  Get the "O" or the "1"
A60E-A60F  OPEN"I"?
A610-A611  Jump if OPEN"I"
A612-A613  OPEN"O"?
A614-A615  Jump if it's the video display
A616-A617  B = FM error code
A618-A619  Ignore
A61A-A61B  Ignore
A61C-A61D  Ignore
A61E-A620  Ignore
A61F-A620  B = DN error code
A621-A62A  Jump if the printer
A62B-A62D  A = file type
A62E-A630  Binary?
A631-A632  Jump if it's binary
A633-A634  Flag OPEN"I"
A635-A636  Read the leader and a block
A637-A638  Jump if IO error
A639-A640  Set the flags for the block type
A641-A642  Jump if it's a file-header block
A643-A644  Jump if it's an end-of-file block
A645-A646  A = block length
A647-A648  Loop if it's equal to zero
A649-A64A  Save the block length
A64B-A64C  Jump
A64D-A64E  File already open?
A64F-A650  Jump if a file is open
A651-A652  Locate the file
A653-A654  Jump if IO error
A655-A656  Save it as the next location in the cassette buffer
A657-A658  Return
A659-A65A  Jump if it isn't the cassette
A65B-A65C  Jump if the cassette
A65D-A65E  Bump the device number

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DRAW and CIRCLE statements and then notate the graphics with descriptive text. Super Screen allows you to create graphics. Instead of a confusing checkerboard appearance, you now have true graphics. The standard Color Computer display screen is totally inadequate for sophisticated tasks. All well written, user friendly programs use error trapping techniques to prevent crashed programs and lost data using the same standard syntax as hi-res graphics.

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COMBINE TEXT WITH HI-RES GRAPHICS
You can now write truly professional looking programs that combine text with hi-res graphics. Super Screen allows you to create graphics displays with the Basic LINE, DRAW and CIRCLE statements and then note the graphics with descriptive text. You can even use PRINT @ if you wish for greater programming convenience. Super Screen's versatility will amaze you.

PRINT @ IS FULLY IMPLEMENTED
The PRINT @ statement is a valuable asset to the programmer when formatting text on the screen. The standard Color Computer will report an error if you specify a location higher than 511 but Super Screen allows locations all the way to 1224! You get a big screen and a powerful formatting tool as well. Of course, Super Screen also supports the CLS command allowing you to clear the big screen using standard Basic syntax.

ON ERROR GOTO
That's right! Super Screen gives you a full implementation of ON ERROR GOTO including the ERR and ERL functions. Now you can trap errors and take corrective action to prevent crashed programs and lost data using the same standard syntax as other computers. The ON ERROR GOTO capability overcomes a serious deficiency of Color Computer Basic and greatly improves your capability to handle sophisticated tasks. All well written, 'user friendly' programs use error trapping techniques and yours can too! Now that's powerful.

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No more frustration as you edit a long line in your Basic program: just hold the space bar down and automatically step to the desired position in the line. Need a line of asterisks? Hold the key down and auto repeat will give them to you. Those of you who spend many hours at your keyboard will appreciate this outstanding addition to Super Screen's long list of impressive capabilities.

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Super Screen recognizes several special control code characters that allow selection of block or underline, solid or blinking cursor and other functions. You can Home Up the cursor or you may erase from the cursor to the end of a line or to the end of the screen just like many other computers. These special codes give you an extra dimension of versatility and convenience that put Super Screen in a class by itself. AND MORE GOOD NEWS...

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ACCOUNTING SYSTEM
The Mark Data Products accounting system is ideal for the small businessman needing a fast, efficient means to process income and expenses, prepare detailed reports and maintain most of the information required at tax time. The system is a family of programs which operate by means of a 'menu' selection scheme. When the operator selects a task to perform, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary accounting reports including a transaction journal, a P&L or income report, an interim or trial balance and a balance sheet. Up to 255 separate accounts may be defined and a single disc system can hold over 1,400 transactions. This system automatically enhances the monitor screen to a 51 character by 24 line display, 32k of memory is required along with an 80-column printer and one or more disc drives.

The MDP system:
• Is accurate, user friendly and simple to use.
• Is easy to customize for specific user requirements.
• Automatically updates the chart of accounts.
• Provides an audit trail.
• Includes end of period procedures.
• Is capable of future expandability.

This accounting software equals or exceeds higher priced packages for other computers and includes a detailed operating manual.

Requires 32k and a Single Disc Drive
PRICE: $99.95

ORDER ENTRY SYSTEM
The Mark Data Products sales order processing system provides a fast, efficient means to enter orders, print shipping papers and invoices, prepare sales reports, and when the monitor receives the system automatically enhances the monitor screen to a 51 character by 24 line display. 32k of memory is required along with an 80-column printer, and one or more disc drives.

The MDP order entry system is a family of programs which operate interactively by means of a 'menu' selection scheme. Up to 900 products may be defined and a single disc system can hold over 600 transactions. When the operator selects a task to be performed, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary paperwork including shipping and invoice forms, daily sales reports, a monthly or other period sales report and a receivables report.

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A65C-A65E X = ASCII flag
A65F-A660 File already open?
A661-A662 Jump if a file is open
A663-A665 U = start of the cassette buffer
A666-A667 Save it
A668-A669 Save the file type
A66A-A66B Save the ASCII flag
A66C-A66E X = start of the file-name buffer
A66F-A671 Move the file header into the cassette buffer
A672-A673 Flag file-header block
A674-A675 A = block length
A676-A677 Save the block length
A678-A67A Write the file-header block
A67B-A67C A = OPEN"O" value
A67D-A67E Flag OPEN"O"
A67F-A680 Jump

A681-A6D0 Locate-File Routine
A681-A683 X = start of the cassette buffer
A684-A685 Save it
A686-A687 A = locate flag
A688 Locate?
A689-A68A Jump if no locate
A68B-A68D Clear the screen
A68E-A68F X = cursor position
A690-A691 B = S
A692-A693 Display the S
A694-A695 Save the new cursor position
A696-A697 Read the leader and a block
A698-A699 Set the flags for the block type and an error
A69A-A69B Jump if IO error or it isn't a file-header block
A69C-A69E X = start of the file buffer
A69F-A6A1 U = start of the file-name buffer
A6A2-A6A3 B = file-name length
A6A4-A6A5 Clear a hole on the stack
A6A6-A6A7 A = character from the cassette buffer
A6A8-A6A9 Y = locate flag
A6A9-A6AC Locate?
A6AD-A6AE Jump if no locate
A6AF-A6B0 Current device = video display
A6B1-A6B3 Display the character
A6B4-A6B5 Subtract a file-name character from the cassette character
A6B6-A6B7 Combine it with the total
A6B8-A6B9 Save the new total
A6BA Comparison done?
A6BB-A6BC Loop until the comparison is done
A6BD-A6BE A = comparison total
A6BF-A6C0 Jump if the file names match
A6C1-A6C2 Locate the next file?
A6C3-A6C4 Jump if locate the next file
A6C5-A6C6 Check the block
A6C7-A6C8 Return if done
A6C9-A6CA Loop until done
A6CB-A6CC A = F
A6CD-A6CE Display the F
A6CF Zero A
A6D0 Return

A6D1-A6F2 Cassette Routine
A6D1-A6D3 Data block?
A6D4-A6D5 Jump if it's a data block
A6D6-A6D8 Read the leader
A6D9-A6DA Read the block
A6DB-A6DC Check the block type
A6DD-A6DE Loop until done
A6DF-A6E0 Read the leader and a block
A6E1-A6E2 Check the block type
A6E3-A6E4 Loop if it's a data block

A6E5-A6E6 Jump if IO error
A6E7-A6E8 A = block type
A6E9 Invert the block type
A6EA-A6EB Jump if it's a data block
A6EC Adjust for the error code
A6ED-A6EE Save the error code
A6EF-A6FF Clean up the stack
A6F1-A6F2 Jump

A6F3-A700 Video Routine
A6F3-A6F5 A = character in the upper left of the video display
A6F6-A6F7 Invert the character
A6F8-A6F9 B = invert/noninvert flag
A6FA Noninvert?
A6FB-A6FC Jump if it's noninvert
A6FD-A6FF Display the new character
A700 Return

A701-A70A Cassette Routine
A701-A702 Turn on the cassette
A703-A704 Read a block
A705-A707 Turn off the cassette
A708-A709 B = cassette error code
A70A Return

A70B-A748 Read-Cassette-Block Routine
A70B-A70C Disable the interrupts
A70D-A70E Invert the video character
A70F-A710 X = start of the cassette buffer
A711 Zero the value
A712-A713 Read a bit
A714 Move it into A
A715-A716 Sync byte?
A717-A718 Loop until the sync byte has been read
A719-A71A Read the block type
A71B-A71C Save the block type
A71D-A71E Read the block length
A71F-A720 Save the block length
A721-A722 Figure the checksum
A723-A724 Save the checksum
A725-A726 A = block length
A727-A728 Save the block length
A729-A72A Jump if it's equal to zero
A72B-A72C Read a byte
A72D-A72E Save it in the buffer
A72F-A730 Memory error?
A731-A732 Jump if memory error
A733-A734 Figure the new checksum
A735-A736 Save the new checksum
A737-A738 Block done?
A739-A73A Loop until the block is done
A73B-A73C Read the checksum
A73D-A73E Checksums match?
A73F-A740 Jump if the checksums match
A741-A742 A = checksum-error code
A743-A745 Ignore
A744-A745 A = memory-error code
A746-A747 Save the error code
A748 Return

A749-A754 Read-Byte-from-the-Cassette Routine
A749-A74A A = number of bits to read
A754-A74B Save the bit counter
A74D-A74E Read a bit
A74F Put the bit into A
A750-A751 All bits read?
A752-A753 Loop until all the bits have been read
A754 Return

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---See List of Advertisers on page 130---
as a struggling high-school student who needed to take a foreign language, I jumped into a Spanish class and was bombarded with multiple lists of Spanish vocabulary. After a few nights of studying with flash cards, I knew I needed a better way. This is when my CoCo came to the rescue. If you have the same problem with your foreign-language class, take a look at this program.

