Inside: Peripherals Buyer's Guide

HOT CoCo™

A WAYNE GREEN PUBLICATION
April 1984 USA $2.95

THE MAGAZINE FOR TRS-80 COLOR COMPUTER®, MC-10®, AND DRAGON™ USERS.

What Do You Add to Your CoCo?

What to Look For In a Disk Drive

Fix Your Broken Joysticks

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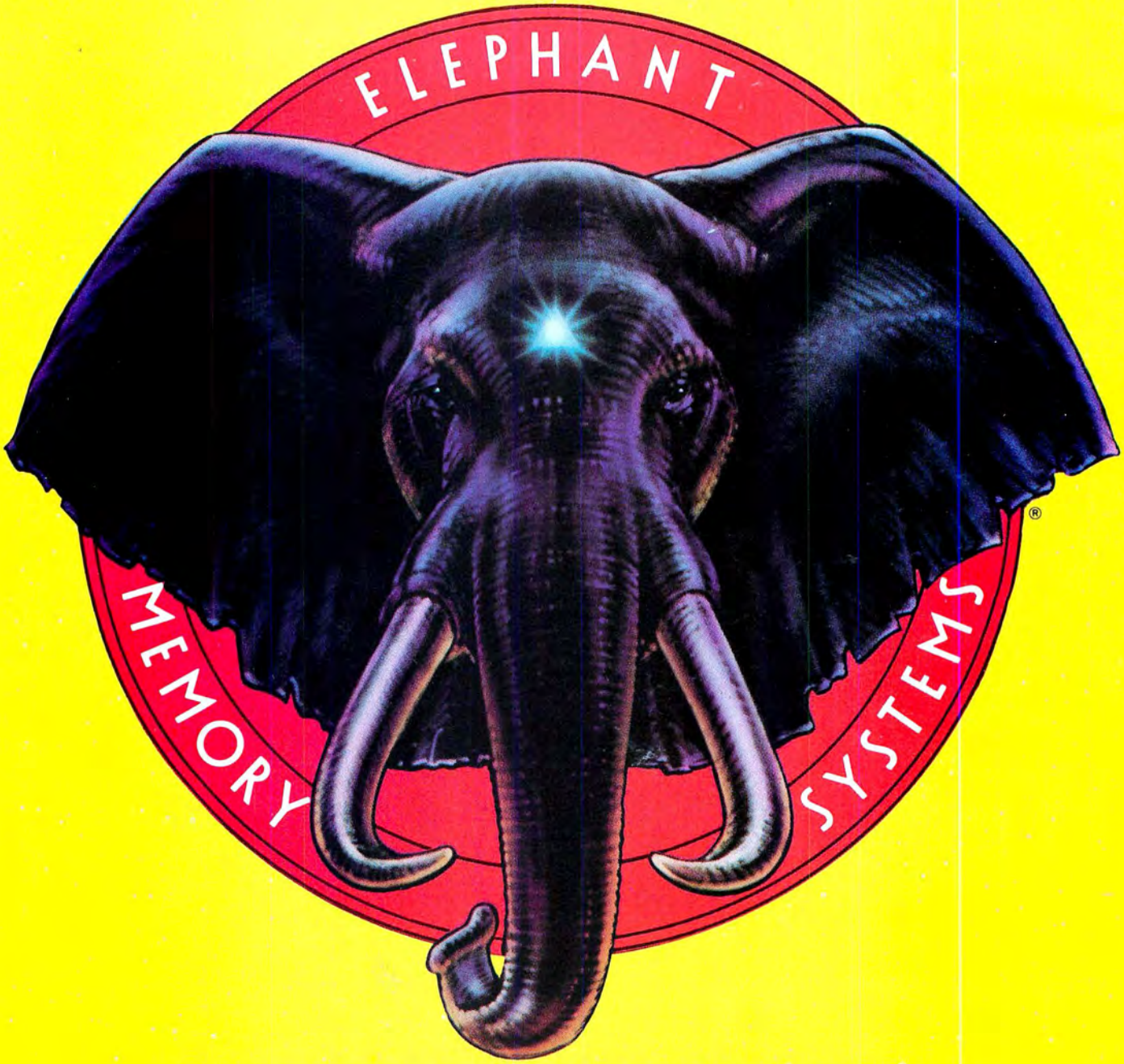

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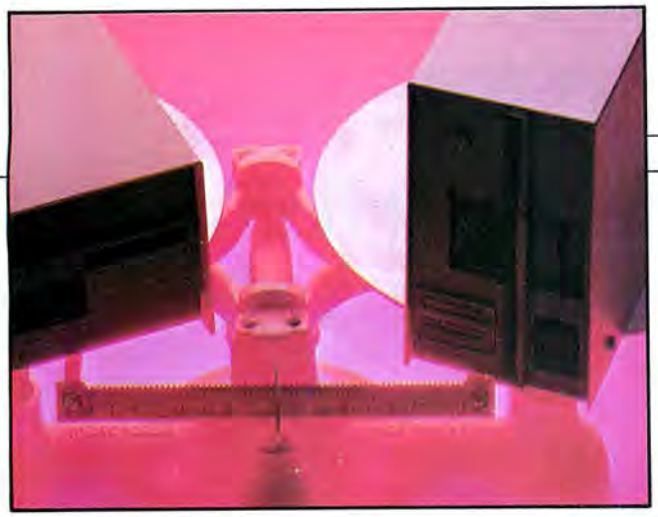

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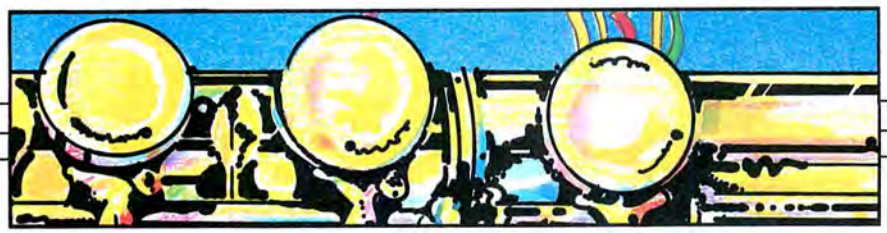

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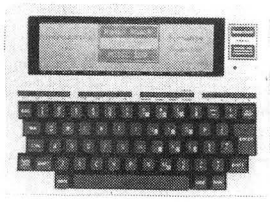

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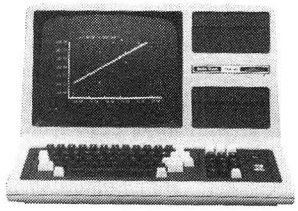

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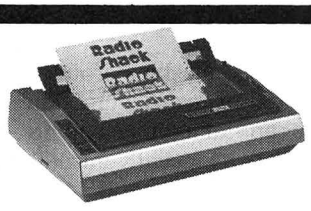

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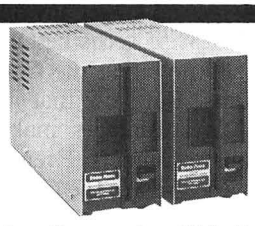

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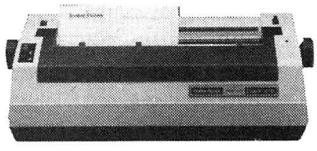

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DIGRESSIONS

CoCo 2 Gets 64K And Great Price

There is no longer any question. Tandy's recently announced 64K CoCo 2 at $259.95 is the best computer buy around.

We all know that the CoCo has been the best machine around for quite some time. But now that it's priced only $60 over a Commodore 64, the CoCo 2's advantages make it the more appealing machine to money-conscious consumers. Even when compared to the recently introduced PCjr and Coleco Adam, the CoCo comes out looking pretty good.

The CoCo has four things going for it: a powerful Basic, lots of software (finally), a proven track record, and most importantly easy serviceability. There is hardly a better Basic around for graphics on a home computer than Extended Color Basic. Ever try to get a Commodore to draw a circle? You can do it easily with the CIRCLE command on the CoCo; the Commodore needs a whole routine.

Many vendors and the Shack itself have greatly increased the amount and variety of software for the CoCo within the last year. The software base rivals that of the Commodore 64, and dwarfs that of the newer machines listed above. The CoCo is reliable, with few quirks in its operation. The PCjr is not yet available at this writing; no one knows what its performance record will be. The Adam's track record has been less than perfect. It has peculiar habits; for instance, if you leave the Adam's cassette drive on top of the CPU, it erases your tape.

Where do you go to get your Commodore or Adam fixed? Toys 'R Us? The Shack's umpteen thousand stores are a big plus not only for service, but also as a convenient source of software and peripherals. If you are near a Computer Center, technical advice is readily available too. And let's not forget Tandy's telephone help service.

I could mention a dozen or so other good things about the CoCo, like a large, enthusiastic group of third-party vendors, innumerable user's groups, and fine supporting magazines (of which *HOT CoCo* is best). But you know all this already. The question is: Do your friends know?

Don't let Commodore, IBM, or any other computer company steal the limelight the CoCo deserves. Tell your computer-shopping friends all the advantages of owning a CoCo. Tell them to go out and look at the other machines; then look at the CoCo. They'll find that the CoCo delivers much more computer for the dollar.—*M.N.* ■

Telewriter-64™

the Color Computer Word Processor

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

THE ORIGINAL

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

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

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

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

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

TELEWRITER-64

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

64K COMPATIBLE

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

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

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

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

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

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

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

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

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

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

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

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

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

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs $49.95 on cassette, $59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

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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 = 1TO20 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, reinsert 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.

Anyone who owns the new CoCos with the 1.2 ROMs, have noticed poor keyboard response in some published programs. To solve this, you can insert this line: FOR Z = 1TO4:POKE340 + Z,255:NEXT after any line that makes reference to PEEK 338-345. This loop will slow down a Basic program. Another way is to directly insert a POKE xxx,255, where xxx is any keyboard location between 338 and 345. Example: IF PEEK(341) = 251 THEN Y = Y – 1. Change to: IF PEEK(341) = 251 THEN POKE341,255:Y = Y – 1.

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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↙23

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↙See List of Advertisers on page 130

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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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The ergonomically-superior HJL-57 has sculptured, low profile keycaps; and the three-color layout is identical to the original CoCo keyboard.

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Feedback

CoCo Synthesizer?

Does anyone out there know of a company that sells music-synthesizer keyboards for the CoCo? If so, please send me an address so I can write them for information.

Ryan Moody
Rt. #2 9 Cedar Creek
Shawnee, OK 74801

Color Basic Word Processor

While browsing through your premiere issue, I came across Ken Knecht's superb "CoCo Word Processor" (*HOT CoCo*, June 1983, p. 36). What a boon to all CoCo owners. It's an outstanding program that offers professional word processing to anyone with Extended Color Basic.

However, for those of us with Color Basic machines, commands like VARPTR and INSTR don't exist—and they control five important features of Mr. Knecht's program: delete a line, make room for an insert, and global find/delete/replace string.

By making the changes shown in the accompanying Table, Color Basic owners can also have quality word processing. Try them out on Mr. Knecht's program, and you'll never need to buy Color Scripsit.

Duncan F. Dempster
Kahaluu, HI

Yes, you can run my word processor under Color Basic with your modifications, but you will encounter some problems. Extended Color Basic's LINE INPUT command does not appear in Color Basic. Simply replacing it with INPUT will do funny things to your input if you use commas, quotation marks, or colons.

You could use a separate subroutine to replace INPUT—the easiest being to build the string using INKEY$ to get each character. However, this leaves a problem with the backspace (CHR$(8)). You must carefully plan the code to handle this.

Also, building strings this way leads to frequent garbage collecting, which will slow the program once you've entered a significant number of strings in the array. You must also surround the string with quotation marks before you save it on tape, so you can recover it in the author program with an INPUT#1 instead of LINE INPUT#1.

Now you know why I specified Extended Color or Disk Basic for the program.

Ken Knecht
Yuma, AZ

1) Delete lines 10000–10040 and substitute these:

```
10000 IF E+1>200THENPRINT"ONLY 2
00 LINES":GOTO100
10010 FOR I1=E+1 TO A+1 STEP -1
10020 A$(I1)=A$(I1-1)
10030 NEXTI1:RETURN
```

2) Delete lines 12000–12040 and substitute these:

```
12000 FORI1=A TO E
12010 A$(I1)=A$(I1+1)
12030 NEXTI1:RETURN
```

3) Delete lines 14070–14090 and substitute these:

```
14065 Y=1
14070 FORX=L1 TO L2
14075 FORF=Y TO LEN(A$(X))
14080 IF MID$(A$(X),F,LEN(S1$))=
S1$ THEN 14100
14090 NEXTF
14095 Y=1:NEXTX:GOTO 100
```

4) Delete lines 14100–14160 and substitute these:

```
14100 IFC$-"D" THEN 14105 ELSE 1
4120
14105 IFF=1 THEN A$(X)=RIGHT$(A$
(X),LEN(A$(X))-LEN(S1$)):GOTO141
70
14110 IFF-1+LEN(S1$)=LEN(A$(X))T
HENA$(X)=LEFT$(A$(X),F-1):GOTO14
095
14115 A$(X)=LEFT$(A$(X),F-1)+RIG
HT$(A$(X),LEN(A$(X))-(F-1+LEN(S1
$))):GOTO14170
14120 IFC$="R" THEN 14123 ELSE 1
4140
14123 IFF=1THENA$(X)=S2$+RIGHT$(
A$(X),LEN(A$(X))-LEN(S1$)):GOTO1
4170
14125 IFF-1+LEN(S1$)=LEN(A$(X)TH
ENA$(X)=LEFT$(A$(X),F-1)+S2$:GOT
O14095
14130 A$(X)=LEFT$(A$(X),F-1)+S2$
+RIGHT$(A$(X),LEN(A$(X))-(F-1+LE
N(S1$))):GOTO14170
14140 PRINTX;LEFT$(A$(X),F-1)+CH
R$(91)+S1$+CHR$(91)+RIGHT$(A$(X)
,LEN(A$(X))-(F-1+LEN(S1$)))
14145 PRINT"FIND NEXT? (Y/N)";
14150 B$=INKEY$:IFB$=""THEN14150
14160 IFB$="Y" THEN14170 ELSE100
14170 Y=F+1:GOTO14075
```

Table. Color Basic Word Processor

Readers to the Rescue

*On page 13 of January's "Feedback" we published a letter, Where's the Bug?, in which a reader asked for help with a problem he was having with Ken Knecht's "CoCo Word Processor" (*HOT CoCo, *June 1983, p. 36). Evidently, the program was printing at least one line of a block or indented form letter one character to the left of the margin.*

Mr. Knecht hadn't experienced the problem, but he said that others had written to him of the same thing. He didn't have the answer, suggested that perhaps it was due to a bug in Basic's print routine, and asked readers for help. Here are the replies.—eds.

Fix and Swap

Since I only use a DMP-200 printer, I can't separate CoCo bugs from printer bugs.

When you send a control code specifying a new typeface to the printer, you'll get the bug. Try PRINT#-2, CHR$(27);CHR$(18);TAB(10) "TEST":. You don't need to put this line in a program.

Try PRINT#-2,CHR$(27);CHR$(18):PRINT#-2,TAB(10)"TEST":. This won't result in the bug, but the printer received a line feed before it printed "test."

Therefore, it seems that the tab count will be incorrect if the control code (printed correspondence) is still in the buffer when it receives a character.

Now try PRINT#-2,TAB(10); CHR$(27);CHR$(18);"TEST". You should have the correct tabbing with no bug and no line feed.

I use the CoCo Word Processor and have several modifications, such as single-sheet feed, proportional spacing on the DMP-200, and forward and

backward multiple space. I'll pass these on to interested readers if they send me a self-addressed, stamped envelope or are willing to exchange other helpful information.

Robert Gault
832 N. Renaud
Grosse Pointe Woods, MI 48236

1.0 ROM to 1.1

Mr. Knecht might be right about a bug in CoCo's Basic, because I replaced my 1.0 ROM (Color Basic) with a 1.1 version, and the problem went away.

Tom Garcia
Tucson, AZ

1.1 ROM to 1.2 (?)

I have a 64K disk system (upgraded from 4K) and a DMP-120 printer and agree that there must be a bug in Basic's print routine.

I found a temporary fix by entering POKE151,255:POKE152,255 to change the line-printer delay in the CoCo. This works, but slows down the printer.

Then I replaced my 1.1 Basic ROM with a 1.2, and the problem vanished.

I don't know exactly what was wrong. It occurred under certain conditions when strings were manipulated and then printed. Since this doesn't seem to be a common problem, it might be a certain combination of 1.1 ROM and printer, a particular production run of ROM, or a combination of 1.1 ROM and some older version of another chip (my machine is a two-year-old D board).

Dennis J. Duke
Bessemer, AL

CHR$ to the Printer

I have an Epson RX-80 with the Epson serial board and 2K buffer. I haven't loaded Mr. Knecht's program, but I wrote a cassette label program and found a similar alignment problem.

Occasionally when a CHR$ is sent to the printer, it leaves a partial backspace in the print buffer. This backspaces the text when it prints it. I haven't yet found the relationship between the printer commands and the amount of backspace, but it exits.

I've found two fixes. You must send either one to the printer (preferably followed by enter) before you send any text.

If you're using pica type, a backspace—CHR$(8)—would clear out the buffer. With elite type, send a series of DELETE commands—CHR$(127)—long enough to clear the buffer.

Randolph D. Carney
Lancaster, PA

Backwards Attacker

To let the ship in Matt Togliatti's "Attacker" (*HOT CoCo*, October 1983, p. 82) go backwards, change line 100 to the following:

```
100 X=X+3:A=JOYSTK(0):B=JOYSTK
(1):IF A>45 THEN X=X+2 ELSE IF A<15
THEN X=X-5
```

Add line 15 and change line 20 as follows to choose the number of ships you have each game:

```
15 INPUT"HOW MANY SHIPS";NM
20 PMODE4,1:SCREEN1,1:PCLS:PMODE
3,1  :X=10:Y=26:A$="T150O1V31CDC
GABV25CV20CV15DV10DV5EV1E":SC=1:
ES=2
```

I've been a subscriber since *HOT CoCo* first came out, and I think it's a great magazine.

Brian Patrick
Huntsville, AL

CoCo 2 to 64K

I took advantage of Radio Shack's before-Christmas sale and bought a 16K, Extended Color Basic Color Computer 2. It's great fun, but I eventually decided to upgrade it to 64K. However, I found Radio Shack's prices for doing so just a little steep.

Therefore, from an ad in your November issue, I purchased Compukit's (16206D Hickory Knoll, Houston, TX 77565) 64K Upgrade Kit for $62.95. It's easy to install, and even comes with a test program, but I did have a few minor problems and thought I'd pass them along:

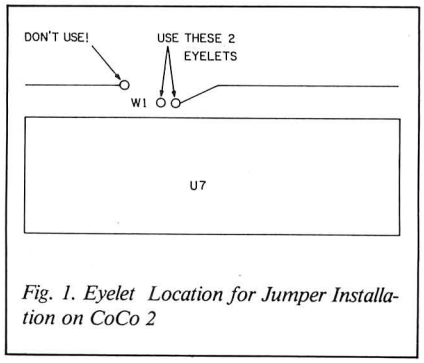


Fig. 1. Eyelet Location for Jumper Installation on CoCo 2

- Removing the CoCo 2's cover will void the 90-day warranty.
- Be very careful not to bend the pins when removing and installing chips. If you've never worked with ICs before, let someone who has do the installation for you. Make sure that the end of the chip with pin 1 faces the rear of the board.
- The left side of U7 is marked W1. the instructions from Compukit say to solder a jumper across the two eyelets here, but it is confusing. The attached Fig. 1 shows which eyelets to use.

Compukit told me to use two ¼-watt resistors in the jumper installation. Heat the lead on one end with a soldering iron while pressing on the eyelet with the end of the lead. When the solder around the lead melts, let the lead slide in a little and then hold it steady until the solder cools. Use the other resistor and do the same with the other eyelet.

You should now have two ¼-watt resistors sticking vertically out of the board. Slide the little plastic device that came taped to the chip tube down over the wires and jumper them together. Trim the wires to about ¼ inch before you install the jumpering device and it will look like it belongs there.

- The test program that came with the upgrade kit has three errors in it. Make the following line changes:

```
110 IFMEM=16000THEN?"LESS THAN
32K":END
(Insert an = between MEM and 16000.)
140 DEFUSR0=16000
(delete a 0.)
160 IF A THEN?"32K"ELSE?"64K"
(Add spaces between IF, A, and THEN.)
```

I hope this information is of some help to readers who want to use Compukit's upgrade on their CoCo 2s. The price is good, and my CoCo 2 runs great.

Paul H. Bock, Jr.
Sterling, VA

Nice and Dark

I've never been pleased with the light printouts from my DMP-100. Finally, I switched the ribbon with one from my Commodore VIC-1525 printer, and find that the DMP-100 now prints nice and dark.

I enjoy your magazine each month.

Paul E. Collins
Caldwell, NJ

Payroll Tax Update

This short listing adds the current tax tables to Mike Charlton's "CoCo Payroll" (*HOT CoCo*, January 1984, p. 74). I've checked this update, but I suggest, as does Mr. Charlton, that readers also monitor it for accuracy.

Also, thanks for the help on the problem I had with this program.

John Howton
Ocala, FL 32671

```
18000 'FED.TAX-SINGLE
18010 IFZ2<=1400THENFT=0:RETURN
18020 IFZ2>1400ANDZ2<=4100THENFT
=(.12*(Z2-1400))/PP(I):RETURN
18030 IFZ2>4100ANDZ2<=9500THENFT
=(.15*(Z2-4100)+325)/PP(I):RETUR
N
18040 IFZ2>9500ANDZ2<=14400THENF
T=(.19*(Z2-9500)+1135)/PP(I):RET
URN
18050 IFZ2>14400ANDZ2<=22000THEN
FT=(.25*(Z2-14400)+2065)/PP(I):R
ETURN
18060 IFZ2>22000ANDZ2<=27800THEN
FT=(.3*(Z2-22000)+3963)/PP(I):RE
TURN
18070 IFZ2>27800ANDZ2<=33000THEN
FT=(.34*(Z2-27800)+5710)/PP(I):R
ETURN
18080 IFZ2>33000THENFT=(.37*(Z2-
33000)+7512)/PP(I):RETURN
19000 'FED.TAX-MARRIED
19010 IFZ2<=2400THENFT=0:RETURN
19020 IFZ2>2400ANDZ2<=9620THENFT
=(.12*(Z2-2400))/PP(I):RETURN
19030 IFZ2>9620ANDZ2<19188THENFT
=(.17*(Z2-9620)+868)/PP(I):RETUR
N
19040 IFZ2>19188ANDZ2<=23608THEN
FT=(.22*(Z2-19188)+2494)/PP(I):R
ETURN
19050 IFZ2>23608ANDZ2<=28192THEN
FT=(.25*(Z2-23608)+3466)/PP(I):R
ETURN
19060 IFZ2>28192ANDZ2<=34216THEN
FT=(.28*(Z2-28192)+4792)/PP(I):R
ETURN
19070 IFZ2>34216ANDZ2<=44824THEN
FT=(.33*(Z2-34216)+6277)/PP(I):R
ETURN
19080 IFZ2>44824THENFT=(.37*(Z2-
44824)+9778)/PP(I):RETURN
```

Program Listing. CoCo Payroll Tax Update

Swiss CoCo

Do you or any of your readers know if I can use a Color Computer in Switzerland, provided I have a voltage adapter and an American TV set as a monitor?

Andreas Luecke
2509 Avery St.
Parkersburg, WV 26101

It might work, but it's a risk we don't recommend. Does anyone else have a better answer?—eds.

Go To the Head Of the Class

I enjoy your magazine and find more in it of interest than in any other Color Computer magazine.

As a teacher, mother, and grandmother, I particularly liked your education issue in December. There were many things in it I could use.

Janet Minnia
San Antonio, TX

Classroom CoCo

We are a new computer school and Color Computer resource center. We don't sell computers, but we do promote computer literacy and education, and we'd like to know what schools are doing with the Color Computer.

We'd also like to get their reasons for using computers in the classroom—or at least, in the school building.

Mary Jane Spencer, Prop.
Rainbow Adventure
Box 355
235 East King St.
Shippensburg, PA 17257

I Even Like the Ads

In January's *HOT CoCo* you asked me to tell you what I like and dislike about the magazine.

Well, you have a good publication, and I enjoy the reviews, Dr. ASCII, and the program listings. I even like the ads—they are often my first place of information for new things for my CoCo.

As for dislikes, there are none.

Harold Mizell
Norton, KS

High Scores

We received a couple new names to add to the high game scores this month. Keep them coming.

Name	Game	Score
Carol Thomson Owen Sound, Ontario	Space Assault (Beginner Level)	75,110
	Popcorn (Level 5)	75,010
Lori Thomson Owen Sound, Ontario	Ghost Gobbler (Level 5)	83,110
Richard Wasserman Brooklyn, NY	Galax Attax	50,100
Ray Gallantry Brampton, Ontario	Bloc Head	64,275
	Keys of the Wizard (Level 1)	632
Dan Shargel Arroyo Grande, CA	Whirlybird Run	78,450
Doug Burke Kenora, Ontario	Lancer	117,700
Greg Burke Kenora, Ontario	The King	156,900
	Colorpede	1,376,460
	Doodle Bug	1,470,200
	Zaksund	556,780
	Pyramid	200
	Ninja Warrior	74,500
	Frog Trek	14,700
M.A. Brickles Allen Park, MI	Defense	103,660
	Scarfman	121,600
	Death Trap	60,838
	The Frog	20,340
	Solo Pool	80
Michael E. Nadeau Peterborough, NH	Buzzard Bait	138,000
Mark E. Reynolds Bennington, NH	Mudpies	113,800
	Tut's Tomb	39,360

Back Issues

I've received my second copy of *HOT CoCo*, and I have nothing but praise for it. Now I'd like to get all the back issues that I've missed. Please tell me how to complete my CoCo library.

David Sullivan
Frankfurt, W. Germany

We sell back issues for $3.50 plus $1 shipping and handling (each issue). For 10 or more magazines, include $7.50 shipping per order.

We can't bill for back issues, so please send a check, money order, or credit-card information to Back Issues, HOT CoCo, *Pine St., Peterborough, NH 03458, or (in the U.S.) call, toll-free, 1-800-258-5473.—eds.*

Circuit Drawer In Disk Basic

I've found a problem with the "Circuit Drawer" program (*HOT CoCo*, February 1984, p. 56). The program as written will not work with Disk Basic, due to the use of the array AS$.

AS is a Disk Basic command used in conjunction with the FIELD statement. See page 86 of the disk manual. I suggest changing all occurrences of AS$ to XS$.

Bill Boogaart
Calgary, Alberta

HOT CoCo's Consumer Watch

HOT CoCo has received a number of complaints against Snake Mountain Software in regards to unfilled orders. We have attempted to contact the company, but have received no response.

Send your letters to Feedback, HOT CoCo, *80 Pine St., Peterborough, NH 03458.*

Clubhouse

Have a Color Computer Club?
Reach prospective members through a letter to Feedback.

Brussels

A group of Radio Shack computer users meets each Monday at 8 p.m. behind the Nossegem town hall (near Brussels Airport). We have more than 50 members and are starting a CoCo department. If you're interested, come to a meeting, or write me.

Foulon Marc
50, Roberts Jones
1180 Brussels
Belgium

Acadiana

We're starting the Cajun CoCo Club for TRS-80 Color Computer, MC-10, TDP-100, Dragon, and other 6809 users. Our goals for 1984 are to have over 200 members and to start a local BBS. Pooyie!

Bob Hoevel
Cajun CoCo Club
104 Karen St.
New Iberia, LA 70560
318-365-7706

Moncton, N.B.

CoCoMUG (Color Computer Moncton User's Group) would like to hear from prospective members and other user's groups.

CoCoMUG
Leo Allain, Pres.
91 Woodland Drive
Moncton, New Brunswick
E1E 3C4

Morgantown, W. (almost heaven) Va.

The Mountain State Color Computer User's Group has changed its mailing address. We meet the third Sunday of each month and have a newsletter.

Mountain State Color Computer User's Group
Donald G. Barber, Jr.
Box 1084
Morgantown, WV 26507
304-599-4493

Port Hardy, B.C.

The North Island CoCo Club meets the first Tuesday and third Wednesday of each month at the Port Hardy Secondary School. We have a software, reading, and hardware library.

North Island CoCo Club
Box 1740
Port Hardy, British Columbia
V0N 2P0
604-949-6761

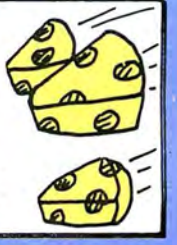
Niagara Peninsula

The Niagara Regional CoCo Club meets from 1–4 p.m. every second Sunday in the cafeteria of Confederation High School (670 Tanguay Ave., Welland, Ontario). Anyone interested can contact Gerry Chamberland at 416-357-3462, or phone or write me.

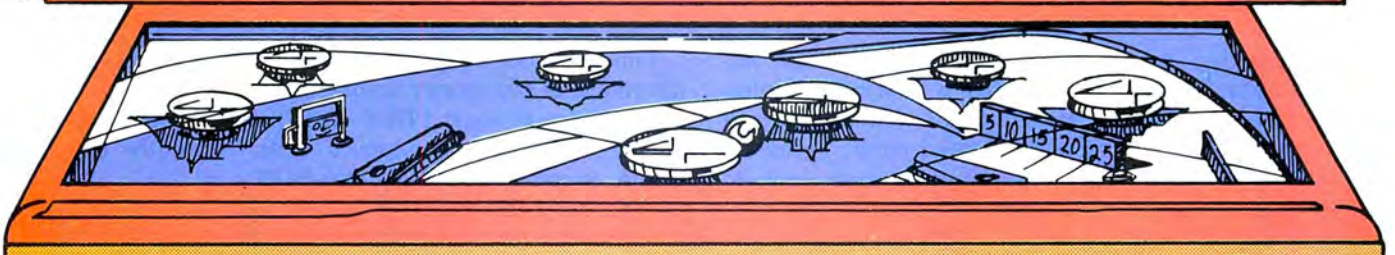
Gilles Prescott
7707 Jubilee Drive
Niagara Falls, Ontario L2G 7J3
416-734-3529

ELMER'S ARCADE

TANTRUM PART II— CHEESE BOMBS



Robert Dukette



instant CoCo

by Richard Ramella

I don't spend all my time splurging pennies at Elmer's Arcade. Sometimes I lie on the floor beneath my computer and engage in deep thoughts about humanity. Sometimes, when I am on the verge of fitting the last jigsaw piece into the puzzle—say, world peace or a cheap interstellar drive—I fall asleep.

And that's where I was and what I was doing when a rough hand shook my shoulder.

"Get me Warp 12, Scotty!" I cried out.

"Captain, she won't take it!"

"Well—" I opened my eyes. Elmer was standing over me. It was he who had spoken.

"Oh," I said, somewhat relieved I wasn't actually on the bridge of the Enterprise facing a horde of Ywerti ships. I crawled from beneath the desk and was surprised to see a second person in the room, a middle-aged man in a sharkskin suit.

"Allow me to introduce Silas Barnaby of Aunt Sally Software," said Elmer.

"Aunt Sally Software!" I said.

"You ought to hang some tapestries to cut down on the echo," the man said.

"*THE* Aunt Sally Software?" It was difficult to believe the guy was from a software firm. Most micro moguls, as we all know, are no more than 16 years old.

"The same," said Barnaby. He turned to Elmer, "Are you sure this is the guy who wrote Cheese Bombs?"

"At my guidance," said Elmer.

Barnaby shook my hand. "For a kid who couldn't add two plus two in Assembly language, you do okay in Basic."

"Thanks," I said.

System Requirements

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"I don't want to rush you," Barnaby went on, "but I did bring the contract with me."

"Contract?" I said.

"I've already signed," said a happy Elmer.

"It's a good one," said Barnaby. "A five-thou advance against straight royalties of 25 percent. We make 50,000 copies each on disk and tape. And they'll be in the pipeline of our worldwide distribution system within two weeks. Of course, we reserve the right to opt for an arcade version, and in that eventuality you'll get 2 percent of the gross."

"I . . . I . . . I . . ."

"So sign," said Elmer.

"Let me get this straight, Mister Barnaby. You want rights to Cheese Bombs."

"Normally," said Barnaby, "I'd be a bit more coy, but yes, we want those rights very badly."

"Paydirt!" Elmer chortled.

"You don't hear many people chortle these days," Barnaby said. "Lewis Carroll coined the word. A chortle is a blend of a chuckle and a snort, and you do it very well, Elmer."

"I can't sign," I said.

"Here, let me guide your hand," said Elmer.

"I already sold the program to a magazine."

"What!" cried Elmer. "Get it back! Burglarize the magazine's office!"

"They have already paid me," I said sorrowfully.

"You never mentioned that! What about my share?"

"I was going to get around to it."

Barnaby had already folded the contract back into his sharkskin covering.

Oh, I could go on and on about what happened next. Basically, it was just Elmer foaming at the mouth about how I had cheated him, about how my brains would fit into very small receptacles with room left over for lots of other things. His departure was somewhat like a tornado moving slowly out of my life.

I sat numbly alone before the computer. Let's see...25 percent of $25 times 100,000 copies sold...No, that way lay madness.

I picked up the telephone and called the magazine. No, I didn't try to get the program back. A promise made is a debt unpaid. I asked if it would be possible to write another article for the program.

This article. The one you're reading.

I wanted to let you know what a great program Cheese Bombs is.

But I still haven't done my job.

If you visited Elmer's Arcade in *HOT CoCo*'s March issue, you recall that Elmer had written a terrible children's poem called *Tantrum*. Last month's game, Cheese Louise, set that poem into the computer. The little mouse, Louise, had to move through a jumble of three hopping robots to claim bits of cheese and points.

"A score in the thousands is possible. For you masochists, I've made the top rating, Provolone, available only to the player who successfully protects Pete for a score of 6,000 or more."

This month we continue the saga of *Tantrum*. In the second part of Elmer's poem, which I will altogether spare you, Louise eats a magical morsel of cheese that causes her to become a giant mouse. Two of the robots run away, but robot Pete gets trapped in a closet, where he must dodge cheese bombs thrown by Louise. In Elmer's poem, peace is eventually made between robots and mouse, and Louise reverts back to her original size.

Now, while trying not to think about software fortunes, let's play Tantrum Part II—Cheese Bombs.

To start, type RUN and tap the enter key. There is a brief title, and the game begins immediately.

Louise is too large to get on the screen, but in a closet at center screen is the orange robot named Pete. There are two vertical and three horizontal shafts going through the closet, and through them come cheese bombs. They're yellow.

You must help Pete avoid the cheese bombs by tapping the four arrow keys so he will jump out of the way. If a bomb hits him, he gets all gooey and the game ends.

It's as simple as that.

Well, there's a little bit more. Each bomb that Pete successfully dodges scores points for you. There are six playing levels, and they are marked by the color of the screen. Pete must dodge 10 cheese bombs on each level except the last one, magenta. At this level, the game continues until Pete is hit by a cheese.

Here are the color levels and the points scored for each averted cheese on that level: Green, 1; Yellow, 2; Blue, 4; Red, 8; Buff, 16; Cyan, 32; Magenta, 64.

If you reach the magenta level, you just keep scoring 64 points for every bomb that misses Pete.

As you first play Cheese Bombs, you may think it's tough. But keep tapping those arrow keys and experimenting with Pete's available movement. No matter from where the bomb comes, there is always a position Pete can take to avoid it.

At first the cheese bombs travel slowly. In succeeding color levels, the bombs get faster, and so must you.

A score in the thousands is possible. For you masochists, I've made the top rating, Provolone, available only to the player who successfully protects Pete for a score of 6,000 or more. For the other ratings and the relationships, see DATA line 140 of the Program Listing.

And that, somewhat sadly, is that for this month. If you want help debugging any program I do for Elmer's Arcade, write me: Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926. You must include a self-addressed, stamped envelope. If you have a printer, include a listing of the program as it is in your machine. In any case, tell where you get an error message and what the program seems to be doing wrong. I can't help if you've modified the program in any way.

P.S.—Guess what? That rat Elmer just called. He told me it was all a joke. The guy Barnaby was his brother-in-law, not a rep for Aunt Sally Software. He was still laughing when he hung up.

I don't know whether to feel relief or sadness. Obviously, I haven't been called up to the big leagues after all. But on the other hand, I didn't miss a golden opportunity. I suppose I feel...kind of the same. You go enjoy a few games of Cheese Bombs. I'm going to crawl under my computer desk and solve some intergalactic problems. ■

"You go enjoy a few games of Cheese Bombs. I'm going to crawl under my desk and solve some intergalactic problems."

```
110 REM * ELMER'S ARCADE #10 * A
PRIL 1984
120 CLEAR 500
130 DIM V$(14)
140 DATA CURD,COTTAGE,CREAM,PROC
ESS,JACK,LIMBERGER,MOZZARELLA,GO
RGONZOLA,SWISS,LONGHORN,NEUFCHAT
EL,EDAM,BRIE,CAMEMBERT,PROVOLONE
150 FOR A=0 TO 14
160 READ V$(A)
170 NEXT
180 W=1
190 Z1=1
200 X1=32
210 QQ=1
220 CLS
230 H$=CHR$(128)
240 PRINT @ 232,"TANTRUM - PART
2"
250 PRINT @ 266,"CHEESE BOMBS"
260 A=TIMER
270 IF A>1000 THEN A=A-1000: GOT
O 270
280 FOR B=1 TO A
290 C=RND(10)
300 NEXT
310 X=1
320 P=1024
330 R=139
340 J=18
350 V=1
360 Y$=CHR$(143+16)
370 U1$=CHR$(94)
380 D1$=CHR$(10)
390 L1$=CHR$(8)
400 R1$=CHR$(9)
410 FOR A=1 TO 10
420 Z$=Z$+CHR$(128)
430 NEXT A
440 Z=112
450 A$=CHR$(128)
460 B$=CHR$(129+Z)
470 C$=CHR$(130+Z)
480 D$=CHR$(131+Z)
490 E$=CHR$(132+Z)
500 F$=CHR$(133+Z)
510 I$=CHR$(136+Z)
520 K$=CHR$(138+Z)
530 M$=CHR$(140+Z)
540 N$=CHR$(141+Z)
550 O$=CHR$(142+Z)
560 P$=CHR$(143+Z)
570 A$(1)=Z$
580 B$(1)=Z$
590 C$(1)=Z$
600 D$(1)=A$+A$+A$+A$+F$+K$+A$+A
$+A$+A$
610 E$(1)=A$+A$+A$+P$+P$+P$+P$+A
$+A$+A$
620 F$(1)=A$+A$+A$+K$+P$+P$+F$+A
$+A$+A$
630 G$(1)=A$+A$+A$+A$+K$+F$+A$+A
$+A$+A$
640 H$(1)=A$+A$+A$+D$+K$+F$+D$+A
$+A$+A$
650 A$(2)=Z$
660 B$(2)=Z$
670 C$(2)=A$+A$+A$+A$+F$+K$+A$+A
$+A$+A$
680 D$(2)=M$+M$+M$+M$+P$+P$+M$+M
$+M$+M$
690 E$(2)=A$+A$+A$+A$+P$+P$+A$+A
$+A$+A$
700 F$(2)=A$+A$+O$+M$+M$+M$+M$+N
$+A$+A$
710 G$(2)=A$+E$+I$+A$+A$+A$+A$+E
$+I$+A$
720 H$(2)=Z$
730 A$(3)=A$+A$+A$+K$+A$+A$+F$+A
$+A$+A$
740 B$(3)=A$+A$+A$+K$+F$+K$+F$+A
$+A$+A$
750 C$(3)=A$+A$+A$+M$+P$+P$+M$+A
$+A$+A$
760 D$(3)=D$+A$+A$+A$+P$+P$+A$+A
$+A$+D$
770 E$(3)=M$+M$+M$+M$+M$+M$+M$+M
$+M$+M$
780 F$(3)=Z$
790 G$(3)=Z$
800 H$(3)=Z$
810 Q$=LEFT$(Z$,8)
820 A$(4)=Z$
830 B$(4)=Z$
840 C$(4)=Z$
850 D$(4)=P$+C$+Q$
860 E$(4)=P$+D$+Q$
870 F$(4)=P$+P$+Q$
880 G$(4)=F$+A$+Q$
890 H$(4)=F$+D$+Q$
900 A$(5)=Z$
910 B$(5)=Z$
920 C$(5)=Z$
930 D$(5)=Q$+B$+P$
940 E$(5)=Q$+D$+P$
950 F$(5)=Q$+P$+P$
960 G$(5)=Q$+A$+K$
970 H$(5)=Q$+D$+K$
980 CLS
990 GOSUB 1540
1000 X=1
1010 GOSUB 1650
1020 N=0
1030 D=RND(10)
1040 IF SS>4999 THEN Z1=2: X1=64
1050 IF D=1 THEN FOR F=192 TO 22
0 STEP Z1 ELSE IF D=2 THEN FOR F
=223 TO 195 STEP -Z1: GOTO 1100
1060 IF D=3 THEN FOR F=288 TO 31
6 STEP Z1 ELSE IF D=4 THEN FOR F
=319 TO 291 STEP -Z1: GOTO 1100
1070 IF D=5 THEN FOR F=352 TO 38
0 STEP Z1 ELSE IF D=6 THEN FOR F
=383 TO 355 STEP -Z1: GOTO 1100
1080 IF D=7 THEN FOR F=17 TO 433
 STEP X1 ELSE IF D=8 THEN FOR F=
497 TO 81 STEP -X1: GOTO 1100
1090 IF D=9 THEN FOR F=14 TO 430
 STEP X1 ELSE IF D=10 THEN FOR F
=494 TO 78 STEP -X1: GOTO 1100
1100 S$=INKEY$
1110 IF S$="" AND N=0 THEN 1160
ELSE IF S$="" THEN 1170
1120 IF S$=R1$ AND X=4 THEN X=1
ELSE IF S$=R1$ AND X=1 THEN X=5
1130 IF S$=U1$ AND X=1 THEN X=2
ELSE IF S$=U1$ AND X=2 THEN X=3
1140 IF S$=D1$ AND X=3 THEN X=2
ELSE IF S$=D1$ AND X=2 THEN X=1
1150 IF S$=L1$ AND X=5 THEN X=1
ELSE IF S$=L1$ AND X=1 THEN X=4
1160 GOSUB 1650
1170 PRINT @ G,CHR$(128);
1180 IF PEEK(P+F)<>128 THEN PRIN
T @ F,Y$;: GOTO 1310
1190 PRINT @ F,Y$;
1200 G=F
1210 FOR T=1 TO J
1220 NEXT T
1230 NEXT F
1240 SS=SS+(QQ*V)
1250 N=N+1
1260 IF N=10 AND W<7 THEN W=W+1:
 J=J-3: N=0: V=V*2: CLS W: GOSUB
 1540: GOSUB 1650
1270 PRINT @ 480,"SCORE:";SS;
1280 SOUND 200,1
1290 IF N=0 THEN FOR T=1 TO 3: S
OUND 147,3: SOUND 176,2: SOUND 1
93,2: NEXT
1300 GOTO 1030
1310 IF SS<9 THEN A=0
1320 IF SS>9 THEN A=1
1330 IF SS>29 THEN A=2
1340 IF SS>69 THEN A=3
1350 IF SS>149 THEN A=4
1360 IF SS>309 THEN A=5
1370 IF SS>629 THEN A=6
1380 IF SS>1269 THEN A=7
1390 IF SS>1499 THEN A=8
1400 IF SS>1799 THEN A=9
1410 IF SS>2399 THEN A=10
1420 IF SS>2999 THEN A=11
1430 IF SS>3499 THEN A=12
1440 IF SS>4999 THEN A=13
1450 IF SS>5999 THEN A=14
1460 PRINT @ 448,"RATING: ";V$(A
);" CHEESE";
1470 PRINT @ 0,"TASTE MY CHEESE,
 VARLET !";
1480 K=RND(90)
1490 SOUND K,1
1500 SOUND K+50,1
1510 SOUND K+100,1
1520 SOUND K+150,1
1530 GOTO 1470
1540 FOR A=192 TO 223
1550 PRINT @ A,H$;
1560 PRINT @ A+96,H$;
1570 PRINT @ A+160,H$;
1580 NEXT
1590 FOR A=14 TO 494 STEP 32
1600 PRINT @ A,H$;
1610 PRINT @ A+3,H$;
1620 NEXT
1630 G=192
1640 RETURN
1650 PRINT @ R,A$(X);
1660 PRINT @ R+32,B$(X);
1670 PRINT @ R+64,C$(X);
1680 PRINT @ R+96,D$(X);
1690 PRINT @ R+128,E$(X);
1700 PRINT @ R+160,F$(X);
1710 PRINT @ R+192,G$(X);
1720 PRINT @ R+224,H$(X);
1730 RETURN
1740 END
```

Program Listing. Tantrum Part II, Cheese Bombs

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The Basic Beat

THE FIRST STEPS TO BASIC PROGRAMMING LESSON 11

by James W. Wood

You've reached the end of the trail. This month's "Basic Beat" is the last, so I'll give you a final exam and then show you how to transfer Assembly listings to Basic.