When you first run the program, you must input a list of vocabulary, rules, or whatever you want to study. Foreign translations are first and English next. For accents on certain Spanish words, I found it useful to use the inverse-video mode for that letter. When you are through, type "end" at the Foreign Translation prompt. You return to the menu and can make corrections (on a disk system only) or study the information.

If you need to make corrections, press 5 and follow the prompts.

You are now ready to study. Press 3 from the menu and the screen clears to ask if you want the incorrect-answer option. If you press Y, and then miss a word, the computer quizzes you on that word until you get it right. This option helps when you are first learning a list. If you don't want to be tested again on a missed word, press N. The computer asks in which language you want to answer. Press 1 for English or 2 for foreign. The computer chooses a random word from the list and displays it. Type in the corresponding word in the other language (like flash cards) and press the enter key. The computer tells you if you are right or wrong. The correct answer appears if you input a wrong answer.

You can continue to study, or you might want to press R to return to the menu. If you go back to the menu, press 2 and the computer displays the number of words that you got right and wrong. If you got more right than wrong, it provides some music. You can return to study the list and the computer continues to keep score until you run the program again or load in another list.

To enhance the program you can add some different tunes in the See Score routine or create a way to add words to a previously saved list. You can also write a routine to prevent the problem of broken words caused by word-wrap. Table 1 lists the program's variables, and Table 2 describes the program line by line.

Remember, this program works with any language and for other things such as learning math formulas. The use of the LINE INPUT statement allows all kinds of information to be input, including commas, quotes, and extra spaces.

Address correspondence to Don Fletcher, 1910 Country Club Lane, Redlands, CA 92373.

System Requirements

32K RAM
Disk Basic Two Drives
16K RAM
Extended Color Basic
Program Listing 1. Language Aid for Disk

Program Listing 2. Language Aid for Cassette
EXQUISITE SCREEN SCROLL

If you've ever tried to move a large number of shapes on the screen in a Basic program, you know how slow high-resolution graphics can be. I'm going to show you a way to partially remedy that problem.

The idea is to move the whole screen instead of just shapes on it. The Color Computer lets you define the beginning of a high-resolution screen on any 512-byte boundary. By continuously incrementing the start location you can scroll the screen.

The 512-byte limit represents one twelfth of the screen at a time if you are using graphics mode 3 or 4. This makes for slightly jerky motion, but everything on the screen moves more or less simultaneously. Changing the start location of the screen actually involves changing the area of memory that is bit-mapped to the video image. I'll get back to this later.

Almost all the information needed to scroll the graphics screen is contained in Getting Started with Color Basic, section 4, part A. Most of the information I am using can be found on pages 258–263.

This section tells you how to set up the start of the graphics work area (actually of the screen bit-map) and how to set the graphics mode using only Color Basic. It tells you that you can start the graphics page on any 512-byte boundary. This divides a graphics page consisting of 6,144 bytes (mode 3 or 4) into 12 sections. Regardless of the start position, 12 of these minipages will be on the screen at one time. As the other graphics modes are mapped differently, they will display only three to six of these minipages. Graphics modes 3 and 4 seem to work the best, so I will stick to them for the rest of the discussion.

The starting location is designated by the page-select register. This register consists of a 7-bit word of information. If you do a PMODE 3,1 in Extended Basic, you would be at the first graphics page, which starts at location 1536 (non-disk system). This means that the page-select register was set to 3, or 0000011 in binary, as 1536 is the third 512-byte boundary in the system. More of this is explained in Getting Started with Color Basic.

The register is not represented by a single location, but by several; each bit in the register must be set separately. You can set the bits by sending POKE commands to the locations below:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Reset Bit</th>
<th>Set Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>65481,0</td>
<td>65480,0</td>
</tr>
<tr>
<td>1</td>
<td>65482,0</td>
<td>65481,0</td>
</tr>
<tr>
<td>2</td>
<td>65483,0</td>
<td>65482,0</td>
</tr>
<tr>
<td>3</td>
<td>65484,0</td>
<td>65483,0</td>
</tr>
<tr>
<td>4</td>
<td>65485,0</td>
<td>65484,0</td>
</tr>
<tr>
<td>5</td>
<td>65486,0</td>
<td>65485,0</td>
</tr>
<tr>
<td>6</td>
<td>65487,0</td>
<td>65486,0</td>
</tr>
<tr>
<td>7</td>
<td>65488,0</td>
<td>65487,0</td>
</tr>
<tr>
<td>8</td>
<td>65489,0</td>
<td>65488,0</td>
</tr>
<tr>
<td>9</td>
<td>65490,0</td>
<td>65489,0</td>
</tr>
</tbody>
</table>

System Requirements

16K RAM
Extended Color Basic
Joystick (optional)
Switchable Expansion Is Here

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---\n
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Choose. The VDG register and the control register are set by the following, respectively.

POKE 65472,0: POKE 65475,0: POKE 65477,0

and

POKE 65314, 224 OR (PEEK(65314) AND 7)

These commands are covered in the back of the book.

The only bit of information not covered in the Getting Started book is how to decrement the memory location that holds the screen start location. This is not the start location covered above. The one above dictates which area of memory is bit-mapped to the video image. The second start location is used as a starting reference for the Extended Basic X,Y coordinate system. This resides in location 186 (MSB) and 187 (LSB).

Two must be added to the contents of location 186 for each 512-byte boundary you increment and must be subtracted for each 512-byte boundary decrement. If this is not done, the X,Y coordinates will not be offset from the top of the screen. This was necessary in Program Listing 2 as it uses the coordinate system.

Listing 1 reserves eight pages of graphics memory, or 24 of the 512-byte boundary. In Program Listing 1, I is used as the pseudo-register. The program decrements I from 15 down to 4 then resets I to 15 and continues; this causes continuous scrolling on the screen. By setting I to 15 the screen bit-map start location is set to 7680. This is the beginning of graphics page 5 of Extended Basic. By decrementing I you scroll from the beginning of page 5 to the beginning of page 1. The algorithm for setting the bits in the page-select register to the configuration represented by integer I is as follows:

IF (AND 1) = 1 THEN set the bit ELSE reset the bit
(AND 2) = 2
(AND 4) = 4
(AND 8) = 8
(AND 16) = 16
(AND 32) = 32
(AND 64) = 64

According to Getting Started with Color Basic, you must do two other things to set the graphics mode. These are fixed lines of code and are dependent upon which graphics modes you choose.

What good is this technique anyway? Listing 2 gives an example of how you can use this technique in a game format. A flying saucer is put onto the dot pattern. You can control this saucer by the right joystick to go up and from side to side. The idea is to get the saucer to the top of the screen. Every time the ship goes up 32 lines in the Y coordinate, the screen scrolls down 16 lines. This is not an actual game, but a demonstration, so don't expect anything dazzling to happen.

When the screen scrolls, the appropriate number of lines must be subtracted from the saucer's Y coordinate, and the start location in locations 186 and 187 must be reset to keep the coordinate biased correctly. Changing 186 and 187 to different or random values could also cause some special effects.

Address correspondence to Richard Uglum, I1l7A E. Potter Ave., Milwaukee, WI 53207.

By using an integer to represent a pseudo-register, you can set bits 0-6 according to the bit configuration of the integer. Thus if integer I is 3 and the appropriate POKE commands are sent to the screen, the start location would be 1536. Now integer I can be incremented to 4, the POKE sequence followed, and the start location would be at the next 512-byte boundary.

In Program Listing 1, I is used as the pseudo-register. The program decrements I from 15 down to 4 then resets I to 15 and continues; this causes continuous scrolling on the screen. By setting I to 15 the screen bit-map start location is set to 7680. This is the beginning of graphics page 5 of Extended Basic. By decrementing I you scroll from the beginning of page 5 to the beginning of page 1. The algorithm for setting the bits in the page-select register to the configuration represented by integer I is as follows:

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Listing 1 reserves eight pages of graphics memory, or 24 of the 512-byte segments. Graphics mode 3,1 is set and 200 dots are randomly put on the screen. The graphics mode is then set to page 5 and pages 1-4 are copied to 5-8. A decrementing loop is then run from 15 to 4 with the graphics screen start location being reset with each decrement.