Take the final exam (Fig. 1), using any notes or earlier columns if you need help. The answers are printed upside down at the end of the column. Multiply the number correct by four to determine your score. The grading scale is as follows: 61–70, passing; 71–80, good; 81–90, very good; and 91–100, excellent.

If you passed, there's a diploma for you after you've finished this lesson. Remove it and fill in your name and the date. To make it look official, have it notarized and framed.

```
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3F00 BD     A1B1      00120 LABEL     JSR       POLCAT
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3F0B 26     F9        00160           BNE       SCREEN
3F0D 20     F1        00170           BRA       LABEL
            0000      00180           END
00000 TOTAL ERRORS

LABEL     3F00
POLCAT    A1B1
SCREEN    3F06
```

Program Listing 1. An Assembly Program

Assembly to Basic

Basic is a useful language. There are few math operations, business applications, or graphics that it can't perform. However, Basic is much slower than Assembly language (another programming language). But Basic is built into your CoCo; Assembly isn't.

You need an assembler if you want

System Requirements

4K RAM
Color Basic

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This certifies that _____
has completed the "Basic Beat" series as presented in *HOT CoCo* magazine.
Awarded this _____ day of _____, 19_____.
Congratulations,

James W. Wood
James W. Wood, Instructor

```
10 CLS
20 PRINT"MACHINE LANGUAGE HEX PO
KER.":PRINT
30 PRINT"PLACE DATA IN LINE 280.
"
40 INPUT"ORG (HEX)";A$
50 IF LEN(A$)>4 THENPRINT"TOO LO
NG":GOTO40
60 IF LEN(A$)=3 THEN A$="0"+A$
70 FORA=1TO4
80 C$(A)=MID$(A$,A,1)
90 IF ASC(C$(A))>64 THEN C$(A)=S
TR$(ASC(C$(A))-55)
100 NEXTA
110 V=VAL(C$(1))*4096+VAL(C$(2))
*256+VAL(C$(3))*16+VAL(C$(4))
120 PRINTV;"IS DECIMAL FOR ";A$:
VV=V
130 READ DA$:IF LEN(DA$)=1 THEN
DA$="0"+DA$
140 FOR A=1TO2
150 C$(A)=MID$(DA$,A,1)
160 IFASC(C$(A))>64 THEN C$(A)=S
TR$(ASC(C$(A))-55)
170 NEXTA
180 POKEV,VAL(C$(1))*16+VAL(C$(2
))
190 IF LD$="00" AND DA$="00" THE
N 200 ELSE LD$=DA$:V=V+1:GOTO130
200 PRINT"START ADDRESS=";VV
210 PRINT"END ADDRESS=";V
220 PRINT"EXECUTE              (E)"
230 PRINT"QUIT                 (Q)"
240 IN$=INKEY$
250 AB$=INKEY$:IFAB$="E"THEN EXE
C VV:END
260 IF AB$="Q"THEN END
270 GOTO250
280 REM **DATA LINE HERE**
```

Program Listing 2a. Program to Enter Assembly Listings from Color Basic

```
10 CLS
20 PRINT"MACHINE LANGUAGE HEX PO
KER.":PRINT
30 PRINT"PLACE DATA IN LINE 280.
"
40 INPUT"ORG (HEX)";A$
50 V=VAL("&H"+A$)
60 PRINTV;"IS DECIMAL FOR ";A$:V
V=V
70 READ DA$
80 IF LEN(DA$)=1 THEN DA$="0"+DA
$
90 VA=VAL("&H"+DA$)
100 POKEV,VA
110 IF LD$="00" AND DA$="00" THE
N 120 ELSE LD$=DA$:V=V+1:GOTO70
120 PRINT"START ADDRESS=";VV
130 PRINT"END ADDRESS=";V
140 PRINT"EXECUTE              (E)"
150 PRINT"QUIT                 (Q)"
160 PRINT"SAVE TO TAPE         (S)"
170 IN$=INKEY$
180 AB$=INKEY$:IFAB$="E"THEN EXE
C VV:END
190 IF AB$="E" THEN EXEC VV
200 IF AB$="Q"THEN END
210 IF AB$="S"THEN230
220 GOTO180
230 PRINT"INSERT TAPE,":PRINT"PR
ESS PLAY AND RECORD."
240 INPUT"GIVE NAME TO SUBROUTIN
E.";SN$
250 CSAVEM SN$,VV,V,VV
260 GOTO140
270 REM***DATA LINE HERE****
```

Program Listing 2b. Program to Enter Assembly Listings from Extended Color Basic

Final Exam (True-False)

1.) CLEAR is used to erase all printing on the screen.
2.) PRINT A will print the letter A.
3.) NEW will erase all values that were POKEd into high memory.
4.) The CoCo can distinguish between the variables A and AB.
5.) PRINT 5+2*3 will display the number 21.
6.) A<>B means that A does not equal B.
7.) String variables can be added.
8.) RND(20) is used to round off numbers.
9.) CLS 8 will turn the screen orange.
10.) There are four SET positions in one PRINT@ position.
11.) There are only 256 PRINT@ positions on the video monitor.
12.) MUSIC is the Color Basic command to generate tones.
13.) SET graphics are faster than CHR$ graphics.
14.) POINT can be used to determine the color of a SET position.
15.) ABS (2.3)=2.
16.) INT (2.8)=2.
17.) The computer ignores everything after REM in a line.
18.) The statement W=W+1 will increase the value of W by 1.
19.) The READ command accesses information in DATA lines.
20.) Video memory starts at memory location 1024.
21.) PRINT CHR$(66) will print the letter C.
22.) MID$("COMPUTER",3,4)="PUT".
23.) PRINT#1 allows the Color Computer to store data on tape.
24.) The line FOR E=1 TO 10 STEP 3:NEXT E will assign values to E of 1, 3, 6, and 9.
25.) A TRS-80 Model III Basic program listing will always work when typed into a Color Computer.

Fig. 1. Your True/False Final Exam

```
3F00                    00100           ORG     $3F00
3F00 8E   0400          00110 START     LDX     #$400
3F03 A6   84            00120 SCREEN    LDA     ,X
3F05 81   EF            00130           CMPA    #$0EF
3F07 2F   04            00140           BLE     OKAY
3F09 80   70            00150           SUBA    #$70
3F0B 20   02            00160           BRA     LOOP
3F0D 8B   10            00170 OKAY      ADDA    #$10
3F0F A7   80            00180 LOOP      STA     ,X+
3F11 8C   0600          00190           CMPX    #$600
3F14 26   ED            00200           BNE     SCREEN
3F16 39                 00210 DONE      RTS
          0000          00220           END
00000 TOTAL ERRORS

DONE      3F16
LOOP      3F0F
OKAY      3F0D
SCREEN    3F03
START     3F00
```

Program Listing 3. Assembly Program to Rotate Colors

to write your own Assembly-language program. This is a software program that converts the short Assembly-language commands into numbers, then POKEs these numbers into specific memory locations. The computer's central processing unit understands this code directly—it's the computer's own language; whereas, an interpreter must translate Basic commands each time they are executed.

Assembly programs from various sources are available in ROM-pack, cassette, and disk versions. I used Radio Shack's EDTASM+ on the programs in this lesson.

You'll often see Assembly-language listings published without the equivalent Basic program. If the Assembly listing contains the assembled machine-language code in the form of a base-16 number, you can enter it without an assembler.

Program Listing 1 looks different

from a Basic listing. To use it directly, you must own a 16K CoCo and an editor/assembler.

Our mission is to enter the listing into the computer without an assembler. I'll show you a way to accomplish this with a Color Basic computer, and an easier method that only works on an Extended Color Basic machine.

Listing 1 fills the screen with the keyboard letter being pressed. You can't enter the program as is without an assembler, but Program Listings 2a and 2b let Basic enter Listing 1.

Listing 2a is for Color Basic and Listing 2b is for Extended Color Basic. Extended Color Basic changes the hexadecimal numbers to base-10 numbers, but you must program Color Basic especially for that task.

What are hexadecimal numbers, anyway? Listing 1 is loaded with hexadecimals. The left column starts with 3F00 and ends at 3F0D. 3F00 is a hexadecimal number. It represents 3 times 16 cubed, plus 15 times 16 squared, plus 0 times 16, plus 0 times 1, which equals 16128.

The decimal system has 10 symbols, 0–9. Hex has 16 symbols: 0–9, plus A, B, C, D, E, and F. Figure 2 shows the relationship between decimal and hex.

Changing a hex number to decimal isn't extremely difficult. Multiply the value of each symbol times its position value and add the results. The hex number E6 equals 14 times 16 plus 6 times 1, and the computer can handle the work. After converting the hex numbers to decimal, you must POKE them into memory locations.

The left column of Listing 1 consists of memory locations. The second and third columns are hexadecimal numbers that represent the compiled program. The fourth column consists of line numbers (100–180). Column five has labels. Column six contains the Assembly-language commands, and column seven consists of numbers, addresses, and labels. I could have included an eighth column for remarks.

To run Listing 1 from Basic, POKE the numbers from the second and third columns into the memory locations (first column). Starting at the command ORG, take numbers from the second and third columns in groups of two. They would be BD, A1, B1, 8E, 04, 00, A7, 80, 8C, 06, 00, 26, F9, 20, F1, 00, and 00. Place these in the DATA line of Listing 2 and run the program. Answer ORG? with 3F00 (for a 4K machine, use ED8).

After you POKE the machine-language program into memory, the program from Listing 2 will give you its starting and ending addresses and then a choice of quitting or running the program.

The Extended Color Basic version of Listing 2 will save the machine-language program on tape. You can quit and save Listing 2 on cassette. You can use Listing 2 over with another DATA line for another program. You can enter NEW, and by entering EXEC 16128 (starting address), the machine-language program that you POKEd into memory will still work. NEW does not erase the program POKEd into memory.

The 4K machine would need an EXEC 3800. If you want to save the Basic listing, change line 40 to A$="3F00" so you won't have to remember how to respond to ORG?.

Only the Extended Color Basic machine will save the machine language to tape. However, you can use this tape on either the Color Basic or Extended Color Basic computer. Enter CLOADM to load the machine-language tape and type EXEC to run it. You can't list the program, however.

Listing 1 is interesting, but it doesn't leave you with much to play with. Program Listing 3 is an Assembly-language program that rotates colors. Green graphics are changed to yellow, yellow to blue, and so on. Orange changes back to green.

After using Listing 2 to POKE the hexadecimal numbers from Listing 3 into memory, type NEW. Type in Program Listing 4 and run it to call the program that Listing 3 POKEd into memory.

When you become tired of that, try Program Listing 5. It also needs the information you POKEd into memory from Listing 3. Make up graphics of your own and use Listing 3 to flash the color around.

While you are still dazzled by these graphics displays, I'll quietly take my leave. But keep an eye out; there are more programs and programming methods on the way. So long, Graduate! ■

```
10 CLS0:CLEAR200,16128
20 REM TOP
30 FORX=2TO60STEP2
40 C=C+1:IFC=9THENC=1
50 SET(X,0,C):NEXTX
60 REM TOP
70 FORY=2TO28STEP2
80 C=C+1:IFC=9THENC=1
90 SET(60,Y,C):NEXTY
100 REM BOTTOM
110 FORX=60TO2STEP-2
120 C=C+1:IFC=9THENC=1
130 SET(X,30,C):NEXTX
140 REM LEFT
150 FORY=28TO2STEP-2
160 C=C+1:IFC=9THENC=1
170 SET(2,Y,C):NEXTY
180 EXEC16128
190 FORT=1TO100:NEXTT:GOTO180
```

Program Listing 4. Program to Call Listing 3

Decimal	Hex
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F
16	10
17	11
18	12
19	13
20	14
255	FF

Hex number ____ ____ ____ ____
4,096s 256s 16s 1's

Decimal number ____ ____ ____ ____
1,000s 100s 10s 1's

Fig. 2. Decimal/Hexadecimal Relationships

```
10 CLS0:CLEAR200,16128
20 FORX=2TO14STEP2
30 A=63-X:B=31-X
40 C=C+1
50 FORZ=X TO A
60 SET(Z,X,C):SET(Z,B,C)
70 NEXTZ
80 FOR Z=X TO B
90 SET(X,Z,C):SET(A,Z,C)
100 NEXTZ,X
110 EXEC16128
120 FOR T=1 TO 100:NEXTT:GOTO110
```

Program Listing 5

The following are false.
1,2,3,5,8,11,12,13,14,15,21,22,23,24,25

Answers to Final Exam

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CoCo 16K ECB . . . . . Tape: $19.95 Disk: $25.95

CRISS–CROSS MATH

As the program begins, your child is presented with a nine square playing board. It is your choice as to which square you choose. After a choice is made, a MATH PROBLEM appears in the square. You score your first X by answering the problem correctly. If your answer is incorrect, the square clears and your opponent is allowed his choice of squares. The game is over when three squares vertically, horizontally, or diagonally are won by the same player. When playing against the computer, every answer you get wrong is won by the computer. Multi-level ADDITION AND SUBTRACTION program.

CoCo 16K . . . . . Tape: $12.95

FRACTIONS

SIDE ONE: Fraction Lessons, explains fractions with the aid of graphics. Child studies the different ways fractions can be represented. Lessons include:

IMPROPER FRACTIONS
MIXED FRACTIONS
PROPER FRACTIONS

Many educators have praised the use of motion and color to display the fractional equivalents.

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Atari 16k . . . . . Tape: $19.95
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Joystick Draw is the simple way to explore your artistic talents! Program operation is easy enough for a child to use, but effective enough that TCE uses it to design many sophisticated high-resolution graphic screens. Joystick Draw's design allows you or your child to save those masterpieces for future revisions or for use in other programs (instructions included). Your child will spend many hours enjoying this program and at the same time improving his or her eye hand coordination! You will find Joystick Draw to be an easy way to design those more sophisticated graphics for your own programs!

CoCo 16 ECB . . . . . Tape: $16.95

SPELL BOMBER

As captain of your ship, you must destroy the enemy bomber by spelling the mystery word. In this exciting and educational game the bomber gets closer with each inaccurate letter. You have only EIGHT tries to guess the mystery word or your ship will be bombed! If you guess the word correctly, GENERAL QUARTERS will sound and your ship will fire a missile to destroy the bomber, Three levels are available: EASY, MEDIUM, and HARD. Challenging for all ages!

Atari 16K . . . . . Tape: $18.95
CoCo 16k ECB . . . . . Tape: $18.95 Disk: $22.95
Vic 20 13k . . . . . Tape: $18.95

SPELLING BEE

The word is pronounced vocally and it is up to you to type in the correct spelling. If wrong, the computer will be your friend and flash the word on the screen for just an instant. OK! Try typing the word in again. STILL WRONG! The computer wants success and allows you to see the word again this time a little longer. If you just can't spell the word, the computer realizes you need to learn to spell the word and leaves the word on the screen for you to copy. Try your best and the computer has a surprise for your reward!

SPELLING BEE I . . . GRADE 1 & 2
SPELLING BEE II . . GRADE 3 & 4
SPELLING BEE III . . . GRADE 5 & 6
SPELLING BEE IV . . . GRADE 7 & 8

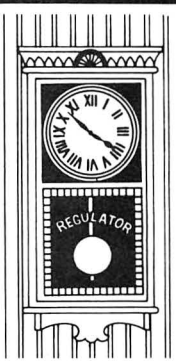
CoCo 16k ECB . . . . . TAPE: $16.95 Each

TC—INVENTORY

Many insurance companies offer a discount for policy holders which have complete inventories on file. TC — Inventory is designed to help you organize, maintain, and compile the personal belongings of your home. Program is user friendly and menu driven. TC — Inventory allows input for location of item, price of item, serial number of item, date of purchase, and a text written description of the item. Don't put off recording your personal belongings until its too late. Requires printer for hard copy.

CoCo 32k ECB . . . . . Tape: $16.95

TEACHING CLOCK



Torn between teaching time on a digital or a conventional (face and hands) clock? Well, this program combines the two using high resolution graphics and prompts! Your child will learn to tell time with the aid of a specially designed CLOCK! Child enters the time, if wrong, the center of the clock displays a graphic aid. If the child is correct a musical reward is heard. Program offers three levels: hours, quarter hours, and five minute intervals.

Apple 48k . . . . . Disk: $19.95
Atari 32k . . . . . Tape: $16.95
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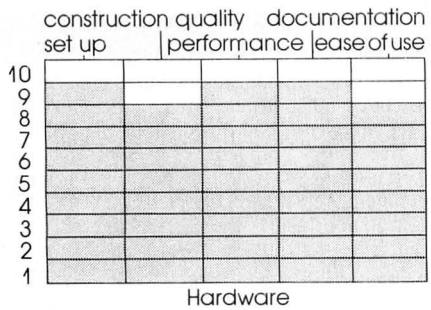
Black Sanctum, Shenanigans, Sea Quest, Tut's Tomb, Stellar Search, Icemaster, Foodwar.

edited by Mark E. Reynolds



Premium Keyboard
Micronix Systems Corp.
8147 Delmar
St. Louis, MO 63130
$79.95

by Guy Wright
***HOT CoCo* staff**

What has 56 keys but no lock?—how about Micronix Systems' Premium Keyboard?

Although some users might feel that the CoCo's original keyboard works just fine, the Premium Keyboard is obviously an improvement.

This keyboard comes with a nine-page user's manual and a program called Versakey that lets you program four function keys (more about the function keys later).

The first three pages of the user's manual cover the installation, and although they are simple and profusely illustrated with photographs, I felt that they could have been even clearer and the photographs more detailed.

This does not mean, however, that it is difficult to install the keyboard. On the contrary, there are no wires to solder, no chips to touch, and no pins to bend. With a little common sense, anyone who can unscrew seven screws, unplug the old keyboard, and plug in the new one can install the Premium Keyboard in a few minutes.

The key layout is identical to that of the original, but you now have four function keys in the lower left corner of the keyboard.

The Color Computer scans the new keyboard as a matrix of seven rows by eight columns (a maximum of 56 keys), whereas the original keyboard only uses 52 of these positions (both shift keys are polled as one key). Although the Basic ROM does not specifically scan the extra four matrix positions, the four function keys do generate ASCII codes, so it is a relatively easy matter to incorporate these keys into programs.

The user's manual gives more than enough technical information to make writing programs with function-key scanning a simple matter (you get a three-line programming example), and the machine-language driver program, Versakey, offers more programming help.

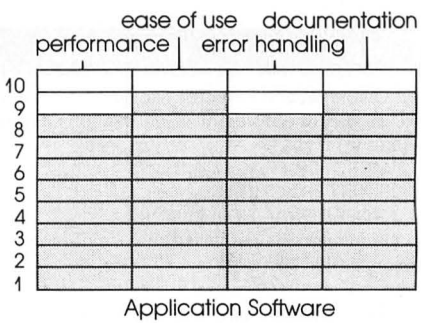
Versakey is relatively simple to use. After loading the program, press F1 (function key one) and the computer responds, "DEFINE:". Press any key (or combination of keys), and the computer prints the ASCII code for the key and asks for a definition.

Enter a string and press the F1 key when finished. From then on pressing that key generates the string. You can embed RETURNs and use multiple statements in the string definition, making the program very versatile. Note: The F4 key acts as a control key, thus giving four possible codes for each key: L, shift L, control L, and shift-control L.

Versakey also provides auto-repeat and type-ahead. A nice feature is the ability to save the program with defined key strings to tape or disk. The manual includes a complete Assembly listing of the program and gives all memory addresses. Versakey is a little awkward to use the first time, but after defining three keys, I was ready to redefine the entire keyboard.

The Premium Keyboard with Versakey is definitely worth the money if you use your Color Computer often. The keyboard is smooth operating and comfortable, and touch typists will feel right at home. There is a slight bit of sponginess to the keys, which should diminish with use.

The Premium Keyboard is easy to install, well documented, and solidly constructed. ■



Bar Zapper, Pie Zapper, and Graph Zapper
Southern Software Systems
485 South Tropical Trail
Suite 109
Merritt Island, FL 32952
$15.95, v. 1.0 (16–32K cassette),
$19.95, v. 2.0 (32K disk)
$44.95, all three cassette programs
$56.95, all three disk programs

by Scott L. Norman

Thomas Ernst's three Zappers are flexible, easy-to-use programs that produce high-resolution versions of three common graphs. While they do

have their limitations, the Zappers are suited to many applications in education, personal finance, and business.

The disk programs let you store data on tape or disk, and present you with a directory of the /DAT files on the working disk whenever you load data into the program.

The 32K tape and disk versions can store completed graphs in addition to the raw data files. To review as many features as possible, I have concentrated on the 32K disk editions.

Bar Zapper

The 32K version of Bar Zapper makes it easy to prepare graphs displaying up to 24 bars, with as many as five sub-bars per data item. With 16K, you can still display a total of 24 bars, but you are limited to three sub-bars. Sub-bars might show how several quantities vary from year to year, with each quantity broken down into the data for each year.

Bar Zapper has several layers of menus. The main menu lets you enter or edit bar data, load or store complete graphs, or zap a graph. Though this sounds like the option for killing a file, it is actually the process of setting up a display. The program calls up two other menus that assign labels and scales to the x and y axes, put a title on the graph, and define shading patterns for the bars.

The program is easy to use. Most menu items are self-explanatory, and the 25-page instruction booklet does a good job of explaining the options. It even includes an index, a rare feature in such a compact, low-priced package.

Editing can be a little tedious. Often you have to cycle through several lines of acceptable information before reaching the item you want to change.

The best way to describe a graphing program is with graphs. Figure 1 shows off some of Bar Zapper's features. It is a plot of the United States' imports and exports for certain categories of electronic products, and displays data for June of 1982 and 1983.

Since Bar Zapper is stripped down, you can't control the general formats of the graph title and the axis labels. You have to get used to vertical lettering on the y axis. The ability to handle negative numbers and exponential notation, however, more than compensates for this.

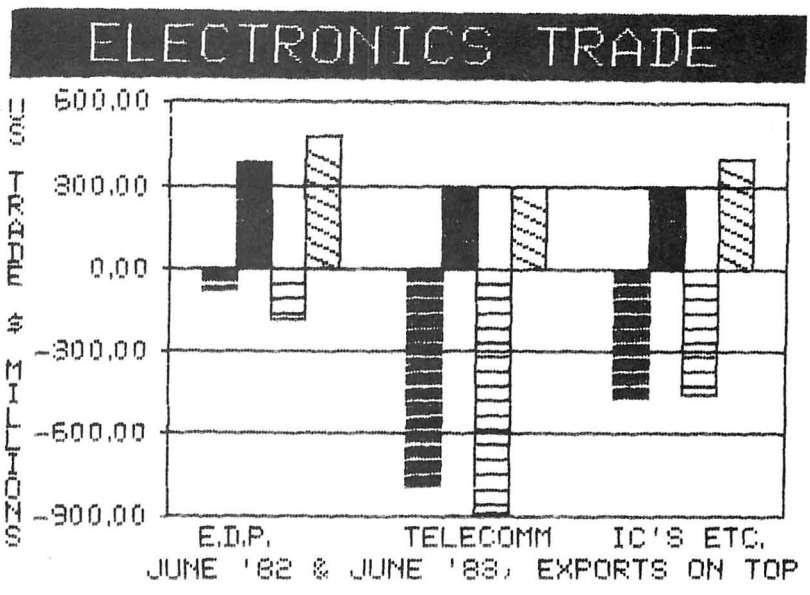


Fig. 1. A 3-Bar, 4-Sub-Bar Graph Prepared With Bar Zapper

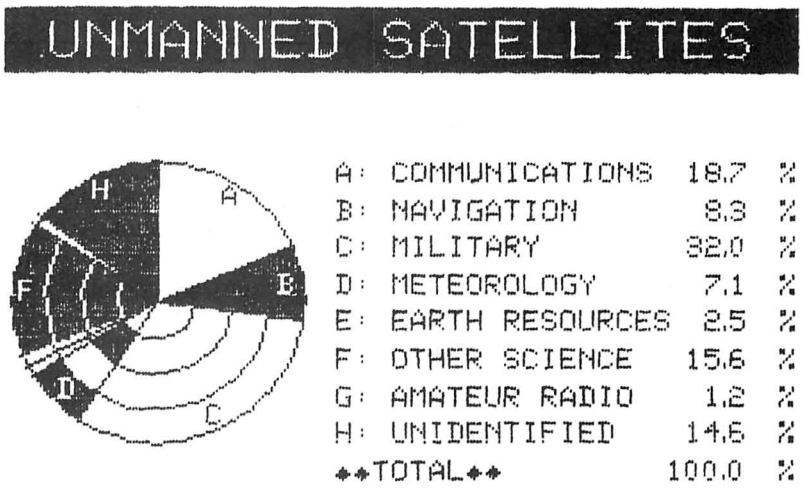


Fig. 2. A Pie Zapper chart. Note that small sectors E and G have identification letters that could not be printed on the chart.

There is no way to generate a key or legend chart to identify the bars, so I used the x-axis label to give you a clue to the organization of the graph. This is often necessary with multigroup Bar Zapper or Graph Zapper charts.

Bar Zapper's y-axis scale shifts to exponential notation whenever a number to be plotted is larger than 999.0 or smaller than 0.1. When that happens, the exponent appears by itself at the upper right side of the y axis.

The mantissa, carried out to two decimal places, stays in its usual place at the left of each tic mark. The Zappers handle the entire range of numbers allowed by Color Basic.

Bar Zapper numbers all tic marks on the vertical axis, but you can control the clutter by specifying the number of plotted marks. The horizontal scale lines extending from the tics are also optional.

As a final touch, a staircase-label option lets you fit more labels onto the horizontal axis by writing them in a staggered, descending format. There are trade-offs to be made between density and clarity here, and the manual spells them out.

One of the best features of the Zappers is the ease with which you can alter the data and the display features. If you don't like the way a graph

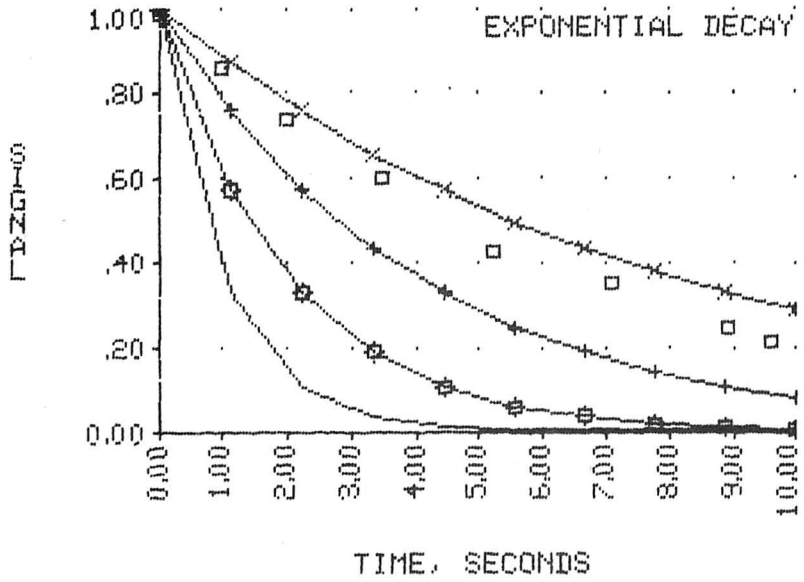


Fig. 3. A Graph Zapper graph of typed-in data (squares) and computed results. The curves represent the function y = exp(−x/t), with t values of 1, 2, 4, and 8 seconds (bottom to top).

looks, you can change it.

You can only edit bar *data* files; you can store completed graphs and recall them for viewing or printing, but you can't easily modify the actual data. It is always a good idea to save the data before going on to zap a graph.

Pie Zapper

The Pie and Bar Zappers are similar in operation. Pie Zapper can produce charts with up to 19 sectors, in two formats. You identify sectors by single letters, with the names of all data items listed separately on the chart, or by names arranged around the chart, connected to their sectors by straight lines.

Pie Zapper is happy with exponential notation and noninteger data. Negative numbers don't come up in pie-chart applications.

Figure 2 shows an example of the first pie format, a breakdown of unmanned objects in Earth orbit at some point during the summer of 1983. I entered only the number of satellites in each category, and the program calculated the percentages and drew the chart accordingly.

Pie Zapper cannot separate one or more sectors from the rest of a chart as a means of highlighting them.

Pie Zapper's processes of data entry, editing, and storage are very much like those of Bar Zapper, and the same precaution about saving raw data applies. If you insert a new sector into an existing file, the program shades the sector that was formerly in its position. The whole scheme of which sector gets which shading moves downstream by one increment.

Graph Zapper

This was the first of the three programs written, and is, in some ways, trickier to use than the other two. Still, it is not a difficult program.

Graph Zapper's big attraction is its ability to plot points defined either by what you have typed in or by an equation in a Basic subroutine. You can even mix the two types of data.

You can use five plotting symbols and connect points with straight lines. You can leave the background of the graph area blank, place dots at the intersections of x- and y-axis tic marks, or set up a complete x/y grid.

Screen prompts guide keyboard data entry, much the same as for the other two Zappers.

Using the equation-plotting option calls for a little more work. The documentation describes how to set up a subroutine as part of the Graph Zapper program itself. You must pay attention to line numbers and variable names, but other than that, things go well.

You can also construct a routine that prompts you to enter a parameter at run time, allowing you to plot a family of related curves. This is one of the options I demonstrate in Fig. 3.

Following the manual's examples, I wrote a simple routine to plot the decaying exponential function y = exp(−x/t), in which I entered the time constant, t, from the keyboard.

Figure 3 shows the results, with t values of 1, 2, 4, and 8 seconds represented by small dots (covered by the connecting line), circles, crosses, and x's, respectively.

Notice that there are other, unconnected symbols on the plot: small squares, intended to simulate data points that, say, a laboratory worker might enter to compare some sort of experimental results with a mathematically correct exponential signal.

To superimpose these points on the computed curves, you must store the equation graph, then construct and store a file for the experimental data. The final step is to load both graph and data, specifying that everything is to be plotted against the same scales. The technique can be extended to multiple data files.

I enjoyed working with the Zappers. They are logically organized, and it is easy to pick one up and produce a graph even when you have been away from them for a while.

I reviewed Radio Shack's Disk Graphics program in the February issue of *HOT CoCo*. Since the three Zappers together perform many of the same functions as the Shack's software, and at a comparable price, take a look at the major similarities and differences between the two products.

The Zappers are easier to use, if less versatile than Disk Graphics. They lack a color printing capability, and there is no analog to Radio Shack's Supersheet for changing the size of a printed graph. You have to live with the stock values, 4 3/16 inches wide by 3 1/16 inches high.

The Zappers also lack automatic scaling routines, so you must define maxima and minima for the axes.

The Zappers have no built-in printer driver, but their documentation does include a detailed explanation of how to interface with Custom Software Engineering's Graphics Screen Print Routine (which includes a magnification capability). Owners of similar routines should experience little trouble in customizing the Zappers.

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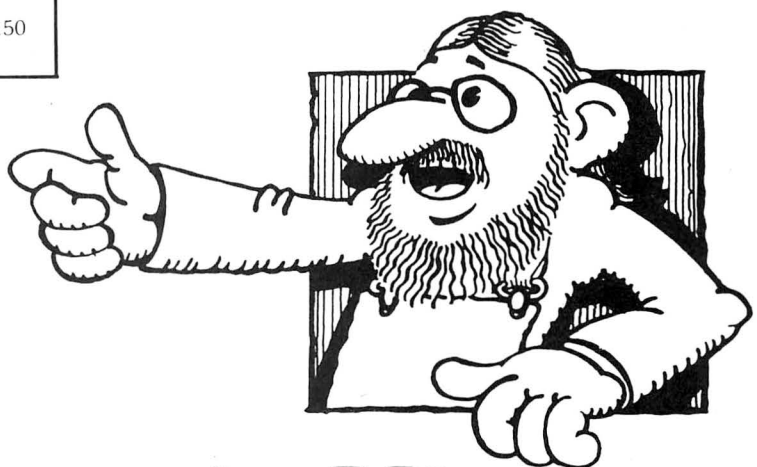

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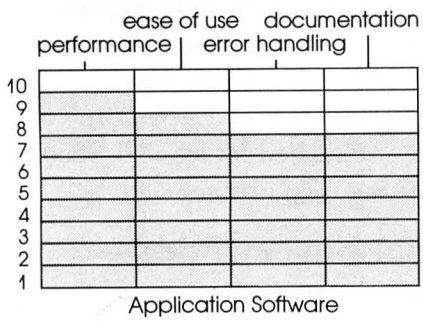
I was pleased with the power and flexibility of the Zappers. The exponential notation and negative number capabilities were especially welcome—and unmatched by Disk Graphics. I do wish they could generate key charts, though, as well as let me control the label and title formats and add comment lines to a graph.

An important consideration is the ease with which you can interface programs to each other. The Zappers' simple file structure and well-written documentation give them a head start in this area. It should be easy to write routines to link them to spreadsheet programs, for example. ■



Simplex
Skyline Marketing Corp.
4510 W. Irving Park Road
Chicago, IL 60641
16K, Extended Color Basic
$29.95, cassette

by Scott L. Norman

If you don't know what the simplex method is, or at least understand what it's good for, you might want to pass this one by. On the other hand, if you are familiar with the subject, you should find this program useful.

That sounds like a "You can't get there from here" story, but since Simplex represents the tip of an enormous mathematical iceberg, you'll have to understand it in order to appreciate the software.

Michael L. Peck's Simplex lets you employ some of the power of linear programming, the most popular mathematical-optimization technique.

Linear programming is often defined as a method of allocating limited resources among competing demands in some optimal way, and it has been successfully applied to a wide range of problems in distribution, transportation, finance, and other areas of management and engineering. You can use the simplex method to solve many types of linear programming problems.

In mathematical terms, Simplex maximizes or minimizes linear polynomial functions of several variables, subject to constraints that you can in turn express as linear polynomials. The expression to be optimized is called the objective function, and the variables are called decision variables. The objective function and constraints taken together are referred to as the model for the problem.

You do not need to understand the details of the method in order to use Simplex; however, you need the ability to formulate a problem in terms of an expression to be optimized under appropriately framed constraints.

Full-fledged linear-programming models can involve thousands of variables and constraints, and often consume large blocks of processing time on the largest mainframes. The CoCo's capabilities are a little more modest. A 16K machine handles a 19-variable, 19-constraint model, while 32K computers can handle 38-by-38 cases.

The memory required for a model and the time required to find a solution are more sensitive to the number of constraints than to the number of variables. A 32K computer can deal with a 20-constraint, 100-variable model, according to the documentation.

These numbers assume that you've reserved the maximum amount of memory. For this reason, and because Simplex benefits from the speedup POKE that doesn't work with the disk system, I recommend that you seriously consider sticking with cassettes for any but the smallest models.

The only version of Simplex is in Basic, so you can easily transfer it from tape to disk, and the main menu gives you the option to switch from tape to disk data storage once the program is running.

Other menu options let you enter a model from the keyboard or from a stored file, list the model on the screen or printer, edit it, save it, run (i.e., solve) it, and perform a range or sensitivity analysis to see how much things can change without destroying the optimum nature of the solution.

Simplex suffers from cryptic prompting messages and condensed notation. For example, when you run the program, you first get the following message: MAX PROBLEM SIZE (M,N)?

It is asking for the largest numbers of constraints and variables you want to use, in that order. That is in the documentation, but it would be nice if the prompts were a little more explicit.

When you want to change an individual element in the matrix of coefficients for the constraints, the editing prompt is as follows: I,J,A(I,J)? This is perfectly good matrix notation, but it is terse.

In the same vein, you must use a kind of shorthand to type in the objective function and the constraints. The program recognizes each variable by an index number, and your first task is to enter the nonzero coefficients for the objective function, one at a time.

A comma separates each from the index number for its variable, and a final entry specifies maximization or minimization of the function.

After the last entry, the prompt switches to row 1 for the first constraint. Use the same notation as objective functions to type in constraints. However, the last entry for each is the equality or inequality condition.

Simplex places a few restrictions on the forms of these constraints. To begin with, the figures in the right column must be positive or zero. It also assumes that variables are positive.

Simplex assumes that inequalities (of either sense) include the limiting case of equality. If this causes trouble in a particular application, you might have to adjust the numerical value of a constraint. If you have a constraint that really means $y<5$ instead of $y<=5$, then you might have to enter it as $y<4.99$ or something similar.

The notation used for data entry isn't too bad, but Skyline Marketing can do better. They have another version of Simplex, called PortaMax, for Radio Shack's Model 100 that is much easier to use.

Portamax lets you enter the objective function and each constraint on a single line, in standard algebraic notation. This would be a worthwhile enhancement to Simplex.

Simplex has a number of subcommands for editing any portion of the model, including changing the goal of the whole exercise from minimize to maximize, or vice versa. You can direct the listing to the screen or printer.

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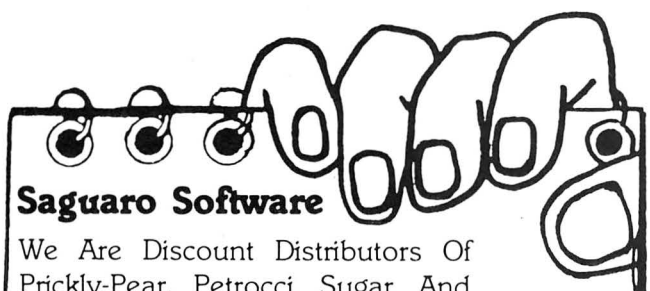

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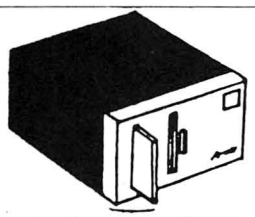

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vised simplex method; it indicates its progress by signaling whether Phase I or Phase II is working.

With Disk Extended Color Basic disengaged, my CoCo can handle the POKE 65495,0 speedup routine incorporated in the program, and thereby reach a solution for my test model in approximately 36 seconds. Without the speedup, this jumped to almost 52 seconds.

Simplex's outputs are the optimized values of the objective function and each decision variable, the reduced cost of each variable, the amount of slack for each constraint (i.e., the margin by which any equalities were satisfied), and the dual price (the value of an additional unit or resource capacity, in economic terms).

The program also informs you of the number of iterations required to reach a solution. Again, you can route the output to the screen or to the printer. Video displays are formatted into screen pages.

The next step in linear programming is usually the performance of postoptimalization analysis. The simplest form is the range, or sensitivity, analysis.

Simplex calculates the amount by which each coefficient in the objective function can increase or decrease without violating the optimal solution. It does the same for the right side of each constraint, as well. INF denotes an infinite allowable change.

My Color Computer required almost 11 seconds to perform the range analysis for a test case, without the high-speed POKE; invoking it lowered the time to 7.5 seconds.

Once you have gone through this cycle, you can use Simplex's Current Solution command to obtain an instant replay of the model solution and range analysis without actually redoing all the calculations.

Surprisingly enough, Simplex lacks a facility for saving results to disk or tape. It stores the models as ASCII files, in this order:

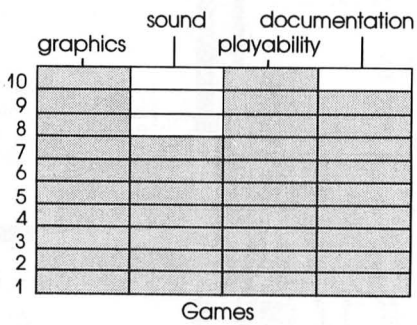
- the numbers of constraints and variables;
- the names assigned to the variables (up to four characters each);
- MAX or MIN, the condition to be met;
- the inequality or equality signs for the constraints, in order;
- the coefficients in the objective function, including zeros for missing variables; and
- the coefficients in the constraints, again including zeros as needed.

In principle, it should be possible to manipulate these files with other programs.

Every prospective user must make his own decision as to the utility of a program like Simplex. It certainly represents no threat to mainframe performance, but it does fill a niche in the Color Computer's repertoire of applications software.

Author Peck is probably getting as much out of Basic as he can, and he has produced a program of considerable value to the student and to the manager who has to deal with small-scale problems. If you're thinking about those 1,000-variable jobs, you probably have access to a lot of computing power anyway.

Oh, by the way, Simplex gives the right answers. I checked. ■



SR-71
Tom Mix Software
3424 College N.E.
Grand Rapids, MI 49505
32K, Extended Basic
$28.95, cassette
$31.95, disk

by Scott L. Norman

The folks from Tom Mix have outdone themselves with SR-71. For my money, this is the most complex, realistic, and nerve-wracking flight program that CoCo owners can get their hands on. I love it.

The premise of the simulation is that a polar-orbiting, unmanned satellite has failed, so you must fly the Lockheed SR-71 Blackbird, the United States' premier reconnaissance aircraft, to photograph a specific target in the USSR. You must take off from a Turkish airbase, penetrate the missile defenses that rim the southern borders of the Soviet Union, photograph the target, penetrate the defenses again on your way out, and deliver your film to a military field in Japan—a piece of cake.

Your plane doesn't carry any weapons; all the firepower belongs to the guys on the ground. Your rewards come in flying a precise mission and amassing points in the post-flight debriefing.

Program author Lee Earle displays considerable knowledge of the fact and folklore surrounding the real Blackbird. Many of the program's details agree with my own reference material, and the others seem authentic enough to pass muster. The four-page instruction leaflet does a good job of explaining the hazards of the mission and briefing you on tactics.

Not only is SR-71 a factual simulation, it's also fun to play, and the fine graphics package is part of the reason why. There are eight high-resolution screens in all: an opening title that features a very creditable three-view drawing of the Blackbird, some introductory text drawn in one of those ersatz computerish fonts, five maps, and the SR-71's instrument panel.

The game is written in Basic, and allows you to use the high-speed POKE if your system will handle it. This makes flight control a little smoother, but it's hardly a necessity.

The mission begins with a briefing that shows you a large-scale map of the Soviet Union with 18 key cities and the Turkish and Japanese airfields. You're given a target and an altitude and compass heading at which to make your photo run (must get the sun angle right, you know).

You are also assigned an initial frequency on which to contact a vital navigation satellite. This is a secure link that provides accurate range and bearing data regarding cities or any missiles that the defenses might have fired at you.

The access frequency changes each time you interrogate the bird, and recording the new frequency is just one more job for the busy pilot.

The actual flight begins with the Blackbird at 5,000 feet, climbing in full afterburner. This is your first opportunity to become familiar with the instrument panel, and quite a panel it is. The central instrument is a flight director, which you can give a radar screen overlay.

There are also readouts for air-

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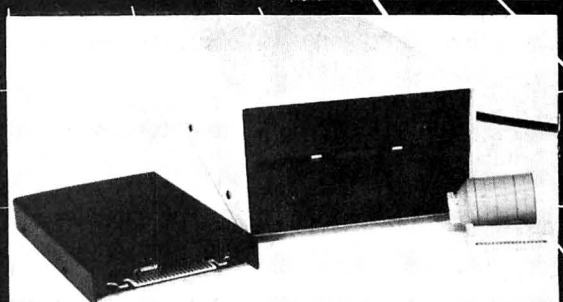

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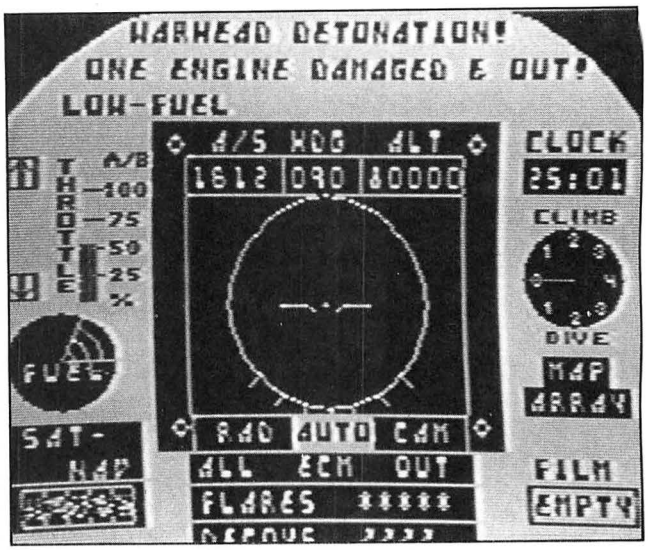

The SR-71 Dashboard

speed, heading, altitude, climb/dive rate, throttle setting, fuel, mission clock, satellite access frequency, defensive systems status, and film consumption. A threat-warning annunciator panel takes the place of the real Blackbird's Reconnaissance Systems Officer, keeping you advised of hostile fire, damage, or dangerous flight conditions.

You use the right joystick for the conventional flight controls, while the vertical arrows and the shift key control the throttle. (2.5-percent thrust increments for the arrows by themselves, 25 percent when shifted.)

Flight characteristics have a realistic feel to them. Initial climb is fairly sluggish, stalls are quite possible, and high-speed turns take a lot of time and airspace.

The program uses audio tones to signal the acceptance of control inputs of any kind. This, together with the generally leisurely response, makes the simulation feel a lot like Tom Mix's Space Shuttle, which, until now, I thought was the best CoCo flight simulator around.

Although the Blackbird carries no offensive armament, it is equipped with various defensive systems: electronic countermeasures (ECM), six magnesium parachute flares for thermal deception, and four decoy missiles that generate spurious radar signals. These provide some measure of protection against the three types of surface-to-air missiles (SAMs) that the Soviets will fire at you.

There are problems, however. A defense that works against one type of SAM will be ineffective against another. For example, the sophisticated SAM-9 homes on the very ECM signal that jams the earlier SAM-7!

While the threat-warning panel will tell you that a missile is on its way, it cannot identify the type; learning to figure that out is part of the way Blackbird pilots earn their pay in this simulation.

There is also the matter of imperfect intelligence. Soviet missiles are assumed to cover a circle 1,200 miles in diameter around each of the six cities in which they are based, but this is not always reliable.

At any time during the mission, an M command will call up the map that appears during the preflight briefing (SR-71 uses several toggled single-letter commands).

You can ask to see your present position, the location and identities of the Russian cities (your target will be highlighted), and the presumed extent of the missile zones. You can also get a reminder of the desired photo altitude and heading. A compass rose and distance scale help you plot your course to the target.

There is also an option to expand the scale of the map. The quadrant you specify is redrawn to cover the entire screen, and once again you have options for displaying cities and missile zones.

There is a position option, too, but your location isn't actually shown on the quadrant map. The display reverts to the main map, instead.

The mission clock normally runs in near-real time, although it is only updated every two or three seconds. The Blackbird has a handy Autopilot mode, during which there is a 10:1 speedup in simulation time to help pass some of the longer and less eventful stretches of initial climb and cruise. The Autopilot plus radar modes give a 60:1 speedup.

The clock pauses when you are examining a map or interrogating the navigation satellite. This can be a very welcome feature when things get a little hectic.

And get hectic they will. The aircraft's rate of fuel consumption guarantees that you cannot avoid trouble by threading the single gap in the missile defenses—at least not for any target I've ever been assigned! You simply must penetrate the defensive zones if you want to have a chance of getting to your destination in Japan.

Your biggest task, then, is to use the Blackbird's flying capabilities and defensive systems, together with your own savvy, to evade or destroy the SAMs.

Assuming your target is on the far side of the defenses, successful photography is primarily a matter of careful navigation and fuel management. Of course, you get to exercise your cunning again on the outbound flight.

If your target is actually within a missile umbrella, as many are, things simply stay hectic all the time.

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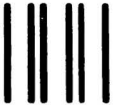

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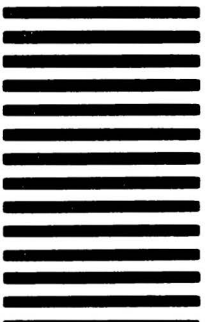

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344F4

SR-71 provides a whole spectrum of damage scenarios; I've had my ECM and satellite navigation systems shot out, lost an engine, and sustained fuel tank leakage, and still managed to compile fairly respectable scores.

Every game or simulation must make certain compromises with reality, and SR-71 is certainly no exception. The Russian missiles appear to have unlimited fuel, for example; it doesn't seem possible to simply outrun them, at least not within a defensive zone.

The Blackbird in the program is also capable of considerably higher speed and somewhat lower ceiling than the officially recognized records for the real thing.

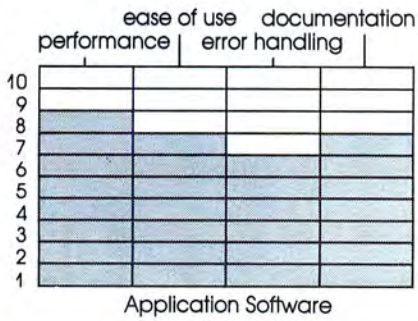
Finally, the distance covered by a typical mission is considerably longer than the published unrefueled range of the actual aircraft. Not that an aerial refueling could have been included in a 32K game; as things stand, the disk version occupies all but 1,300 bytes or so of memory.

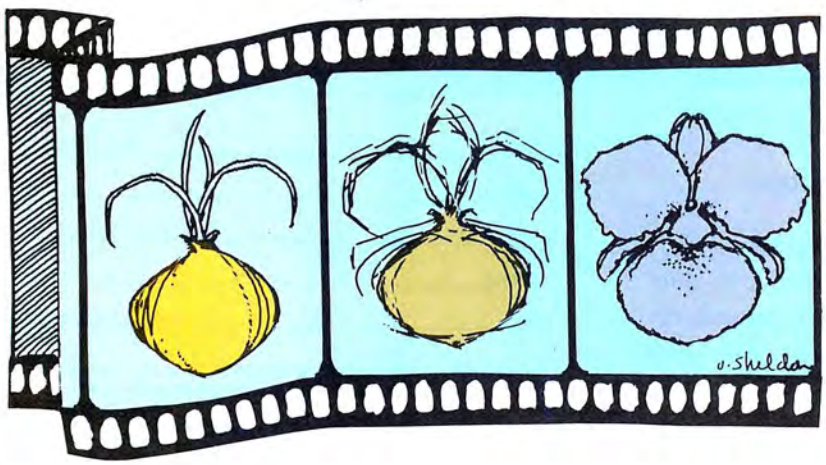
Author Earle has devised a nice way to compensate for the lack of this particular diversion: the airbase in Japan falls within range of the SAM site at Vladivostok. That's right—the Russians can shoot at you all the way home! Lovely.

SR-71 is a rich, complex simulation. As someone who has long been fascinated by the enigmatic Blackbird, I'm duly impressed with the game.

Some Air Force Public Information genius once proposed a motto for another bunch of photo-reconn pilots: Alone, Unarmed, and Unafraid. The comment of one grizzled veteran was right on target: "Two out of three ain't too bad!" ■

MPP Created Graphics





MPP—Tutorial
Superior Graphic Software Products
P.O. Box 451
Canton, NC 28716
16K, Extended Color Basic
$34.95, Disk or Cassette

by Steve Brown

Perhaps the greatest of all the Color Computer's strengths is the graphics capabilities of Extended Color Basic. You only need to play a couple of the better animated games on the CoCo to see the power of the 6809 processor and the tack-sharp graphics to recognize real programming power.

But programming graphics on the CoCo can also be a frustrating chore. Producing a detailed drawing by figuring where to put the LINE, CIRCLE, and PAINT commands is tedious, trial-and-error work.

Now, Superior Graphic Software's MPP (Motion Picture Programming)—Tutorial has changed all that. This program lets you draw compli-

cated pictures on the CoCo's graphics screens and save them to tape or disk so you can later merge them into your own Basic programs.

There is no more figuring X and Y coordinates, because MPP lets you draw your pictures right on the screen, and it teaches you how to use multiple screens to create animation effects.

MPP is in Basic and uses simple one-key commands to do complex drawing. You can use the joystick or keys to draw on the screen or create a drawing pixel-by-pixel. You can also copy the screens in memory, save them to disk or tape, and later manipulate them with your own Basic program to create animation using Extended Color Basic commands.

The MPP disk comes with the Basic drawing program and a number of supporting programs to instruct you and demonstrate use of the MPP system to create colorful animation.

First, run the Drawinst program to get an idea of how MPP works. The instructions are clear, but they don't give complete details of all procedures such as disk input/output (I/O), or using GET and PUT statements. Still, you find more in the instructions than you can remember from a single reading.

Next, run DOS-Draw. It presents a clean graphics screen with the blinking cursor in the upper left corner. If you can remember any of the commands to move the cursor or draw a figure, you can do so using either the arrow keys or joystick. Fortunately for those of us who aren't quick studies, you can press the H key at any time to display a complete help screen with the command sets available. You have so many commands at your fingertips that it takes a while to sort out what does what. In fact, a look at those commands illustrates the power and flexibility of MPP.

Command Set

You can use the following commands to draw on the screen. Press a single key and the program carries out the command or waits for follow-up commands.

- Draw and Erase set the cursor to draw or erase a line.
- Move or Hold moves or holds the cursor without drawing or erasing. This lets you get the cursor to another spot on the screen.
- Create a Figure draws a line, box, or an arc. You set up the limits for any figure, and it is drawn on the screen. The ARC command draws a circle or any portion of one.
- Color of Line and Background Color swap or toggle the background colors, if you draw in the two-color mode. If you draw in one of the four-color modes, you can specify the appropriate colors by pressing the keys corresponding to colors 1–8.
- Wash is MPP's version of the Basic PAINT command. You specify both the color inside the figure and the border color.
- Set toggles the graphics screen color set.
- Klear clears the screen to the background color, erasing anything already drawn.
- Joystick enables/disables the joystick for drawing.
- Graphics Mode and Page to Start let you change PMODE and graphics page while working on a drawing. You can get some wild effects by switching between PMODEs.
- Replace invokes Extended Color Basic's PCOPY command to copy the contents of one graphics page to another. You define the source page to be copied (1–8) and the destination page.
- Image copies and moves an entire block to a new spot on the screen.
- Tape or Disk I/O saves or loads graphics pages or partial pages.
- Array moves arrays with GET or PUT commands.
- Help returns you to the text screen that displays all commands. The help screen also displays information about the parameters in effect on the drawing page. This information includes the current graphics PMODE; the start page specified; whether the DRAW, ERASE, or MOVE command is in effect; the current color specified for lines and for background; the current specified color set; and the last command given.

"MPP also lets you program animation."

Animation

MPP also lets you program animation.

Extended Color Basic's GET and PUT commands accomplish the ac-

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tion. MPP lets you use multiple graphics pages and GET/PUT to create slick, smooth animation.

MPP's animation effects include the PSET and PRESET commands, and it also supports the logical operators AND, OR, and NOT to allow special graphics effects.

I/O Functions

The I/O commands are straightforward. For cassette, the program asks for a title for the picture and the number of graphics pages you want to save. You must save at least four pages. The program then saves the program as a machine-code file.

Instructions are also given for cassette users who might create a picture using the disk-based DOS system but use that picture in a cassette system.

Disk users are given a three-option menu when using I/O: D for a directory listing, ALL to see all MPP files on the disk, or a single picture's eight-character file name to display that picture only. When you select ALL, MPP displays the pictures in all MPP disk files one by one, until you press S to stop. MPP then returns to the drawing screen.

Documentation

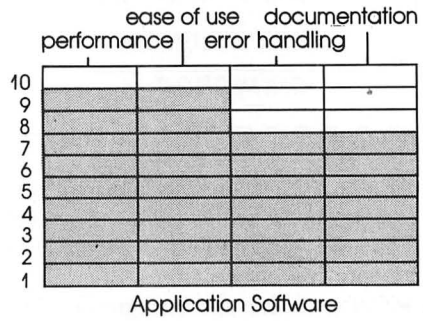
MPP documentation is adequate, but the real documentation lies in the demonstration programs on the disk, and in the instructions in the programs. First, Superior Graphics Software clearly explains how to create a picture using MPP. Then the demonstration shows you how to use the pictures in your own programs to create the desired effects.

As it turns out, MPP is easier to use than it is to read about.

Onions and Orchids

It is difficult to be critical about any program that takes the tedium and hair pulling out of creating graphics. As such, MPP generates only minor criticism. Its text screens do contain a number of glaring spelling errors. The misspellings don't affect the program, but they do give it an amateurish look.

Minor complaints aside, MPP is a powerful programming tool. Its strongest virtue is that it takes the hit-or-miss drudgery out of creating exciting graphics screens. MPP is more than a tutorial, it is a programming utility that finds a constant place in the front of my disk library. ■



Color Basic Compiler
Computerware
P.O. Box 668
Encinitas, CA 92024
32K, Extended Color Basic
$39.95, disk

by Lawrence O. Parker

Most people have come to accept the fact that learning machine language is the only way to program smooth, animated graphics. But programming in machine language isn't easy. I wonder how many good ideas are passed by because the originator lacks the programming skills to perfect the graphics.

Computerware's Color Basic Compiler is a valuable aid to Basic programmers. It lets you write programs or subroutines in Basic and then convert them into machine language. The results are astounding. In fact, you might have to add delays to slow the execution.

The Color Compiler supports 48 instructions, most of which are a subset of Extended Color Basic. With few exceptions, you code your program in Basic and assume the compiler will understand.

In a 32K machine, the compiler leaves about 15K for your machine-language program. The utility is coded in Basic and designed in modular form to let you add your own instructions.

The 6809 machine-language code generated is position independent, so it can reside anywhere in memory, including the ROM-pack area at hex $C000. The Color Compiler can also pass a parameter back and forth between a Basic program and the compiled program. Thus, you can execute Basic statements that the Color Compiler doesn't support, but you can still gain the speed of machine language.

The compiler comes on a single-sided disk with a selection of sample programs. It is easy to compile a program. The compiler first prompts you for the machine-language location (execution address). All number inputs are in hexadecimal.

You cannot save programs in ASCII to compile, but they can reside on any disk. In keeping with the Basic format, if you don't give an extension, .BAS is assumed. The utility next asks whether you want to send the compiler information to the screen or printer.

The compiler lists such information as the start, end, and execution addresses needed to save the compiled program. The CLEAR address printed is the upper limit for Basic before you reload the compiled program. The utility also prints the corresponding machine-language address for each line number in the Basic program, and the addresses of any arrays used.

Compiling a program usually requires only one try, if you don't have any errors. The Color Compiler prints the errors it discovers and stops. If you have errors in lines 50 and 120, the utility does not proceed beyond line 50. You must then correct the error, resave the program, and recompile. Then it finds the error in line 120.

As always, a few restrictions apply when writing a Basic program. You are limited to 200 lines, but you can change this by setting variable PL in line 0. However, if you make the variable too large, you will get an out-of-memory (OM) error.

You are also limited to 100 line-number references (GOTOs and GOSUBs), but you can change the variable LB to vary this initial value. Variable names in your program are limited to a single letter, A–Z.

You are allowed only one-dimension arrays, but the manual shows how to use these with such commands as GET and PUT, so there should be no real inconvenience.

The Color Compiler doesn't support STRING variables or their functions. All, if any, DATA statements must appear just before the required END statement.

The Color Compiler is an integer compiler; it allows only integer (no decimal) numbers in the range of −32768 to 32767. You can use numeric expressions, but they are evaluated from left to right, whereas

Basic evaluates multiplication and division first and then addition and subtraction. To ensure the proper numeric evaluation, always use parentheses. The Color Compiler allows nested parentheses to any level.

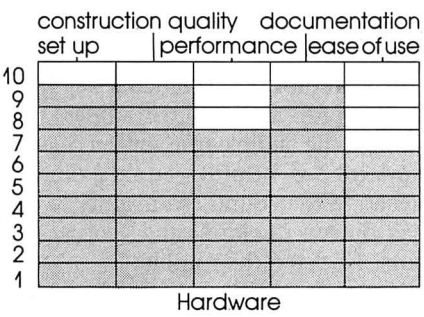
The Color Basic Compiler includes almost all the Extended Color Basic commands and functions. There are a few format modifications, but the manual thoroughly explains them.

One new format lets you POKE 2 bytes into memory at once. Unfortunately, there was no complementary instruction such as PEEK. In fact, there is no PEEK instruction. This caused many problems when I tried to interface to the Basic parameters in page 0.

The manual is well written and supplies a complete list of all allowable instructions and their formats. There is even a section on programming tips and tricks.

A comprehensive error list provides a synopsis of possible causes. A complete technical section includes a variable list and complete subroutine description.

The Color Basic Compiler is a good piece of software. It is going to be one of my most-used utilities. ■



Monolink Video Driver
Acorn Computer Systems
11931 W. Bluemound Road
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$15, kit
$20, assembled and tested

by Carlos Calle

The Monolink Video Driver is a good piece of hardware that lets you use a monochrome monitor with the Color Computer. It produces sharp contrast on a 12 MHz (or better) monitor.

You can buy the driver in kit form if you are handy with a soldering iron, or you can opt for the assembled and tested unit. The latter comes on a 2-inch-by-1½-inch printed board, with an input header and 3 feet of attached coaxial cable.

The assembly instructions with the kit are clear and complete. You have to solder six resistors, one radio-frequency (RF) choke, an electrolytic capacitor, two standard capacitors, one transistor, the coaxial cable, and the three leads of the input header all to the printed board. Then you solder these leads to the header, and you are done. With seven pages of step-by-step instructions, you can't go wrong.

Installing the unit is not difficult, and again the instructions help. You must remove the computer's case, locate and remove the RF modulator, install the input header into the modulator socket, and then mount the modulator on the header.

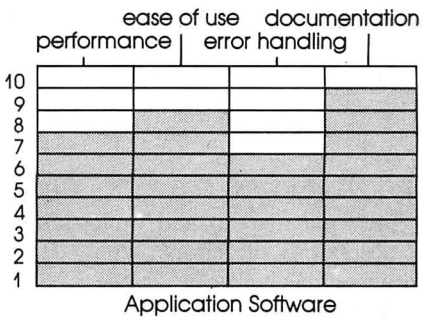
If your computer has an early board, the RF modulator is located under the metal shield, which you have to remove as well.

Attach the board to the top of the metal shield with the adhesive pad provided, and, finally, file a small notch on the back of the computer's top cover to provide a pathway for your new cable. I filed this notch about halfway between the reset button and the RF output jack (marked "TO TV" on the case), and I consider that a good location. Do the filing away from your opened computer to avoid depositing dust.

The Monolink Video Driver also includes an LED power-on indicator, with instructions for its installation. This is a useful addition and adds only a couple of steps to the video-driver installation.

This piece of hardware provided excellent contrast with both an Apple III monitor and an older Sony monitor. One of the nicest features of the design is the capability of using a monochrome monitor and a standard color television simultaneously.

If you use one of the word processors or terminal programs that expand the Color Computer display to 51 or 64 columns, a monitor is almost a necessity, and the Monolink Video Driver is probably the best way to interface it to your Color Computer. I recommend it. ■



Complete Personal Accountant
Programmer's Institute
P.O. Box 4170
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16K, Extended Color Basic
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$79.95, 32K disk

by Howard B. Culbreth

The advertisement for the Complete Personal Accountant states that it's a "class act" and that if it costs more, it's because it's the "star of the show..."

After putting the program through its paces, I can't say anything to counter these claims—the Complete Personal Accountant is a "class act." If anything, the ad understates its capabilities.

Properly implemented, it is a comprehensive home-accounting package that can handle your checkbook(s), set up and analyze budgets, schedule payments and appointments, maintain mailing lists, print graphs of your financial records, and update and print your net worth.

The disk version is capable of both tape and disk input/output from the menus, providing an easy way to make tape back-ups of your files. If you also make tape copies of the programs, you can maintain your files against disk-system failure.

Likewise, if you start out with the tape version, the transition to disk operation is a simple matter of moving the files over to the disks.

The Complete Personal Accountant is professionally packaged. It arrives with a hard-cover ring binder containing a 145-page manual and the program disk in a pocket.

The manual contains a table of contents, an index, an appendix, and sample printouts. The sheets are printed on both sides, nicely arranged and easy to read. The manual is well organized and doesn't assume you're

a computer expert. The instructions are thorough, and many reappear throughout the text to reinforce your understanding of certain points.

There are 10 programs, or modules, that make up the packages.

Chart of Accounts

Study the manual and understand the accounting principles presented in the appendix before using the Chart of Accounts module. The disk includes a standard chart that you can modify to suit your needs. The thought and time you give in setting it up will determine much of this program's usefulness. It's worth the time to do it well, because many of the other programs access this chart.

For each category in this module, you can include up to nine subcategories. This is very helpful for those who have more than one checking or savings account. Note, however, that the income/expense and net worth statements will only accumulate the subcategories into a total for their main categories. They will not handle the subcategories separately.

Checkbook Maintenance

This module is the heart of the package. One main menu and two submenus drive it. There are provisions to add a new month, add a new checkbook, load and save check files, edit existing files, reconcile your bank statement (balance checkbook), and print out an individual check and the checkbook transactions.

This program has a Save Check Summary File option that creates a file that the financial statements access. You can use it only after you've balanced the checkbook.

One of this module's most useful features is that you can use subcategories for both checks and deposits. You can distribute each check or deposit to several accounts.

Similarly, you can distribute deposits to differing categories. And you can flag any entry as tax deductible, which can ease the pain of assembling information at tax-preparation time.

You can review the entries, return to the main module menu, or edit both new and current accounts. To edit, simply retype the defective field.

Checkbook Search

This module lets you search the check files by description, account number, check number, deposit number, or date and send the results to the screen or printer. You can browse through the entire file, or use the Sort and Dump options.

This module is also handy for gathering information at tax time.

Detailed Budget Analysis and Summary Budget Analysis

These modules let you implement and maintain a comprehensive budget. The programs are thorough, and the manual and menus lead you through the necessary set up. They depend on having up-to-date check files and the Chart of Accounts files available.

Net Worth/Income Expense

This module is another valuable feature, if all the previous files are available and up to date. There are provisions for entering and reporting transactions that do not normally pass through the checkbook (such as loans, savings, property, and so on).

This module does not let you trace information. It simply gathers the information, assumes that it is correct, summarizes it, and prints the results. For this reason, you should maintain supplemental records.

This program disregards all the subcategories in your Chart of Accounts and plugs them into their respective main categories.

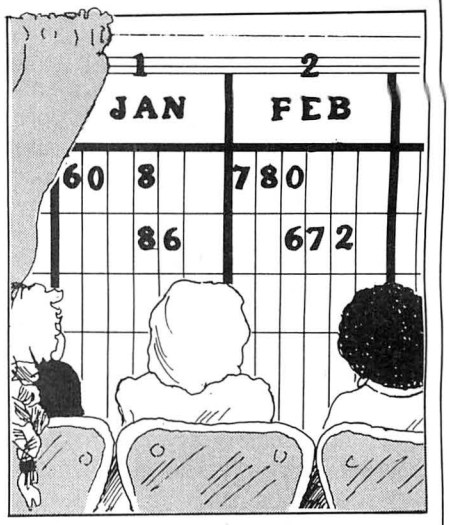
Many people never take the time to determine their net worth. This information can be valuable when preparing wills, considering insurance, applying for loans, and so on. Although there are some limitations, you can use this module for such purposes.

Payments Calendar and Appointments Calendar

These two modules are much the same. They let you set up, load, edit, and save scheduled payments and appointments. You can then send the files to the screen or printer, and call them up by any particular month.

Mailing List

With the mailing list, there are provisions to set up, load, edit, and print names and addresses. You can sort on the account number, name, state, or zip-code fields, and search them, plus two address fields and the city field. The sorts are not fast, but they work.



The Color Graph module uses high-resolution graphics to display bar charts of your records. These show the relationships of certain accounts to their category totals (i.e., each expense account as compared to the total expenses).

The overall result is somewhat limited, because the screen can display so few items at one time. When you page to the remaining items, you lose the effect and relationships of the previous ones. An option to print out the graphs would be an asset.

Summary

Besides the few minuses that I've already mentioned, there is one other thing that gave me some minor problems.

The author has included a key-beep feature for the input routines. Although the audible recognition of each keystroke is helpful, it takes time to generate the sound, so a quick typist can outrun the input and generate errors. I deleted the routine.

On the other hand, the Complete Personal Accountant has many valuable features. If you start out with the tape version, the later transition to a disk system will be easy and cost-free. You only need standard Color Computer hardware to run it. The documentation and instructions are excellent, and attractively packaged.

At first, the price tag might appear high. But when you consider the capabilities of this program, the value per dollar exceeds that of many utilities and games on the market.

It is a pleasure to see a well-planned program that is easy enough for novices to use and reasonably priced. ■

Gameware

The past few months have brought some remarkable improvements in the quality of Color Computer games. Several interesting programs cross the review desk each month, and we've created this Gameware section to offer concise reviews of several products, thereby keeping readers better informed of new developments in the game market.

Mark Data Products

This month, Mark Data Products (24001 Alicia Parkway, Mission Viejo, CA 92691) offers some spice for those of you with a taste for mystery, magic, and adventure. I looked at three of their 32K graphics-enhanced adventures and found them very interesting.

Black Sanctum, Shenanigans, and Sea Quest ($24.95 each, cassette/$27.95 each, disk) take you to unusual places and present you with strange tasks, as adventures are wont to do.

In **Black Sanctum**, you must find your way to an 18th-century monastery and use your wits in a struggle to defeat the forces of evil that reside there. To find the monastery, take a hint from one of Lewis Carroll's books. And once you're there, listen once in a while.

I'd solved Black Sanctum when it was a 16K text-only adventure. It's still the same story with the same solution, but the fine graphics accent your imagination to make the situation that much more life-like. And the graphics in this and the other Mark Data adventures are animated—clouds, waves, and people move—adding another touch of realism.

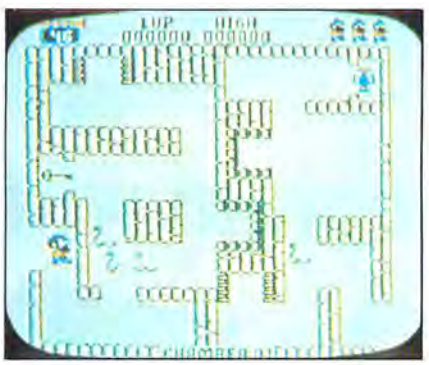
Sometimes the scene gives you a clue that isn't mentioned in the text, so keep your eyes open.

Shenanigans uses the same quality graphics to help you find your way from your apartment, past the evils of the city—landlords, muggers, and the corner pub—to an enchanted land beyond the subway. There you must search high and low (have fun trying to see what's under the pretty girl) to collect the materials that will get you over the rainbow to the pot of gold.

Neither Shenanigans nor Black Sanctum are particularly difficult adventures, but I like them. Total playing time for each was probably not more than three hours or so, but they're challenging enough to make me struggle for a solution at various points, but logical and solvable enough to keep me interested.

Black Sanctum

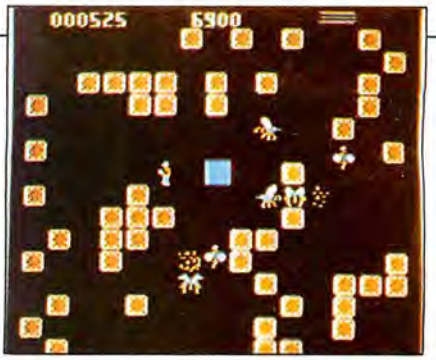
Stellar Search



Tut's Tomb

I still haven't finished **Sea Quest**, in which you must outfit yourself for an undersea treasure hunt. It offers the same great animated graphics and engaging situations to recommend it as another fascinating game.

For arcade gamers, Mark Data continues in the mysterious vein with **Tut's Tomb** (32K/$24.95, cassette/$27.95, disk), which puts you, as the intrepid explorer, into the twisting bowels of an ancient Egyptian tomb.



Icemaster

Foodwar

You must move quickly from room to room, collecting treasures and keys while avoiding the hazards that increase as you go on.

Tut's Tomb offers state-of-the-art CoCo graphics. This, and the fun, kept me playing even though the joystick control was very frustrating at first. Now I find this a first-rate game. It would be nice if those games that allow only up/down, right/left movement offered an arrow-key option.

One thing the documentation doesn't tell you—use the space bar to fire your flashbomb.

Owl-Ware

Stellar Search (32K/$27.95, cassette/$30.95, disk) from Owl-Ware (Box 116 W, Mertztown, PA 19539) is a true arcade-adventure combination and should be especially popular with Trekkies. It consists of four different games that you, as the commander of the Starship Enterprise, must complete in order to accomplish your mission. The four games total over 86K, so you must load Stellar Search in sections so it will fit on a 32K machine.

The graphics are good and the adventure part of the game is relatively easy. In a straight arcade portion of the fourth game, you must bomb the

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surface of a mountainous planet to level out a landing strip. That's the most difficult part of the program—especially at the higher levels.

Because you can load each of the four games separately, you can play your favorite without playing through the games before it.

Stellar Search is especially appropriate for beginning adventurers and uses some interesting programming techniques. The game stands on its own merit, but its appeal should receive an additional boost in direct proportion to your interest in the Star Trek saga.

Arcade Animation

The folks at Arcade Animation (21 The Fairway, Upper Montclair, NJ 07043) have added two new members to the ranks of zany game plots (have you seen Outhouse from Computer Shack or DataSoft's Pooyan, for example?).

Icemaster pits a tiny human against large mosquitos—or is it a regular-size human against *giant* (New Hampshire-size) mosquitoes? His weapons?—man-size blocks of ice that he must push onto his adversaries, squashing them out of existence.

"Tut's Tomb offers state-of-the-art CoCo graphics. This, and the fun, kept me playing even though the joystick control was very frustrating at first."

The graphics in this game are very impressive, but I had some trouble with the joystick control, which left me with the overall impression that the game is frustrating. It was difficult to maneuver the man quickly or precisely enough to feel that I had significant control of the action.

The joystick control in their second game, **Foodwar**, is also tricky, but the action is delightful and challenging enough to keep you trying.

You control a character who begins on one side of the screen and must run across to the other and eat an ice-cream cone before it melts. But as soon as he begins to move, cooks pop up from holes in the floor and begin chasing him and throwing food. There's some food lying around that he can throw back, though, but a slip-up means he doesn't get that ice cream.

The game offers 10 skill levels, and, at least at the lower levels, it's not too hard to run across to the ice cream. But to stick around in each screen long enough to chalk up points by successfully fighting off the chefs takes real practice. The animated characters and holes in the floor are relatively large, meaning you have less free space in which to maneuver. You need well-practiced control for this one.—*M.E.R.* ■

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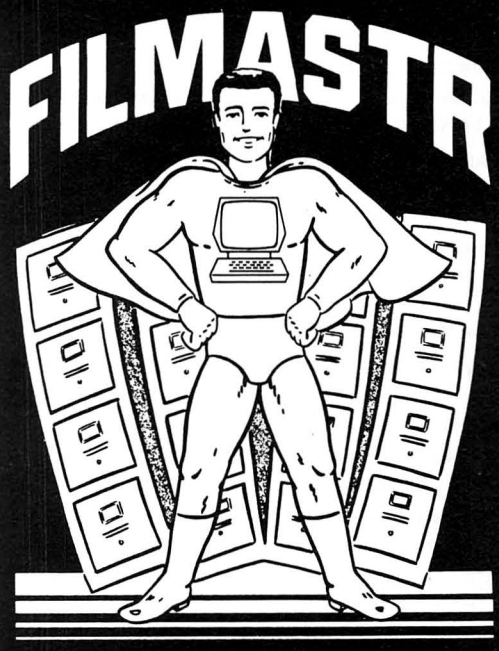

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HOT CoCo's Peripheral Buyer's Guide

Soup up your CoCo with add-ons listed here.

compiled by Cynthia Smith and Celeste Wrenn

Chances are that once you have owned your Color Computer for a while you will be ready to invest in peripherals for it. To help you in your selections, we have compiled the *HOT CoCo* Buyer's Guide to Peripherals.

HOT CoCo has surveyed manufacturers of keyboards, parallel printer interfaces, port expansion devices, and miscellaneous peripherals. This guide will give you information on the variety, functions, and prices of peripherals on the market, along with contact information.

Since there are so many joysticks, disk systems, and printers on the market, we plan special buyer's guides just for these products in upcoming issues.

Before you invest in any peripherals for your Color Computer, be sure to research the products thoroughly. The following information was supplied by the manufacturers. *HOT CoCo* has not tested the products and cannot guarantee any manufacturer's claims.

Replacement Keyboards

Many CoCo owners don't mind the "Chiclet" keyboard that comes with the older CoCos, or the limited-travel ones that come with the newer CoCos. But if you do much word processing, data-base management, or just a lot of typing, those original-equipment keyboards can get tiresome.

Replacement keyboards are one of the hottest peripherals going for the CoCo for just this reason. All the keyboards in this buyer's guide are of superb quality. Some offer features not found on the original keyboards, such as programmable function keys. Use the table to compare price and features. You might then check with friends or a nearby user's group to see what they know about the lot.

Port Expansion Devices

That one ROM port on your CoCo can get awfully lonesome. And if you're the type of user that is always plugging and unplugging cartridges in it, you've often wished for a better way. The expansion units in this buyer's guide eliminate much of the need to insert and remove ROM packs. They also reduce the risk of burning out your chips by inadvertently unplugging a ROM pack with the computer turned on.