This does all the scrolling from page 5 to page 1 in 12 steps. Instead of decrementing all the way down to boundary 3, the program resets I, the pseudo-register, to 15 and continues to cause continuous scrolling. This effect seems to work best in graphics mode 3 or 4, but you can use other modes.

This is not an actual game, but a demonstration, so don't expect anything dazzling to happen.
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Instant CoCo

by Amee Eisenberg

Last month, in my column on cassette I/O (input/output) I promised to explain some techniques for getting a good load from a touchy tape. Most of my suggestions this month can be summed up in three words: Maintain your recorder. If your equipment's in bad shape, no tape is going to load.

Assuming that your recorder is O.K., the tape loading variable that you have the most control over is the volume. When presented with volume levels louder than it can handle, an audio amplifier clips, that is, it flattens out the extreme ends of the signal and produces noise. In an expensive stereo, this can blow your speakers; in a CCR-81, this yields garbage sound. If you try to load a clipped signal, you get an I/O error.

When your tape won't load, the first thing to fiddle with is the volume. If the computer finds the program, then gets an I/O error, turn down the volume. If the computer never finds the program, turn up the volume.

The quality of the tape will affect the ease with which you can load it. High-quality audio tape, like that used for Instant CoCo, doesn't add a lot of hiss to the recorded sound. Three-for-a-dollar bargain tapes do. Bad tape is no bargain.

A well-used tape recorder needs routine maintenance. When you listen to a tape, a dirty play/record head reveals itself by dimming the sound of the entire recording. If you're having trouble loading your tapes, try cleaning the head. If you use the recorder frequently do it once a week.

With the cassette door open and no cassette in the machine, press the play button. You'll see the play/record head and the capstan roller move into position. The play/record head is the squarish, silver block. Dip a cotton swab in some isopropyl alcohol (rubbing alcohol) and wipe the front of the head clean. If you haven't done this in a while, it might take three or four swabs to get it clean.

Head misalignment is the major cause of load failures. If the read/write head is out of vertical alignment with the cassette, the tape won't load. This is an easy problem to hear. Place a cassette in your recorder, press the play button and insert a small Phillips-head screwdriver through the hole above the rewind button onto the head-alignment screw. While listening to the tape, turn the screw. You will hear the sound get dimmer and brighter depending on which way you turn. When the sound is at its ear-piercing sharpest, the play head is correctly aligned with the tape.

If your tape recorder varies its speed while playing the tape, the tape won't load. The giveaway on this is that none of your tapes load. In extreme cases, you can hear the warble in the tape. The fix for this is to take it to your Radio Shack dealer and get it adjusted.

By listening to your computer tapes, you can diagnose the problems that are causing a loading failure. Sometimes a minor alignment or volume adjust makes the difference between hours of frustration and hours of pleasurable computing.
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This month I will explore what is fast becoming the "sacred cow" of educational computing. Logo was developed by Seymour Papert, and first used as a method of manipulating robots for artificial intelligence. It consists of a set of commands called primitives that you can combine into groups called procedures. A procedure can consist of primitives or other procedures that are defined. Table 1 shows some of the primitives available in Logo.

The following Logo procedure draws a box:

```
TO BOX
  FD 30 RT 90
  FD 30 RT 90
  FD 30 RT 90
END
```

Executing some Logo-type commands is more effective than describing them, so I have created a Basic program that emulates Logo. I call this program Slowgo because of its obvious limitations.

To use this program, type in the code carefully and run it. You see a title page and an instruction to name a procedure. For the first time simply press enter.

I have included three sample procedures for your review. It takes some time to convert these procedures, so wait for the next set of instructions. The name of each procedure appears as it is defined (converted to Basic DRAW statements). To run each procedure, press the number that appears in front of it.

After the procedure is drawn, you can press enter to get back to the selection menu where you can select a second procedure or press X to start over again. Experiment with the three procedures.

You can try to define your own procedure by first entering the name you want to give the procedure, then pressing enter. To enter the steps of the procedure, type each primitive separated by a space. Only the following primitives are available:

```
FORWARD or FD
BACK or BK
RIGHT or RT
LEFT or LT
PENCOLOR or PC
```

Do not press enter until the procedure is completely defined. After finishing a procedure, you can press the enter key to enter another procedure, or press enter again to define the procedure for drawing. Here are some examples you might try.

```
Procedure Name: TRIANGLE
Procedure: FD 40 RT 120 FD 40 RT 120 FD 40 RT 120
Procedure Name: VLETTER
Procedure: LT 30 FD 50 BK 50 RT 60 FD 50
```

Slowgo lets you use a procedure as long as it has been previously defined. Since SIXSIDE, BOX, and STAR are defined first, you can also use these in your procedures. Try these:

```
Procedure Name: MOVEBOX
Procedure: BOX RT 20 BOX RT 20 BOX RT 20 BOX
Procedure Name: HONEY
Procedure: PC 2 SIXSIDE RT 120 SIXSIDE RT 120 SIXSIDE
```

Slowgo is a very limited application of Logo. You can only use 240 characters to define a procedure. Since Slowgo actually duplicates any previously

**System Requirements**

- **16K RAM**
- **Extended Color Basic**
The Educated Guest

defined procedure that is called you may run out of characters fast. Try this example:

Procedure Name: SIXSTAR
Procedure:STAR RT 20 STAR RT 20 STAR RT 20 STAR RT 20 STAR RT 20 STAR RT 20 STAR RT 20

The Radio Shack implementation of Logo is much more powerful. It supports the usual Logo primitives and some unique primitives such as HATCH. One of the powerful features of Logo is the ability to perform recursion. A recursive procedure is a procedure that calls itself. Here is an example:

```
recursion. A recursive procedure is a procedure that calls itself. Here is an example:

```

In this example, the procedure turns forward and back to draw a line and then returns itself. This example is like a continuous loop in Basic. However, recursion can be used for more than continuous repetition. It is as though a first procedure is able to make a duplicate of itself, call that duplicate into action, and then return to the first procedure.

Other versions of Logo also support manipulation of lists of words with commands based on Lisp. It has been my experience that kids can learn the graphics portion of Logo with ease. Even the most rudimentary word manipulation with Lisp, however, can be quite complex. I would like to see a language for kids that allows easy experimentation.

Here, as promised, is my challenge for readers to respond. I will give a Slowgo award of recognition to the reader who can come up with the best Basic implementation of Logo. Perhaps you might allow for longer procedures, include more of the standard primitives such as REPEAT, and finally, recursion. I will talk more about these topics in a future column.

For you machine-language programmers, I offer the Mediumgo award of recognition for the best machine-language implementation. The Fastgo award requires more

### Table 1. Logo Primitives

<table>
<thead>
<tr>
<th>Primitive</th>
<th>Abbreviation</th>
<th>Purpose</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORWARD</td>
<td>FD</td>
<td>move forward 'x' spaces</td>
<td>FD 10</td>
</tr>
<tr>
<td>BACK</td>
<td>BK</td>
<td>move back 'x' spaces</td>
<td>BK 10</td>
</tr>
<tr>
<td>RIGHT</td>
<td>RT</td>
<td>turn right 'x' degrees</td>
<td>RT 10</td>
</tr>
<tr>
<td>LEFT</td>
<td>LT</td>
<td>turn left 'x' degrees</td>
<td>LT 10</td>
</tr>
<tr>
<td>PENCOLOR</td>
<td>PC</td>
<td>lets you draw with colors</td>
<td>PC 10</td>
</tr>
</tbody>
</table>