Some of these devices let you use more than one port at the same time, increasing the capabilities of your CoCo. The features vary from unit to unit, and you should first define what your needs are and then, armed with the specs in the table here, narrow the field to those best suited to you. You might then contact the manufacturer and describe your needs. You'll get information more specific to your situation this way.

Parallel Printer Interfaces

Those inexpensive dot-matrix printers that you hear so much about are ideal for the CoCo, except for one thing: They require parallel output from the computer, while the CoCo puts out a serial signal. For a little more money, though, you can get a device that converts either the CoCo's serial or ROM port to parallel output.

The most popular type of parallel printer interface is that which hooks up to the serial port. This leaves the ROM port free for disk drives, EDTASM+, or whatever else you want to use the cartridge slot for. If you use an interface that needs the serial port, you forfeit the CoCo's modem capabilities.

As with any peripheral in this guide, narrow your choices using the specifications listed in the Parallel Printer Interface table. Then contact the manufacturer for more detailed information.

Miscellaneous Peripherals

We've put together a sampling of other devices for your CoCo. Some are unique, and have very specific uses. Others, such as speech-synthesis units, are fun for the hobbyist, or they can be used for professional applications.

Read the short descriptions presented here. You might not be interested in everything, but maybe you'll enjoy learning about all the different gadgets available for the CoCo. ■

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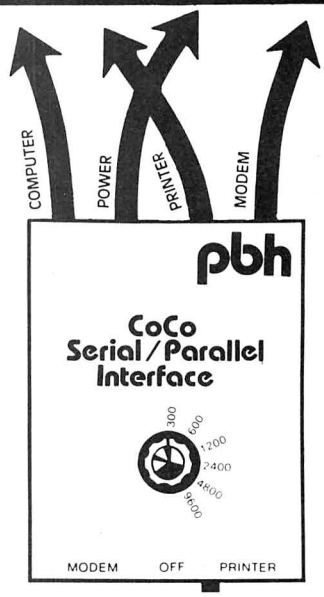

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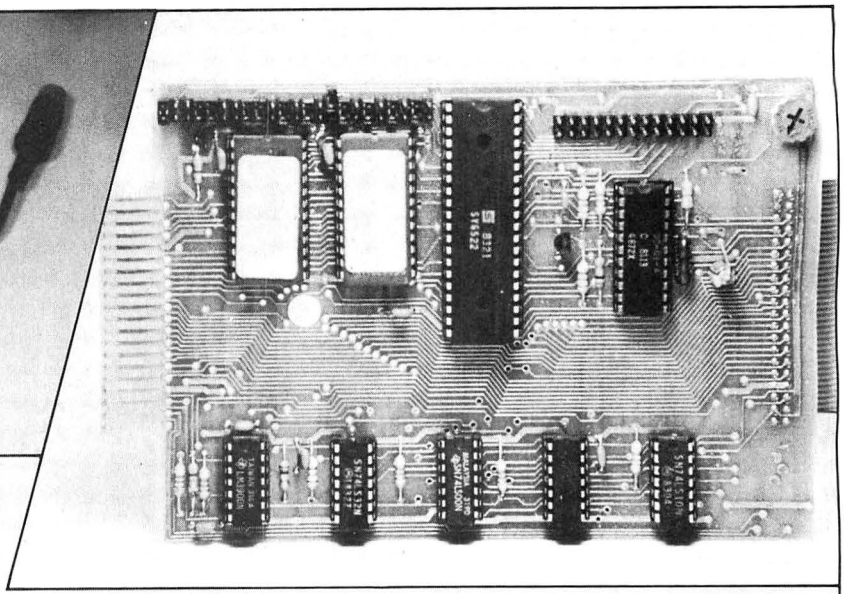

Keyboards

Product Name	Company Name And Address	Price	Warranty	Service Available?	Number of Keys	Number of Function Keys	Full Travel?	Shielded for RFI/EMI?	Soldering Required?	Alterations Required?
HJL-57	HJL Products Inc. 955 Buffalo Road P.O. Box 24954 Rochester, NY 14624 716-235-8358	$79.95	1 year	Y	57	4	Y	Y	N	N
Keyboard Upgrade Kit	Radio Shack (catalog number 26-3016)	$39.95	90 days	Y	53	0	N	N	N	Must be installed by Radio Shack
KeyTronic Keyboard	KeyTronic Corporation Building 14, S.I.P. Spokane, WA 99216 800-262-6006	$89.95	90 days	Y	53	1	Y	Y	N	N
Premium Keyboard	Micronix Systems Corporation 8147 Delmar Blvd. St. Louis, MO 63130 314-721-7969	$79.95	90 days	Y	57	4	Y	N	N	N
Professional Keyboard	Micronix Systems Corporation	$59.95	90 days	Y	57	4	Y	N	N	N
Spectrum Projects Keyboard	Spectrum Projects 93-15 86th Drive Woodhaven, NY 11421 212-441-2807	$79.95	1 year	Y	57	4	Y	N	N	Cut one post
SuperPro Keyboard	Mark Data Products 24001 Alicia Parkway #207 Mission Viejo, CA 92691 714-768-1551	$69.95	90 days	Y	53	0	Y	N	N	Cut one post

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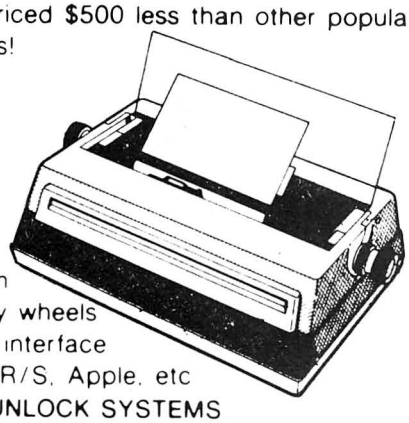

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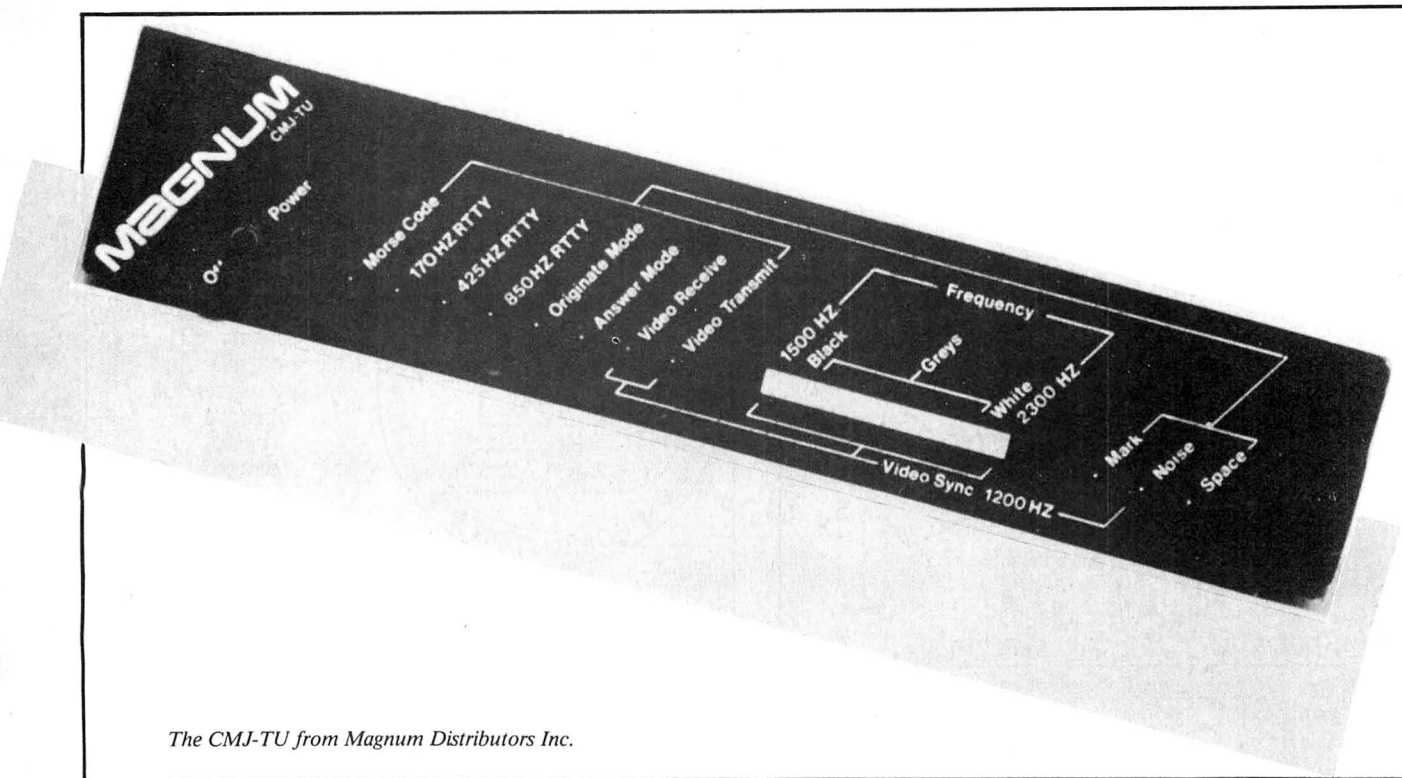
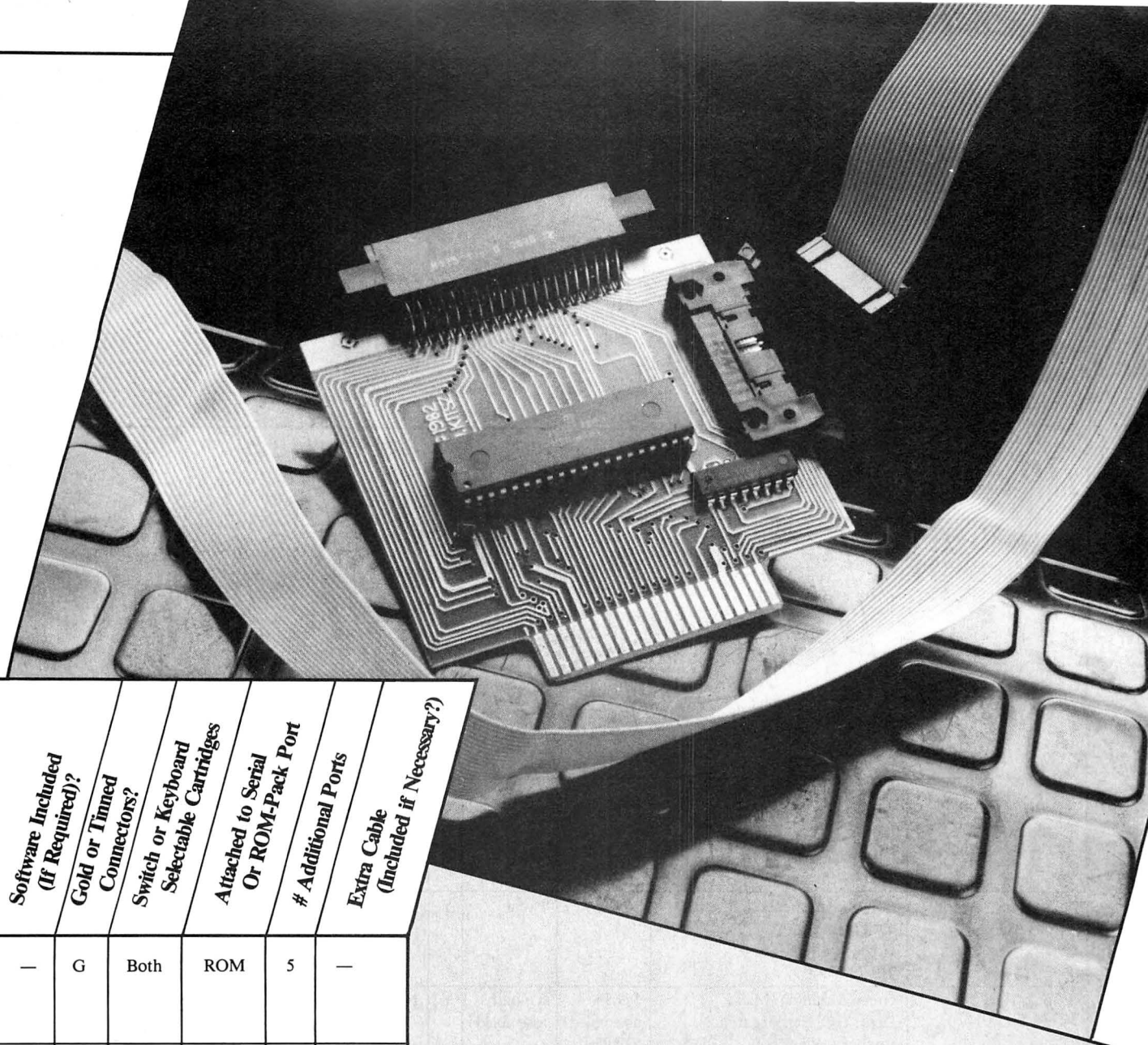


The CMJ-TU from Magnum Distributors Inc.

Port Expansion Devices

Product Name	Company Name And Address	Price	Warranty	Service Available?	Built-in Power Supply?	On-Board RAM?	Buffered Circuitry?	Own On/Off Switch?	Own Reset Switch?	Own On/Off LED?
BT-1000 Expansion Interface Unit	Basic Technology Dept. H, P.O. Box 511 Ortonville, MI 48462 313-627-6146	$250	180 days	Y	Y	Opt.	Y	Y	N	Y
BT-2000 Companion	Basic Technology	$225	180 days	Y	Y	N	Y	Y	Y	Y
Color Computer Speech and Expansion Unit	Electronic System Design Specialists (ESDS) 13911 Ridgedale Drive Suite 400 Minnetonka, MN 55343 612-544-1225	$198	90 days	Y	Y	N	Y	N	Y	Y
Magnum Distributors' Port Expansion Device Multifunction	Magnum Distributors 1000 S. Dixie Hy. W. #3 Pompano Beach, FL 33060 305-785-2002	$95	90 days	Y	N	Y	N	N	N	N
Multi-Pak Interface	Radio Shack (cat. number 26-3024)	$179.95	90 days	Y	Y	N	N	Y	N	N
Multiport	Oliprog Systems P.O. Box 2190, Station C Downsview, Ontario, Canada M3N 2S9 416-736-1504	$99.50	90 days	Y	N	N	Y	N	N	Y
PBJ Port Expansion Device	PBJ Inc. 911 Columbia Ave. North Bergen, NJ 07047 201-330-1898	$149.95	90 days	Y	Y	Opt.	Y	N	N	N
Spectrum Projects Port Expansion Device	Spectrum Projects 93-15 86th Drive Woodhaven, NY 11421 212-441-2807	$69.95	90 days	Y	N	N	N	Y	N	Y



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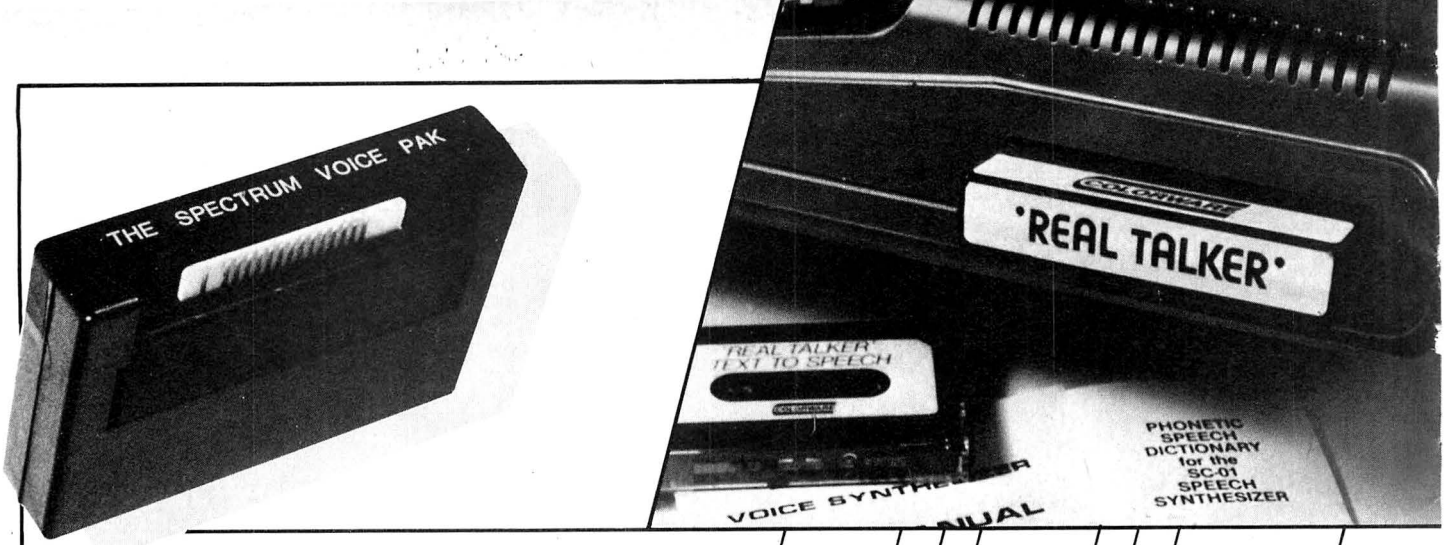
—	G	Both	ROM	5	—
Y	G	K	ROM	4	—
—	G	K	ROM	3	Some
—	T	S	ROM	4	—
—	T	K	ROM	4	N
—	G	K	ROM	6	Y
—	T	S	ROM	2	—

CoCo Port Parallel Printer Interface



Parallel Printer Interfaces

Product Name	Company Name And Address	Price	Warranty	Service Available?	Switch-Selectable Baud Rates?	If So, What Range?	Cables Included If Necessary?	Hook Up to Serial Or ROM Port?	Work with All Parallel-Interface Printers?	Gold or Tinned Connectors?
BT-1010	Basic Technology Dept. H, P.O. Box 511 Ortonville, MI 48462 313-627-6146	$79.95	180 days	Y	N	—	Y	R	Y	G
Botek Instruments Converters	Botek Instruments 4949 Hampshire Utica, MI 48087 313-739-2910	$69	1 year	Y	Y	300–9,600 6 positions	Y	S	Y Any with Centronics port	G to printer T to computer
CoCo Port	Green Mountain Micro Dept. HC, Bathory Road Roxbury, VT 05669 802-485-6112	$49.95 assembled $39.95 kit	6 months assembled	Y	N	—	N	R	Any with Centronics port	G
Cosmos Connection	Cosmos Computer Services Inc. 112 W. Wisconsin Ave. Kaukauna, WI 54130 414-766-1851	$69	90 days	Y	Y	600 1,200 2,400	Y	S	Gemini 10 and 15, 10x and 15x, any with 5+ volts to pin 18	G to printer T to computer
Dayton Associates' 8010X Interface	Dayton Associates 7201 Claircrest Bldg. B Dayton, OH 45424 513-236-1454	$29.95	90 days	Y	Y	110–9,600	Y	*	Gemini 10x and 15x	NA
Dayton Associates' Blue Streak Serial-to-Parallel Converter	Dayton Associates 7201 Claircrest Bldg. B Dayton, OH 45424 513-236-1454	$54.95	180 days	Y	Y	300–9,600	Y	S	Any with Centronics port	G to printer T to computer
Parallel Printer Interface	P.B.H. Computer Products Inc. P.O. Drawer 55868 Houston, TX 77055 713-956-0207	$89.95	90 days	Y	Y	300–9,600	Y	S	Any with Centronics port	G
Spectrum Projects Serial-to-Parallel Converter	Spectrum Projects 93-15 86th Drive Woodhaven, NY 11421 212-441-2807	$49.95	90 days	Y	Y	300–4,800	—	S	Epson only	—

*Unlike other devices on this chart, the Dayton interface attaches to the Gemini printer, not the computer.

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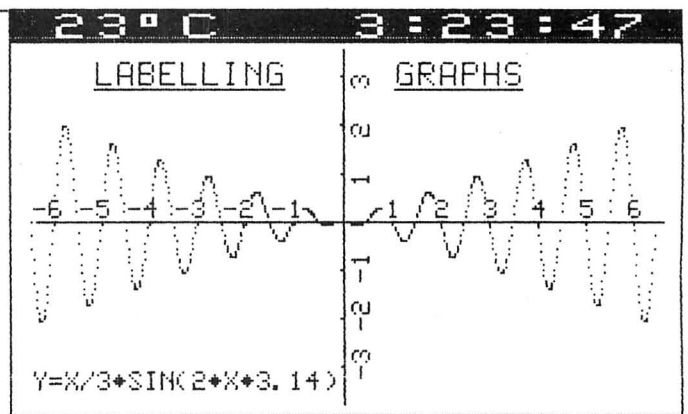

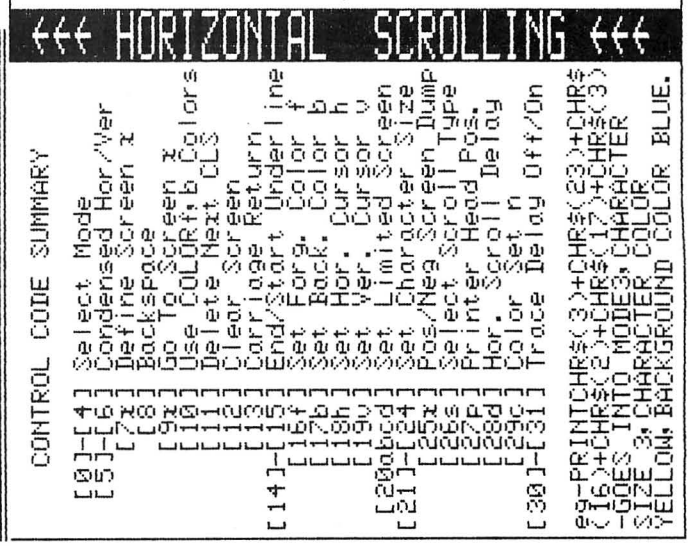

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↙See List of Advertisers on page 130

Miscellaneous Peripherals

96K Expander

Company Name: Dynamite Electronics Inc.

Address: Box 896, Hartselle, AL 35640

Phone: 205-773-2758

Price: $89.95

Warranty: 1 year

Service: Company

Description: The 96K Expander is a plug-in cartridge that allows use of all 64K of RAM for 64K computers. It occupies the upper 8K of memory. It is available with a Help program with a keyboard command, and includes an interrupt switch for running machine-language programs or accessing the cartridge when the computer fails to function properly.

ATM-80

Company Name: Cybertron Technology

Address: 3131 Timmons #723, Houston, TX 77027

Phone: 713-840-1272

Price: $184.95

Warranty: 90 days

Service: Company

Description: The ATM-80 is a data-acquisition and control system for the Color Computer. It features a 20 μs, 8-bit, A-to-D converter; 32-channel analog multiplexer; programmable gain amplifier; peak detector amplifier; 8-bit D-to-A converter; 4-bit I/O port; 2K RAM; control software in ROM; and user's manual.

Battery Back-Up

Company Name: Sav-A-Byte

Address: 2857 Emanuel Church Road, W. Columbia, SC 29169

Phone: 803-356-2398

Price: $99

Warranty: 10-day unconditional return, 90-day warranty

Service: Customer pays only shipping charges

Description: Battery Back-Up prevents memory loss due to loss of power. It works to keep your memory alive up to four hours during a power failure. It plugs into the ROM port without blocking it.

BT-1020 Real-Time Clock/Calendar

Company Name: Basic Technology

Address: Dept. H, P.O. Box 511, Ortonville, MI 48462

Phone: 313-627-6146

Price: $109

Warranty: 180 days

Service: Company

Description: This is a cartridge plug-in unit that gives the time of day, date, and all the other functions of a real-time clock/calendar. It has a built-in rechargeable battery back-up.

BT-1030 Versatile Interface Port

Company Name: Basic Technology

Address: Dept. H, P.O. Box 511, Ortonville, MI 48462

Phone: 313-627-6146

Price: $69.95

Warranty: 180 days

Service: Company

Description: A parallel port with two 8-bit ports and control lines, two 16-bit timers and shift register. It is ideal for home control or data input applications.

CMJ-TU

Company Name: Magnum Distributors Inc.

Address: 1000 S. Dixie Hwy. W #3, Pompano Beach, FL 33060

Phone: 305-785-2002

Price: $250

Warranty: 90 days, parts and labor

Service: Factory

Description: Enables you to transmit and receive SSTV, RTTY, CW, and WX/FAX. With text-to-speech option in CMJ-IF the Color Computer speaks words as received and displayed on the monitor when receiving RTTY and CW. (Needs CMJ-IF interface to CoCo.)

CoCo Cooler

Company Name: REM Industries Inc.

Address: 9420 "B" Lurline Ave., Chatsworth, CA 91311

Phone: 818-341-3719

Price: $39.95 plus $2 shipping

Warranty: Lifetime on motor switch and blade.

Service: Company

Description: Brings operating temperatures to ambient, regardless of accessory load. Reduces the temperature of the entire computer. Installs in one minute.

CoCo Cooler

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $49.95

Warranty: 90 days

Service: Company

Description: An internal cooling system for D and E board Color Computers. To install you must remove old RF shield and replace with a new one painted black. Comes with an internal fan and its own cord.

Color Mate

Company Name: Computer Systems Distributors

Address: P.O. Box 9769, Anaheim, CA 92802

Phone: 714-772-1390

Price: $495

Warranty: 90 days

Service: Factory

Description: This is an expansion chassis for the Color Computer including 64K RAM, programmable baud-rate serial port, 2K ROM, Winchester hard-disk port, SDOS operating system, Basic compiler, text editor, assembler, debugger, and utilities. Includes 400 pages of documentation.

Colorspeak Voice Synthesizer

Company Name: Bumblebee Software

Address: P.O. Box 25427, Chicago, IL 60625

Phone: 312-275-4183

Price: $129 (10 percent off to sight impaired)

Warranty: 90 days service/parts and labor, 10-day money-back guarantee

Service: $30 flat service rate

Description: This hardware voice synthesizer is a cartridge-style pack. Its operating system software is in ROM. Operating software is a 4K machine-language program that includes text-to-speech, inflection, spelling, and phoneme modes. It includes a user's manual, phoneme dictionary, and demo tape that includes speak and spell, speak and math, talking timer, memory examine, and talking terminal programs. Operating software is not loaded from tape.

Colorware Light Pen

Company Name: Colorware Inc.

Address: 78-03 Jamaica Ave., Woodhaven, NY 11421

Phone: 212-647-2864

Price: $19.95

Warranty: 90 days

Service: Company

Description: The Colorware Light Pen plugs into your joystick port and comes with six programs on cassette. It is compatible with light-pen software such as Computer Island's Fun Pack.

CP/M-CoCo Coupler 1

Company Name: Wayne Technology

Address: P.O. Box 5196, Anaheim, CA 92804-1196

Phone: 714-772-5757

Price: $250

Warranty: 90 days

Service: Company

Description: Allows you to access the largest number of programs available. CoCo Coupler 1 adds the power of a 4 MHz, Z80A. Requires no modifications and plugs into the cartridge port. Maintains full Radio Shack compatibility and requires 64K with one or more disks with controller. Digital Research's CP/M 2.2 included.

EPROM Programmer

Company Name: Saturn Electronics Company Inc.

Address: 62 Commerce Drive, Farmingdale, NY 11735

Phone: 516-249-3388

Price: $140

Warranty: 1 year

Service: Company

Description: Plugs into the ROM port and uses on-board software. It requires no personality modules and has no switches. Will program 2500, 2700, and 68700 series EPROMs. Has gold-plated contacts.

Keyboard Beeper Cartridge

Company Name: Eng Systems Laboratories

Address: 8203 Springfield Village Drive, Springfield, VA 22152

Phone: 703-569-8660

Price: $59.95

Warranty: 30 days, satisfaction guaranteed

Service: Preauthorized return to ESL, nominal service fee.

Description: General enhancement device provides beep in response to each valid keystroke; front-accessible reset switch; three power indicators for +12, −12, and +5V supplies; extension cable and connector; interrupt control switch that allows power-up into game pack or Basic. Permits copying of game pack to RAM, disk, or cassette. No hardware or software modifications are needed to implement or support the device.

Mem-Pak

Company Name: PBJ Inc.

Address: 911 Columbia Ave., North Bergen, NJ 07047

Phone: 201-330-1898

Price: $110 (with 16K)

Warranty: 90 days repair/replacement

Service: Company

Description: The Mem-Pak is a memory-expansion cartridge that can expand memory in the form of EPROM or RAM and can accommodate up to 16K. The RAM cartridge can only be implemented on an unmodified revision E or older computer or by using the C-C Bus. Bare board with documentation available for $17.95.

Mitronix CW Modem

Company Name: Mitronix

Address: 5953 Teutonia Ave., Milwaukee, WI 53209

Phone: 414-466-6151

Price: $54.95 (CW programs range $9.95–$26.95)

Warranty: 90 days

Service: Company

Description: A Morse-code interface used to change tones into digital pulses. A visual indicator is mounted on the unit to show that you are locked onto the signal, and that it is being received. It uses an optoisolator for keying a transmitter, instead of a relay that is subject to wear. There are five CW programs to choose from.

P-C Pak

Company Name: PBJ Inc.

Address: 911 Columbia Ave., North Bergen, NJ 07047

Phone: 201-330-1898

Price: $69.95 (parallel only), $62.75 (clock only), $114.95 (both)

Warranty: 90 days repair/replacement

Service: Company

Description: A dual-function cartridge containing both a fully buffered Centronics-compatible parallel port, and a real-time clock that can be battery powered. The P-C Pak can be purchased with either or both functions populated. Available as a bare board with documentation for $17.95.

Programmable Sound Module

Company Name: Oliprog Systems

Address: P.O. Box 2190, Station C, Ontario, Canada, M3N 259

Phone: 1-416-736-1504

Price: $99.50

Warranty: 90 days

Service: Company

Description: ROM pack with case. Produces infinitely variable sounds through the TV speaker. Completely software driven with on-board operating system. Ready to plug in and run.

Proto CoCo

Company Name: PBJ Inc.

Address: 911 Columbia Ave., North Bergen, NJ 07047

Phone: 201-330-1898

Price: $10.95 (three for $20)

Warranty: not applicable

Service: not applicable

Description: Proto CoCo is a prototyping board for the Color Computer that accommodates either point-to-point wiring or wire-wrap. All signals are identified on the board. It is designed to fit inside the disk controller case.

ProtoEPROM-CC

Company Name: Prototech Inc.

Address: P.O. Box 12104, Boulder, CO 80303

Phone: 303-499-5541

Price: $149.95

Warranty: 90 days

Service: Company

Description: This product is an EPROM burner and ROM emulator. It programs 2716, 2732, and 2732A 5V EPROMs. User can run the contents of the EPROM as if it were a ROM pack. An additional ROM-pack connector is provided on-board to allow the ProtoEPROM-CC to be used simultaneously with a ROM pack or disk. It includes 4,096 words of RAM to allow the programmer to debug a program before committing it to EPROM. Plugs into the ROM port of the CoCo and is powered by the computer.

"This guide will give you information on the variety, functions, and prices of peripherals on the market..."

Real Talker

Company Name: Colorware Inc.

Address: 78-03 Jamaica Ave., Woodhaven, NY 11421

Phone: 212-647-2864

Price: $59.95

Warranty: 90 days (30-day money back)

Service: Company

Description: This hardware voice synthesizer in cartridge-pack form comes with Colorware's Text-to-Speech program. The Phoneme Editor program allows you to create speech at the phoneme level. Real Talker is compatible with 16K, 32K, and 64K Extended or nonextended CoCo. It works with a disk system with the 4-Branching Cable (available from Colorware for $29.95).

RS-232 Switcher

Company Name: DSL Computer Products

Address: 13726 W. Warren, Dearborn, MI 48126

Phone: 313-582-8930

Price: $29.95 (two-way), $39.95 (three-way)

Warranty: 30-day exchange

Service: Contact Company

Description: This product allows up to three items to be connected to the Color Computer RS-232 port. You can access any peripheral by turning the switch. Models for two-way and three-way access are available.

RS-232 Three-Position Switcher

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $29.95

Warranty: 90 days

Service: Company

Description: Allows you to independently hook up any of three RS-232 devices at one time.

SAM Saver

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $14.95

Warranty: 90 days

Service: Company

Description: An on/off power indicator for the Co-Co. It installs externally and requires no soldering.

"Before you invest... research the products thoroughly..."

Spectrum Control Center

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $99.95

Warranty: 90 days

Service: Company

Description: Includes two-position RS-232 Switcher, on/off indicator, cassette level meter, and manual/automatic tape switch. It also includes jacks for joysticks, modem, and tape.

Spectrum Light Pen

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $19.95

Warranty: 90 days

Service: Company

Description: Plugs into the joystick port and reads the colors off your screen. Used for entertainment purposes, and as an educational tool for those too young to control the keyboard.

The Spectrum Remote Reset

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $12.95

Warranty: 90 days

Service: Company

Description: An aluminum bar that allows you to reset your Color Computer from the front of the machine.

Spectrum Voice Pak

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $69.95

Warranty: 90 days

Service: Company

Description: A complete phoneme-based voice system that uses the famous Votrax SCO1 chip synthesizer in a cartridge-style pack. The Voice Pak adds speech to any Basic program in minutes.

The Color Burner

Company Name: Green Mountain Micro

Address: Dept. HC, Bathory Road, Roxbury, VT 05669

Phone: 802-485-6112

Price: $49.95 assembled/$39.95 kit form

Warranty: 6 months

Service: Company

Description: An EPROM programmer specifically for the 2716, 2732, 2764, 27128, and 27256 EPROMs. Duplicates from software and EPROMs. Programming software requires Extended Color Basic, minimum 16K. Gold-edge connectors ensure glitch-free, reliable programming. Specifications: Two 6821 PIAs plus voltage control logic, four transistors, personality module socket and zero insertion force EPROM socket. Requires three 9-volt alkaline batteries and EPROMs (not included) and 230 mA current draw (maximum).

The Color Pack

Company Name: Green Mountain Micro

Address: Dept. HC, Bathory Road, Roxbury, VT 05669

Phone: 802-485-6112

Price: $29.95 assembled, $19.95 kit

Warranty: 6 months assembled

Service: Company

Description: The Color Pack plugs into the ROM port and serves as a receptacle for user-programmed EPROMs, or for extra ROM. It comes with its own software, and is operated from the keyboard. The contacts are gold plated for reliable operation.

TV Stand

Company Name: Howard Medical Company

Address: 1690 N. Elston, Chicago, IL 60622

Phone: 312-944-2444

Price: $19.95 and up

Warranty: 1 year. 30-day return for any reason

Service: Factory

Description: This stand goes over or behind the computer and elevates a TV or monitor. Plexiglass construction matches the computer appearance. It comes in smoked gray, ivory, or clear. Printer stands are also available.

Video Clear

Company Name: Spectrum Projects

Address: 93-15 86th Drive, Woodhaven, NY 11421

Phone: 212-441-2807

Price: $14.95

Warranty: 90 days

Service: Company

Description: A rejection filter and cable that help eliminate interference on your Color Computer. This device is especially useful for people with disk drives.

Word-Pak

Company Name: PBJ Inc.

Address: 911 Columbia Ave., North Bergen, NJ 07047

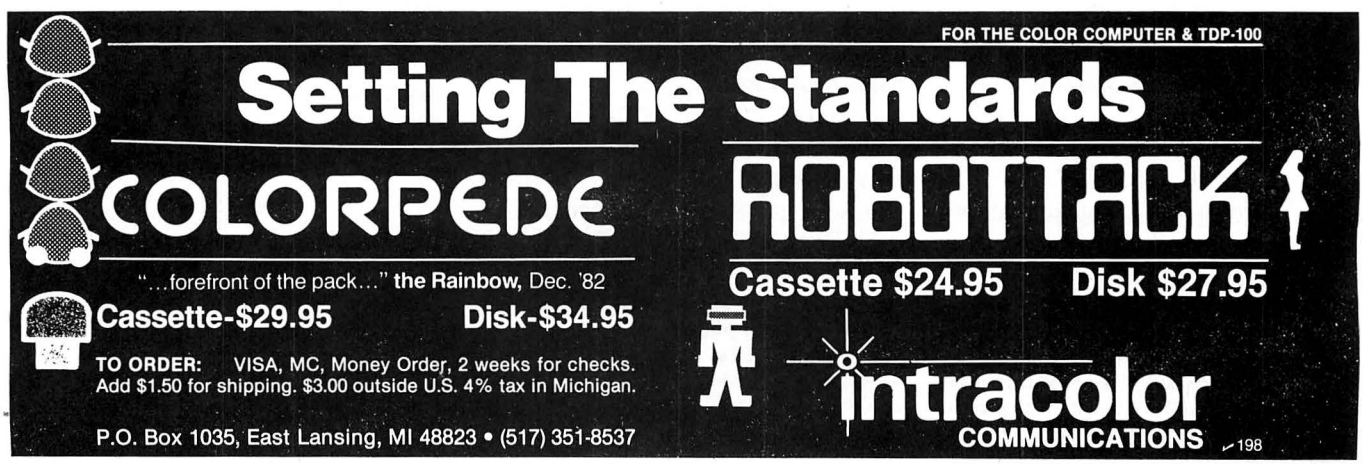
Phone: 201-330-1898

Price: $139.95

Warranty: 90 days repair/replacement

Service: Company

Description: Word-Pak is a video cartridge for the Color Computer. It plugs into the ROM port or an expansion bus, and produces a high-quality, 80-column display comparable to high-priced terminals. Software provided with the board includes many of the standard screen functions required for terminal emulation. Software patches are available to run FLEX, OS-9, and CP/M.



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BY MICHAEL L. JOHNSON

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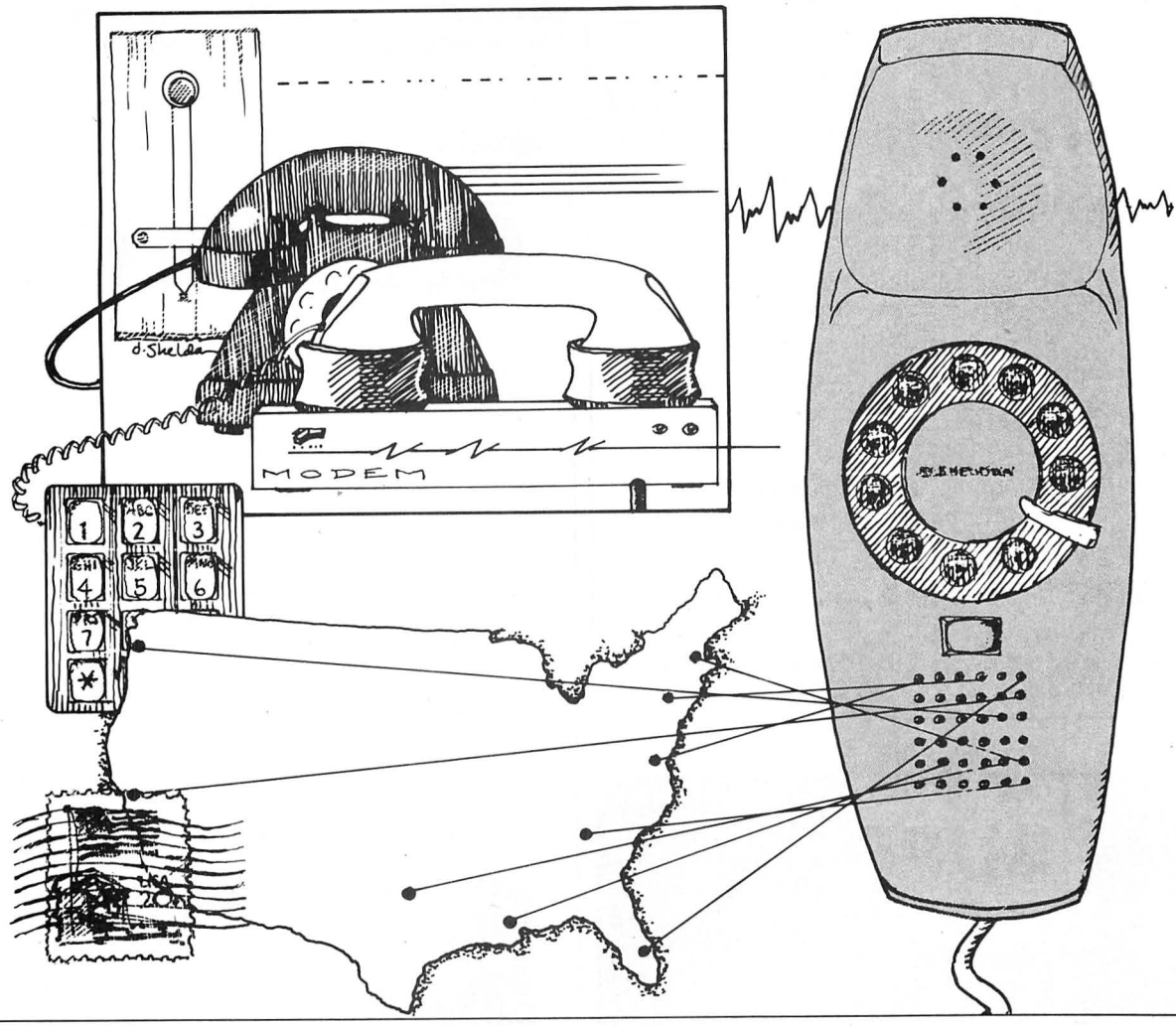

Is electronic communication for you? If you own, or are considering the purchase of a modem and terminal package for your Color Computer, you might have been confused by some esoteric terms. If you are curious by talk of bulletin-board services (BBSs), information systems, and electronic mail (email), here is some important information.

Your questions about modems and communications systems are answered in this tidy CoCo tutorial.

Equipment

The first piece of communication equipment you need is a modem. These devices come in all shapes and sizes. The modem for the Color Computer sold by Radio Shack uses the RS-232 serial port. This poses a problem for those who want to use their printer and modem at the same time. You can solve it with the purchase of a Videotex (catalog #26-2222) package from Radio Shack that connects the modem to the end of the ROM pack.

Modems have different baud rates (the speed at which they communicate). This is important if you use your modem for long-distance calls. Modems usually come in two rates, 300 and 1,200 baud; the slower 300 baud modem is the most common.

Other modem features include auto-dial and auto-answer. Your terminal program drives auto-dial and lets the modem dial numbers unassisted. Auto-answer means that the computer picks up the phone, a feature necessary for unattended computers like those used for bulletin-board systems.

Your terminal package is important and should be evaluated carefully. Consider one difference between programs: Is the storage media cassette, disk, or ROM pack?

Cassette-based programs take a long time to load, and if your system crashes, the line might be busy when you try to get back on-line. If you do not have a disk system, a ROM pack is best. It loads in a few seconds, leaves more room for a text buffer, and you can still use the cassette for storage.

A disk system is the best of choices since the disk has a larger and faster storage system, and most packages let you save phone numbers and sign-on messages for later use.

You also want to consider other package features including expanded display format (15-by-15, 32-by-16, and

51-, 64-, 85-by-24), full duplex, and half duplex. It is useful to have a program with an expanded display format so you can accurately read Apple's, Model III's, or other computers' outputs without screen wraparound.

Full duplex means that your screen doesn't display typed characters. In half duplex, the characters are sent to the modem and the display. CompuServe and others echo characters back to make them appear on your screen.

Information Services

When you have your modem and terminal package you can start communicating. Information services such as CompuServe, Dow Jones News Retrieval, and The Source are among the many available to you with your modem.

CompuServe is available through Radio Shack. With Videotex you usually get a sign-on package with a free hour on the service, a user identification, and a password. If you want continued service, sign up for it and receive a new password. Once on-line with CompuServe, you have information at your fingertips ranging from encyclopedias to adventure solutions.

The email feature of CompuServe lets you send electronic messages through the computer. All you need to know to use email is the identification of the receiver. Short messages on email are more reasonable than a long-distance phone call, but longer ones can take quite a bit of time to type. Email is, of course, faster than the Post Office.

The CB Simulation is one of the highlights of CompuServe. Since people all over the country use the system simultaneously, they can all use the CB Simulation, each with their own "handle."

A number of special-interest groups (SIGs) are available with CompuServe. These are like bulletin-board systems for various types of computers, programming languages, and so on, and they are available to anyone. There is a Color Computer SIG with Wayne Day as the sysop (system operator), and there is soon to be an OS-9 SIG.

CompuServe's games include adventures, casino games, and multiuser games.

The *Academic American Encyclopedia* is at the top of CompuServe's educational section. It gives references and information related to specific topics, and though it costs five dollars per hour extra, it is a great tool for students. Another great idea is the College Board section that gives information on how to take the SATs. You will also find general help with test-taking techniques.

You can even do electronic shopping with CompuStore. Purchases are charged right to your VISA card.

In the programming area of CompuServe you can use languages that don't run on your computer and save these programs on allocated disk space. The first 128,000 bytes are free and then it costs $4 a week for each 64K you want to store. Basic, Fortran, Pascal, a PDP macroassembler, Bliss, and Snobol languages are available.

CompuServe costs (at the writing of this article) $6 per hour from 6 p.m. to 5 a.m., billed in minute increments. Access to the service at other times costs you twice as much.

"BBSs are run by individuals who have a computer dedicated to handle calls from users. People can call a service to leave or receive messages, catch up on local news, trade programs, and share programming techniques."

The Source, a *Reader's Digest* product, is available in computer and book stores around the nation for $50 to $100. It includes only the sign-on package, not a terminal package.

Here you also find electronic-mail service. The Source offers several other ways to communicate through the system including the "chat option" that allows users to talk to each other. With the teleconferencing feature, businesses or individuals in different locations can have a round-table discussion and even share notes.

The Source also has a wealth of news information at its disposal including UPI news releases, sports bulletins, stocks and other Wall Street business, reference libraries, and several newspapers.

Shop-at-home services, several on-line games, and travel information are among The Source's more interesting features.

The Source's educational options include drills in elementary subjects, math, foreign languages, and geography.

Bulletin-Board Services

BBSs are run by individuals who have a computer dedicated to handle calls from users. People can call a service to leave or receive messages, catch up on the local news, trade programs, and share programming techniques. People who run BBSs are called sysops (system operators), and usually do this as a hobby.

With the chat function you can call the sysop to talk, ask questions, or get technical help. Access it with the C key.

Several commands control public and private bulletin boards. You might be notified, upon signing on, that you have a message waiting, or you might want to scan (s) the list of titles. You can retrieve (r) a message, or several at once, using the new messages (n), marked messages (m), forward (f), or backward (b) commands.

Another feature common to all bulletin boards is the help feature that lists commands and their meanings. To get it, press the ? key or the help (h) key at the command level.

One last item is downloading. This feature gives you access to a wide assortment of public-domain software. A sysop might put a text file in the download section for his users to read.

Table 1 is a partial list of bulletin-board numbers, many of which I acquired through the Colour-80 board of Orange Park, FL (904-264-0335).

(Check *HOT CoCo*'s On-Line section in Feedback each month for new BBSs—eds.)

With all the communications services offered, a modem for your Color Computer is a wise investment. ■

Colour-80	904-264-0335
Communications Hex	904-721-3271
Color-80 #26	303-249-7866
Colorburst	305-525-1192
CoCo Nest #1	212-423-4623
CoCo Board II	404-378-4410
Concept 80	212-836-3019
Rainbow #1	212-441-3755
Rainbow #2	212-441-3766
Rainbow #3	212-441-5719
Flexnet	405-722-6809
Bee Color BBS	503-649-4497
N. C. Software	612-533-1957
Desert BBS	619-367-3269
Forum 68	803-279-5392
OS-9 BBS	312-397-8308

Table 1. CoCo Bulletin Boards

Write to Michael L. Johnson at 7481 Greenway Drive, Jacksonville, FL 32244, or through CompuServe (71446, 377).

BY GEORGE C. SIEVERS

COLOR LISP

Discover more about the Lisp programming language with this adaptation for your Color Computer.

Lisp is a programming language that differs in syntax and data structure from more traditional languages. It is a list processor, and falls between machine language and higher-level languages such as Basic, Pascal, APL, or Fortran. Much of today's research in symbolic math systems, natural language interfaces, and artificial intelligence is being done in Lisp or in a higher-level language based on Lisp.

Where many languages work with numbers, Lisp works with objects in symbol manipulation. Relationships between objects such as "chair" and "block" are represented in lists. Each object or number making up a list is called an atom, and two special atoms come predefined in every Lisp system.

These atoms are T and NIL, and can usually be thought of as true and false, respectively. NIL also represents the empty list, and the atoms NIL and ( ) are equivalent in all respects.

Lists are built out of atoms and other lists, with a left parenthesis to mark the beginning of a list and a right parenthesis to mark the end. (ABC), (MUL 2 3), (A(B(CD)E)FG), and ( ) are all examples of lists. With Lisp, one program can produce another program and execute it.

Using Color Basic Lisp

Type in the Color Basic Lisp interpreter in the Program Listing and try the examples given along with any ideas you might have. (Before running the program type PCLEAR1.) Color Basic Lisp is only a subset of a full-blown Lisp system, but it teaches aspects of Lisp programming. All the examples in this series are geared toward Color Basic Lisp, and important differences are pointed out along the way.

To type an expression to the interpreter, enter a statement like (ADD 1 1). There is no need to press the enter key because as soon as you close all the open parentheses, the expression is evaluated and answered. In this case, a two is returned. Remember that atoms must be separated by a space or carriage return, so that (ADD 11) is not the same as (ADD 1 1).

"Where many languages work with numbers, Lisp works with objects in symbol manipulation."

Lisp is a more highly interactive language than Basic. It actually processes some of your input as you type, so speed typists, beware. A moderate, steady pace is best and protects against typos. When you do make an error, delete it immediately to avoid filling the interpreter's internal memory with mistakes.

To make these deletions, immediately close the remaining open parentheses. Backspacing will not work. When the error prompt returns, type (%) to delete the mistake.

As the Lisp interpreter operates it reads and evaluates an s-expression and prints the results. An s-expression is evaluated using these rules: The value of T is T, the value of NIL is NIL, and the value of any number is itself. The value of any other atom is the s-expression to which it is bound. Type in some atoms and let the interpreter evaluate them for you.

Lisp Functions

In Color Basic Lisp an apostrophe is used to quote an s-expression. When you quote something, you tell the interpreter not to evaluate any further. (MUL 2 3) is a function call resulting in 6, and '(MUL 2 3) is just a list of three atoms. The apostrophe is equal to the QUOTE function.

The function EVAL provides an extra round of evaluation and is useful

System Requirements

32K RAM
Extended Color Basic
Disk optional

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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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for taking lists apart. The Lisp functions CAR and CRD also do this.

CAR returns the first element of a list: (CAR'(ABC)) would return A. CDR returns a list of all elements of a list except the first: (CDR'(ABC)) would return (BC). The DELETE function removes part of a list by taking an atom and a list as arguments and returning a test copy of the list with all top-level occurrences of the atom deleted.

You can also put lists back together. CONS, LIST, and APPEND do this. CON takes a list and a new first element for the list and returns it with the element added. LIST lists arguments, and APPEND strings the top-level contents of each list given as an argument into a single list.

Since the Color Computer has no "ON ERROR...GOTO" statement, whenever there is an error that breaks the program, type GOTO 30 and continue. Do not type RUN as that will clear all variables and whatever you have done will be lost. The only time I got a program-breaking error was after I had input an illegal Lisp function. Using this error-recovery procedure, I was able to continue.

This program also contains options for loading files from disk and saving files to cassette, disk, screen, or printer. You can also "prettyprint" Lisp functions to the printer.

If you do not have a printer or a disk, and don't wish to deal with the choice of menus every time you want to save a file, edit line 320 to read:

```
320 R=X:X=AL:ON(R-6000)GOSUB4050,
50,4120,4150,4190,4285,4265,4275,4399,4500,
4600,4650,4700,4750
```

As Mr. Beer points out, there are several good texts written about Lisp. The February, March, and April 1983 issues of *Scientific American* ran a series of articles on Lisp by Doug Hofstader, listed under the column "Metamagical Themas." You will find some interesting examples in that reading. I am indebted to Mr. Beer for his excellent series in *80 Micro*, and for this opportunity to bring Lisp to the Color Computer user. ■

Address correspondence to George Sievers, 3733 W. 80th Ave., Merrillville, IN 46410.

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*Color Basic Lisp is a Color Computer version of Randy Beer's "Basic Lisp" (*80 Micro, *March and April 1983, pp. 176, 254). The length of this Lisp tutorial prohibits publication of the series in full, but readers are invited to send a self-addressed, stamped envelope to* HOT CoCo, *80 Pine St., Peterborough, NH 03458, for a reprint of the articles.—eds.*

Program Listing. Color Lisp

```
5 REM     * BASIC LISP VER 1.2 *
10 REM * BY RANDY BEER; AUG., 19
81 *
11 REM * ADAPTED FOR THE COLOR C
OMPUTER BY: *
12 REM * GEORGE C. SIEVERS; MAR.
, 1983 *
13 REM *INCLUDES CHANGES IN THE
LOAD, SAVE AND PRINTF ROUTINES T
HAT ENABLE PRINTF TO WORK WITH A
 PRINTER AND ALLOW LOADS FROM DI
SK OR TAPE AND SAVES TO DISK,TAP
E,SCREEN OR PRINTER
15 CLS:CLEAR550:DIMLM(1100),PL(1
100),OB$(90),PT(90),ST(350),FP(5
0),T1(15),X1(15):N=3000
22 PRINTTAB(XX)"BASIC LISP VER 1
.1":PRINT:PRINT"INITIALIZING....
.WAIT":PRINT
24 FORJ=0TO48:READOB$(J),PT(J):N
EXT:PE=48:FE=1:OB$(46)=CHR$(13):
FP(1)=MEM
26 FORJ=1TO1099:PL(J)=J+1:NEXT:P
L(1100)=N:BS=1
28 T=3001:LP=3043:RP=3044:CC=33:
N1=58:N2=44:LB=3031:QU=3030:NB=3
032
30 A=0:QT=0:J=0:PRINT:PRINT"$ ";
:GOSUB50:GOSUB265:GOSUB210:GOTO3
0
50 J1=0:GOSUB90
55 GOSUB100:IFX<>LP THENRETURN
60 J1=J1+1:X1(J1)=BS:T1(J1)=BS:L
M(T1(J1))=0:BS=PL(BS):IFQ THENRE
TURN
65 GOSUB55:IFX=RP THEN80
70 IFLM(T1(J1))<>0THENPL(T1(J1))
=BS:T1(J1)=BS:BS=PL(BS)
75 LM(T1(J1))=X:IFQ THENRETURNEL
SE65

80 PL(T1(J1))=N:X=X1(J1):IFLM(X)
=0ANDPL(X)=N THENPL(X)=BS:BS=X:X
=N
85 J1=J1-1:RETURN

90 A$=INKEY$:IFA$=""THEN90ELSEPR
INTA$;:KK=ASC(A$):RETURN

100 IFKK=40THENX=LP:GOTO200
105 IFKK=41THENX=RP:IFJ1=1ORJ1=2
ANDQT THENRETURNELSE200
110 IFKK=39THENQ=-1:QT=QT+1:GOSU
B60:LM(T1(J1))=QU:Q=0:GOSUB90:GO
SUB55:Q=-1:GOSUB70:Q=0:GOSUB80:Q
T=QT-1:RETURN
115 IFKK<CC THENGOSUB90:GOTO100E
LSE125
120 IFKK<CC ORKK=40ORKK=41ORKK=3
9THEN130
125 I$=I$+A$:GOSUB90:GOTO120
130 IFASC(I$)<N1 AND ASC(I$)>N2
THEN150
135 FORJ=0TOPE:IFOB$(J)=I$THENX=
J+N:I$="":J=0:RETURNELSENEXT
145 J=0:PE=PE+1:OB$(PE)=I$:X=PE+
N:I$="":RETURN
150 WW=VAL(I$):GOSUB10000:I$="":
RETURN
200 GOSUB90:RETURN
210 IFA$<>CHR$(13)THENPRINT
215 J1=1:X1(J1)=X:GOSUB225:PRINT
:RETURN
225 IFX>5000THENPRINT"; UNPRINTA
BLE MACHINE CODE";:RETURNELSEIFX
>4000THENPRINT#DV,FP(X-4000);:RE
TURN
230 IFX=>N THENPRINT#DV,OB$(X-N)
;:RETURN
235 IFX=0THENRETURN
237 IFLM(X)=QU THENPRINT#DV,"'";
:X=LM(PL(X)):GOSUB225:RETURN
240 J1=J1+1:X1(J1)=X:PRINT#DV,"(
";
245 X=X1(J1):X=LM(X):GOSUB225
250 X=X1(J1):J1=J1-1:X=PL(X):IFX
=N THENPRINT#DV,")";:RETURNELSEI
FX>N THENPRINT#DV," . ";:GOSUB22
5:PRINT#DV,")";:RETURNELSEIFX=0T
HENX=1/0
255 J1=J1+1:X1(J1)=X:PRINT#DV,"
";:GOTO245
265 FP(1)=MEM:IFX>4000ANDX<5001O
RX=N ORX=T THENRETURN
270 IFX>N THENV=X:X=PT(X-N):IFX=
0ANDA=0THENER=6:GOTO25000ELSERET
URN
275 ST(A+1)=TT:ST(A+2)=AL:ST(A+3
)=C:ST(A+4)=E:A=A+4
280 AL=PL(X):E=X:X=LM(X):GOSUB26
5
285 IFX=>N ANDX<4001THENER=1:GOT
O25000
290 IFX>6000THEN320ELSEIFX>5000T
HEN315ELSEIFLM(X)=LB THEN335ELSE
IFLM(X)=NB THEN337ELSEER=1:GOTO2
5000
315 TT=X:GOSUB500:ON(TT-5000)GOS
UB4000,4010,4025,4035,4060,4070,
4295,4290,4085,4095,4130,4170,42
00,4220,4230,4245,4255,4300,4315
,4310,4450:GOTO330
320 R=X:X=AL:ON(R-6000)GOSUB4050
,50,4120,4150,4190,4285,4265,427
5,30100,30000,30000,4650,4700,47
50
330 E=ST(A):C=ST(A-1):AL=ST(A-2)
:TT=ST(A-3):A=A-4:RETURN
335 TT=AL:E=PL(X):AL=LM(E):GOSUB
500:AL=TT:GOSUB500:C=LM(E):A=A-S
T(A):GOTO340
337 TT=AL:E=PL(X):AL=LM(E):GOSUB
500
338 ST(A+1)=TT:ST(A+2)=1:C=LM(E)
:A=A+1
340 IFC<>N THENPT(LM(C)-N)=ST(A)
:A=A+1:C=PL(C):GOTO340
345 A=A-ST(A)-1:TT=PL(E)
350 IFTT<>N THENX=LM(TT):GOSUB26
5:TT=PL(TT):GOTO350
355 C=LM(E):A=A-ST(A)
360 IFC<>N THENPT(LM(C)-N)=ST(A)
:A=A+1:C=PL(C):GOTO360
365 A=A-ST(A)-1:GOTO330
500 C=0:IFAL=N THENIFC=0THENA=A+
1:ST(A)=0:GOTO510ELSE510
505 X=LM(AL):GOSUB265:C=C+1:A=A+
1:ST(A)=X:IFPL(AL)<>N THENAL=PL(
AL):GOTO505
510 A=A+1:ST(A)=C:RETURN

4000 IFST(A)<>1THENER=2:GOTO2500
0
4005 A=A-1:IFST(A)=N THENX=N:A=A
-1:RETURN
4006 IFST(A)<200ANDST(A)>0THENX
=LM(ST(A)):A=A-1:RETURN
4007 ER=4:GOTO25000
4010 IFST(A)<>1THENER=2:GOTO2500
0
4015 A=A-1:IFST(A)=N THENX=N:A=A
-1:RETURN
```

Listing continued

Listing continued

```
4017 IFST(A)<2001ANDST(A)>0THENX
=PL(ST(A)):A=A-1:RETURN
4020 ER=4:GOTO25000
4025 IFST(A)<>2THENER=2:GOTO2500
0
4030 A=A-1:T2=BS:BS=PL(BS):LM(T2
)=ST(A-1):PL(T2)=ST(A):A=A-2:X=T
2:RETURN
4035 IFST(A)<>2THENER=2:GOTO2500
0
4040 A=A-1:IFST(A-1)<N ORST(A-1)
>4000THENER=3:GOTO25000
4045 PT(ST(A-1)-N)=ST(A):A=A-2:R
ETURN
4050 X=LM(AL):RETURN
4060 WW=0:FORJ=1TOST(A):A=A-1:IF
ST(A)>4000ANDST(A)<5001THENWW=WW
+FP(ST(A)-4000):NEXTELSEER=5:GOT
O25000
4065 A=A-1:GOSUB10000:RETURN
4070 IFST(A)<>2THENER=2:GOTO2500
0
4075 A=A-1:IFST(A)<4001ORST(A)>5
000ORST(A-1)<4001ORST(A-1)>5000T
HENER=5:GOTO25000
4080 WW=FP(ST(A-1)-4000)-FP(ST(A
)-4000):A=A-2:GOSUB10000:RETURN
4085 WW=1:FORJ=1TOST(A):A=A-1:IF
ST(A)>4000ANDST(A)<5001THENWW=WW
*FP(ST(A)-4000):NEXTELSEER=5:GOT
O25000
4090 A=A-1:GOSUB10000:RETURN
4095 IFST(A)<>2THENER=2:GOTO2500
0

4100 A=A-1:IFST(A)<4001ORST(A)>5
000THENER=5:GOTO25000
4105 A=A-1:IFST(A)<4001ORST(A)>5
000THENER=5:GOTO25000
4110 IFFP(ST(A+1)-4000)=0THENER=
7:GOTO25000
4115 WW=FP(ST(A)-4000)/FP(ST(A+1
)-4000):A=A-1:GOSUB10000:RETURN
4120 IFLM(AL)=>N ANDLM(AL)<4000T
HENX=LM(PL(AL)):GOSUB265:PT(LM(A
L)-N)=XELSEER=3:GOTO25000
4125 AL=PL(AL):IFAL=N THENER=2:G
OTO25000ELSEAL=PL(AL):IFAL=N THE
NRETURNELSE4120
4130 IFST(A)<>1THENER=2:GOTO2500
0
4135 A=A-1:IFST(A)=>N ANDST(A)<5
000THENX=T:A=A-1:RETURNELSEX=N:A
=A-1:RETURN
4150 C=LM(AL):X=LM(C):GOSUB265:I
FX=N THENAL=PL(AL):IFAL=N THENRE
TURNELSE4150
4155 AL=PL(C)
4160 X=LM(AL):GOSUB265:IFPL(AL)=
N THENRETURNELSEAL=PL(AL):GOTO41
60
4165 AL=PL(C)
4170 IFST(A)<>2THENER=2:GOTO2500
0
4175 A=A-1:IFST(A)=ST(A-1)THENX=
T ELSEX=N
4180 A=A-2:RETURN
4190 PL(E)=BS:BS=E:X=LM(AL):PT(X
-N)=AL:IFLM(PL(AL))=N THENLM(AL)
=LB:RETURNELSEIFLM(LM(PL(AL)))=L
B ORLM(LM(PL(AL)))=NB THENPT(X-N
)=LM(PL(AL)):RETURNELSELM(AL)=LB
:RETURN
4200 IFST(A)=0THENX=N:A=A-1:RETU
RNELSEX=BS:BS=F=ST(A):A=A-F:FORJ=1T
OF:IFST(A)=0THENER=4:GOTO25000EL
SEG=BS:BS=PL(BS):LM(G)=ST(A):A=A
+1:NEXT:PL(G)=N:A=A-ST(A)-1:RETU
RN
4220 A=A-1:IFST(A)=N THENX=T ELS
EX=N
4225 A=A-1:RETURN
4230 IFST(A)<>1THENER=2:GOTO2500
0ELSEA=A-1
4235 IFST(A)>4000ANDST(A)<5000TH

ENX=T ELSEX=N
4240 A=A-1:RETURN
4245 IFST(A-1)>4000ANDST(A-1)<50
00THENFORJ=1TOST(A)-1:A=A-1:IFST
(A-1)>4000ANDST(A-1)<5000THENIFF
P(ST(A)-4000)<FP(ST(A-1)-4000)TH
ENX=T:NEXT:A=A-2:RETURNELSE4252E
LSE4250
4250 ER=5:GOTO25000
4252 X=N:A=A-2:RETURN
4255 IFST(A-1)>4000ANDST(A-1)<50
00THENFORJ=1TOST(A)-1:A=A-1:IFST
(A-1)>4000ANDST(A-1)<5000THENIFF
P(ST(A)-4000)>FP(ST(A-1)-4000)TH
ENX=T:NEXT:A=A-2:RETURNELSE4261E
LSE4260
4260 ER=5:GOTO25000
4261 X=N:A=A-2:RETURN
4265 IFAL<>N THENX=LM(AL):GOSUB2
65:IFX<>N THENAL=PL(AL):GOTO4265
4270 RETURN
4275 IFAL<>N THENX=LM(AL):GOSUB2
65:IFX=N THENAL=PL(AL):GOTO4275
4280 RETURN
4285 X=E:RETURN
4290 IFST(A)<>1THENER=2:GOTO2500
0ELSEA=A-1:X=ST(A):GOSUB210:X=0:
A=A-1:RETURN
4295 IFST(A)<>1THENER=2:GOTO2500
0ELSEA=A-1:X=ST(A):GOSUB265:A=A-
1:RETURN
4300 IFST(A)<>1THENER=2:GOTO2500
0
4305 A=A-1:X=ST(A):IFX=>N ANDX<5
000THENGOSUB225:X=0:A=A-1:RETURN
ELSEER=3:GOTO25000
4310 IFST(A)=0ORST(A-1)=N THENX=
N:A=A-ST(A)-1:RETURNELSEX=BS:FOR
J=A-ST(A)TOA-1:Y=ST(J):IFY=0ORY>
2000ANDY<>N THENER=4:ST(A)=Y:GOT
O25000
4312 IFY<>N THENZ=BS:BS=PL(BS):L
M(Z)=LM(Y):Y=PL(Y):GOTO4312
4313 NEXT
4314 A=A-ST(A)-1:PL(Z)=N:RETURN
4315 IFST(A)<>2THENER=2:GOTO2500
0
4320 A=A-1:IFST(A)<4001ORST(A)>5
000THENER=5:GOTO25000
4325 A=A-1:IFST(A)<4001ORST(A)>5
000THENER=5:GOTO25000
4330 WW=FP(ST(A)-4000)^FP(ST(A+1
)-4000):GOSUB10000:A=A-1:RETURN
4399 IFLM(AL)<3000 OR LM(AL)>400
0THENER=1:GOTO4447ELSET2=PT(LM(A
L)-N):IFT2>2000 OR T2=0THENER=1:
GOTO4447ELSEIFLM(T2)<>LB AND LM(
T2)<>NB THENER=1:GOTO4447
4400 PRINT#DV:PRINT#DV:PRINT#DV,
"(DEFUN ";:X=LM(AL):A$=CHR$(13):
GOSUB230:PRINT#DV," (";:X=LM(T2)
:GOSUB230:PRINT#DV," ";:T2=PL(T2
):X=LM(T2):J1=1:X1(J1)=X:GOSUB22
5:J=0:J2=0
4405 T2=PL(T2):IFT2<>N THENPRINT
#DV:PRINT#DV,TAB(3);:X1(J2)=-2:X
=LM(T2):GOSUB4410:GOTO4405ELSEPR
INT#DV,"))";:X=0:RETURN
4410 IFX>4000THENPRINT#DV,FP(X-4
000);:RETURN
4415 IFX=>N THENPRINT#DV,OB$(X-N
);:RETURN
4420 IFLM(X)=QU THENPRINT#DV,"'"
;:X=LM(PL(X)):GOSUB225:RETURN
4425 J=J+1:T1(J)=X:D=LM(X):B=D-N
:IFB=40 OR B=41 OR B=31THEN4445E
LSEIFB<>6 ANDB<>9ANDB<>10ANDB<>1
4ANDB<>20ANDB<>21THENPRINT#DV,"(
"; ELSE 4435
4430 X=T1(J):X=LM(X):GOSUB4410:X
=T1(J):J=J-1:X=PL(X):IFX=N THENP
RINT#DV,")";:RETURN ELSEJ=J+1:T1
(J)=X:PRINT#DV," ";:GOTO4430
4435 T1(J)=PL(T1(J)):PRINT#DV,TA
B(X1(J2)+2)"(";:J2=J2+1:X1(J2)=P
OS(0):X=D:GOSUB4415:PRINT#DV
4440 X=LM(T1(J)):PRINT#DV,TAB(X1
(J2)+2);:GOSUB4410:X=T1(J):J=J-1
:X=PL(X):IFX=N THENJ2=J2-1:PRINT
#DV,")";:RETURN ELSEPRINT#DV:J=J
+1:T1(J)=X:GOTO4440
4445 T1(J)=PL(T1(J)):PRINT#DV,TA
B(X1(J2)+2)"(";:J2=J2+1:X1(J2)=P
OS(0):X=D:GOSUB4415:PRINT#DV," "
;:X=LM(T1(J)):GOSUB4410:PRINT#DV
:T1(J)=PL(T1(J)):GOTO4440
4447 E=0:LM(E)=LM(AL):GOTO25000
4450 IFST(A)<>2THENER=2:GOTO2500
0ELSEA=A-1:IFST(A)>2000THENER=4:
GOTO25000ELSEA=A-1:IFST(A)<N ORS
T(A)>4000THENER=3:GOTO25000ELSEJ
=ST(A+1):D=ST(A):X=BS:Z=N
4455 IFJ<>N THENIFLM(J)=D THENGO
TO4460ELSEZ=BS:BS=PL(BS):LM(Z)=L
M(J) ELSEIFZ=N THENX=N:RETURN EL
SEPL(Z)=N:RETURN
4460 J=PL(J):GOTO4455
4500 PRINT:PRINT"; HIT ENTER TO
BEGIN";:GOSUB90:PRINT#DV,FE,PE,B
S:FORJ=2TOFE:PRINT#DV,FP(J):NEXT
:FORJ=49TOPE:PRINT#DV,OB$(J):PRI
NT#DV,PT(J):NEXT:FORJ=1TOBS:PRIN
T#DV,LM(J),PL(J):NEXT:X=0:RETURN
4600 PRINT:PRINT"; HIT ENTER TO
BEGIN";:GOSUB90:INPUT#DV,FE,PE,B
S:FORJ=2TOFE:INPUT#DV,FP(J):NEXT
:FORJ=49TOPE:INPUT#DV,OB$(J),PT(
J):NEXT:FORJ=1TOBS:INPUT#DV,LM(J
),PL(J):NEXT:X=0:RETURN
4650 X=0:A=A-1:IFPE>48THENPRINT:
PRINT"; ";OB$(PE);" DELETED FROM
 OB LIST";:PT(PE)=0:OB$(PE)="":P
E=PE-1
4655 RETURN
4700 TT=LM(AL):E=PL(AL):AL=E
4705 X=TT:GOSUB265:IFX<>N THENAL
=E:GOSUB4800:GOTO4705ELSERETURN
4750 TT=LM(AL):E=PL(AL):AL=E
4755 X=TT:GOSUB265:IFX=N THENAL=
E:GOSUB4800:GOTO4755ELSE RETURN
4800 IFAL<>N THENX=LM(AL):GOSUB2
65:AL=PL(AL):GOTO4800
4805 RETURN
10000 FORJ=1TOFE:IFFP(J)=WW THEN
10010
10005 NEXT:FE=FE+1:FP(FE)=WW:X=F
E+4000:RETURN
10010 X=J+4000:RETURN
25000 X=ST(A):J1=1:X1(J)=X:IFA$<
>CHR$(13)THENPRINT
25001 A$=CHR$(13):ON ER GOTO2500
2,25003,25004,25005,25006,25007,
25008
25002 PRINT"; ";:X=LM(E):GOSUB23
0:PRINT" INVALID FUNCTION NAME";
:GOTO25050
25003 PRINT"; IMPROPER NUMBER OF
 ARGUMENTS TO SUBR OR NSUBR";:GO
TO25050
25004 PRINT"; ";:GOSUB225:PRINT"
 INVALID ATOM";:GOTO25050
25005 PRINT"; ";:GOSUB225:PRINT"
 INVALID LIST";:GOTO25050
25006 PRINT"; ";:GOSUB230:PRINT"
 INVALID NUMBER";:GOTO25050
25007 PRINT"; ";:X=V:GOSUB230:PR
INT" UNBOUND ATOM";:GOTO25050
25008 PRINT"; DIVISION BY ZERO";
:GOTO25050
25050 X=0:GOTO30
30000 ON(R-6000-9)GOTO30005,3004
0
30005 PRINT:DV$="PTSD":INPUT"SCR
EEN,PRINTER,DISK OR TAPE     (S,
P,D,T)";Y1$:Y$=LEFT$(Y1$,1):FD=I
NSTR(DV$,Y$):IF FD=0 THENRETURNE
LSEDV=FD-3:OPEN"O",#DV,"LISPFILE
":GOSUB4500:DV=0:CLOSE:RETURN
30040 PRINT:DV$="T"+CHR$(0)+"D":
INPUT"TAPE OR DISK (T,D)";Y1$:Y$
=LEFT$(Y1$,1):FD=INSTR(DV$,Y$):I
F FD=0 THENRETURNELSEDV=FD-2:OPE
N"I",#DV,"LISPFILE":GOSUB4600:DV
=0:CLOSE:RETURN
30100 PRINT:INPUT"DEVICE # (0,-2
)";DV:IFDV<>0 AND DV<>-2 THEN 30
100 ELSE GOSUB4399:DV=0:RETURN
50000 DATA NIL,3000,T,3001,SETQ,
6003,EQ,5012,CAR,5001,CDR,5002,C
OND,6004,DEFUN,6005,ATOM,5011,LI
ST,5013,APPEND,5020,ADD,5005,SUB
,5006,MUL,5009,CONS,5003,NUMBERP
,5015,GREATERP,5016,LESSP,5017,E
VAL,5007
50001 DATA PRINTF,6009,AND,6007,
OR,6008,DELETE,5021,SET,5004,DIV
,5010,NOT,5014,POWER,5019,PRINT,
5008,PATOM,5018,READ,6002,QUOTE,
6001,LAMBDA,6006,NLAMBDA,6006,SA
VE,6010,LOAD,6011,RPAREN,3044,LP
AREN,3043,QT,3045,CR,3046
50002 DATA SP,3047,DOWHILE,6013,
DOUNTIL,6014,%,6012,(,0,),0,',0,
CR,0," ",0,FREE,4001
```

END

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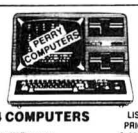

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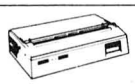

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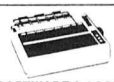

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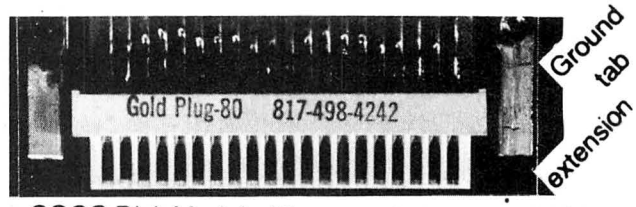

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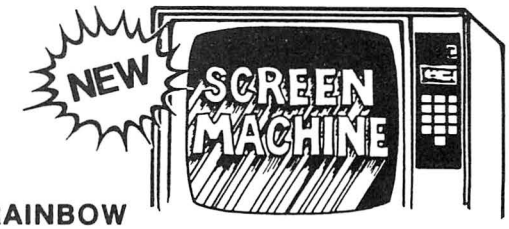

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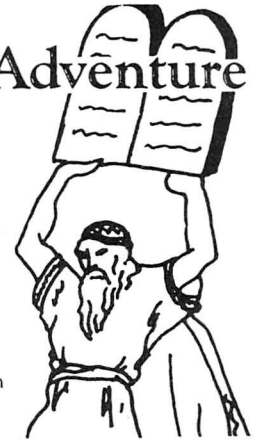

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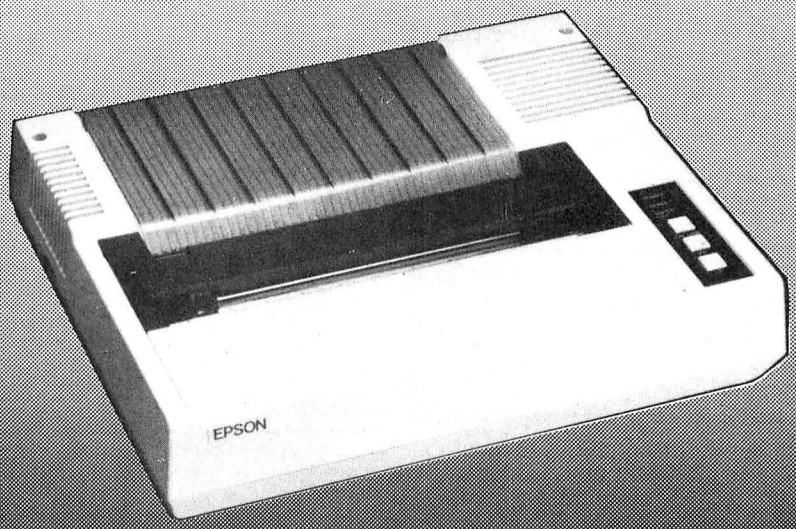
THE COCO/FX-80 CONNECTION



Produce correspondence-quality print when you team your CoCo with the new Epson FX-80 printer.

I had been using my MX-80FT with the CoCo for over a year when I heard that Epson was coming out with a new model, the FX-80. Since most of my CoCo's on-line time is spent word processing, I wanted a truly correspondence-quality dot-matrix printer without the slowness of the daisy wheel. The Epson FX-80 was my answer.

The FX-80 has two correspondence modes in addition to emphasized font. Both automatically print in an emphasized mode that fills the spaces between dots so effectively they are barely noticeable.

The first correspondence mode is the elite with 12 characters-per-inch (cpi) like the popular typewriter style. Though the spacing is correct, elite looks more like enlarged, compressed font than typewriter printing. The proportional mode, though still 10 cpi, is typewriter quality, and here is how it works.

A typical margin setting for one of the more advanced word processors such as the Telewriter 64 might be left margin = 10, characters = 60, and right margin = 10, in standard 10 cpi font. Each character you type is assigned a uniform, predetermined space on the page. Because letter size differs, the print tends to look drawn-out and pica-like.

In the proportional mode, the printer knows exactly how much space each character occupies and closes in the line accordingly. Print quality depends on the percentage of narrow and wide letters per line, and, on the average, a 60-character line prints four to six fewer characters than a nonproportional, 10-cpi font, or about 11 cpi. This is similar to elite spacing, but with a much more appealing shape than the elite font. The result is typewriter quality from a dot-matrix printer.

If your word processor doesn't support proportional printing, you have a minor problem. For example, when you set your character width to 60 characters, the word processor puts as many words as possible before carriage-return and line-feed commands move it to the next line. Since the FX-80 moves narrow characters closer together, you end up four to six spaces short at the end of a line.

To correct this, change your characters-per-line instructions from 60 to 65 and hyphenate appropriately when you proofread. If an occasional line is too long, imbed a new characters-per-line instruction for a single line. The improved quality is worth the inconvenience.

Among its many convenient features,

System Requirements

16K RAM
Extended Color Basic
Epson FX-80 Printer

the FX-80 has a hinged, removable noise shield and a built-in tractor drive that leaves the top and sides of the printer free from unnecessary hardware. To save you time, printing speed is twice that of the MX-80 in both correspondence modes, and there are 63 different character fonts to choose from. If you aren't satisfied with these, you can create your own from the FX-80's 2K memory with a simple command.

The FX-80's memory buffer makes a real difference in printing speed because the CoCo continuously sends data, stopping only for carriage-return/line-feed commands. If you notice an error in copy, you can edit it before the printer is finished since the CoCo is released when it dumps its memory into the printer buffer.

Any software that supports the MX-80 also works with the FX-80 since ASCII codes for both printers are the same. I suggest you order the Gold Eagle (Model 8155) 4K serial interface. As for cost, the FX-80 is only slightly more than an MX-80FT.

You can save even more if you don't buy a cable. With about $10 worth of parts and five minutes of your time, you can do the following. From your local Radio Shack store, buy a model #26-3020 cable (four-pin DIN to four-pin DIN) ($4.95), a male DB-25 connector model #276-1547 ($2.99), and a model #276-1549 hood ($2.19), for a total cost of $10.13. If you need a reference, look on page 123 of your 1983 Radio Shack catalog.

Cut off one end of the cable, leaving about three inches in case you want to use the connector for something else in the future. Choose a low-wattage soldering pencil. Put the connector in a vise and carefully solder the wires according to Table 1. It takes just a few seconds to solder the wires to their associated pins with a properly tinned iron.

Now you're ready to install the Gold Eagle serial interface. Lift off the sound shield to expose the front screws and remove the four screws. Pull off the paper-feed knob. Gently remove the top cover and put it beside the FX-80 being careful of the wires that are still attached.

Cable	DB-25	Four-Pin DIN
Red wire	Pin 7	3 Signal gnd
White wire	Pin 3	4 Serial data out
Green wire	Pin 20	2 Status
Yellow wire	Not used	1 Not used

Table 1. Soldering Sequence For FX-80 Cable

Standing in front of the FX-80, identify the connector in the right third of the circuit board. This is where the Gold Eagle plugs in. Look closely before pressing down, making sure all the pins on the Gold Eagle line up with their mates on the Epson board.