Program Listing. Slowgo

```
creativity. I would like to see a language or program that allows kids to easily manipulate words. How about creating the following types of commands:

Type Thing
Type Action
Type Description
Make Sentence With ‘Thing’, ‘Action’, and ‘Description’
Move Sentence Up
Center Sentence
Make Billboard

Nonprogrammers, don’t be scared away from this task. I am an advocate of top-down development: Start with a regular English-language description of the task. What you need first is an understandable description of what this type of program should do. If you think you can describe a language manipulation program that is easy and fun, let me hear from you.

There have been many claims about the benefits of using Logo. This ranges from claiming that Logo can be used to teach structured programming, to claiming that using Logo enhances problem-solving skills in children. I would like to see some hard evidence for these claims. Specifically, I would like to see evidence that answers the following questions:

“What evidence exists that Logo is more effective than alternative approaches?”

- What evidence exists that children (or adults) who are taught to use Logo acquire skills beyond those required to use the language?
- Does Logo enhance a generalized problem-solving skill?
- Does using Logo enable students to learn new computer languages more easily?
- Do students who first learn Logo apply a more structured approach to programming in other languages?
- Can students learn other academic skills through a course in Logo?
- What evidence exists that Logo is more effective than alternative approaches?
- Is Logo more effective than Basic (or other languages) as a first computer language?
- When academic skills are taught can Logo be more effective than traditional approaches?
- Are the problem-solving skills acquired through learning Logo more effective than alternative problem solving techniques?

I am skeptical about the rash of claims and mystique that is beginning to surround the wholesale adaptation of Logo in education. I will, however, reserve further judgement until I have had a good chance to review the literature. If you are aware of critical evidence either through direct experience or reading, please let me know.

Contact Charles Santee c/o HOT CoCo, 80 Pine St., Peterborough, NH 03458.
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"KRICKIT"

You’ve just typed in the Gettysburg Address and now you see that your computer only heard every other word!

THE KRICKIT CHIRPS ONLY WHEN YOUR COMPUTER HAS CAUGHT THE KEY. With the Kricket, there is no wasted effort pounding keys to make sure they contact or looking at the screen after every character. You can keep your eyes on the listing and not lose your place.

Works great with text editors and DBM’s (Teletypewriter-64 and Homebase, to name a few) or when entering programs with just the BASIC line-editor in your computer. Just plug in! Needs no software or hardware modifications. Built-in speaker! Uses no CPU time! Your computer has better things to do than sound key beeps.

The Kricket has other valuable features, too. A convenient switch controls the Cartridge Interrupt line. Instead of clumsy, messy tape on fingers 7 or 6, just flip the switch to access Basic with a game pak installed. It also has a more accessible reset switch, lit photo-power indicators, gold edge-fingers and an extension cable.

We are sure that after you try the Kricket you will never want to be without it. Take 30 days to decide you like it or return it for a full refund. 24-hour order line. Order yours today for only $9.95 (plus shipping and handling). COD, Visa, and Mastercard accepted.

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T.C.E. 389
P.O. Box 2477 Gaithersburg, Maryland 20879 (301) 963-3848
Put Some Variety Into Those Random Numbers

How random are the numbers that you generate with Color Basie's RND command? Radio Shack hasn't given much information about the random function. RND isn't even listed in their *Quick Reference Guide*. Here is a one-liner that shows you how random the numbers really are.

```
10 PRINT RND(5000): GOTO 10
```

Every time I run this program on my computer, after a cold start, I get the same set of numbers. Try it and see what you get. This is just one of the CoCo's peculiarities.

There are several solutions to the problem. Here is one: Add a line 5 to the one-liner above.

```
5 POKE 280, PEEK(275)
```

This is what you are doing: RAM location 280 is one of the seed addresses for the RND function. The 275 address is one of the memory locations that continually changes value, like a clock, as part of the TIMER operation. So, you are POKEing a fresh numeral right where RND lives every time you use this POKE/PEEK technique.

Use line 5, with your own line number, somewhere near the start of any program that has a random-number generation routine. One time is sufficient for each program, no matter how many times RND is used.

Tom Garcia
Tucson, AZ

Word Processor Utility

This short utility (Program Listing 1) is useful in word or text processors based on string entering of text, as found in *HOT CoCo*, June 1983, p. 36.

The routine emits a sound when entering a text at so many characters under any inputting condition, either by INPUT, LINE INPUT, or typing on the screen.

Given in Assembly language, the routine uses the EDTASM+ followed by a Basic driver (Program Listing 2). It is position independent and can be located anywhere in memory. You can obtain the sound after you input so many characters by POKEing in address 492, the number of characters desired plus one. For example, to obtain the sound after 200 characters, POKE492,201.

Alain Dussault
Laval, Quebec
Canada

Easy LINEINPUT In Standard Color Basic

Here's a short routine that simulates the LINEINPUT command on a standard Color Basic CoCo:

```
5000 IN$= "": I = 733: EXEC41872
5010 J = PEEK(I): IF J = 0 THEN RETURN ELSE IN$ = IN$ + CHR$(J):
               I = I + 1: IF I < 982 THEN 5010 ELSE RETURN
```

The simplicity of this routine is due to the use of an undocumented ROM routine at $A390. (This routine might not work on newer CoCos because of this—eds.) These two lines input IN$ to a maximum length of 249 characters. If you enter a string of such length, however, there is a short delay after input is complete. No garbage collection will ever occur during input, though.

Be sure the program calling this subroutine has cleared enough string space. Quotes, commas, and colons are allowed within IN$. The subroutine uses I and J, common scratch variables. Input begins at the current cursor position.
Readers Forum

You'll see no prompt or even a question mark. Pressing break when running this subroutine works like enter, so you must press break twice to stop the program.

Ronny Ong
Arlington, TX

Create a Cassette
Menu with TIMER

You can use the TIMER function of Extended Basic to create a menu for use with the cassette. Pack your favorite programs in a long tape (like 60 minutes), and calculate the value of TIMER needed to get to each program by the fast forward button. Then you can use the MOTOR on and off function to get to each program quickly.

Jae Nam Noh
Orlando, FL

Better Keyboard Response

Here's a one liner (Program Listing 3) to solve your keyboard response problems. If you are using machine-language programs that originated with the older CoCos (1.1 ROM) and are now using them on the new 64K and CoCo 2 computers (1.2 ROM), you probably notice the poor keyboard response on some of these programs.

Radio Shack changed the vector addresses when using the POLCAT routine. This one liner checks for all the references to the old vector address and changes them to the new address in the 1.2 ROM.

CLOADM your machine-language program, but do not execute. Then type in the listing and run it. You don't even need to know the starting or ending address of your program. When you run the program you see "working" displayed on the screen for a few moments. When the OK prompt appears, go ahead and execute your program.

Guier Wright
Peter Pap/askas
HOT CoCo Staff

Using a Brand X Recorder
With the CoCo

Although Radio Shack recommends using their cassette recorder as a data-storage device for the Color Computer, many people prefer to use a recorder that they already own. My experience with several inexpensive recorders indicates that usually only a minor modification is required to achieve reliable recording.

It appears that with many off-brands, the voltage signal sent from the computer overpowers the recorder's automatic level-control circuit. This results in distortion of the signal sent to the tape. The solution to this problem lies in adding a resistor in the line connecting the output of the computer to the input of the cassette, reducing the signal and bringing it back to acceptable levels.

I have found that 150k-ohms works well with my recorder, but the value used is a function of the characteristics of the recorder and should be established through experimentation. You can actually hear the quality difference in the before and after by listening to the audio signal.

A convenient way to attach the resistor (1/8 watt) is to solder it between the center posts of a spare male/female phono-plug pair connecting the outside shield with a stiff wire. Once attached and debugged, the pair is held together on-end with a piece of heat-shrinkable tubing.

This minor modification combined with good data tapes has given me two years of CoCo computing free of tape-reliability problems using a Brand X recorder.

Thomas Szlucha
Fairport, NY

HOT CoCo pays $25 for each Reader's-Forum submission used. In the case of duplicate submissions, selection is based on the earliest postmark.
Due to the unexpectedly large number of inquiries to Doctor ASCII, we must ask that you enclose a self-addressed, stamped envelope if you want an immediate reply. Please be patient, as the doctor must answer many questions.

Send your questions to Doctor ASCII, c/o HOT CoCo, Pine St., Peterborough, NH 03458.

Q. I have a 64K CoCo with Extended Basic. I wish to LLIST to the CGP-115 Color Graphic Printer with 32 characters per line, not 40. Is there a POKE that will do this? I've tried POKE 115,32 with no results.

Daniel W. Flynn Jr. 
Oscoda, MI

A. The explanation of the POKE115,## in the CoCo's documentation is misleading. The value at address 155 tells the CoCo that it should pause after ## characters have been sent to the printer to allow sufficient time for the print head to return to the left side of the page. It does not generate a carriage return and line feed after it has encountered a line of ## characters as one is led to believe. Since most printers come with their own built-in RAM buffer, this POKE is often ignored.

If you save a program in ASCII to tape or disk, Program Listing 1 will let you print it out in a 32-character format.

Q. Where can I get a screen-dump program for my C. Itoh Prowriter printer?

R. Jones 
Middletown, PA

A. The Radio Shack one might work. Your Prowriter is made by TEC, the maker of the Radio Shack LP VIII. Since I do not have access to a Prowriter, I could not tell for sure. Custom Software Engineering, 807 Minuteman Causeway (D-2), Cocoa Beach, FL 32931, markets a screen-dump program for your printer at $9.95.

Q. A few years ago, I purchased a 4K CoCo, and last December I upgraded it to 32K and Extended Basic. When I got it back, the CoCo's mains had been reversed, and the antenna switch became live. Once I sorted this out, the CoCo worked, but all the colors were wrong. Also, when demonstrating this to the Radio Shack people, we found that some of their machines were wrong, too. Is there any way I can fix the problem myself?

Hedley Jones
Epsom, Surrey
England

A. Order the Color Computer Technical Reference Manual, RS number 26-3193, $14.95, and write to Motorola Semiconductors, 3501 Ed Bluestein Blvd., Austin, TX 78721, for specification sheets on CoCo's vital parts such as the MC6847, MC6821, MC1372, MC6883, and MC6809E.

Q. I made my own 64K upgrade on my E board CoCo several months ago using the standard procedure. When I use the program listed in the July 1983 issue of HOT CoCo to move into 64K, I do indeed move into 64K mode and can write above the ROMs by POKEs or by transferring machine-language routines to this area from low RAM. My problem is that I cannot overwrite my Basic ROMs and 64K commercial programs such as Super Color Writer, and your "40K Custom Color Basic" will not work correctly.

Tim Harris
Ames, IA

A. You have the symptoms of what Radio Shack calls a 32K E board machine. Your problem lies in one of two areas. First, in reference to "64K Modification" (HOT CoCo, July 1983, p. 44), retrace the steps starting with the first one in the center column at the bottom of p. 46. When doing this, note that the pins in Fig. 2 should have been numbered counterclockwise from the notch. If you have it wired correctly, then I suspect a partly bad 74LS02 or 74LS138. This modification uses NOR gates in these chips that are otherwise not used, and the fact that they are bad would not show up until this modification is made.

Q. After using my CCR-81 to record a program for my CoCo, it is disturbing to find a hidden bug. I often list the program, correct the error, and then attempt to CSAVE it. Doing this usually results in trouble, namely, an erasure of the program. Is there a technique to solve my problem? Is there a product that will let me alter my programs?

Craig McCormick
Fairfax, VA
A. The CCR-81 tape recorder, like all tape drives, is a sequential storage device. If you want to access the fifth file on a tape, you must go past the four that precede it. One way to alleviate the problems associated with tape storage on your CoCo is to space your files apart, keeping track of the reading of the tape counter at the beginning of each file. This way, when you change a program and make it longer, you may erase your program from memory. An error in your program could wipe out Basic’s RAM pointers, effectively erasing your program from memory.

The product that would help alleviate your programs most is a disk drive because it is much faster than tape and it is a random-access device. You are usually not concerned about where a program is physically located on a disk. It need not even be stored in contiguous granules because the operating system takes care of this housekeeping for you. If a new version of a program is larger than the old one, additional granules will be allocated to that file following a save.

Q. I’ve purchased a software package that lets me enter a TRS-80 Model I/III program into my CoCo using the joystick port. It works fine except that when I list the entered program, I get back a bunch of garbage. I was wondering if this was caused by the same reason the new MC-10’s programs won’t load into the CoCo: different tokens. If so, where can I get a list of tokens so that I can develop a conversion program as I have seen for the MC-10? Any suggestions would be greatly appreciated.

Bill Smith
Pasadena, TX

A. If your program works with ASCII files, then no conversion is necessary. If not, look at the early issues of 80 Micro. A comprehensive index appears in the 1983 Special Anniversary Issue. You might also get the information on tokens from a local TRS-80 user’s group.

Q. I have a 32K F board CoCo with one disk drive. I have heard that I have the same board as the new 64K CoCo except for a ROM. Will my computer support the new operating system, OS-9? If so, will it use the full 64K?

Brian Spellman
Clinton, MD

A. You already have a 64K computer, and yes, it will support OS-9. You can also run FLEX and many other programs that will use the 64K with the standard Disk Color Basic or even cassette. The odds are that even your case is white like the new computer’s under its silver paint.

Q. I purchased an adventure game called Bedlam from Radio Shack about four months ago and have never been able to escape. Can you help me? I have gotten the blue pill, window hook, and green key. Where does the green key go? What is the blue pill for, and how do you get out? Please tell me some clues. I’m going crazy.

Bob Adams
Westerly, RI

A. Program Listing 2 gives you a window on memory. With it, you can peer into the innards of your adventures and find all the key words and phrases that are presently eluding you.

If you have an adventure game such as Bedlam that EXECs in low memory, first PCLEAR8 or offset load the adventure so that when you load in my program it does not overwrite part of the adventure game. With this program running, the up- and down-arrow keys change the area of memory that corresponds to the display screen. Since the clues that you want will correspond to the ASCII codes for text, you can read them directly out of memory and even compile your own Bedlam dictionary if you wish.

Q. I’m considering upgrading my 16K Extended Basic Color Computer by purchasing the new Radio Shack 64K RAM upgrade and the keyboard upgrade. Assuming I did, how would the resulting 64K unit differ from the new 64K Extended Basic Color Computer 2? Would the OS-9 system and the Color Computer 2 disk 0 work as well with the upgraded unit as with the Color Computer 2 version?

James K. Boudreau
Marietta, GA

A. The new 64K machine is not a Color Computer 2. The Color Computer 2 is the machine that is marketed with 16K in the smaller case. As to comparing an upgraded machine with the new 64K one, the only functional difference would be that the new machine might have newer versions of the ROMs, namely Color Basic 1.2 and Extended Basic 1.1. OS-9, FLEX, and other 64K programs will work with either set of ROMs.

If you buy a disk, Radio Shack has created a real dilemma. If you buy one that has the new 1.1 Disk Basic ROM in...
its controller cartridge, you can boot OS-9 with a single disk. With the older disk ROM, you need to run a program called * from a second disk first and then insert the OS-9 disk when prompted. The problem that arises with the new ROM is that many existing disk programs, including ones sold by Radio Shack, will not work with the new ROM. If you are in the market for new disk software, be sure to check that it is compatible with the ROM that you get.

Q. I've read the article "64K Modification," which appeared in the July issue of HOT CoCo, but I'm still confused. What is required to modify my 32K Extended Basic 1.0 machine, which is equipped with an F board?

James R. Vespi
Dolgeville, NY

A. Your computer will do everything that the new 64K CoCo will without modification! The odds are that it even has a white case under its silver paint. Radio Shack has never sold a 32K CoCo with an F board—just a 64K machine that they painted silver.

Q. In the November issue, you told a reader to check his 64K upgrade with a memory-testing program. Can you give us one?

Jack Thompson
Gaithersburg, MD

A. Program Listing 3 should suit your needs. To check to see if your D or E board was upgraded correctly to 64K, run the program with the E Board Test. If this checks out, you followed the instructions correctly up until step 1 at the bottom of p. 46 ("64K Modification"). If the first part is okay, run the ROM Area test. If this test does not check out or your machine hangs up with this test, retrace your steps beginning with step 1 at the bottom of p. 46. Keep in mind that Fig. 2 on that page should be numbered counterclockwise from the notch.

Q. I've written many programs for my CoCo where I needed continuous pixel movement. For example:

```
10 CLS0: M = 247: H = 31: V = 16
20 IF PEEK(341) = M THEN V = V -1
30 IF PEEK(342) = M THEN V = V +1
... 
60 SET(H,V,8): GOTO 20
```

This was done on an earlier model CoCo. However, now they tell me that the chip was changed and that the keyboard rollover table (341-345) holds the ASCII code, or something like that. Can you help?

In Elmer's Arcade, HOT CoCo, November 1983, p. 14, the author uses IF PEEK(341 AND 8) = 0 ... , IF PEEK(342 AND 8) = 0 ... , IF PEEK(343 AND 8) = 0 ... , and IF PEEK(344 AND 8) = 0 ... Will this be my alternative? What does it mean?

Barry Hornstein
E. Rockaway, NY
In your reference to Elmer's Arcade, none of those PEEKs when ANDed with eight will be zero if you have the newer 1.1 Color Basic ROM (EXEC 41175 to find out). The purpose of the AND 8 is to check to see if the 8 bit is set. If true, the result is eight; if false, the result is zero. This can be verified with pencil and paper by converting the number to binary and then checking to see that the fourth bit from the right is one.

Q. I have a new MC-10 Color Computer with the 16K expansion module. I also have Radio Shack's book TRS-80 Color Computer Programs, RS number 62-2313. I can run many of the programs, but cannot run those that have PEEK in them somewhere. For example, "Dragrace," HOT CoCo, November 1983, p. 68, with PEEK(65280) and "Orange Trap," HOT CoCo, November 1983, p. 126, with PEEKs 341, 342, 343, and 344. Any suggestions?

Pastor Mark S. Camp
Baldwin, MO

A. In "Dragrace," the author was checking to see if the fire buttons were pressed on the joysticks. Normally, address 65280 contains the value 255. If the right fire button is pressed, it is changed to 254 and if the left is pressed, it is changed to 253. If both are pressed at the same time, it is changed to 252. The other addresses in "Orange Trap" refer to the keyboard rollover table, which is explained in the preceding Q and A.

Q. I've seen ads for disks called flippies. What is the difference between them and the normal ones?

Mae Freudiger
Brooklyn, NY

A. A normal disk, whether single or double sided, has only one index hole and one write-protect notch. The index hole is the small hole next to the large one in the center of the disk. You can use a cheap hole punch to turn your disks into flippies. Make a template or use an old disk with the magnetic media removed. Use it with a felt-tip marker to indicate where a second set of index holes and a second write-protect notch should be on your new flippy. If you mark the positions correctly, the finished product will be completely symmetric with respect to the holes and notches. (See Fig. 1.)

Carefully slip a piece of paper or light card stock between the magnetic media and the housing to avoid scratching the media, then use the hole punch to punch a hole in the housing only for a new index hole. Do not punch a hole in the magnetic media! Repeat this procedure on the flip side of the disk. Next, punch a hole completely through the disk in the position that you marked for a new write-protect notch. Punch it so that the new notch is half-moon shaped.

If you do this to your disks, you can use both sides, thus halving the cost and space needed to store programs. Generally speaking, a single-sided disk is one that has been certified on only one side. Most likely, the second side has not been tested. This is not a guarantee, but I have personally never come across a disk with a bad second side. Let me know how it works out for you.

![Fig. 1. A Flippy Disk](image-url)
Sometimes life holds some pleasant little surprises. I recently found some fellows writing terrific FLEX utilities practically in my own back yard. The routines work well and the price is right—as in free.

The gentlemen in question are Bruno Puglia, Leo Taylor, and Joe Mardo, and they have been at this for about three years. Their principal goal is promoting the cause of transportable FLEX software for all sorts of 6800 and 6809 systems; they aren’t even Color Computer owners. The interests of the CoCo FLEX community are well represented in their work, however.

Two of their newest utilities are a supercharged CAT and COPY. These are fairly big (seven and 18 sectors, respectively), but each replaces several standard utility commands and incorporates novel features besides. The syntax is mainstream FLEX, so it’s easy to get the hang of using the new commands.

Three disk files are furnished for each routine: an assembled binary command file, a commented source file, and a .DOC file that you can print out to give yourself a manual. (Some of their shorter utilities skip the latter and incorporate the documentation in the source-file header.)

These self-contained manuals are complete: CAT’s runs to six pages, COPY’s to nine. The TSC assembler is recommended for people who want to customize the source file for their own purposes.

I can only compare CAT and COPY (from now on, these names will always refer to the Taylor-Puglia commands) with the stock versions in my everyday FLEX—Frank Hogg Lab’s version 5.0:3. The new material should work equally well with any other CoCo FLEX. CAT replaces not only the old CAT, but also the DIR and FILES commands.

CAT has eight options. You can change the default options (i.e., the ones in effect at power-up) by going into the source file, making the changes outlined in the manual (which amount to setting FCBs equal to zero or one as desired), and reassembling.

Subsequent use of any option on the command line turns off all the defaults, so you have to enter every option you want explicitly to do anything nonstandard.

In case you forget which defaults are in effect for your system, the command CAT + brings up a help list with a “yes” for those that are enabled, or a “no” for those disabled.

CAT can use the standard syntax for quick-and-dirty jobs. For example, CAT 1 .TXT (with the space) lists all the files on drive 1 whose names begin with A, or that have the .TXT extension, while CAT 1 A.TXT (no space) lists everything whose name begins with A and whose extension is .TXT—nothing unusual so far.

The fun begins when you invoke some of the options; a single letter designates each one:

- A—Alphabetize the catalog listing according to the first letter of the file name.
- D—Display each file’s creation date.
- F—List each file’s directory number.
- M—Generate a maximum (DIR-type) listing. This is equivalent to D, F, and S (see below) options, plus routines needed for interpreting the beginning and ending track and sector data and file protection codes.
- N—List nonexistent (deleted) files that might still reside on the disk. Of course, such files might not be intact. They might have been partially overwritten since deletion.
- P—Use the paging subroutine to generate a formatted listing (handy for disks with numerous small files).
- R—Repeat CAT when any key is pressed (except for E, which exits to FLEX). This is useful for cataloging many disks in succession, with the same set of options in effect.
- S—Display file sizes, in sectors.

The calling syntax is simple enough:

```
CAT + [Option letters ]
```
The option letters can appear in any order, without spaces.

Here's an example of a full-bore catalog. The subject was one of my utility disks, containing the new CAT and some other Taylor-Puglia routines (the COPY is the standard utility, however). The command was CAT + AM, i.e., I called for an alphabetized maximum listing, as shown in Fig. 1.

The Begin and End data are in track/sector format. The files are organized according to the first letter of their names, while the file numbers are assigned according to location on the disk. Note the sequence in which the last three files are listed. File sizes are in grams, and there are no protection codes ("PRT" column) in effect for this particular disk.

The summary line at the bottom of the listing includes data on Biggy, the largest file on the disk. This would have been the same even if I had called for a selective directory in which the 57-sector files did not appear.

Total gives the total number of sectors in the current display, followed by the number occupied on the disk, and Free is just the number of empty sectors remaining.

CAT uses an adaptive display: The number of columns printed or displayed on the screen will vary, depending on the options selected. For example, when I tried a quick search for any deleted files with CAT + N, I received a listing four columns (four file names) wide, organized according to the file numbers.

CAT is both useful and easy to learn. COPY is even more of a workhorse, although it requires a little more effort to become familiar with its details. It is compatible with the syntax of the original COPY command, but, once again, it branches off with many new options (17).

The letters that enable the new option or options go before the drive numbers in the general syntax of the command:

COPY [Options], <Drive>,<Drive> [,<Match List>]

You can specify any number of options in any order. Some of them are dangerous (in terms of possibly damaging a desired file), and these draw a request for a Y/N verification before the routine will proceed. The error trapping seems to work very effectively.

Here's a quick rundown of COPY's options:

- A—Copy in alphabetical order.
- C—Allow copying of corrupt (damaged) files.
- D—if the source and destination disks contain files with identical names, this guarantees that the destination will wind up with the newest version.
- E—Delete any existing destination disk file that matches a source file. Sometimes you may want to copy the older version of a file, and this does it.
- F—Copy by file number. This lets you use file numbers, rather than a match string list, as arguments of COPY. This is handy for building working copies of a system disk, where only FLEX.SYS and a few well-chosen utility commands are desired.
- K—Kill duplicate copy on the source disk. This is useful for getting rid of unwanted copies of files, but is potentially dangerous.
- L—List without copying. Disables the actual copy subroutine, allows you to preview what would have happened had it been allowed to run. For example, COPY KDL 1,0 previews which files would be deleted from drive 1 because a newer version exists on drive 0, but it doesn't actually delete them.
- M—Converts a FLEX serial file into a random file. You can use it with the R option below to recover a random file by track and sector.
- N—Copies files on the source disk that are not on the destination disk in any form. You can use it to add all new files to a back-up disk.
- O—Turns off all default options.
- P—Prompt before copying. Requests a yes/no answer before copying the next file. It's useful for scanning through a long source disk to build subsets of the files on a destination copy.
- R—Reads a file from a specified track and sector, without using the directory. You can use it to recover files if the directory has been destroyed, or to recover deleted files (assuming they have not been overwitten).
- S—Make a second copy of every file with .CPY extension.
- T—Overrides any protection on track 0 (where some systems store data files).
- U—Use current FLEX date, rather than source file date, for all copies.

W—Wait for a keypress before copying. It removes the necessity to copy COPY.CMD onto the source disk. After COPY is loaded into RAM, the routine pauses and lets you remove the system disk and insert the source disk into the same drive.

Z—Delete a file from the source disk after it has been copied. The result is that files are moved, not copied, from one disk to another.

There are many neat ways to use combinations of these options to automate complicated copying tasks. My favorite application is the production of dedicated, special-purpose working disks (like my customized DynaCalc package) that contain subsets of the utility command set.

COPY's self-contained documentation does a fine job of providing other examples—very professional stuff, indeed.

How can you get copies of CAT and COPY? The authors are primarily interested in promoting the cause of FLEX. Therefore, they have placed these routines in the public domain. Until the crush gets too great, you can get copies by sending a formatted disk, together with return postage and a large return envelope, to:

Bruno D. Puglia
27 Maitland Ave.
Randolph, MA 02368
617-961-3548 (weekends only)

To make things easier, members of your group should decide among themselves to send just one disk and make their own copies later. A few strategically placed disks can go a long way toward preserving the man's sanity, as well as giving him the time to write more good stuff.

And speaking of user's groups, one of Bruno's current enthusiasms is a national group for FLEX. I'd be happy to act as a clearinghouse for any thoughts you have on forming a FLEX group. Whether or not Re:FLEX would be the appropriate vehicle for any major exchanges of information remains to be seen.

Random Basic Comes to OS-9

My first piece of software that runs under OS-9 has arrived, and it isn't the expected Basic-09; rather, it's another version of Computerware's Random Basic (Box 668, 4403 Manchester Ave., Suite 102, Encinitas, CA 92024, 714-436-3512, $75).
As you might recall from the January column, I have a weak spot for the FLEX edition of Random Basic due to its large numerical range: 1.0 E-99 to 9.999...E+99. That comes in very handy for many problems in the physical sciences where very large and very small quantities are commonplace.

The OS-9 version, referred to on the disk label as Random Basic CC9, continues the tradition. In fact, it seems to be about as straight a translation of the earlier Random Basic as you might reasonably expect.

The ability to handle random, sequential, and ISAM (indexed sequential address mode) files is still there, as are user-defined functions, extended variable names to make programs more readable, and a host of other features.

There are a couple of welcome additions, though. For one thing, there are actually two versions of the language on the disk: Basic9 and Basic11. They boast nine-digit and 11-digit precision, respectively, using binary-coded decimal internal arithmetic. That accounts for the language's ability to handle such an extended range of numbers, although it also accounts for its lack of speed.

The new dialect also has commands that are specific to its operating system. For example, SHELL passes (forks) control to the OS-9 shell, letting you carry out any normal shell function while retaining Basic and any user program and variables in RAM. The clear/break combination returns you to Basic.

Although I have had little opportunity to exercise Basic CC9 thus far, I'll mention one new operator that ought to be a part of every Basic under the sun: SORT. You can guess what it does. The complete syntax is SORT <Array #1>, [<Array #2>]

where the arrays (of either numerical or string type) are singly dimensioned. The operator sorts Array #1 in ascending order. If you specify Array #2, its elements will be put into the same order as those of Array #1. This provides an easy method of setting up an index to preserve the original ordering of some array that is subjected to further manipulations.

The two versions of Basic reside in the CMDS directory of the Computerware disk. There are also a BAS directory containing a short demonstration program, and a couple of isolated files: an introductory document, a sample command file that shows you how to automatically load and start a program, and a new printer driver and descriptor.

As the last, but very recent, word, the newest upgrade of Random Basic (v1.6) has just arrived. There are 15 new commands for doing graphics, reading the joysticks, and sending information to any designated port. You can mix text and graphics on a single display if you use the high-res capability of Frank Hogg Labs' O-Pack.

While the graphics capability was there in OS-9 all along, it is now much easier to use—rather like Extended Color Basic. More on this in future columns. ■

Write Scott Norman c/o HOT CoCo, Pine St., Peterborough, NH 03458.

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**Coming Next Month**

We want to help you make the wisest choices of peripherals, so our April Peripherals Issue contains a buyer's guide to help you with these important purchases.

The poet who said "April is the cruelest month" obviously didn't know what else April's HOT CoCo contains. The regulars are all with us: Dr. ASCII, Graphically Speaking, Product News, Elmer's Arcade Gust for the fun of it), The Educated Guest, and reviews of The Color Accountant, Motion Picture Programming (animated graphics), and Simplex.

**HOT CoCo** features are a sure thing to help you use your new peripherals, or your not-so-new ones. Broken joysticks? Don't throw them out. Brian Alsop shows you how to fix them. Considering a modem? Michael Johnson is on-line about CoCo communications. Use your CoCo with the Epson FX-80 printer after reading the feature by Steve Eichman.

In April you'll also learn how to buy a disk drive, and how to build a transient-protection device. And for all you techies or would-be techies, we'll include an I/O quick-reference sheet.

Selecting and buying peripherals is a serious issue. So is April's HOT CoCo. But using them is fun, and April's HOT CoCo has plenty of that too. ■
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Datacam 35 comes in two monitor sizes (12" and 19"), and records CRT images in a slide format. CRT graphics can be photographed on Polarchrome 35mm film for speedy processing, or on 35mm color film.

Datacam 1 comes in the same two sizes and is useful for instant hardcopy photography. 3-by-4 prints for reference data, notebook presentations, or file information. It can be used with Kodak Instant Color film and comes with batteries and film. Prices of individual models vary from $500 to $1,000.

Contact Photographic Sciences Corporation, 770 Basket Road, P.O. Box 338, Webster, NY 14508. 800-828-6489 outside New York and 716-265-1600 (New York residents).

Reader Service  554

Letters and Numbers For Preschoolers

Software Specialists has introduced two new educational programs for children of pre-school age. Both programs focus on an early learning approach that uses the computer as a fun tool to promote enthusiasm for learning.

In Early Letter Recognition, the child presses a key for one of the 26 letters of the alphabet for either a graphics rendition of the letter or an animated display using it.

Kid’s Choice presents one of three displays at random, with each pressing of a particular number key, and has 30 displays in all. Routines associated with some of the number keys allow the child to participate in an activity based upon that number.

Kid’s Choice requires 16K Extended Color Basic and Early Letter Recognition is available for Color Basic and Extended Color Basic. Cost is $12.95 each, or $19.95 if you purchase both. Contact The Software Specialists, P.O. Box 2029, Princeton, NJ 08540. 609-443-6782.

Reader Service  559

New for Business

80 Custom Software has a new program designed especially for small businesses. This complete accounting system has up to 28 user-definable income and expense accounts, and up to 300 entries stored in memory at one time.

Records printed to the screen or optional printer include account totals, income and expense totals, individual entries, and a simple balance sheet. Individual entries can be listed by selected accounts or numerically in order of input. Business Manager supports monthly and yearly statements.

The program runs on a 32K Extended Basic tape or disk system and saves data to either tape or disk. Offered with complete instructions it sells for $24.95 tape and $29.95 disk from Reitz Computers & Electronics, 3170 W. Central Ave., Toledo, OH 43606. 1-800-242-COCCO.

Reader Service  557

Extra Eyes And Tails For Your Dragon

Elkan Electronics has developed three new add-ons for use with the Dragon and Color Computer. The first, Dragon’s Eye, is an on/off indicator that reminds you not to let your Dragon overheat. Installation time is 10 seconds, it requires no soldering, and does not invalidate your guarantee. Dragon’s Eye is priced at £3.95.

Dragon’s Tail is a joystick extension that makes it easier to plug your joystick into the Dragon, and saves wear and tear on your machine. It sells for £2.95. The joystick Y-adapter called Dragon’s Fork-tail enables you to use the joystick port for two purposes at once. Price is £3.95.

All three products are available from computer outlets or direct by order from Elkan Electronics, Freepost, 11 Bury New Road, Prestwich, Manchester, M25 6LZ, or from the new U.S. office at 1369 McCarter Highway, New­ark, NJ 07104.

Reader Service  566

High-Score CoCo Utility

Teachers and test users will find Test-Aid useful. This program allows you to create a large bank of four-alternative, multiple-choice test questions; edit questions in the bank; select questions in the bank for inclusion on an exam; print a formatted copy of the exam; and generate different orders of items for an exam.

Test-Aid features menu-driven commands and formatted entry and display screens. The program handles questions up to 700 characters long, and allows you to store and load question banks from tape. Printed copy has automatic word-wrap at line endings and page breaks between separate test items.

Complete with instruction manual, the program comes on tape, requires 32K or 64K Extended Color Basic, and sells for $18 plus $1 shipping. Contact Infotools, 111 Country Club Lane, Oxford, OH 45056. 513-523-8473.

Reader Service  555

Plan For The Future

FICA-83 is a software program for the CoCo designed to calculate the approximate monthly pension check under the 1983 changes to the Social Security Act.

The computation of retirement benefits is a complex process and FICA-83 can eliminate much of this confusion. The program is also a valuable aid in retirement planning, and calculating Social Security pension under a variety of options.

You can use the program for a printout to the TV screen or to a hard copy with an 80-column line printer. Now available on cassette tape, FICA-83 comes complete with written instructions. It requires 16K Extended Color Basic.
PRODUCT NEWS

and tape recorder. Price of the tape is $19.95 plus $2 shipping, from Parsons Software, 118 Woodshire Drive, Parkersburg, WV 26101.

Reader Service  553

Tax-Time Relief

This comprehensive tax preparation package saves time and anxiety for individuals and professional tax preparers. The program supports most tax forms and schedules now in use, is fully menu driven, and actually interviews you as you prepare the tax return.

Your data-entry errors can be immediately corrected by an edit mode similar to that of Color Computer Basic. The calculator mode supports all math functions on any line item that requires numeric data entry, and an audio warning sound alerts you to invalid math operations.

Printer outputs are made directly on government-approved forms and schedules using pin-feed or tractor-feed printers that support the CoCo serial-port interface.

The tax package comes with a comprehensive manual, and runs on 32K Extended Color Basic with one or two disk drives. The price is $149.95. Contact Micro Data Systems, 6 Edward Drive, Ashland, MA 01721.

Reader Service  551

Overload Protection

A new economical electrical outlet multiplier that has been introduced by Pilgrim Electric Company automatically shuts off the power when an overload occurs. The Model OS-4 has 4 NEMA 5-15R three-wire grounded receptacles. These are specifically intended for a CPU, printer, disk drive, and terminals. The product also features a built-in master on/off switch, red pilot light, and circuit breaker reset button. A heavy duty, 6-foot #14-3 SJT line cord is standard.

UL listed, the new Model OS-4 plugs into any 125 VAC, 15 or 20 Amp outlet and handles up to 1,875 watts. Priced at $28.95, they are now available from Pilgrim Electric Company, 29 Cain Drive, Plainview, NY 11803. 516-420-8989.

Reader Service  550

Free Communication Terminal Program

New for the Color Computer and the MC-10, Commterm allows both computers to access remote bulletin boards or timesharing services, or to act as terminals on-line to other computers.

Star-Kits Software Systems Corporation is offering Commterm free to anyone who sends a blank cassette and an SASE. Star-Kits gives users permission to copy the program or documentation for their own purposes. In return for making the program available, Star-Kits asks that Commterm users evaluate the program's worth and send what they consider a fair contribution to the company to encourage further development of such programs.

Contact Star-Kits at P.O. Box 209, Mt. Kisco, NY 10549. 914-241-0287.

Reader Service  562

CSPOOL

Micro Works has released CSPOOL, a print spooler for the CoCo and CoCo 2. CSPOOL lets you use your printer and computer concurrently, takes 26 bytes of Color Basic's memory, and gives 32K of print buffer.

It intercepts characters sent to the printer and stores them in the upper 32K of RAM. This allows a Color Basic program, that would normally wait for the printer, to return almost instantaneously with "OK." You can then run other programs.

CSPOOL is free with the purchase of a 64K RAM Upgrade Kit from The Micro Works, or you can purchase it separately on cassette or disk for $19.95. It requires 64K and is not for FLEX or OS-9.

BOOKS

Rainbow Quest
for the Color Computer
A computer fantasy for young Color Computer users. Rainbow Quest is an adventure that combines fiction and programs. Readers must cross the planet Rainbow and master a series of challenges to succeed on the Quest. Each challenge is a program on cassette. Included are arcade games, puzzles, and mazes. Book and cassette sold together. $24.97 BK7391 128 pp.

Computer Carnival
For the TRS-80 Models I and III. These sixty programs for beginners will entertain and educate. Children will find mazes, word games, graphics, puzzles, and quizzes. Card games, logic tests, word and number puzzles, and letter games make Computer Carnival a learning experience. The Carnival Companion cassette of all sixty programs is also available. Computer Carnival and Carnival Companion $24.97 CC7389 Computer Carnival $16.97 BK7389 216 pp. Carnival Companion $9.97 TP7389

Inside Your Computer
Find out what goes on inside your Color Computer. Inside Your Computer explains microcomputer circuits and how they work. Topics include chips, interpreters, circuits, machine language, binary numbers, algorithms, ASCII code, software, and what they all mean to the computer. Includes many photographs and schematics. $12.97 BK7390 108 pp.

Annotated BASIC, vol. 1 and 2
This two-volume set teaches you the hows and whys of BASIC programming. TRS-80 Level II programs are taken apart and described in detail. Each program is accompanied by documentation, program annotation, BASIC concepts and definitions, and a flowchart. Volume I $10.95 BK7384 160 pp. Volume II $10.95 BK7385 125 pp.

The Selectric™ Interface
You can turn an IBM Selectric I/O writer into a letter quality printer for your computer. The Selectric Interface gives you the programs and step-by-step instructions you need for Selectric models 2740, 2980, and Dura 1041. With slight modifications, the instructions will work for various chips. $12.97 BK7386 124 pp.

Kilobaud Klassroom
Learn electronics with this hands-on course. This collection of electronics projects starts with simple concepts and takes you on to building your own small computer. You'll learn electronics theory and get the practice you need to master digital electronics. $14.95 BK7386 393 pp.

CSPOOL

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CSPOOL is free with the purchase of a 64K RAM Upgrade Kit from The Micro Works, or you can purchase it separately on cassette or disk for $19.95. It requires 64K and is not for FLEX or OS-9.
Contact The Micro Works, P.O. Box 110, Del Mar, CA 92014. 619-492-2400.

**PRODUCT NEWS**

**Contact The Micro Works, P.O. Box 110, Del Mar, CA 92014. 619-492-2400.**

**Mt. Kisco, NY**

**Available in both VHS and Beta formats, and explains each of Star-Kits' software products for the CoCo and other 6809-based computers.**

The Video Tape Sampler is priced at $20. After viewing it the user can erase and reuse the tape or return it to Star-Kits for full credit.

**Contact Star-Kits Software Systems Corporation, P.O. Box 229, Mt. Kisco, NY 10549. 914-241-0287.**

**Reader Service 1 561**

**Picture-Perfect Developer Program**

PKB & Associates announces the release of BWDEV Black/White Developer, a 16k non-Ex- tended program for the CoCo designed to assist photographers in film developing.

The program operates by asking a series of questions about the variables of film developing such as type of film, type of developer, normal or push processing, and developer temperature. It then calculates the variables and starts the timing process for each step of development with audible tones as reminders of agitation intervals.

**BWDEV** works with Tri-X, Plus-X, and Panatomic-X films and Microdot-X, D-76 and HCl10 (dilution B) developers, including push processing of Tri-X to 1250EI.

It comes on tape and sells for $19.95 (add $2 for COD). Contact PKB & Associates, 5603 Linwood Court, Seabrook, MD 20706. 301-577-2930. **Reader Service 1 563**

**Low-Price Printer**

The DTC Style Writer, a daisy-wheel printer with hardware and software features, is being offered for $899.

Specifications and features include a standard 35K buffer memory for speed throughput of approximately 20 pages. The use of the buffer allows the computer to fully load up the printer memory within seconds. Then you can use the computer for further applications while the DTC Style Writer finishes printing. With a multi-copy feature, repeat copies are possible without reloading the printer buffer memory from the computer. As an option, a 64K expanded buffer is available at $49.

Other features include: full bidirectional printing, automatic proportional spacing, standard Centronics parallel interface, graphics plotting, two-color printing, and a momentary pause for paper, print wheel, and ribbon changing.

The print wheel is available in 17 different type fonts, and works with a long-life cartridge ribbon. A user-oriented, self-test diagnostic routine evaluates the printer's internal electronic circuits and print mechanism.

Other options include a forms tractor for continuous paper feed, a bidirectional cut-sheet feeder, and 17 different type fonts to choose from. A variety of interconnecting cables enable the DTC Style Writer to work with most major personal computers in use today.

**Contact Data Terminals and Communications, 590 Division St., Campbell, CA 95008. 408-378-1112.**

**Reader Service 1 552**

**Check-Mate Computing**

Chess-D, a chess program for the Color Computer, uses methods of the current computer chess champion programs. It inspects 10,000 moves per second and at tournament level play (3 minutes per move) Chess-D can look ahead at least five plays. Players can set or change the lookahead level at any point during play from novice to expert level.

All chess moves are recognized or played as needed, including En Passant, Castling, and Promotion to any piece. All moves are entered through the keyboard using algebraic notation. A built-in opening book assures that the game starts correctly. A player can play as either black or white and can switch in the middle of the game.

**The CoCo version uses high-res graphics and requires 64K RAM. The cassette sells for $39.95, and the disk for $49.95 with complete documentation from Computer Systems Distributors, P.O. Box 9769, Anaheim, CA 92802. 714-772-1390.**

**Reader Service 1 552**

**Access the World Of CP/M**

CoCo Coupler 1 gives CP/M capability to your CoCo and is compatible with your disk controller and disk drives. Plug it between the computer and disk controller and it provides a platform for your disk controller cartridge. It needs no system modification.

To operate, menu select CP/M and the firmware loads the CP/M operating system. Select Color Basic, and your CoCo programs will run perfectly.

The CoCo Coupler 1 contains a 4 MHz 280A microprocessor and firmware for execution of CP/M programs. In addition to CP/M utilities, you receive the Wayne Technology disk copy and format utilities.

**CoCo Coupler 1 requires 5.0 VDC @ 225 mA ± 10% supplied by the Color Computer. The disk format is compatible with Omikron/TRS-80 Model I, and display control emulates the Lecroy Siegel ADM-3A terminal.**

It comes with a 90-day warranty, assembled and tested with CP/M 2.2 disk and manual. The price is $250. Contact Wayne Technology, P.O. Box 5196, Anaheim, CA 92804, 714-772-5775. **Reader Service 1 566**
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GIMIX STATE OF THE ART 6809 SYSTEMS FOR THE SERIOUS USER.

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The intelligent serial I/O processor boards significantly reduce system overhead by handling routine I/O functions, thereby freeing up the host CPU for running user programs. This speeds up system performance and allows multiple terminals to be used at 19.2K baud.

For the user who appreciates the need for a bus structured system using STATIC RAM and powered by a ferro resonant constant voltage transformer, GIMIX has single user systems that can run both FLEX and OS-9 or multi user systems for use with UniFLEX or OS-9.

GIMIX versions of OS9 and UniFLEX include maintenance and support by Microware (90 days) and TSC (1 year). Maintenance and support after this period are available at extra cost. (NOTE: this support and maintenance is only for use with approved GIMIX hardware)

GIMIX 6809 systems support five predominant operating systems:

- OS-9 GMX III,
- OS-9 GMX II,
- UniFLEX,
- OS-9 GMX I,
- FLEX

and a wide variety of languages and development software.

Whatever your application: software development, instrumentation, process control, educational, scientific or business; whether you need single or multi-user capabilities, GIMIX has hardware and the operating systems to get the job done reliably.

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You've invested a lot of time and money into your computer. It's time that investment paid off!

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Introducing The Color Accountant (from The Programmer's Institute), the only complete personal financial package specifically designed for the TRS-80 Color Computer. This unique package includes:

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After the initial setup, THE COLOR ACCOUNTANT requires less than an hour of data input each month.

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All programs are menu-driven and allow add/change/delete. Each file and statement can be listed to screen or printer, and saved to cassette or diskette. THE COLOR ACCOUNTANT also comes with 40 pages of documentation that leads you step-by-step through the entire package. The TRS-80 COLOR Ext. Basic requires 16K for this package.

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Hi Res Screen & Utilities Package

This is the same Hi-res screen that is used on FHL FLEX. Using the same control codes and the same features. The utilities include a three way copy utility that allows copying files between FLEX, OS-9 and Radio Shack DOS. For CoCo OS-9 - $34.95

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