Gently work it down using reasonable pressure. Then, carefully but snugly tighten the four screws, securing the Gold Eagle to the mounting studs.

Now, identify the screw labeled FG on the FX-80's board. It is just to the left of the far left corner of the Gold Eagle circuit board. Strip a 1½-inch piece of wire (18-gauge or smaller) and loop it under the FG screw. Solder the other end to the lug labeled FG on the Gold Eagle, located within an inch of the FG screw. The Gold Eagle will not work without this ground wire.

To option the Gold Eagle, carefully install the jumpers that come with it on the following lugs: J2, J11, J13, J17, J18, and J19. No other lugs should be jumpered. If you're going to use other than 600-baud then you must use one of the other lugs from J1 through J6 in place of J2 (see page 4 in your Gold Eagle instruction book). To be sure you get them right use a thin pair of long-nosed pliers or surgical clips to install, remove, or change the jumpers. There will be some spares in case you make a mistake.

You will notice that the FX-80's cover does not accept the DB-25 connector. Close examination, however, reveals a door that snaps out leaving adequate room for it. Connect the cable to the RS-232 serial output connector on the back of your CoCo and try it. If it doesn't work, check your connections, options on the Gold Eagle board, and your ground connection.

The following menu-driven, easy-to-use program lets you access the full capabilities of your new FX-80. You can combine fonts by combining menu choices. For example, double width, double strike would be 25, enter. I have not incorporated all 63 fonts, but you will find just about everything you will ever use. Undoubtedly the margin and skip-over-perforation modes will be the most popular. With your CoCo and your new FX-80 you'll produce true correspondence-quality print. ■

Address correspondence to Steve Eichman, P.O. Box 752, Stockton, CA 95201.

Program Listing. FX-80 Print Commands.

```
10 CLS:SOUND 100,1
20 PRINT@230, "FX-80 PRINT COMMA
NDS"
30 GOSUB 500
40 CLS: PRINT@10,"****MENU****"
50 PRINT@67, "1 CHG SPACING TO 7
/72 INCH"
60 PRINT TAB(3) "2 DOUBLE WIDTH"
70 PRINT TAB(3) "3 CONDENCED"
80 PRINT TAB(3) "4 EMPHASIZED"
90 PRINT TAB(3) "5 DOUBLE STRIKE
"
100 PRINT TAB(3)"6 ELETE
110 PRINT TAB(3)"7 PROPORTIONAL
120 PRINT TAB(3) "8 SET MARGINS"
130 PRINT TAB(3) "9 SET BAUD RAT
E"
140 PRINT TAB(2) "10 DIRECT TO P
RINTER"
150 PRINT TAB(2) "11 CANCEL ALL
COMMANDS"
160 PRINT TAB(2) "12 TEST SENTEN
SE"
170 PRINT TAB(2) "13 ITALICS"
180 INPUT M
190 CLS
200 IF M=1 GOSUB 1000
210 IF M=2 GOSUB 2000
220 IF M=3 GOSUB 3000
230 IF M=4 GOSUB 4000
240 IF M=5 GOSUB 5000
250 IF M=6 GOSUB 6000
260 IF M=7 GOSUB 7000
270 IF M=8 GOSUB 8000
280 IF M=9 GOSUB 9000
290 IF M=10GOSUB 10000
300 IF M=11GOSUB 11000
310 IF M=12GOSUB 12000
315 IF M=13GOSUB 13000
320 IF M=23 OR M=32 THEN GOSUB 2
3000
322 IF M=24 OR M=42 THEN GOSUB 1
4000
324 IF M=25 OR M=52 THEN GOSUB 1
4100
328 IF M=245 OR M=542 OR M=254 O
R M=425 THEN GOSUB 14200
330 IF M=235 OR  M=532 OR  M=352
 THEN GOSUB 34000
332 IF M=26 OR M=62 THEN GOSUB 1
4300
334 IF M=36 OR M=63 THEN GOSUB 1
4400
336 IF M=256 OR M=652 OR M=562 O
R M=625 THEN GOSUB 15000
340 IF M=34 OR  M=43 THEN GOSUB
34000
342 IF M=2313 OR M=3213 THEN GOS
UB 18500
345 IF M=35 OR M=53 THEN GOSUB 3
5000
350 IF M=345 OR M=543 OR  M=435
OR M=534 THEN GOSUB 34000
352 IF M=45 OR M=54 THEN GOSUB 1
6000
360 IF M=65 OR  M=56 THEN GOSUB
6400
362 IF M=356 OR M=653 OR M=536 O
R M=365 THEN GOSUB 15200
370 IF M= 413 OR  M=134 THEN GOS
UB 18600
375 IF M=1354 OR  M=4513 OR  M=1
345 OR  M=5413 THEN GOSUB 16000
377 IF M=2413 OR M=1342 THEN GOS
UB 19100
380 IF M=313 OR  M=133 OR M=331
THEN GOSUB 17000
385 IF M=213 OR M=312 THEN GOSUB
 18000
390 IF M=613 OR  M=136 THEN GOSU
B 19000
400 GOTO 40
500 FOR X=1TO 500:NEXT X:RETURN
```

Listing continued

Listing continued

```
600 FOR X=1TO2000:NEXT X
610 RETURN
700 FOR X=1TO250:NEXT X
710 RETURN
1000 PRINT @227, "LINE SPACING 7
/72 INCH"
1010 GOSUB 500
1020 PRINT#-2,CHR$(27) CHR$(1)
1030 RETURN
2000 CLS: PRINT @235, "DOUBLE WI
DTH"
2010 GOSUB 500
2020 PRINT#-2, CHR$(27) CHR$(87)
 CHR$(1)
2030 RETURN
2040 REM
2050 REM
3000 CLS: PRINT @232, "COMPRESSE
D MODE"
3010 GOSUB 500
3020 PRINT#-2, CHR$(27) CHR$(15)
3030 RETURN
4000 CLS: PRINT @232, "EMPHASIZE
D MODE"
4010 GOSUB 500
4020 PRINT#-2, CHR$(27) CHR$(69)
4030 RETURN
5000 PRINT @235, "DOUBLE STRIKE"
5010 GOSUB 500
5020 PRINT#-2, CHR$(27) CHR$(71)
5030 RETURN
6000 CLS: PRINT @235, "ELETE MOD
E"
6010 GOSUB 500
6020 PRINT#-2, CHR$(27) CHR$(77)
6030 RETURN
6400 CLS: PRINT @ 230, "DBL STRI
KE ELETE"
6410 GOSUB 500
6420 PRINT#-2, CHR$(27) CHR$(71)
 CHR$(27) CHR$(77)
6430 RETURN
7000 CLS: PRINT @231, "PROPORTIO
NAL MODE"
7010 GOSUB 500
7020 PRINT#-2, CHR$(27) CHR$(112
) CHR$(1)
7030 RETURN
8000 CLS: PRINT @234, "SET MARGI
NS"
8010 GOSUB 500
8015 CLS
8020 PRINT @42,"****MENU****"
8030 PRINT @102, "1 RIGHT MARGIN
"
8040 PRINT TAB(6) "2 LEFT MARGIN
"
8050 PRINT TAB(6) "3 FORM LENGTH
"
8060 PRINT TAB(6) "4 SKIP PERFER
ATION"
8065 PRINT TAB(6) "5 RETURN TO M
AIN MENU"
8070 INPUT R
8080 ON R GOSUB 8500,8600,8700,8
800,8900
8090 GOTO 8020
8500 CLS:PRINT @73, "SET RIGHT M
ARGIN"
8505 PRINT @ 128, STRING$(32,"*"
)
8510 PRINT@160, "THE VALUE TO IN
PUT HERE IS EQUAL  TO 80 LESS TH
E DESIRED RIGHT  MARGIN. I.E. RI
GHT MARGIN OF 10=INPUT OF 70. BE
 SURE TO SET YOUR  LEFT MARGIN W
ITH THE PREVIOUS MENU. <PRESS EN
TER TO CONTINUE>"
8514 PRINT@352, STRING$(32,"*")
8515 INPUT Z:CLS
8518 PRINT@137, "INPUT VALUE"
8520 INPUT S
8530 PRINT#-2, CHR$(27) CHR$(81)
 CHR$(S)
8540 RETURN
8600 CLS:  PRINT @73, "SET LEFT
MARGIN"
8610 PRINT @137, "INPUT VALUE: "
8620 INPUT T
8630 PRINT#-2, CHR$(27) CHR$(108
) CHR$(T)
8640 RETURN
8700 CLS: PRINT @75, "FORM LENGT
H"
8710 PRINT @139, "INPUT VALUE: "
8720 INPUT U
8740 PRINT#-2, CHR$(27) CHR$(67)
 CHR$(U)
8750 RETURN
8800 CLS: PRINT @72, "SKIP PERFO
RATION"
8810 PRINT @136, "INPUT VALUE: "
8820 INPUT V
8830 PRINT#-2, CHR$(27) CHR$(78)
 CHR$(V)
8840 RETURN
8860 REM
8870 REM
8900 GOTO 40
9000 CLS: PRINT @10, "****BAUD R
ATE****"
9010 PRINT @77, "1 120"
9020 PRINT TAB(13) "2 300"
9030 PRINT TAB(13) "3 600"
9040 PRINT TAB(13) "4 1200"
9050 PRINT TAB(13) "5 2400"
9060 PRINT TAB(13) "6 9600"
9070 INPUT C
9080 IF C=1 THEN POKE 149,1:POKE
 150,202
9090 IF C=2 THEN POKE 149,0:POKE
150,118
9100 IF C=3 THEN POKE 149,0:POKE
150,87
9110 IF C=4 THEN POKE 149,0 POKE
150,41
9120 IF C=5 THEN POKE 149,0:POKE
150,18
9130 IF C=6 THEN POKE 149,0:POKE
150,1
9140 RETURN
10000 CLS: PRINT @231, "DIRECT T
O PRINTER"
10100 GOSUB 500
10200 POKE 360,162
10210 POKE 361,191
10410 REM
11000 PRINT @231, "CANCEL ALL CO
MMANDS"
11100 GOSUB 500
11200 PRINT#-2, CHR$(18) CHR$(20
) CHR$(27) CHR$(70) CHR$(27) CHR
$(72) CHR$(27) CHR$(53) CHR$(27)
CHR$(45) CHR$(0) CHR$(27) CHR$(8
4)
11300 PRINT#-2, CHR$(27) CHR$(87
) CHR$(0) CHR$(27) CHR$(33)CHR$(
0) CHR$(27) CHR$(112) CHR$(0) CH
R$(27) CHR$(78) CHR$(0) CHR$(27)
 CHR$(108) CHR$(0) CHR$(27) CHR$
(67) CHR$(66) CHR$(27) CHR$(81)
CHR$(80)
11400 POKE 360,130:POKE 361,115
11498 RETURN
12000 PRINT #-2," The Quick Brow
n Fox Jumped Over The Lazy Dog's
 Back 1234567890:- !#$%&'()*= "
12040 PRINT@235,"PRINTING"
12042 GOSUB700
12050 RETURN
13000 PRINT @237, "ITALICS"
13100 GOSUB 500
13200 PRINT#-2, CHR$(27) CHR$(52
)
13300 RETURN
14000 CLS: PRINT@228, "DBL WIDTH
 EMPHASIZED"
14010 GOSUB 500
14020 PRINT #-2, CHR$(27) CHR$(8
7) CHR$(1) CHR$(27) CHR$(69)
14030 RETURN
14100 PRINT@ 228, "DBL WIDTH/DBL
 STRIKE"
14110 GOSUB 500
14120 PRINT #-2, CHR$(27) CHR$(8
7) CHR$(1) CHR$(27) CHR$(71)
14130 RETURN
14200 CLS: PRINT @228, "DBL WIDT
H/EMPH/DBL STRIKE"
14210 GOSUB 500
14220 PRINT #-2, CHR$(27) CHR$(8
7) CHR$(1) CHR$(27) CHR$(69) CHR
$(27) CHR$(71)
14230 RETURN
14300 CLS: PRINT@233, "DBL WIDTH
 ELETE"
14310 GOSUB 500
14320 PRINT #-2, CHR$(27) CHR$(8
7) CHR$(1) CHR$(27) CHR$(77)
14330 RETURN
14400 CLS: PRINT@ 233, "CONDENCE
D ELETE
14410 GOSUB 500
14420 PRINT #-2, CHR$(15) CHR$(2
7) CHR$(77)
14430 RETURN
15000 CLS:PRINT@226, "DBL WIDTH/
DBL STRIKE/ELETE"
15010 GOSUB 500
15020 PRINT #-2, CHR$(27) CHR$(8
7) CHR$(1) CHR$(27) CHR$(71) CHR
$(27) CHR$(77)
15030 RETURN
15200 CLS: PRINT @226, "CONDENCE
D/DBL STRIKE/ELETE"
15210 GOSUB 500
15220 PRINT #-2, CHR$(15) CHR$(2
7) CHR$(71) CHR$(27) CHR$(77)
15230 RETURN
16000 CLS: PRINT@230, "EMPHASIZE
D/DBL STRIKE"
16010 GOSUB 500
16020 PRINT#-2, CHR$(27) CHR$(69
) CHR$(27) CHR$(71)
16030 RETURN
17000 CLS:PRINT@230, "COMPRESSED
 ITALICS"
17010 GOSUB 500
17020 PRINT#-2, CHR$(15) CHR$(27
) CHR$(52)
17030 RETURN
18000 CLS: PRINT@230, "DBL WIDTH
 ITALICS"
18010 GOSUB500
18020 PRINT#-2,CHR$(27) CHR$(87)
 CHR$(1) CHR$(27) CHR$(52)
18030 RETURN
18500 CLS:PRINT@227, "DBL WIDTH
CONDENCED ITALICS"
18510 GOSUB 500
18520 PRINT #-2, CHR$(27) CHR$(8
7) CHR$(1) CHR$(15) CHR$(27) CHR
$(52)
18530 RETURN
18600 CLS: PRINT@232, "EMPHASIZE
D ITALICS"
18610 GOSUB 500
18620 PRINT#-2, CHR$(27) CHR$(69
) CHR$(27) CHR$(52)
18630 RETURN
19000 CLS: PRINT@233,"ELETE ITAL
ICS"
19010 GOSUB 500
19020 PRINT#-2, CHR$(27) CHR$(77
) CHR$(27) CHR$(52)
19030 RETURN
19100 CLS: PRINT@225, "DBL WIDTH
 EMPHASIZED ITALICS"
19110 GOSUB 500
19120 PRINT#-2, CHR$(27) CHR$(87
) CHR$(1) CHR$(27) CHR$(69) CHR$
(27) CHR$(52)
19130 RETURN
23000 PRINT @229, "DOUBLE WIDTH
CONDENCED"
23100 GOSUB 500
23200 PRINT#-2, CHR$(27) CHR$(87
) CHR$(1) CHR$(15)
23300 RETURN
23500 PRINT @225, "CONDENCED EMP
HASIZED"
23510 GOSUB 500
23520 PRINT#-2, CHR$(15) CHR$(27
) CHR$(69)
23530 RETURN
34000 PRINT@224,"THE FX-80 WILL
NOT PRINT CONDEN-CED/EMPHASIZED.
 USE <35> CONDEN-CED/DBL STRIKE
34005 PRINT@160,STRING$(32,"*")
34007 PRINT@352,STRING$(32,"*")
34010 GOSUB600
34020 RETURN
34230 REM
35000 PRINT@229, "COMPRESSED DBL
 STRIKE"
35100 GOSUB500
35200 PRINT #-2, CHR$(15) CHR$(2
7) CHR$(71)
35300 RETURN
```

END

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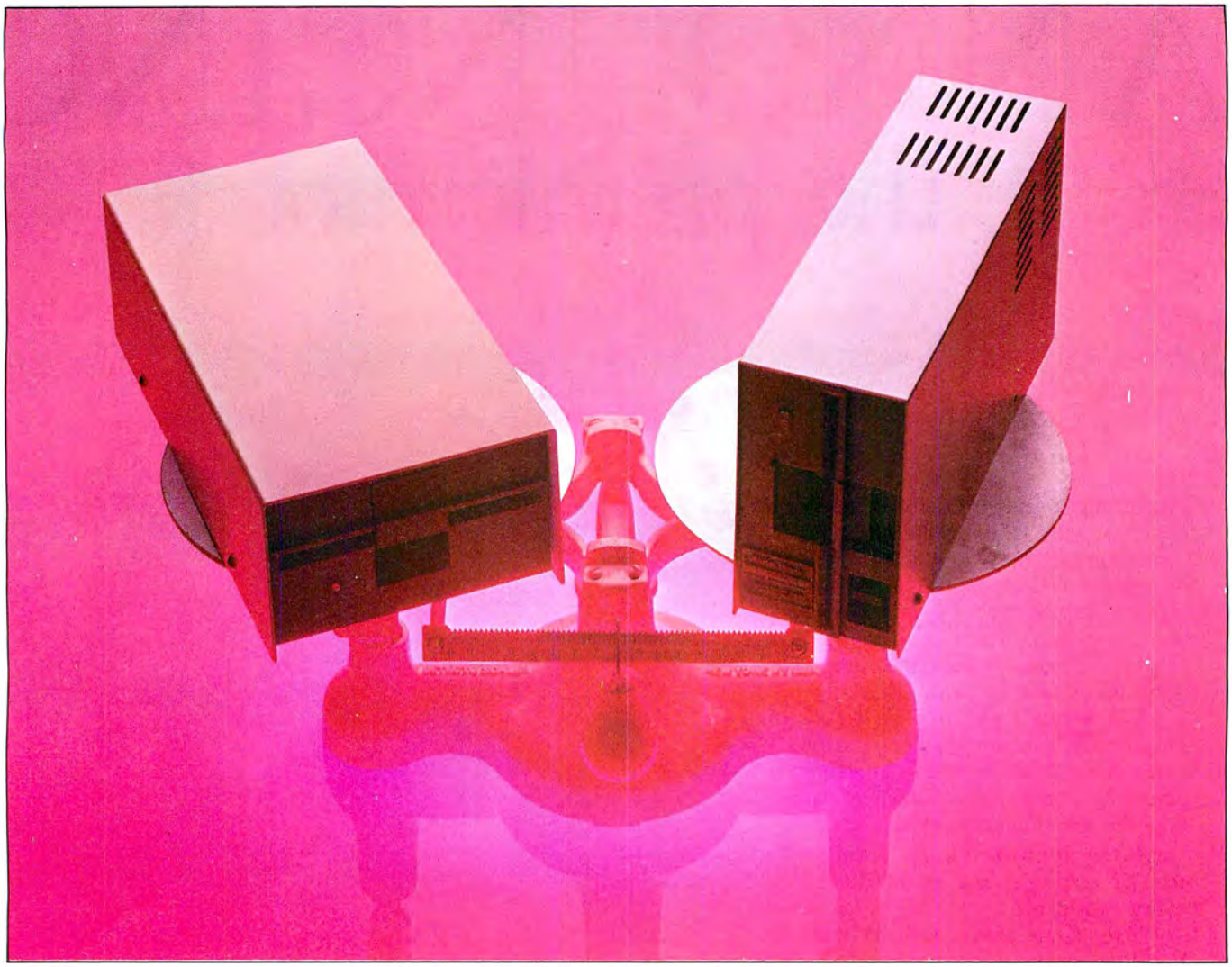

THE DISK DECISION

Sound advice for anyone who wants to buy a CoCo disk drive system. This tutorial guides you.

The most expensive and powerful upgrade you can make for your Color Computer is the acquisition of a disk drive. It requires Extended Basic, and though a full 64K of memory is not absolutely necessary, it lets you get the most out of a disk-driven system.

Adding one or more drives doubles your system investment and gets you the difference between a toy system and a professional item.

For example, tape data transfer takes place at the rate of about 1,500 baud, or roughly 200 bytes per second. Disk data transfer, as conducted by the Basic operating system, occurs at an effective rate of 125,000 baud, or 15K bytes per second. This makes disk I/O roughly 75 times faster than tape.

In addition to sheer speed of information transfer, disks are more convenient. There is no fooling around with leaders, or punching of play, record, and stop buttons. You can access all files on a disk immediately.

The Pieces of a Disk System

A Color Computer disk-drive system consists of three separate parts: the drive itself, a connecting cable, and the disk controller unit. Radio Shack supplies these three items in one package called Drive 0. Other suppliers refer to it

as the Drive 0 Package. Such packages vary in price from $350–$450.

The disk drive itself can be broken down into three subcomponents sold separately by many suppliers: the drive mechanism with its associated logic board (often called a bare drive), the power supply for the drive mechanism and logic board, and the case that houses both the bare drive and its associated power supply.

The disk controller unit consists of two components: the electronic hardware that allows the computer to talk to a disk drive and the software that controls that hardware and usually resides on a ROM chip. In the case of the Radio Shack operating system, that software is called the Disk Basic ROM (version 1.0 or 1.1). At least one other supplier (J & M Systems Ltd., 137 Utah NE, Albuquerque, NM 87108) produces a different but almost totally compatible disk controller unit, into which one can plug a Radio Shack Disk Basic ROM.

Buy Tandy's or Not?

Many CoCo owners buy Radio Shack disk drives, which have been steadily dropping in price. As of this writing, the cost of its Drive 0 package is $399, and additional drives cost $279. Tandy provides a security blanket of prompt, easily available service for the equipment it sells.

Until recently there were several good reasons for not buying a Tandy disk system:

- Tandy supplied a TEC (Tokyo Electric Corporation) brand drive with their Color Computer packages. This drive is poorly made, and is subject to problems relating to a cheap pulley, cheap drive belt, excess oil on the pulley system, and a crudely designed and manufactured plastic cam-head-positioning system.

The most common problem with the TEC drives is drive-speed error. Sometimes this can be remedied merely by cleaning the drive pulley and belt with isopropyl alcohol. Sometimes Tandy's technicians found it necessary to replace the cheaply made pulley with a better quality new one. With the advent of OS-9, which is particularly fussy about the speed accuracy of the drive, I expect owners of the TEC drives to have lots of problems.

- The Tandy disk controller card that they originally distributed has an archaic circuit design. Not only does it require +12 volts in order to operate, but its data-separator circuitry is analog, which could be less reliable than a digital circuit. Worse yet, the contacts by which the disk controller connects to the CoCo are tinned, not gold plated. This is the cause of periodic disk system malfunctions.
- The disk controller cable that Tandy supplies also lacks gold-plated contacts. This probably contributed to disk system problems.

Tandy Redesigns

Tandy has learned from their mistakes. They abandoned the TEC drive and substituted the TPI brand drive that they have been using in the Models III and 4. This drive is better designed (much of it is made by Tandon) and has a respectable track record in use. Unfortunately, the contacts are still tinned, not gold plated.

The Color 2 Disk Kit 0 package (catalog #26-3029) that Tandy will soon be selling as the Drive 0 Package for the CoCo 2 has a redesigned disk controller. Not only does the new disk control ler have a more modern disk-controller chip that requires only 5 volts (as the CoCo 2 has no 12-volt supply on board), but it also has a much cleaner circuit design. It employs a digital phase-locked loop data separator that requires no adjustment.

"I recommend that you stick with Tandy's operating system to maintain compatibility with the existing software base."

You can modify Tandy's disk controllers (both the old and the new one) to retrofit them with gold contacts. For details, write to the E.A.P. Co., Box 14, Keller, TX 76428. These folks supply solder-on, gold-edge card adapters for the Color Computer's disk card. The Color 2 Disk Kit 0 is compatible with all the older-style Color Computers, but the older disk-drive system is not compatible with the CoCo 2, unless you use a Radio Shack Multi-Pak Interface ($179.95).

Some folks might want to run non-Tandy drive hardware. Despite the continuing drop in the prices of Tandy drive systems, buying your own components by mail order will save you money.

High quality, bare disk drives sell for as little as $100, and drives with case and power supply (brand new and guaranteed) commonly sell for $150–$210.

You can order (from Radio Shack National Parts, 900 East Northside Drive, Fort Worth, TX 76102, 817-870-5662) the Tandy disk controller card, which costs about $110. Be sure to also order the disk controller card shell (an extra $2), sold separately and complete with its disk software on board on a ROM chip.

Tandy is no longer shipping the old Disk Basic 1.0 and now is exclusively supplying the Disk Basic 1.1, meaning that you might need to modify some of your non-Tandy disk software to make it compatible with this changed ROM.

I recommend that you stick with Tandy's operating system to maintain compatibility with the existing software base. Even in this case, you have the option of using a different brand of controller. J & M Systems makes an alternative disk controller for the CoCo that has gold-plated contacts and a digital phase-locked loop data separator (Photo 1). If you can buy it without J & M's ROM, then plug in a Tandy Disk 1.0 or 1.1 ROM; it is a good alternative to Tandy's controller. And with the gold-plated contacts, I think it's better.

Be careful about setting up your CoCo with J & M's or any non-Tandy operating system, because this could cause software compatibility problems.

Disk Drive and Cable Options

There is a bewildering variety of 5¼-inch disk drives on the market. Although with the right software and hardware modifications you should be able to use any drive, I advise you to stick to 35- or 40-track, single-sided, double-density type disk drives to keep things compatible with Tandy's system.

Since Tandy's drive has the slowest track-to-track access time of any 5¼-inch drive made (30 msec) that specification does not limit your choice of drive. The TEC drives that Tandy sells cannot access more than 36 or 37 tracks on the disk. The current standard for this kind of drive is 40 tracks.

Because Tandy decided to use 35-track drives, they had Microsoft write the software for the disk operating system so that it only attempted to use 35 tracks on the disk. Even if you buy a 40-track disk drive, Color Disk Basic can only access 35 tracks in normal use. The advantage to having 40-track drives is that they are compatible with other machines. If you are buying a non-Tandy drive, however, you might as well get one that has 40 tracks.

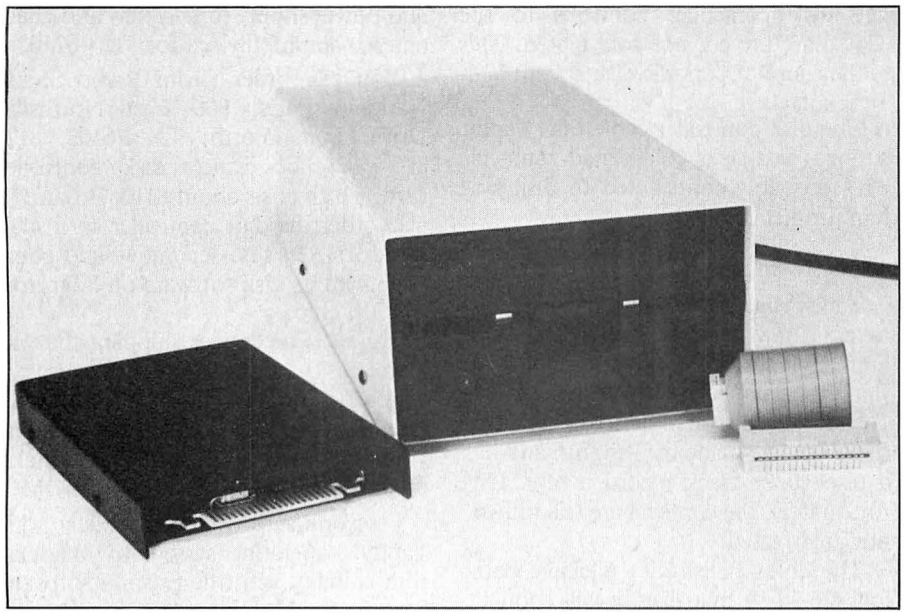

Photo 1. The J & M Disk Drive and Disk Controller Card

If you buy a non-Tandy drive, stay with one of the biggest manufacturers to ensure easy service and maintenance. TEAC (not TEC, TE*A*C), Tandon, and MPI are the most familiar. All three of these brands have proven reliable and durable, and they have good repair records. (See Table 1 for a list of disk-drive retailers.)

"TEAC's new thin-line drive might prove to be even better than the older, full-size TEAC since it uses a direct-drive arrangement for its disk motor system."

The TEAC drive is probably the best for heavy use. Its brushless motor and the screw positioner combine to ensure long life in high-use situations. TEAC's new thin-line drive might prove to be even better than the older, full-size TEAC since it uses a direct-drive arrangement for its disk motor system. This eliminates the problem of dirt accumulating on the drive belt.

If you are going to buy a TEAC or MPI drive, there is one other consideration. Both of these drives have a head-lift solenoid. The Radio Shack Disk Basic operating system cannot deal with this solenoid in two-drive or more operation, so you must defeat that solenoid (or alter the Disk Basic ROM). You do this by *not* jumpering the HS jumper on the drive, but by jumpering the HM (sometimes called HL) jumper. For a full explanation of this, refer to the article "The Bugs in Disk Basic" (*HOT CoCo*, July 1983, p. 48).

If you buy your drives bare and mount them yourself, there are several things you should be careful about. Vertical mountings are preferable to horizontal mountings because they achieve better heat dissipation. Be sure your drives have adequate ventilation or the functioning will be impaired.

Be sure the power supply to your drives is adequate. Disk drives typically require .6 amps at 12 volts and .3 amps at 5 volts for each drive. To run both your CoCo and your drives off the same power source, provide a separately regulated +12V for the drives and the computer. Otherwise you'll run into problems with spikes in the power supply generated by the disk motors switching on and off.

Then, there is the matter of the disk drive cable. Tandy's cable and drives are set up in a rather unusual fashion. They use the dental extraction technique to determine what number each drive thinks it is. That is, on the drive logic board, the select lines for all four drive selects are hooked together. The selection is achieved in Tandy's drive cable, where the teeth (contacts) for all but the drive desired are pulled from the particular connector. In most other systems, drive selection is achieved by a jumper on the disk drive logic board itself.

One other difference between Tandy's system and most other systems is the location of the drive 3 (fourth drive) select. On Tandy's disk controller and on Tandy's drives, this line is assigned to pin 32. Unfortunately, most other drive manufacturers use pin 32 for their side-select line. Tandy's Disk Basic isn't geared to side selection because they do not use double-sided drives. Most other drive manufacturers use one of the lower-numbered pins to select the fourth drive. The incompatibility becomes significant only if you are trying to use four drives or the other side of double-sided drives.

If you are using non-Tandy drives with a Tandy cable, jumper all the select shunts on your non-Tandy drive. If you are using a Tandy drive with a non-Tandy cable, you'll either have to pull teeth on your cable or cut some traces on your Tandy drive's logic board.

If you have only one drive in your system, you might get away with fewer modifications, but when you add a second drive you'll have to make some further modifications. Making your own cable using gold plated connectors costs less and results in a more trouble-free disk system if you have some experience putting insulation-displacement-type connectors onto ribbon cable. Another option is to buy a disk cable with gold-plated connectors ready-made.

"Making your own cable using gold plated connectors costs less and results in a more trouble-free disk system..."

Amdek's Difference

Amdek is advertising a different sort of drive for the CoCo (Photo 2). This type of drive, which uses 3-inch disks rather than the 5¼-inch ones, might represent the future of floppy disk drives. However, very little software is currently distributed on Amdisk format. And much Color Computer software is protected against back-ups, so it cannot be transferred to the Am-

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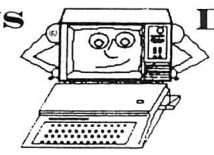

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↙See List of Advertisers on page 130

disk format. Worse yet, the cost per disk for the Amdek's disks is around $5 to $6, whereas a quality 5¼-inch disk can be had for $1.75 to $2.50 each. And 5¼-inch disks are more widely available.

If you do wish to experiment with this new type of drive, it is essential that you also have at least one 5¼-inch drive to keep your system compatible with that of other CoCos. I also recommend, if you buy an Amdek system, that you buy one or more of the disk-copying utilities (Omni Clone from Prickly Pear or Spit-n-Image from Computize, both advertised in this or back issues of *HOT CoCo*) in order to allow you to transfer protected software to Amdisk disks.

Prospective disk-system buyers need to understand the options available to them. This article is not meant as a how-to article for the inexperienced, but as a general overview of the subject for those who have some knowledge, but are unfamiliar with the specifics of the CoCo's system.

If you already own an old-style Tandy disk system that works reliably, don't mess with it! If it periodically crashes, open up the disk controller card case and clean the contacts of both edge-card connectors on both sides of the card with a soft pencil eraser. If this fixes your problem, consider getting the add-on gold-plated connectors mentioned above. If you find that your disks can't be read by systems other than your own, your drives might need head alignment or speed adjustment. ■

Write to Martin H. Goodman at 1633 Bayo Vista Ave., San Pablo, CA 94806.

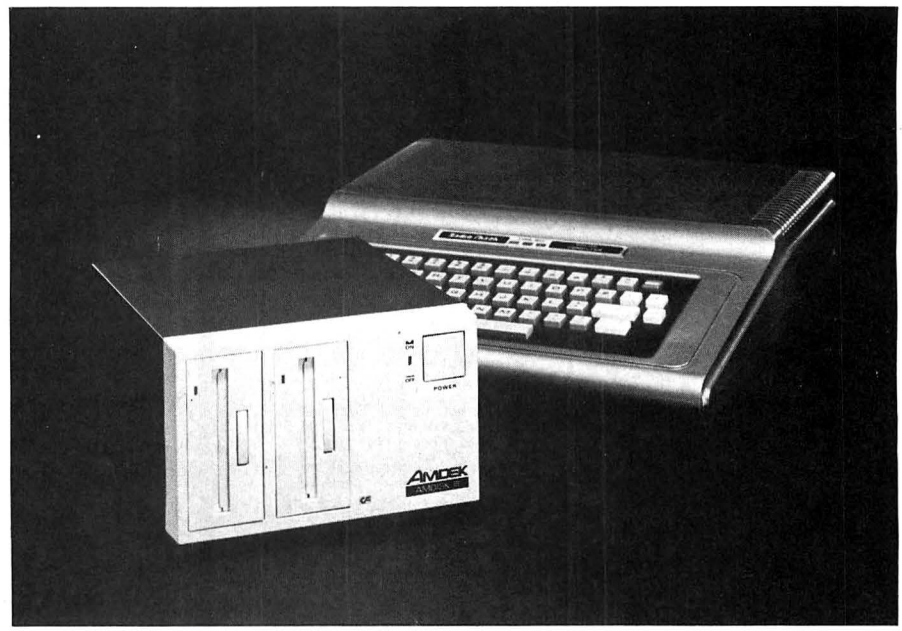

Photo 2. The Amdisk III from Amdek

MITRONIX

MORSE CODE from MITRONIX

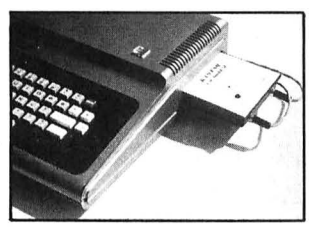

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Table 1. Partial List of Disk-Drive Retailers

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We originally planned to sell this major piece of programming for about $40.00 but decided it was so useful that no 'Real Talker' user should be without it. Besides, it really shows off the capability of 'Real Talker'.

Also included with 'Real Talker' is our unique Phoneme Editor program. It allows you to explore and create artificial speech at the phoneme level. Phenomes are the fundimental sounds or building blocks of word pronunciation. There are 64 different phenomes, as well as 4 inflection levels at your disposal. Creating and modifying speech at the phenome level is both fascinating and educational. The Phenome Editor may also be used to customize the pronunciation of speech produced by the Text-to-Speech program.

You don't have to use any of our utility programs though. If you write your own Basic Programs, you will find the pocket sized Votrax Dictionary (included free) is all you need to make your own Basic programs talk. This dictionary gives you quick access to the phenome sequences used to create approximately 1400 of the most used words in the English language.

How about compatibility? 'Real Talker' is compatible with any 16K, 32K, 64K, Extended or non-extended Color Computer. It works with any cassette or disk based system, with or without the Radio Shack Multi-slot expander. No other synthesizer under $100 can make this claim. Most other CoCo voice synthesizers require an expensive Multi-slot expander in order to work with the disk system. 'Real Talker' requires only an inexpensive Y-adapter. This is an important consideration if you plan on adding a disk or have one already.

'Real Talker' comes completely assembled, tested and ready to use. It is powered by the CoCo and talks through your T.V. speaker so there is nothing else to add. Price includes Text-to-Speech and other programs on cassette (may be transferred to disk), User Manual and Votrax Dictionary. ONLY $59.95

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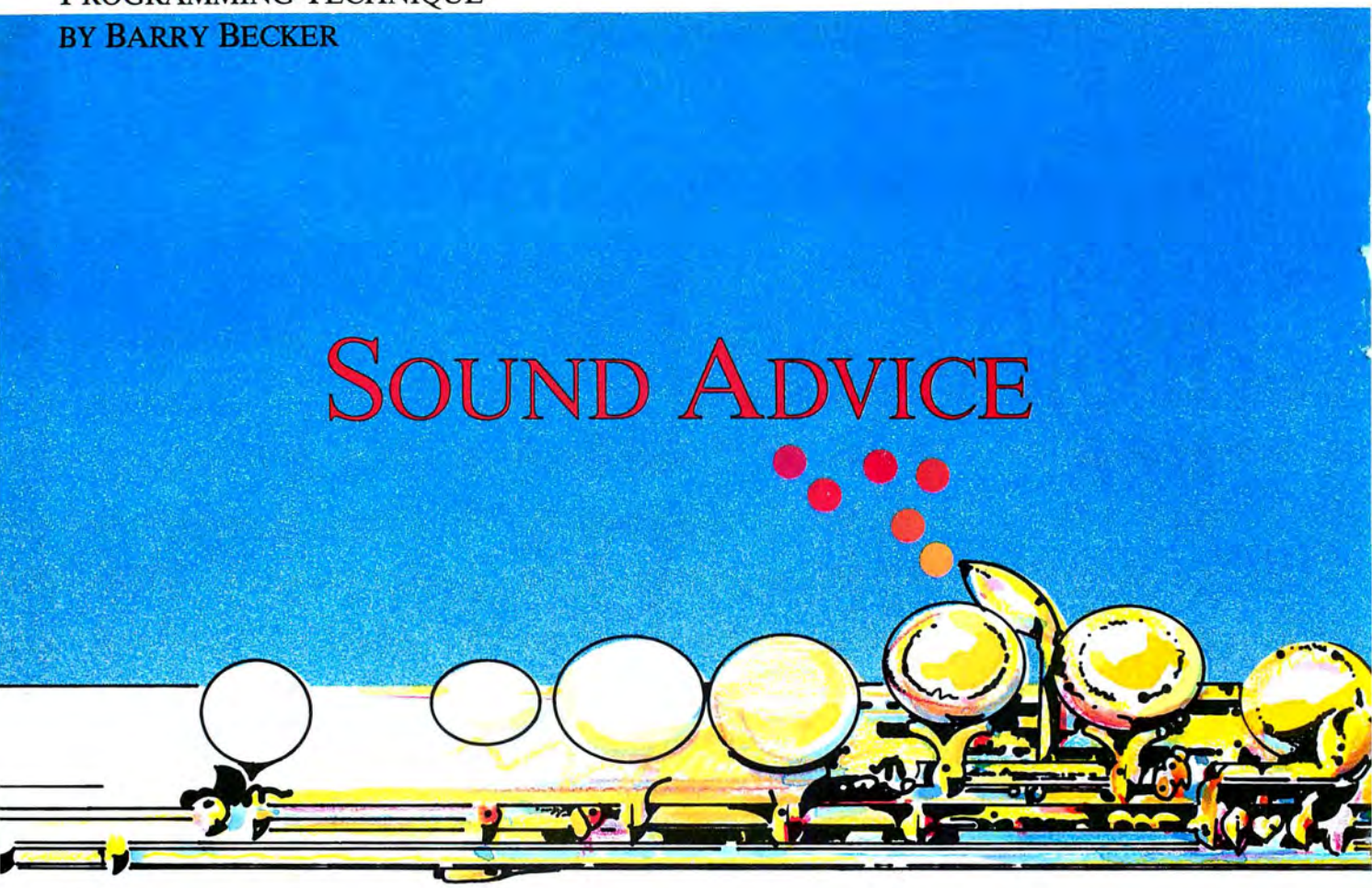
SOUND ADVICE



On one of my journeys through the *Color Computer Technical Reference Manual* (Catalog #26-3193), I decided to investigate something called single-bit sound output, which is the first bit of memory location $FF22 (65314). This is one of the eight memory locations associated with the two peripheral interface adapters (PIA) U4 and U8, which are Motorola-type MC6821 integrated circuits.

The PIA provides the means of interfacing peripheral equipment to the MC6809E microprocessor in the Color Computer. Each PIA contains two 8-bit bidirectional data buses and four control lines. The allocation of each line and the function of the PIA are shown in the Color Computer Memory Map (pages 6 and 7 of the manual).

The single-bit sound output is not the usual source of sound in the Color Computer. It is one of four possible sources. The other three are the 6-bit D/A converter, the cassette recorder, and the expansion-interface connector (game cartridge slot). The connections from the sound sources are shown in Fig. 1. Each sound source ends up at the sound input to the video modulator (U5) for inclusion in the composite signal sent to your TV.

Single bit sound output is not a conventional source of sound, but it works in some situations.

Notice that the single-bit sound doesn't get to the video modulator via the analog switch (U9). Instead it is connected through a 10K resistor to the analog switch output/video modulator sound input. Since the other sound sources come from low-impedance outputs, you must be sure that the analog switch output is disconnected when using the single-bit sound. In this case, you "disconnect" by a memory POKE or by using the AUDIO OFF command.

One problem remains before you can use the single-bit sound. On page 31 of the Tech manual, Table 4 shows the available sound selection and the associated logic conditions for each mode. Beneath the table is a rather cryptic message, which says, "For single-bit sound, PIA U4 pin 11 must be programmed as an output. It is normally programmed as an input."

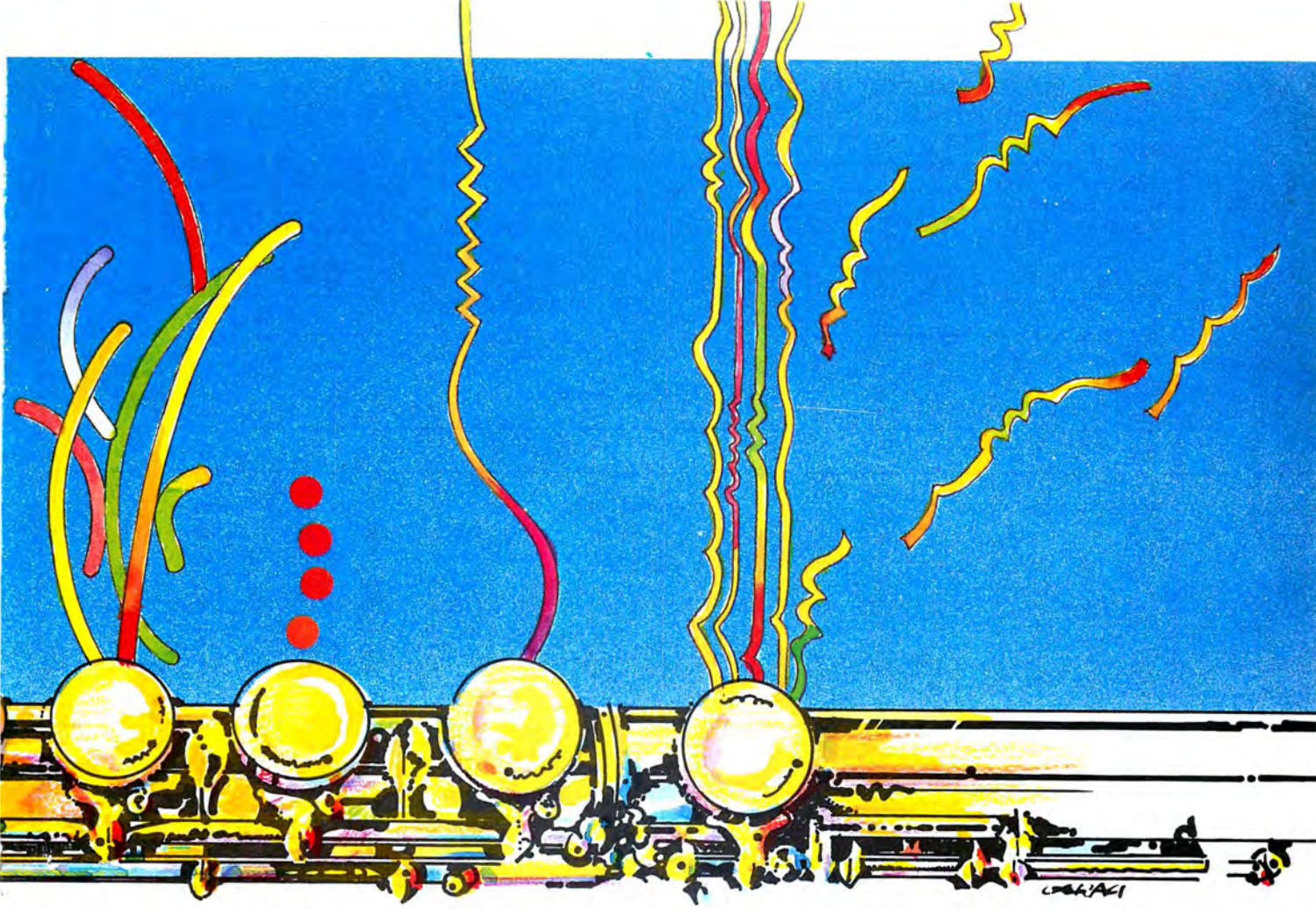
Unfortunately, the manual does not tell you how to do this. Between the Motorola MC6821 data sheet and the memory-map information in the manual, however, I figured out how to access single-bit sound.

The trick is to POKE bit 2 of location $FF23 (65315) to 0. This changes $FF22 (65314) from a peripheral-interface register to the data-direction register. In other words, it lets you specify each bit of peripheral interface register B as either an input or an output. If you POKE a bit in $FF22 to a 1, it becomes an output; if you POKE a bit to a 0, it becomes an input. After you specify the direction you want, you then POKE bit 2 of $FF23 back to 1 to restore $FF22 to normal operation.

You can POKE individual bits of a memory location by ORing or ANDing the contents of the location with a value that produces the desired result. For example, if you AND the number 247 with another number, it forces bit 3 of

System Requirements

16K RAM
Extended Color Basic
Editor/Assembler optional



the second number to 0 without affecting any of the other bits.

In Fig. 2, 247 is converted to its binary equivalent, then ANDed (on a bit-by-bit basis) with any other 8-bit binary number. Since all bits of 247 are 1 except bit 3, the net result is that all bits are retained except for bit 3, which becomes 0.

In a similar manner, you can show that ORing a number with the number 2 causes bit 1 of the original binary equivalent to be set to 1, but retains all other bits.

Program Listing 1, Clikbuzz, is not spectacular; it shows that you get sound out of the single-bit sound output with the above techniques.

By the way, I included the "doubles-clock" POKE at step 10 to get a reasonable buzzing sound for the lowest values of RANGE. If you have a problem with the program and are certain you entered it correctly, try eliminating step 10. This cuts the highest buzz frequency in half, but some Color Computers don't accept POKE 65495,0.

Machine Language

Although I was rather pleased with myself for solving the single-bit sound puzzle, clicks and buzzes get boring. Because Basic is so slow, however, clicks and buzzes are about all you can get—unless you go to (shudder!) machine language.

I intended to make siren-like sounds by creating a square wave that would sweep from a low frequency to a high frequency. I would enter the parameters of the siren (frequency and speed) from a Basic program so that it would be easy to change the sound.

After I finished writing the routine, I made a sequential list starting with the first memory location (16001). The list had four columns: hex address, decimal address, hex contents, and decimal contents. I converted each hex number to decimal and used the decimal values in DATA statements to POKE the routine into memory from a Basic program. (See Fig. 3.)

The results are shown in Program Listing 2, Whooper. The POKEs at the

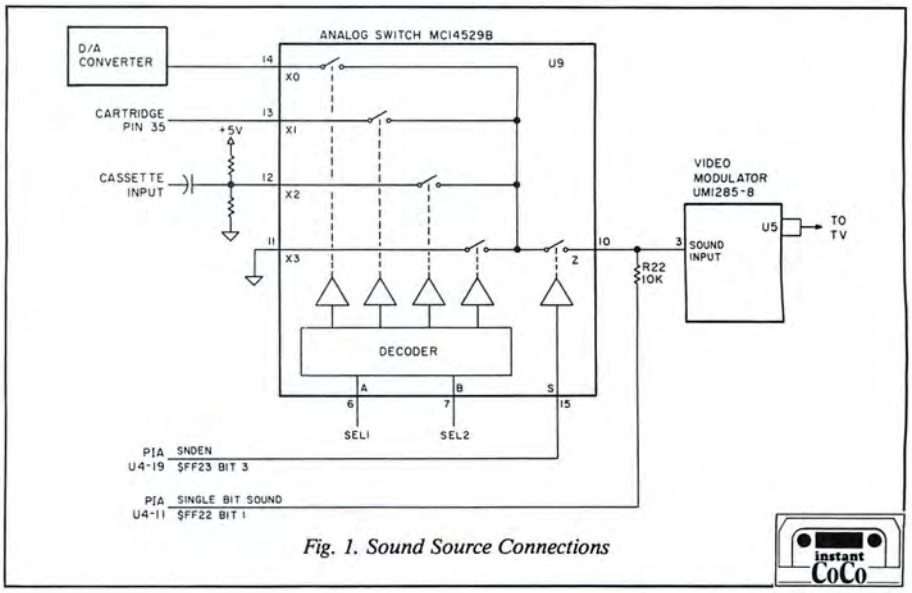


Fig. 1. Sound Source Connections

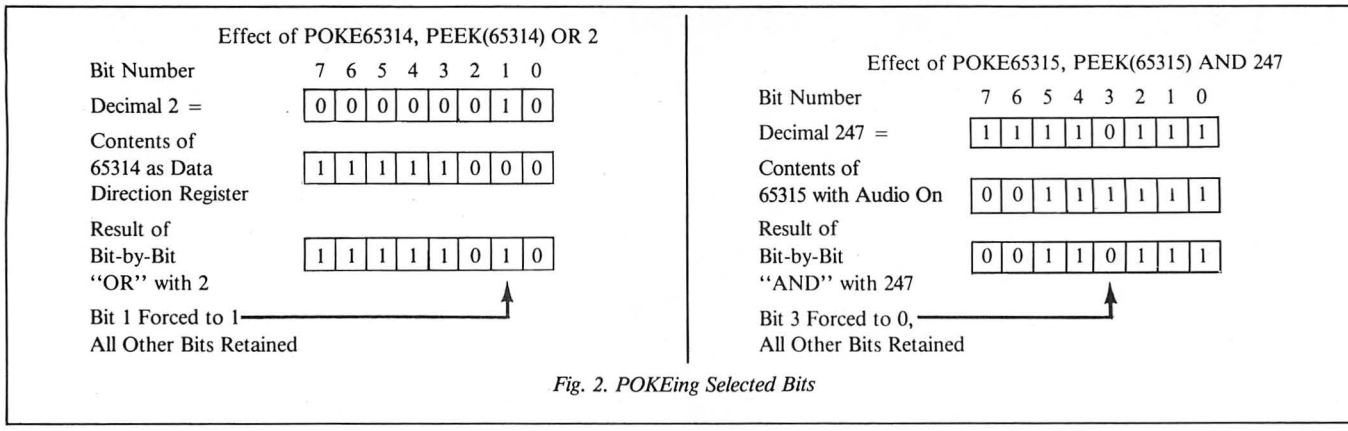


Fig. 2. POKEing Selected Bits

Machine-Language Routine

Address	Code
3E81	B6 3E C0
3E84	B7 3E C3
⋮	⋮ ⋮ ⋮
3EBF	39 — —

Sequential Listing

Hex Addr.	Dec. Addr.	Hex Contents	Dec. Contents
3E81	16001	B6	182
3E82	16002	3E	62
3E83	16003	C0	192
3E84	16004	B7	183
3E85	16005	3E	62
3E86	16006	C3	195
⋮	⋮	⋮	⋮
3EBF	16063	39	57

Basic Program

```
60  FOR X=16001 TO 16063
70  READ M:POKE X,M
80  NEXT X
90  DATA 182,62,192,183,62,195----
    ⋮
170 DATA ---------,57
```

Fig. 3. Determining the Data for POKEing

"I now had clicks, buzzes, whooping, drooping, and chirping."

beginning of the program serve the same purpose as in Clikbuzz.

Program Listing 3 is an attempt to list the Assembly-language routine without the benefit of an assembler. It is simply a Basic listing formatted to look something like an assembler output. Unfortunately, these routines are not position independent; you can't move them to other memory locations without recalculations and respecifying some addresses.

I now had clicks, buzzes, whooping, drooping, and chirping. What more could I want out of that single-bit sound output? Well, how about random noise?

I thought I could generate a list of random numbers and sequentially store them at $FF22. The major problem was how to affect bit 1 of $FF22 without knowing in advance whether it was going to change (based upon the next random number in the list). Figure 4 shows how this was done.

First, accumulator A (ACC A) is loaded with decimal 2 (bit 1 true). Then the random number is ANDed with A.

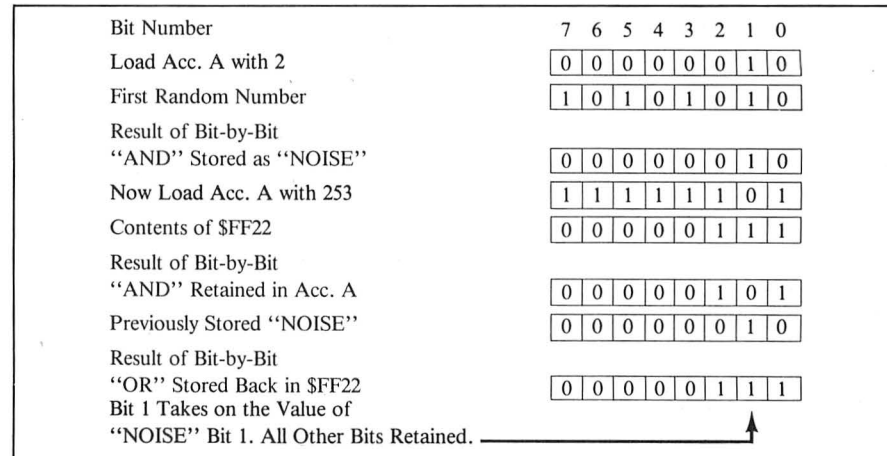


Fig. 4. Randomizing Bit 1 of $FF22

The result is stored as NOISE. It is either all zeros or contains a 1 at bit 1 only, depending on the original random number.

Accumulator A is then loaded with a zero at bit 1 and ANDed with the contents of $FF22. This forces bit 1 of the result to zero. This result, now in accumulator A, is ORed with the previously stored NOISE. The result now contains the same bit pattern that started in location $FF22, except that bit 1 has been randomized. This new result is now stored back in $FF22, and the process can begin again using the next random number in the list.

Program Listing 4, 1Bitnoiz, is the Basic program that creates and runs the machine-language program shown in Program Listing 5. The value entered for RANGE determines the lowest-frequency component of the noise. For small values of RANGE, the sound produced is similar to what you hear when you shut off the computer before you shut off the TV.

Higher values of RANGE produce deeper howling noises that sound something like a rocket lifting off the launch pad. If you enter high values of RANGE and high values of LENGTH at the same time, the program runs for several minutes. Press the reset button to terminate it.

Random Numbers

I reserved more than 1,000 bytes of memory (CLEAR 200,15232), but used just over 40. In the first version of 1Bit-

```
1 '**********CLIKBUZZ**********
2 '
3 'IF YOU 'BREAK' THE PROGRM IN
4 'THE MIDDLE, BE SURE TO RESET
5 'CLOCK TO NORML, POKE 65494,0
6 '
10 POKE65495,0:'DOUBLES CLOCK
19 'TURN OFF 6-BIT SOUND ENABLE
20 POKE65315,PEEK(65315)AND247
29 'SET FF22 TO DATA DIREC.REG.
30 POKE65315,PEEK(65315)AND251
39 'MAKE 1-BIT SOUND AN OUTPUT
40 POKE65314,PEEK(65314)OR2
49 'RESTORE FF22 TO NORMAL
50 POKE65315,PEEK(65315)OR4
60 CLS:PRINT@128,"RANGE(=>1)";
65 'LO #=BUZZ, HI #=CLICKS
70 INPUTR
80 IFR<1THEN70
90 PRINT:PRINT"LENGTH(=>1)";
100 INPUTL: 'DURATION
110 IFL<1THEN100
120 FORX=1TOL
129 'SET 1-BIT SOUND OUTPUT HI
130 POKE65314,PEEK(65314)OR2
140 FORY=1TOR:NEXTY
149 'SET 1-BIT SOUND OUTPUT LO
150 POKE65314,PEEK(65314)AND253
160 FORY=1TOR:NEXTY
170 NEXTX
180 PRINT:INPUT"AGAIN(Y/N)";A$
190 IFA$="Y"THEN120
200 PRINT:INPUT"CHANGE(Y/N)";A$
210 IFA$="Y"THEN60
220 POKE65494,0:'RESTORE CLOCK
230 END
```

Program Listing 1. Clikbuzz

```
1 '********WHOOPER***********
2 '
5 POKE65315,PEEK(65315)AND247
10 CLEAR200,16000:'RESRVE SPACE
11 'FROM 16001 TO END OF RAM
20 DEFUSR0=16001:'DEFINES START
21 'OF MACHINE LANGUAGE ROUTINE
30 POKE65315,PEEK(65315)AND251
40 POKE65314,PEEK(65314)OR2
50 POKE65315,PEEK(65315)OR4
60 FORX=16001TO16063
70 READM:POKEX,M:'LOAD ML PRGRM
80 NEXTX
90 DATA182,62,192,183,62,195,246
100 DATA62,196,134,2,186,255,34
110 DATA183,255,34,189,62,180,18
2
120 DATA62,193,177,62,195,39,34
130 DATA134,253,180,255,34,183,2
55
140 DATA34,189,62,180,90,38,6
150 DATA246,62,196,122,62,195,12
6
160 DATA62,138,182,62,195,183,62
170 DATA194,122,62,194,38,251,57
180 CLS:PRINT@128,"START PERIOD(
1-255)";
185 'DETERMINES FREQUENCY SWEEP
186 'STARTING POINT.LARGE VALUE
187 'OF S=LOWER FREQUENCY
190 INPUTS
200 IFS<1ORS>255THEN190
210 POKE16064,S:'ADD TO ML PRGM
220 PRINT:PRINT"END PERIOD(1-255
)";
225 'END POINT OF FREQ. SWEEP
230 INPUTE
240 IFE=S THEN230
250 IFE<1ORE>255THEN230
260 POKE16065,E:'ADD TO ML PRGM
269 'HI TO LO FREQ SWEEP
270 IFE>S THENPOKE16046,124
279 'LO TO HI FREQ SWEEP
280 IFS>E THENPOKE16046,122
290 PRINT:INPUT"DWELL(1-255)";D
295 'SWEEP SPEED, LOWER NUMBERS
296 'CAUSE FASTER SWEEP
300 IFD<1 ORD>255 THEN290
310 POKE16068,D:'ADD TO ML PRGM
320 PRINT:INPUT"REPEATS";T
330 IFT=0THEN320
340 FORN=1TOT
350 X=USR0(0):'CALL ML ROUTINE
360 NEXTN
370 PRINT:INPUT"AGAIN";A$
380 IFA$="Y"THEN340
390 PRINT:INPUT"NEW LIMITS";A$
400 IFA$="Y"THEN180
410 END
500 '
600 '
700 'YOU CAN PEEK THE ML PROGRM
701 '(IF YOU RUN AT LEAST ONCE)
800 'BY TYPING "RUN 1000"
900 '
1000 FORX=16001TO16068
1010 PRINTPEEK(X);
1020 NEXT
```

Program Listing 2. Whooper

noiz, I generated (in Basic) a list of 1,000 random numbers and POKEd them into that reserved memory area. The machine-language routine got its noise data from that list.

It took more than 20 seconds to generate and POKE that list into memory though, so I tried an alternate method. It occurred to me that the list of random numbers already existed inside the computer. The Basic and Extended Basic ROMs are simply lists of numbers. Except for the special meaning they have to the microprocessor, they are quite random. If you look at location 15236 in Program Listing 5, you will see that it sets the index register to the starting address of the Extended Basic ROM, $8000. The routine uses ROM locations $8000 through $BFFF for a list of noise data that is more than 11,000 bytes long.

Although the machine-language programs shown here are not relocatable, they can be rewritten to run on a 4K machine. Defining the start of the USR routine is different without Extended Basic, but the method is described in *Getting Started with Color Basic*. For 1Bitnoiz, it is necessary to start the index register at $A000, the first Basic ROM location. ■

```
1 '************************************************************
2 '************ASSEMBLY LANGUAGE LISTING FOR WHOOPER************
3 '************************************************************
4 '
5 'DEC  HEX  OP B1 B2   LABEL    MNEMON         COMMENTS
6 '***  **** ** ** **  *******   ******       ***************
16001 ' 3E81 B6 3E C0             LDA    LOAD "START" PERIOD
16004 ' 3E84 B7 3E C3             STA    STORE AS "CURRENT" PERIOD
16007 ' 3E87 F6 3F C4             LDB    LOAD "DWELL"
16010 ' 3E8A 86 02      POSHALF   LDA#   SET UP MASK
16012 ' 3E8C BA FF 22             ORA    CHANGE BIT 1
16015 ' 3E8F B7 FF 22             STA    SET SOUND OUTPUT HIGH
16018 ' 3E92 BD 3F B4             JSR    GO TO TIMEOUT
16021 ' 3E95 B6 3E C1   CYCLE     LDA    LOAD "END" PERIOD
16024 ' 3E98 B1 3E C3             CMPA   DOES "CURRENT"="FINAL"?
16027 ' 3E9B 27 22                BEQ    IF TRUE, GO TO RETURN
16029 ' 3E9D 86 FD                LDA#   SET UP MASK
16031 ' 3E9F B4 FF 22             ANDA   CHANGE BIT 1
16034 ' 3EA2 B7 FF 22             STA    SET SOUND OUTPUT LOW
16037 ' 3EA5 BD 3E B4             JSR    GO TO TIMEOUT
16040 ' 3EA8 5A           DWELL   DECB   COUNT DWELL CYCLES
16041 ' 3EA9 26 06                BNE    IF TRUE, GO TO JUMP
16043 ' 3EAB F6 3E C4             LDB    RE-LOAD DWELL
16046 ' 3EAE 7A 3E C3             DEC    REDUCE CURRENT PERIOD
16049 ' 3EB1 7E 3E 8A   JUMP      JMP    GO TO POSHALF
16052 ' 3EB4 B6 3E C3   TIMEOUT   LDA    LOAD CURRENT PERIOD
16055 ' 3EB7 B7 3E C2             STA    STORE AS "DELAY"
16058 ' 3EBA 7A 3E C2   DELAY     DEC    COUNT DELAY
16061 ' 3EBD 26 FB                BNE    IF TRUE, GO TO DELAY
16063 ' 3EBF 39           RETURN  RTS    GO TO CYCLE, DWELL, OR BASIC
16064 ' 3EC0 00           START           DATA, START PERIOD
16065 ' 3EC1 00           END             DATA, END PERIOD
16066 ' 3EC2 00           DELAY           TEMPORARY STORAGE
16067 ' 3EC3 00           CURRENT         TEMPORARY STORAGE
16068 ' 3EC4 00           DWELL           DATA, DWELL

    NOTE: ALTERNATE AT 16046 (3EAE) IS OPCODE 7C (INC).
```

Program Listing 3. Assembly-Language Listing for Whooper

Write to Barry E. Becker at 37 Dorchester Road, Smithtown, NY 11788.

```
1 '**********1BITNOIZ**********
2 '
10 POKE65315,PEEK(65315)AND247
20 CLEAR200,15232
30 DEFUSR0=15233
40 POKE65315,PEEK(65315)AND251
50 POKE65314,PEEK(65314)OR2
60 POKE65315,PEEK(65315)OR4
70 FORX=15233TO15272
80 READM:POKEX,M
90 NEXTX
100 DATA246,59,169,142,128,0
110 DATA134,2,164,128,151,171
120 DATA134,253,180,255,34,154
130 DATA171,183,255,34,140,191
140 DATA255,39,9,182,59,170
150 DATA74,38,253,126,59,135
160 DATA90,38,220,57
170 CLS:PRINT@128,"RANGE(1-255)"
;
180 INPUTR:'TIME BETWEEN CYCLES
190 IFR<1ORR>255THEN180
200 POKE15274,R
210 PRINT:PRINT"LENGTH(1-255)";
220 INPUTL:'NUMBER OF REPEATS
230 IFL<1ORL>255THEN220
240 POKE15273,L
250 X=USR0(A)
260 PRINT:INPUT"AGAIN(Y/N)";A$
270 IFA$="Y"THEN250
280 PRINT:INPUT"NEW LIMITS(Y/N)"
;A$
290 IFA$="Y"THEN170
300 END
1000 FORX=15233TO15274
1010 PRINTPEEK(X);
1020 NEXT
```

Program Listing 4. 1Bitnoiz

```
1 '************************************************************
2 '************ASSEMBLY LANGUAGE LISTING FOR 1BITNOIZ**********
3 '************************************************************
4 '
5 'DEC  HEX  OP B1 B2   LABEL    MNEMON         COMMENTS
6 '***  **** ** ** **  *******   ******       ***************
15233 ' 3B81 F6 3B A9             LDB    GET "LENGTH"
15236 ' 3B84 8E 80 00   INDEX     LDX#   INDEX TO START OF ROM
15239 ' 3B87 86 02      BEGIN     LDA#   LOAD BIT 1 TRUE
15241 ' 3B89 A4 80                ANDA,X+GET BIT 1 & INCR X-REG
15243 ' 3B8B 97 AB                STA    STORE BIT 1 AT "NOISE"
15245 ' 3B8D 86 FD                LDA#   LOAD BIT 1 FALSE
15247 ' 3B8F B4 FF 22             ANDA   SET BIT 1 FALSE
15250 ' 3B92 9A AB                ORA    GET NOISE,SET NEW BIT 1
15252 ' 3B94 B7 FF 22             STA    SET/CLR NEW 1-BIT SOUND
15255 ' 3B97 8C BF FF             CMPX#  POINTER AT END OF ROM ?
15258 ' 3B9A 27 09                BEQ    IF YES, GO TO "COUNT"
15260 ' 3B9C B6 3B AA             LDA    GET "RANGE"
15263 ' 3B9F 4A           DELAY   DECA   COUNT "RANGE"
15264 ' 3BA0 26 FD                BNE    IF DELAY>0,GOTO "DELAY"
15266 ' 3BA2 7E 3B 87             JMP    GO TO "BEGIN"
15269 ' 3BA5 5A           COUNT   DECB   COUNT "LENGTH"
15270 ' 3BA6 26 DC                BNE    IF LENGTH>0,GOTO"INDEX"
15272 ' 3BA8 39                   RTS    GO BACK TO BASIC PRGRM
15273 ' 3BA9 00           LENGTH          DATA POKED FROM BASIC
15274 ' 3BAA 00           RANGE           DATA POKED FROM BASIC
15275 ' 3BAB 00           NOISE           TMPRY NOISE BIT STORAGE
```

Program Listing 5. Assembly-Language Listing for 1 Bitnoiz

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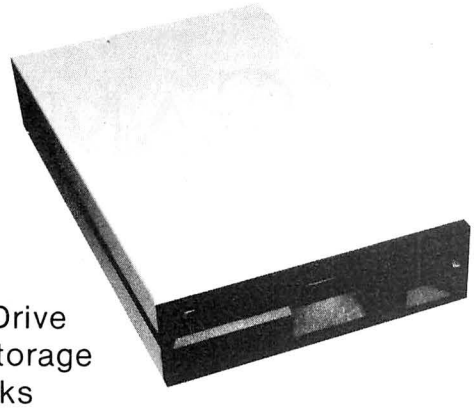

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BY FRANK TIPPS

NEW LIFE FOR AN OLD GAME

Play Tic-Tac-Toe in three dimensional color and get some useful programming techniques with 4NROW.

Three dimensional Tic-Tac-Toe has always been one of my favorite games. It involves challenge, strategy, and luck, and its rules are simple. This CoCo version, 4NRow, combines machine-code subroutines and Basic, to speed the game to an enjoyable level.

Two people can play 4NRow while the computer maintains the game board and indicates a winning combination. One person can play against the computer on four different difficulty levels with the option to play first or let the computer play first.

The Program

You can easily adapt the programming techniques used in 4NRow to other programs, and the game strategy might suggest ideas to solve your own game-programming dilemmas.

Line 10 reserves space at the upper end of 16K memory for the machine portion of the program. Lines 20–80 are hexadecimal machine code. They are string constants, not DATA statements and as such, they require only 2 bytes of memory for each byte of machine code. Data statements would require much more space to represent the machine code, and each byte would have to be separated by commas or put in separate DATA statements.

In this case, you save over 600 bytes of Basic memory by not using commas to separate the machine-code bytes. String constants do not require string space and are not involved in the Basic garbage collection. String constants are the same length and have an even number of characters, both characteristics that are used later.

Patches or changes are easy to implement with the machine code in this configuration. Look at line 20. The 108E3C47 is a LDY #3C47 instruction. Change it to LDY #3C48 by editing the line and changing the character 7 to an 8.

Line 90 assigns some meaningful characters to the codes for the colors. It is easier to remember characters than numbers, just as in Assembly language, LDA for load accumulator A is easier to remember than 86.

Line 100 dimensions an array that holds data for the Extended Basic GET and PUT functions.

Line 110 defines some locations that are used for communications between Basic and the machine code.

Line 120 defines an array used to draw the word Won on the game screen.

Lines 130–310 are the instructions for playing the game. The single-player option requires the right joystick, and the two-player option requires both.

Lines 320–490 set up the machine code. It takes about 16 seconds to do this, and using POKE 65495,0 to speed up the process didn't seem to improve the time. Since the MPU runs at the lower rate when accessing RAM and most of the processing involves getting the data, little is gained by using the double-speed POKE.

Looking back at line 110, the machine code starts at location $3C93, the check-for-win subroutine. In the Basic subroutine in lines 420–490, the FOR loop is set up to use 100 addresses (AD to AD + 99). There are 100 bytes of machine code in each of the 200-character lines, 20–80. Two characters contain the data to be POKEd. This is why the MID$ selects two characters from the Ith position of the string and why there is an even number of characters in each string.

If you use this technique for machine code, remember there must always be two characters for each byte. If the byte is less than $10 (16 decimal), it must be represented in the string with a leading zero (a byte of 4 must be "04").

Lines 500–580 are the option-selection portion of the program. Here you

System Requirements

16K RAM
Extended Color Basic
Editor/Assembler (optional)

select one or two players. With one player, the user selects the level of difficulty. Level one is the easiest and level four the hardest. The level of difficulty limits how far the computer goes in searching for its next move. The one player selection also allows you to go first or not.

Lines 590–740 are the graphics commands for drawing the game board. On a black-and-white TV, the shading of gray gives good definition of the board and player selections.

Lines 750–820 are part of the game strategy. In this game, each board position has a value. The random operation in line 780 determines whether the corners or the middle positions are emphasized in this particular game.

For simple games where there are limited choices of play, some choices are more advantageous than others. From empirical observations, assign values to certain positions or moves and it becomes a simple matter for the computer to select advantageous moves from the various possibilities. Make sure that the computer's move can lead to a win to keep the game challenging.

"When you move first, you have a 50-percent chance of winning because the computer is more consistent at picking the optimum moves."

In 4NRow, assigning values to board positions makes the challenge. At the most difficult level, level four, with the computer making the first move, you have about a 30-percent chance of winning. When you move first, you have a 50-percent chance of winning because the computer is more consistent at picking the optimum moves. There is also a constant switching between offensive and defensive play by the computer. Any game should be challenging, but not unbeatable, and have random moves so it remains unpredictable.

Lines 830–890 control the game and handle the switching between players.

Lines 900–950 conclude the game and control whether to play another game with the same options, or to allow the user to select new options. Line 900 clears the keyboard input before looking for the user input and ignores accidental keystrokes.

Program Listing 1. 4NRow, Basic Version

```
10 CLEAR200,&H3BFF
20 DB$="108E3C47C6018E3C0717012B
1027010630018C3C432FF2CE0000C604
30C93C071701141027 00EF30C93C0817
0109102700E430C93C091700FE102700
D930C93C0A1700F3102700CE33C81011
8300302FCBC610CE000030C93C071700
DA102700B5334111"
30 DC$="83000F2FEDC605CE000030C9
3C071700C21027009D33C81011830030
2FECC603CE000330C93C071700A91027
008433C81011 8300332FECC614CE0000
30C93C0717009010270068334111 8300
032FEDC60CCE000C30C93C078D792756
334111 83000F2FF0"
40 DD$="C611CE000030C93C078D6427
4133441183000C2FF0C60FCE000330C9
3C078D4F272C334411 83000F2FF0C615
8E3C078D3E271BC6138E3C0A8D352712
C60D8E3C138D2C2709C60B8E3C168D23
261B34041F10833C07F73C0535048603
3DF03C0550F73C04"
50 DE$="7F3C03200586FFB73C03394F
AB843AAB843AAB843AAB84A7A0816427
02819C398E3C47F63C003085BF3C0186
32C6CE8E3C47A1842604300120F8108E
3C47E1A42604312120F8CE3C478632A1
C42712E1C4270EA6C4A1842F021F31A1
A42C021F32334111"
60 DF$="B33C012FE0A684814B2C08A6
A481CE2C021F211F10833C471F987F3C
068148 2D252E064FC6151600A581492E
078603C61316009A814A2E07860CC60D
16008F860FC60B16008881442D0E8044
C6043DCB031F98C60F160076 81402D0B
8040C6043D1F98C6"
70 DG$="112067813C2D068030C60C20
5D81382D068038C6142053 81342D0D80
34C6103DCB031F98C6032042 81302D0B
8030C6103D1F98C6052033 81202D0680
20C6102029 81102D1E811C2D048B1420
128118 2D048B08200A81142D04800420
028010C6042007C6"
80 DH$="043D1F98C6018E3C0730868D
123A8D0F3A8D0C3A8D091F30833C07F7
3C0439A6848119270E81E7270AB13C06
2D05B73C061F133940825100B9ECBB88
12B16A00BCE1B74DAE54AD2D830200FF
FFFFFFFFFFFFFFFFFF00000000000000
0000000000000000"
90 GRN=1:YEL=2:BLU=3:RED=4
100 DIM W(7,7)
110 LV=&H3C00:WO=LV+3:X1=WO+1:X2
=X1+1:VA=X2+2:WI=&H3C93:MO=&H3DD
F
120 WI$="D20R6NU10R6U20BR6NR6D20
R6NU20NL6BR6U18NU2R6D18BR6BU20"
130 CLS
140 PRINT@8,"**** 4NROW ****":PR
INT@40,"BY FRANK TIPPS":PRINT@74
,"-WELCOME-":PRINT@103,"TO THE G
AME 4NROW!"
150 PRINT@160,"TO WIN A PLAYER M
UST GET FOUR OFHIS/HER COLORS IN
 A STRAIGHT    LINE."
160 PRINT@288,"THIS MAY BE ACROS
S:    ";CHR$(175);" ";CHR$(175);
" ";CHR$(175);" ";CHR$(175):PRIN
T@345,CHR$(159)
170 PRINT@359,"-OR-":PRINT@376,C
HR$(159):PRINT@384,"DOWN ON A LE
VEL:":PRINT@407,CHR$(159):PRINT@
438,CHR$(159)
180 PRINT@480,"(PRESS ENTER FOR
MORE)";
190 A$=INKEY$:IF A$<>CHR$(13)THE
N190
200 CLS:PRINT@23,CHR$(175):PRINT
@26,CHR$(159):PRINT@56,CHR$(175)
;CHR$(159)
210 PRINT@64,"DIAGONALLY ON A LE
VEL:  ";CHR$(159);CHR$(175):PRIN
T@119,CHR$(159):PRINT@122,CHR$(1
75)
220 PRINT@136,"-OR-":PRINT@153,C
HR$(172):PRINT@160,"DOWN THROUGH
 4 LEVELS:   ";CHR$(172):PRINT@2
17,CHR$(172):PRINT@249,CHR$(172)
230 PRINT@264,"-OR-":PRINT@283,C
HR$(175);"  ";CHR$(159)
240 PRINT@320,"DIAGONALLY THROUG
H 4 LEVELS:";CHR$(175);CHR$(159)
:PRINT@412,CHR$(159);CHR$(175):P
RINT@475,CHR$(159);"  ";CHR$(175
)
250 PRINT@480,"(PRESS ENTER FOR
MORE)";
260 A$=INKEY$:IF A$<>CHR$(13)THE
N260
270 CLS:PRINT"THE PLAYER USING T
HE RIGHT JOY- STICK HAS THE YELL
OW COLOR. THE PLAYER USING THE L
EFT JOYSTICK  HAS THE BLUE COLOR
```

Listing 1 continued

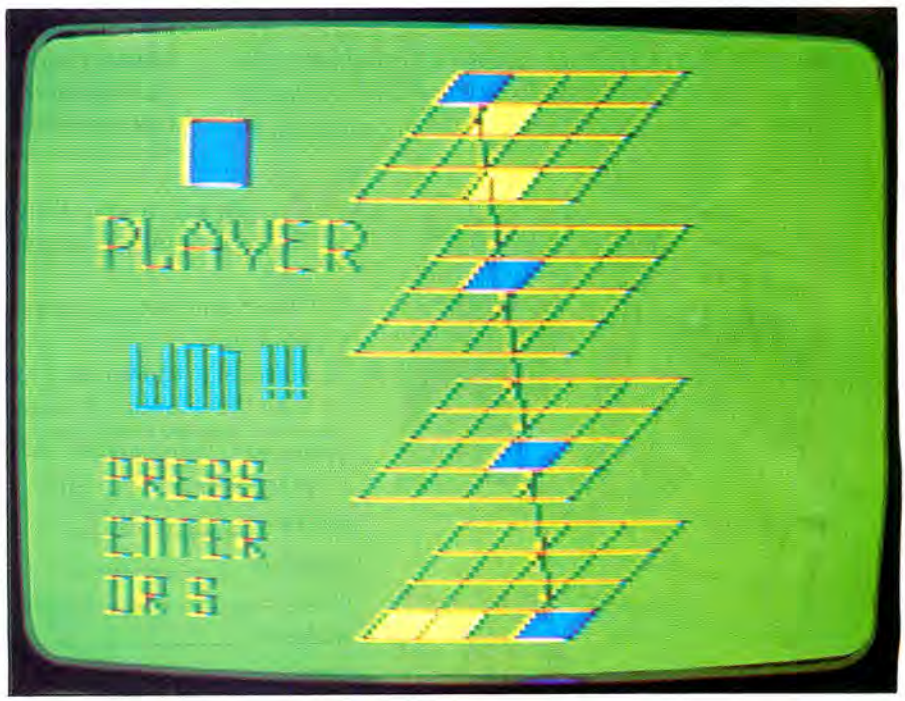

Photo 1. The 4NRow Screen

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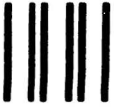

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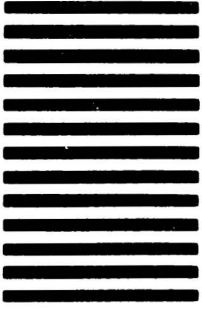

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Lines 960–1110 handle the joystick and fire-button inputs. These lines let you select only unoccupied board positions, and set values for the move.

Lines 1120–1230 perform a translation of a board position into a screen location.

Lines 1240–1280 are the subroutines for creating the cross hair cursor.

Lines 1290–1400 call the machine code to check for a win. If a win has occurred, the winning positions are connected with a line to make that combination obvious to the player or players.

Lines 1410–1570 call the machine code for the computer to make a move. The cursor flashes on the board over the position the computer has selected for a few seconds. This allows you to see the computer's move.

Since the joystick software on the Color Computer is not that responsive, this area of the program can use some help. When you make your move, the cursor jumps from position to position. Each screen position corresponds to bands of X and Y joystick inputs. When the cursor is at the desired screen position, remove your hand from the stick, then depress the fire button to select the position. If you bump the stick while pressing the fire button, you might select another position and lose. There is no recovery from improper selections. A verification scheme after every move would slow the action of the game but you can press break and restart the program with a RUN command.

"4NRow shows what you can do with the Color Computer in just a few lines of code..."

To save you the trouble of disassembling the machine code in lines 20–80, the Assembly listing is included here (Program Listing 2).

4NRow shows what you can do with the Color Computer in just a few lines of code, and the program should be helpful to children learning to visualize in three dimensions. ■

Address correspondence to Frank Tipps, 1837 Cartlen Drive, Placentia, CA 92670.

Listing 1 continued

```
."
280 PRINT@160,"THE JOYSTICKS POS
ITION THE      CURSOR ON THE BOA
RD. THE FIRE    BUTTON IS PUSHED
TO SELECT A     POSITION.":PRINT
290 PRINT"AFTER A WIN, PRESS ENT
ER TO PLAYAGAIN. PRESS S TO RE-S
ELECT THE OPTIONS.":PRINT
300 PRINT@480,"(PRESS ENTER FOR
MORE)";
310 A$=INKEY$:IFA$<>CHR$(13)THEN
310
320 CLS:PRINT@260,"SETTING UP MA
CHINE CODE..."
330 AD=&H3C93
340 A$=DB$:GOSUB420
350 A$=DC$:GOSUB420
360 A$=DD$:GOSUB420
370 A$=DE$:GOSUB420
380 A$=DF$:GOSUB420
390 A$=DG$:GOSUB420
400 A$=DH$:GOSUB420
410 GOTO500
420 I=1
430 FOR A=AD TO AD+99
440 D=VAL("&H"+MID$(A$,I,2))
450 POKE A,D
460 I=I+2
470 NEXTA
480 AD=AD+100
490 RETURN
500 CLS
510 INPUT"NUMBER OF PLAYERS(1OR2
)";PN:IF PN<>1ANDPN<>2THEN510
520 IF PN=2THEN590
530 INPUT"LEVEL OF DIFFICULTY(1-
4)";LD:IF LD<1ORLD>4THEN530
540 IF LD=1THEN POKELV,47
550 IF LD=2THEN POKELV,55
560 IF LD=3THEN POKELV,71
570 IF LD=4THEN POKELV,75
580 INPUT"DO YOU WANT TO GO FIRS
T(Y OR N)";B$:IF B$<>"Y"AND B$<>
"N"THEN580
590 PMODE 3,1:SCREEN1,0:COLOR GR
N,RED:PCLS GRN:NP=0
600 FOR LL=0TO144STEP48
610 FOR FF=0TO80STEP20
620 LINE(90+FF,44+LL)-(130+FF,4+
LL),PRESET
630 NEXT FF
640 FOR FF=0TO40STEP10
650 LINE(90+FF,44+LL-FF)-(170+FF
,44+LL-FF),PRESET
660 NEXT FF
670 NEXT LL
680 LINE(30,20)-(50,40),PRESET,B
690 DRAW"BM00,66S6C4U10R5F2D2G2L
5BM+10,4"
700 DRAW"BM+0,+0C4NU10R5U2BM+4,+
2"
710 DRAW"BM+0,+0C4U6E4F4D2NL6D4B
M+4,0"
720 DRAW"BM+0,-10C4D4F4ND2E4U4BM
+4,+10"
730 DRAW"BM+0,+0C4NR6U6NR3U4R6BM
+5,+10"
740 DRAW"BM+0,+0C4U10R6F2D2G2L3N
L2F4S4"
750 FORX=0TO63:POKEVA+X,1:NEXTX
760 FORZ=0TO48STEP48:FORY=0TO4ST
EP4:FORX=5TO6
770 POKEVA+X+Y+Z,2:NEXTX,Y,Z
780 M=RND(2)+2:IF M=3THEN N=4ELS
EN=3
790 FORZ=0TO48STEP48:FORY=0TO12S
TEP12:FORX=0TO3STEP3
800 POKEVA+X+Y+Z,M:NEXTX,Y,Z
810 FORZ=21TO37STEP16:FORY=0TO4S
TEP4:FORX=0TO1
820 POKEVA+X+Y+Z,N:NEXTX,Y,Z
830 IFPN=2THEN850
840 IF B$="N"THEN870ELSE NP=1
850 PR=1:PAINT(45,30),YEL,RED:GO
SUB960:GOSUB1290
860 IF PR=0THEN900
870 PR=2:PAINT(45,30),BLU,RED
880 IF PN=1THEN GOSUB1410 ELSE G
OSUB960:GOSUB1290
890 IF PR<>0THEN850
900 A$=INKEY$
910 DRAW"BM0,140;S3C4U16R8D8L8BD
8BR16U16R8D8L8F8BR8BU16NR8D8NR4D
8R8BR8NU4R8U8L8U8R8D4BD12BR8NU4R
8U8L8U8R8D4"
920 DRAW"BM0,160;BU16NR8D8NR4D8R
8BR8U16NU2R8D16BR12U16NL4R4BR8NR
8D8NR4D8R8BR8U16R8D8L8F8"
930 DRAW"BM0,180;U16R8D16NL8BR8U
16R8D8L8F8BR16NU4R8U8L8U8R8D4S4"
940 A$=INKEY$:IF A$=CHR$(13)THEN
590
950 IF A$="S"THEN500ELSE940
960 RX=JOYSTK(0):RY=JOYSTK(1):LX
=JOYSTK(2):LY=JOYSTK(3)
970 IF PR=2THENX=LX:Y=LY ELSE X=
RX:Y=RY
980 L=INT(Y/16):C=INT((Y-16*L)/4
):R=INT(X/16)
990 GOSUB1240
1000 F=PEEK(65280)
1010 IF PR=1THEN1040
1020 CO=BLU
1030 IF F<>125ANDF<>253THEN1060
ELSE1070
1040 CO=YEL
1050 IF F=126ORF=254THEN1070
1060 PUT(H-4,V-4)-(H+4,V+4),W,PS
ET:GOTO960
1070 PUT(H-4,V-4)-(H+4,V+4),W,PS
ET
1080 IF PPOINT(H,V)<>GRN THEN960
1090 PAINT(H,V),CO,RED
1100 M=R+4*C+16*L:IF PR=1THEN PO
KEVA+M,&HE7 ELSE POKEVA+M,25
1110 RETURN
1120 ON L+1 GOTO1130,1140,1150,1
160
1130 V=8:GOTO1170
1140 V=56:GOTO1170
1150 V=104:GOTO1170
1160 V=152
1170 ON C+1 GOTO1180,1190,1200,1
210
1180 H=135:GOTO1220
1190 V=V+10:H=125:GOTO1220
1200 V=V+20:H=115:GOTO1220
1210 V=V+30:H=105
1220 H=H+20*R
1230 RETURN
1240 GOSUB1120
1250 GET(H-4,V-4)-(H+4,V+4),W,G
1260 LINE(H-2,V)-(H+2,V),PRESET
1270 LINE(H,V-2)-(H,V+2),PRESET
1280 RETURN
1290 IF PR=1THEN C$="C2"ELSE C$=
"C3"
1300 DEFUSR0=WI
1310 A=USR0(0)
1320 IFPEEK(WO)<>0THEN1400
1330 X=PEEK(X1):Y=PEEK(X2)
1340 L1=INT(X/16):C1=INT((X-16*L
1)/4):R1=X-4*C1-16*L1
1350 L2=INT(Y/16):C2=INT((Y-16*L
2)/4):R2=Y-4*C2-16*L2
1360 R=R1:C=C1:L=L1:GOSUB1120:XX
=H:YY=V:R=R2:C=C2:L=L2:GOSUB1120
1370 LINE(XX,YY)-(H,V),PRESET
1380 DRAW"BM10,90"+C$+WI$+"BR6D1
2BD2D2BR6U2BU2U12BR6D12BD2D2"
1390 PR=0
1400 RETURN
1410 IFNP<>0THEN1440
1420 IF PEEK(VA)=4THEN X=(RND(2)
-1)*3ELSE X=RND(2)+20
1430 NP=1:GOTO1470
1440 DEFUSR1=MO
1450 A=USR1(0)
1460 X=PEEK(X1)
1470 POKEVA+X,25
1480 L=INT(X/16):C=INT((X-16*L)/
4):R=X-4*C-16*L
1500 GOSUB1240
1510 FORK=0TO5
1520 FORI=0TO100:NEXTI
1530 PUT(H-4,V-4)-(H+4,V+4),W,PS
ET:FOR I=0TO100:NEXTI
1540 GOSUB1250:NEXTK
1550 PUT(H-4,V-4)-(H+4,V+4),W,PS
ET
1560 PAINT(H,V),BLU,RED
1570 GOSUB1290
1580 RETURN
```

END

Program Listing 2. 4NRow, Assembly Version

```
3C00                    00110          ORG     $3C00
3C00                    00120 LV       RMB     1   LEVEL OF PLAY
3C01                    00130 LD       RMB     2   LAST ADR FOR MATCHING
3C03                    00140 WO       RMB     1   WON FLAG
3C04                    00150 X1       RMB     1   START POSITION FOR WIN
3C05                    00160 X2       RMB     1   LAST POSITION FOR WIN
3C06                    00170 N        RMB     1   MAX VALUE OF STRAIGHT LINE
3C07                    00180 VA       RMB     64  ARRAY OF BOARD VALUES
3C47                    00190 PL       RMB     76  ARRAY OF POSSIBLE PLAY VALUES
                        00200 *
            3C93        00210 WIN      EQU     *   CHECK FOR WIN SUBROUTINE
3C93 108E 3C47          00220          LDY     #PL  ADR OF POSSIBLE PLAYS
3C97 C6   01            00230          LDB     #1   INCREMENT VALUE
3C99 8E   3C07          00240          LDX     #VA  ADR OF ARRAY VALUES
            3C9C        00250 CK015    EQU     *    CHECK PLAYS 0-15
3C9C 17   012B          00260          LBSR    WINLOP  CHECK EACH COLUMN
3C9F 1027 0106          00270          LBEQ    WON  IF WON, GO TO SET FLAG
3CA3 30   01            00280          LEAX    1,X  INCREMENT TO ADD TO START CHECK
3CA5 8C   3C43          00290          CMPX    #VA+60  CHECK FOR LAST VALUE
3CA8 2F   F2            00300          BLE     CK015  LOOP IF NOT FINISHED
3CAA CE   0000          00310          LDU     #0  SET OFF-SET
3CAD C6   04            00320          LDB     #4  SET INCREMENT
            3CAF        00330 CK1631   EQU     *  CHECK EACH ROW
3CAF 30   C9 3C07       00340          LEAX    VA,U  LOAD START ADR
3CB3 17   0114          00350          LBSR    WINLOP  CHECK FOR ROW WIN
3CB6 1027 00EF          00360          LBEQ    WON  IF WIN, GO SET FLAG
3CBA 30   C9 3C08       00370          LEAX    VA+1,U  INCREMENT TO NEXT ROW
3CBE 17   0109          00380          LBSR    WINLOP CHECK FOR WIN
3CC1 1027 00E4          00390          LBEQ    WON  IF WIN, GO SET FLAG
3CC5 30   C9 3C09       00400          LEAX    VA+2,U  INCREMENT TO NEXT ROW
3CC9 17   00FE          00410          LBSR    WINLOP CHECK FOR WIN
3CCC 1027 00D9          00420          LBEQ    WON  IF WIN, GO SET FLAG
3CD0 30   C9 3C0A       00430          LEAX    VA+3,U  INCREMENT TO NEXT ROW
3CD4 17   00F3          00440          LBSR    WINLOP CHECK FOR WIN
3CD7 1027 00CE          00450          LBEQ    WON  IF WIN, GO SET FLAG
3CDB 33   C8 10         00460          LEAU    16,U  INCREMENT FOR NEXT LEVEL
3CDE 1183 0030          00470          CMPU    #48   IS THIS ALL ROWS?
3CE2 2F   CB            00480          BLE     CK1631  NO,LOOP
3CE4 C6   10            00490          LDB     #16   SET INCREMENT FOR LEVEL TO LEVEL
3CE6 CE   0000          00500          LDU     #0  SET OFF-SET
            3CE9        00510 CK3247   EQU     *  CHECK LEVEL TO LEVEL
3CE9 30   C9 3C07       00520          LEAX    VA,U  GET START POSITION
3CED 17   00DA          00530          LBSR    WINLOP  CHECK FOR WIN
3CF0 1027 00B5          00540          LBEQ    WON  IF WIN, GO SET FLAG
3CF4 33   41            00550          LEAU    1,U  INCREMENT TO NEXT POSITION
3CF6 1183 000F          00560          CMPU    #15  IS THIS ALL LEVEL TO LEVELS?
3CFA 2F   ED            00570          BLE     CK3247  NO, LOOP
3CFC C6   05            00580          LDB     #5  SET INCREMENTS FOR LEVEL DIAGONAL
3CFE CE   0000          00590          LDU     #0  SET OFF-SET
            3D01        00600 CK4851   EQU     *  CHECK UPPER LEFT TO LOWER RIGHT DIAG
ONALS
3D01 30   C9 3C07       00610          LEAX    VA,U  GET START POSITION
3D05 17   00C2          00620          LBSR    WINLOP CHECK FOR WIN
3D08 1027 009D          00630          LBEQ    WON  IF WIN, SET FLAG
3D0C 33   C8 10         00640          LEAU    16,U  INCREMENT FOR NEXT DIAGONAL
3D0F 1183 0030          00650          CMPU    #48  IS THIS ALL LEFT TO RIGHT DIAGONAL
S
3D13 2F   EC            00660          BLE     CK4851  NO, LOOP
3D15 C6   03            00670          LDB     #3  SET INCREMENT FOR UPPER LEFT TO LOW
ER LEFT DIAGONAL ON A LEVEL
3D17 CE   0003          00680          LDU     #3  SET OFF-SET
            3D1A        00690 CK5255   EQU     *  CHECK UPPER RIGHT TO LOWER RIGHT DIA
GONALS
3D1A 30   C9 3C07       00700          LEAX    VA,U  GET START POSITION
3D1E 17   00A9          00710          LBSR    WINLOP  CHECK FOR WIN
3D21 1027 0084          00720          LBEQ    WON  IF WIN, SET FLAG
3D25 33   C8 10         00730          LEAU    16,U     INCREMENT OFF-SET
3D28 1183 0033          00740          CMPU    #51  CHECK FOR ALL DIAGONALS
3D2C 2F   EC            00750          BLE     CK5255  LOOP
3D2E C6   14            00760          LDB     #20  SET INCREMENT
3D30 CE   0000          00770          LDU     #0  SET OFF-SET
            3D33        00780 CK5659   EQU     *  CHECK UPPER BACK TO LOWER FRONT DIAG
ONALS
3D33 30   C9 3C07       00790          LEAX    VA,U  GET START POSITION
3D37 17   0090          00800          LBSR    WINLOP  CHECK FOR WIN
3D3A 1027 006B          00810          LBEQ    WON  IF WIN, SET FLAG
3D3E 33   41            00820          LEAU    1,U  INCREMENT OFF-SET
3D40 1183 0003          00830          CMPU    #3  IS THIS ALL UPPER BACK TO LOWER FRO
NT?
3D44 2F   ED            00840          BLE     CK5659  NO, LOOP
3D46 C6   0C            00850          LDB     #12   SET INCREMENT
3D48 CE   000C          00860          LDU     #12  SET OFF-SET
            3D4B        00870 CK6063   EQU     *   CHECK DIAGONALS UPPER FRONT TO LOWE
R BACK
3D4B 30   C9 3C07       00880          LEAX    VA,U  GET STARTING POSITION
3D4F 8D   79            00890          BSR     WINLOP  CHECK FOR WIN
3D51 27   56            00900          BEQ     WON  IF WIN, SET FLAG
3D53 33   41            00910          LEAU    1,U  INCREMENT OFF-SET
3D55 1183 000F          00920          CMPU    #15  CHECK FOR ALL THESE DIAGONALS
3D59 2F   F0            00930          BLE     CK6063  IF NOT ALL, LOOP
3D5B C6   11            00940          LDB     #17  SET INCREMENT
3D5D CE   0000          00950          LDU     #0   SET OFF-SET
            3D60        00960 CK6467   EQU     *   CHECK DIAGONALS UPPER LEFT TO LOWER
 RIGHT
3D60 30   C9 3C07       00970          LEAX    VA,U  GET START VALUE
3D64 8D   64            00980          BSR     WINLOP  CHECK FOR WIN
3D66 27   41            00990          BEQ     WON  IF WIN, SET FLAG
3D68 33   44            01000          LEAU    4,U  INCREMENT OFF-SET
3D6A 1183 000C          01010          CMPU    #12  IS THIS ALL DIAGONALS?
3D6E 2F   F0            01020          BLE     CK6467  IF NOT ALL, LOOP
3D70 C6   0F            01030          LDB     #15   SET INCREMENT
3D72 CE   0003          01040          LDU     #3  SET OFF-SET
            3D75        01050 CK6871   EQU     *   CHECK DIAGONALS UPPER RIGHT TO LOWE
R LEFT
3D75 30   C9 3C07       01060          LEAX    VA,U  GET START POSITION
3D79 8D   4F            01070          BSR     WINLOP  CHECK FOR WIN
3D7B 27   2C            01080          BEQ     WON  IF WIN, SET FLAG
3D7D 33   44            01090          LEAU    4,U  INCREMENT OFF-SET
3D7F 1183 000F          01100          CMPU    #15  IS THIS LAST DIAGONAL?
3D83 2F   F0            01110          BLE     CK6871  NO, LOOP
3D85 C6   15            01120 CK72     LDB     #21  SET INCREMENT FOR UPPER LEFT TO LO
WER RIGHT THROUGH DIAGONAL
3D87 8E   3C07          01130          LDX     #VA  SET POSITION
3D8A 8D   3E            01140          BSR     WINLOP  CHECK FOR WIN
3D8C 27   1B            01150          BEQ     WON  IF WIN, SET FLAG
3D8E C6   13            01160 CK73     LDB     #19  SET INCREMENT
3D90 8E   3C0A          01170          LDX     #VA+3  SET OFF-SET
3D93 8D   35            01180          BSR     WINLOP  CHECK WIN UPPER RIGHT TO LOWER
LEFT THROUGH DIAGONAL
3D95 27   12            01190          BEQ     WON  IF WIN, SET FLAG
3D97 C6   0D            01200 CK74     LDB     #13   SET INCREMENT
3D99 8E   3C13          01210          LDX     #VA+12  SET START POSITION
3D9C 8D   2C            01220          BSR     WINLOP CHECK LOWER RIGHT TO UPPER LEFT
DIAGONAL
3D9E 27   09            01230          BEQ     WON  IF WIN, SET FLAG
3DA0 C6   0B            01240 CK75     LDB     #11  SET INCREMENT
3DA2 8E   3C16          01250          LDX     #VA+15  SET START POSITION
3DA5 8D   23            01260          BSR     WINLOP  CHECK DIAGONAL UPPER RIGHT TO L
OWER LEFT
3DA7 26   1B            01270          BNE     NOWIN  IF NOT WIN, SKIP
            3DA9        01280 WON      EQU     *  SET WON FLAG
3DA9 34   04            01290          PSHS    B  SAVE INCREMENT
3DAB 1F   10            01300          TFR     X,D  COPY CURRENT ADR
3DAD 83   3C07          01310          SUBD    #VA  SUBSTRACT BEGINNING ADR
3DB0 F7   3C05          01320          STB     X2  STORE LAST OFF-SET
3DB3 35   04            01330          PULS    B   RESTORE STACK
3DB5 86   03            01340          LDA     #3  GET NUMBER OF INCREMENTS
3DB7 3D                 01350          MUL
3DB8 F0   3C05          01360          SUBB    X2  SUBSTRACT LAST POSITION
3DBB 50                 01370          NEGB    COMPLEMENT VALUE
3DBC F7   3C04          01380          STB     X1  SAVE BEGINNING POSITION
3DBF 7F   3C03          01390          CLR     WO  CLEAR WON FLAG
3DC2 20   05            01400          BRA     CKRTN  GO RETURN
3DC4 86   FF            01410 NOWIN    LDA     #-1  SET FLAG FOR NO WIN
```

Listing 2 continued

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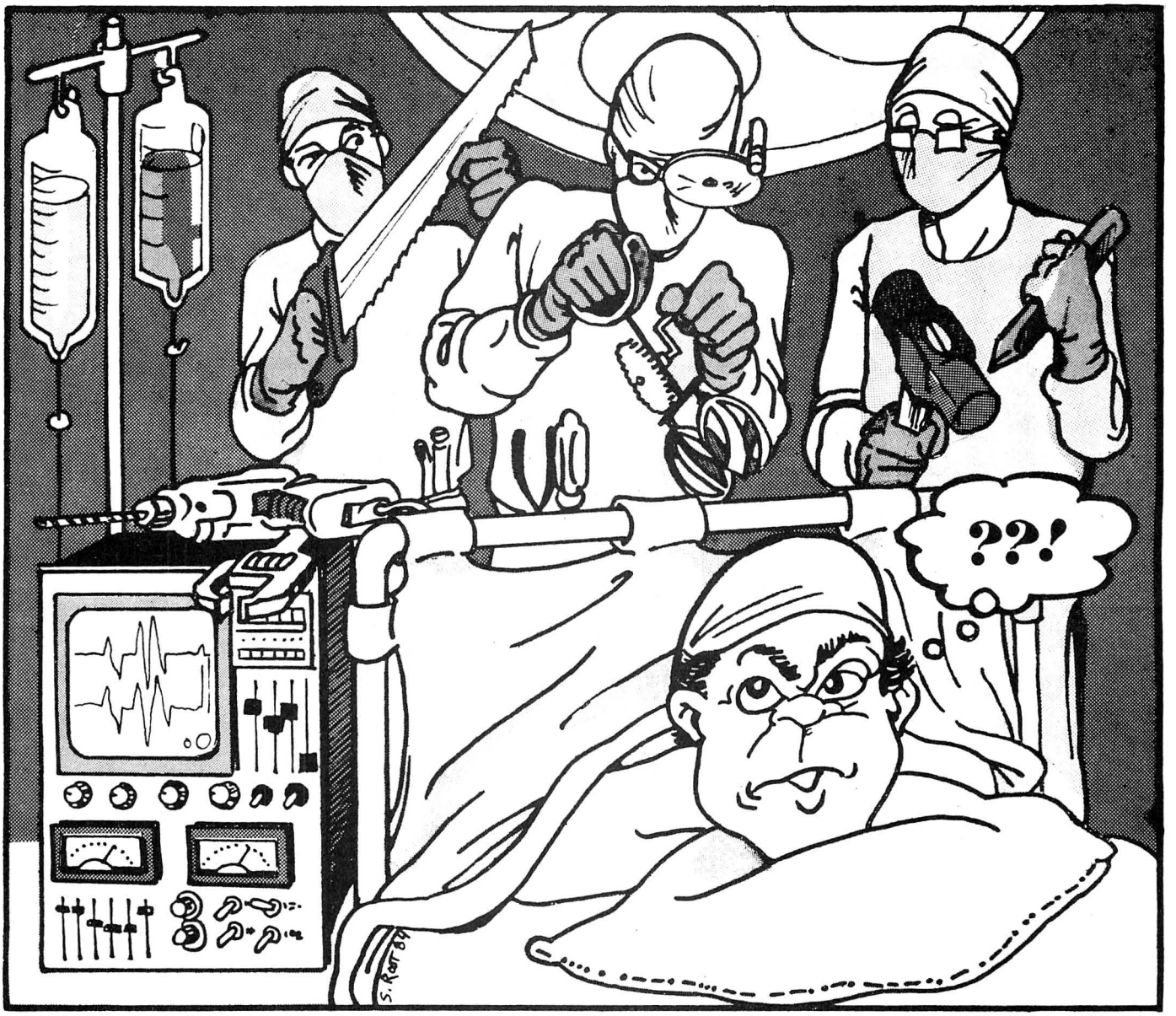

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Listing 2 continued

```
3DC6 B7  3C03      01420          STA     WO
3DC9 39            01430 CKRTN    RTS     RETURN TO BASIC
                   01440 *
           3DCA    01450 WINLOP   EQU     *  CHECK FOR WIN
3DCA 4F            01460          CLRA    CLEAR SUMMING REGISTER
3DCB AB  84        01470          ADDA    ,X  ADD 1ST POSITION VALUE
3DCD 3A            01480          ABX     INCREMENT POSITION
3DCE AB  84        01490          ADDA    ,X  ADD 2ND POSITION VALUE
3DD0 3A            01500          ABX     INCREMENT POSITION
3DD1 AB  84        01510          ADDA    ,X  ADD 3RD POSITION VALUE
3DD3 3A            01520          ABX     INCREMENT POSITION
3DD4 AB  84        01530          ADDA    ,X  ADD 4TH POSITION VALUE
3DD6 A7  A0        01540          STA     ,Y+  STORE POSITION VALUE IN PL ARRAY
3DD8 81  64        01550          CMPA    #100  CHECK FOR PLAYER 2 WIN
3DDA 27  02        01560          BEQ     LOPRTN  IF WIN, RETURN
3DDC 81  9C        01570          CMPA    #-100  CHECK OF PLAYER 1 WIN
3DDE 39            01580 LOPRTN   RTS     RETURN COND CODE Z=1 WIN;Z=0 NO WIN
                   01590 *
           3DDF    01600 MOVE     EQU     *  SUBROUTINE FOR COMPUTER'S PLAY
3DDF 8E  3C47      01610          LDX     #PL  GET PL ARRAY ADR
3DE2 F6  3C00      01620          LDB     LV  GET MAXIMUM PLAY TO BE CHECKED--LEV
EL OF DIFFICULTY
3DE5 30  85        01630          LEAX    B,X  GET LAST ARRAY ADR TO BE CHECKED
3DE7 BF  3C01      01640          STX     LD  SAVE ADR
3DEA 86  32        01650          LDA     #50  GET POSITIVE VALUE FOR FULL LINE
3DEC C6  CE        01660          LDB     #-50  GET NEGATIVE VALUE FOR FULL LINE
3DEE 8E  3C47      01670          LDX     #PL  GET ADR OF PLAY ARRAY
3DF1 A1  84        01680 FINDJ    CMPA    ,X  COMPARE FOR FULL LINE
3DF3 26  04        01690          BNE     GETK  NOT FULL CONTINUE
3DF5 30  01        01700          LEAX    1,X  INCREMENT FOR NEXT PLAY VALUE
3DF7 20  F8        01710          BRA     FINDJ  LOOP
3DF9 108E 3C47     01720 GETK     LDY     #PL  GET ADR OF PLAY ARRAY
3DFD E1  A4        01730 FINDK    CMPB    ,Y  CHECK FOR FULL LINE WITH NEGATIVE V
ALUE
3DFF 26  04        01740          BNE     FINDM  CONTINUE IF NOT FULL LINE
3E01 31  21        01750          LEAY    1,Y  INCREMENT ADR
3E03 20  F8        01760          BRA     FINDK  LOOP
3E05 CE  3C47      01770 FINDM    LDU     #PL  GET ADR OF PLAY ARRAY
3E08 86  32        01780 MLOOP    LDA     #50  GET FULL LINE POSITION VALUE
3E0A A1  C4        01790          CMPA    ,U CHECK FOR FULL LINE + VALUE
3E0C 27  12        01800          BEQ     INCU  SKIP FULL LINES
3E0E E1  C4        01810          CMPB    ,U  CHECK FOR FULL LINE - VALUE
3E10 27  0E        01820          BEQ     INCU SKIP FULL LINES
3E12 A6  C4        01830          LDA     ,U  GET VALUE FOR PLAY
3E14 A1  84        01840          CMPA    ,X  COMPARE TO CURRENT MAX
3E16 2F  02        01850          BLE     CKK  IF </=, SKIP
3E18 1F  31        01860          TFR     U,X NEW MAX, COPY
3E1A A1  A4        01870 CKK      CMPA    ,Y  COMPARE TO CURRENT MIN
3E1C 2C  02        01880          BGE     INCU IF >/=, SKIP
3E1E 1F  32        01890          TFR     U,Y NEW MIN, COPY
3E20 33  41        01900 INCU     LEAU    1,U INCREMENT PLAY ARRAY INDEX
3E22 11B3 3C01     01910          CMPU    LD  CHECK FOR LAST ADR TO CHECK
3E26 2F  E0        01920          BLE     MLOOP  IF NOT, LOOP
3E28 A6  84        01930          LDA     ,X GET MAX VALUE
3E2A 81  4B        01940          CMPA    #75  WILL NEXT MOVE MAKE A WIN?
3E2C 2C  08        01950          BGE     GO  YES, GO ON
3E2E A6  A4        01960          LDA     ,Y  GET MIN VALUE
3E30 81  CE        01970          CMPA    #-50 WILL PLAYER WIN ON NEXT MOVE?
3E32 2C  02        01980          BGE     GO  NO, GO ON
3E34 1F  21        01990          TFR     Y,X SET NEXT PLAY TO BLOCK
3E36 1F  10        02000 GO       TFR     X,D COPY PLAY ARRAY ADR
3E38 83  3C47      02010          SUBD    #PL GET INDEX FOR ARRA
3E3B 1F  98        02020          TFR     B,A  COPY VALUE
3E3D 7F  3C06      02030          CLR N   CLEAR CURRENT POSSIBLE NEXT PLAY INDEX
3E40 81  48        02040          CMPA    #72 CHECK FOR PLAY ARRAY INDEX 72
3E42 2D  25        02050          BLT     S68 IF INDEX < 72,CHECK OTHERS
3E44 2E  06        02060          BGT     S73 IF INDEX>72,CHECK OTHERS
3E46 4F            02070          CLRA  CLEAR VALUE
3E47 C6  15        02080          LDB     #21 SET INCREMENT VALUE
3E49 16  00A5      02090          LBRA    LOOP GO GET NEXT PLAY
3E4C 81  49        02100 S73      CMPA    #73 CHECK FOR INDEX OF 73
3E4E 2E  07        02110          BGT     S74 IF >,CHECK NEXT
3E50 86  03        02120          LDA     #3 GET START INDEX
3E52 C6  13        02130          LDB     #19 GET INCREMENT
3E54 16  009A      02140          LBRA    LOOP GO GET NEXT PLAY
3E57 81  4A        02150 S74      CMPA    #74 CHECK INDEX FOR 74
3E59 2E  07        02160          BGT     S75 IF >,CHECK NEXT
3E5B 86  0C        02170          LDA     #12 GET START INDEX
3E5D C6  0D        02180          LDB     #13 GET INCREMENT
3E5F 16  008F      02190          LBRA    LOOP
3E62 86  0F        02200 S75      LDA     #15 GET START INDEX
3E64 C6  0B        02210          LDB     #11 GET INCREMENT
3E66 16  0088      02220          LBRA    LOOP
3E69 81  44        02230 S68      CMPA    #68 CHECK INDEX
3E6B 2D  0E        02240          BLT     S64 IF <,CHECK OTHERS
3E6D 80  44        02250          SUBA    #68 REMOVE OFF-SET
3E6F C6  04        02260          LDB     #4 SET INCREMENT
3E71 3D            02270          MUL   MULTIPLY
3E72 CB  03        02280          ADDB    #3 INCREMENT FOR 4TH POSITION
3E74 1F  98        02290          TFR     B,A COPY START INDEX
3E76 C6  0F        02300          LDB     #15 GET INCREMENT
3E78 16  0076      02310          LBRA    LOOP
3E7B 81  40        02320 S64      CMPA    #64 CHECK FOR INDEX 64
3E7D 2D  0B        02330          BLT     S60 IF <,CONTINUE
3E7F 80  40        02340          SUBA    #64 SUBTRACT FOR OFF-SET
3E81 C6  04        02350          LDB     #4 SET OFF-SET
3E83 3D            02360          MUL     MULTIPLY
3E84 1F  98        02370          TFR     B,A COPY START INDEX
3E86 C6  11        02380          LDB     #17 GET INCREMENT
3E88 20  67        02390          BRA     LOOP
3E8A 81  3C        02400 S60      CMPA    #60 CHECK INDEX
3E8C 2D  06        02410          BLT     S56 IF <,CONTINUE
3E8E 80  30        02420          SUBA    #48 REMOVE OFF-SET
3E90 C6  0C        02430          LDB     #12 SET INCREMENT
3E92 20  5D        02440          BRA     LOOP
3E94 81  38        02450 S56      CMPA    #56 CHECK INDEX
3E96 2D  06        02460          BLT     S52 IF<,CONTINUE
3E98 80  38        02470          SUBA    #56 REMOVE OFFSET
3E9A C6  14        02480          LDB     #20 GET INCREMENT
3E9C 20  53        02490          BRA     LOOP
3E9E 81  34        02500 S52      CMPA    #52 CHECK INCREMENT
3EA0 2D  0D        02510          BLT     S48 IF <,SKIP
3EA2 80  34        02520          SUBA    #52 REMOVE OFFSET
3EA4 C6  10        02530          LDB     #16 INCREMENT
3EA6 3D            02540          MUL MULTIPLE
3EA7 CB  03        02550          ADDB    #3 ADD OFFSET
3EA9 1F  98        02560          TFR     B,A COPY START INDEX
3EAB C6  03        02570          LDB     #3 INCREMENT
3EAD 20  42        02580          BRA     LOOP
3EAF 81  30        02590 S48      CMPA    #48 CHECK INDEX
3EB1 2D  0B        02600          BLT     S32 IF <,SKIP
3EB3 80  30        02610          SUBA    #48 REMOVE OFFSET
3EB5 C6  10        02620          LDB     #16 INCREMENT
3EB7 3D            02630          MUL   MULTIPLY
3EB8 1F  98        02640          TFR     B,A COPY START INDEX
3EBA C6  05        02650          LDB     #5 INCREMENT
3EBC 20  33        02660          BRA     LOOP
3EBE 81  20        02670 S32      CMPA    #32 CHECK INDEX
3EC0 2D  06        02680          BLT     S16 IF <,SKIP
3EC2 80  20        02690          SUBA    #32 REMOVE OFFSET
3EC4 C6  10        02700          LDB     #16 INCREMENT
3EC6 20  29        02710          BRA     LOOP
3EC8 81  10        02720 S16      CMPA    #16 CHECK INDEX
3ECA 2D  1E        02730          BLT     D015 IF <,SKIP
3ECC 81  1C        02740          CMPA    #28 CHECK INDEX
3ECE 2D  04        02750          BLT     S24 IF <,SKIP
3ED0 8B  14        02760          ADDA    #20 ADD OFFSET
3ED2 20  12        02770          BRA     SETB
3ED4 81  18        02780 S24      CMPA    #24 CHECK INDEX
3ED6 2D  04        02790          BLT     S20 IF <,SKIP
3ED8 8B  08        02800          ADDA    #8 ADD OFFSET
3EDA 20  0A        02810          BRA     SETB
3EDC 81  14        02820 S20      CMPA    #20 CHECK INDEX
3EDE 2D  04        02830          BLT     SET16 IF <,SKIP
3EE0 80  04        02840          SUBA    #4 SET OFFSET
3EE2 20  02        02850          BRA     SETB
3EE4 80  10        02860 SET16    SUBA    #16 SET OFFSET
```

Listing 2 continued

Listing 2 continued

```
3EB6 C6 04          02870 SETB  LDB   #4 SET INCREMENT
3EB8 20 07          02880       BRA   LOOP
3EBA C6 04          02890 DO15  LDB   #4 SET INCREMENT
3EBC 3D             02900       MUL   MULTIPLY
3EBD 1F 98          02910       TFR   B,A COPY START INDEX
3EBF C6 01          02920 LOOP  LDB   #1 SET INCREMENT
3EF1 8E 3C07        02930       LDX   #VA ADR OF VALUE ARRAY
3EF4 30 86          02940       LEAX  A,X GET START VALUE ADR
3EF6 8D 12          02950       BSR   LOOPCK GO CHECK IT
3EF8 3A             02960       ABX   INCREMENT TO NEXT ADR
3EF9 8D 0F          02970       BSR   LOOPCK
3EFB 3A             02980       ABX   INCREMENT TO NEXT ADR
3EFC 8D 0C          02990       BSR   LOOPCK
3EFE 3A             03000       ABX   INCREMENT TO NEXT ADR
3EFF 8D 09          03010       BSR   LOOPCK
3F01 1F 30          03020       TFR   U,D COPY NEXT MOVE ADR
3F03 83 3C07        03030       SUBD  #VA  SUBTRACT ARRAY START ADR
3F06 F7 3C04        03040       STB   X1 SAVE INDEX
3F09 39             03050       RTS   RETURN
                    03060
3F0A A6 84          03070 LOOPCK EQU  * SEARCH FOR BEST PLAY
3F0C 81 19          03080       LDA   ,X GET FIRST VALUE
3F0E 27 0E          03090       CMPA  #25 OCCUPIED BY PLAYER 2?
3F10 81 E7          03100       BEQ   DORTN YES, SKIP
3F12 27 0A          03110       CMPA  #-25 OCCUPIED BY PLAYER 1?
3F14 B1 3C06        03120       BEQ   DORTN YES, SKIP
3F17 2D 05          03130       CMPA  N IS IT MAX?
3F19 B7 3C06        03140       BLT   DORTN NO,SKIP
3F1C 1F 13          03150       STA   N SAVE NEW MAX
3F1E 39             03160       TFR   X,U COPY ADR
                    03170 DORTN RTS   RETURN
0000 TOTAL ERRORS   03180       END
```

```
CK015   3C9C
CR1631  3CAF
CR3247  3CE9
CK4851  3D01
CR5255  3D1A
CR5659  3D33
CK6063  3D4B
CK6467  3D60
CK6871  3D75
CR72    3D85
CK73    3D8E
CK74    3D97
CK75    3DA0
CRK     3E1A
CKRTN   3DC9
DO15    3EEA
DORTN   3F1E
FINDJ   3DF1
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FINDM   3E05
GETK    3DF9
GO      3E36
INCU    3E20
LD      3C01
LOOP    3EF1
LOOPCK  3F0A
LOPRTN  3DDE
LV      3C00
MLOOP   3E08
MOVE    3DDF
N       3C06
NOWIN   3DC4
PL      3C47
S16     3EC8
S20     3EDC
S24     3ED4
S32     3EBE
S48     3EAF
S52     3E9E
S56     3E94
S60     3E8A
S64     3E7B
S68     3E69
S73     3E4C
S74     3E57
S75     3E62
SETT16  3EE4
SETB    3EE6
VA      3C07
WIN     3C93
WINLOP  3DCA
WO      3C03
WON     3DA9
X1      3C04
X2      3C05
```

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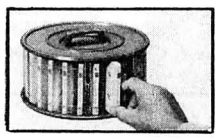

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BY BRAD WATSON

CC/ZAP

Read and write individual sectors directly to and from memory with this advanced CoCo utility.

There are few programming utilities for the advanced programmer—especially utilities written for use with Radio Shack's disk system. For that reason, I decided to write a Zap type of program so the contents of a particular sector can be viewed and then edited easily.

CC/ZAP uses the unique DSKI$ and DSKO$ functions, which let you read and write individual sectors directly to and from memory (actually two string variables).

For the sake of simplicity, I displayed the whole track/sector on the screen in ASCII format. From there, the user can either page forward or backward to other track/sectors, or go into the modify mode to edit the contents of that particular track/sector. Table 1 is a summary of the commands available from the keyboard. ■

Address correspondence to Brad Watson at 14844 Olmsted Drive, Denver, CO 80239.

In the Paging Mode:

+—Pages forward to the next track/sector
−—Pages backward to the previous track/sector
CLEAR—Selects completely new track and sector values
M—Goes into the Modify mode

In the Modify Mode:

Left Arrow—Moves cursor 1 byte to the left
Right Arrow—Moves cursor 1 byte to the right
Shifted Left Arrow—Moves cursor 2 bytes to the left
Shifted Right Arrow—Moves cursor 2 bytes to the right
Up Arrow—Moves cursor 1 byte upward
Down Arrow—Moves cursor 1 byte downward
Spacebar—Modifies current byte under cursor
W—Writes modified track/sector to disk
E—Exits Modify Mode, and returns to Paging Mode

Table 1. Command Summary

System Requirements

16K RAM
Disk Basic

```
10 CLS:PRINT:PRINT"INSERT DISK I
N DRIVE ZERO"
20 INPUT"HIT <ENTER> TO CONTINUE
";A$
30 CLS:CLEAR 1000
40 PRINT"TRACK SECTOR EDITOR"
50 PRINT"BY BRAD WATSON"
60 PRINT"JULY, 1983"
70 PRINT@256,"TRACK # (0-34)";
80 INPUTT:IFT<0 OR T>35 THEN 70
90 PRINT@288,"SECTOR # (1-18)";
100 INPUTS:IFS<1 OR S>18 THEN90
110 DSKI$ 0,T,S,A$,B$
120 CLS
130 FOR A=1152 TO 1279
140 POKE A,ASC(MID$(A$,A-1151,1)
)
150 NEXTA
160 FORA=1280 TO 1407
170 POKE A,ASC(MID$(B$,A-1279,1)
)
180 NEXTA
190 A$="":B$=""
200 PRINT@0,"TRACK SECTOR EDITOR
"
210 PRINT@64,"TRACK";T,"SECTOR";
S
220 PRINT@96,STRING$(32,"-");
230 PRINT@416,"HIT <M> TO MODIFY
 T/S CONTENTS";
240 PRINT@448,"<+> OR <-> TO PAG
E              ";
250 PRINT@384,STRING$(32,"-");
260 T$=INKEY$:IFT$=""THEN260
270 IF T$="+" THEN GOSUB 310:GOT
O110 ELSE IFT$="-" THEN GOSUB 34
0:GOTO110
280 IF T$="M" THEN GOSUB 370
290 IF T$=CHR$(12) THEN30
300 GOTO 200
310 S=S+1:IFS>18 THEN T=T+1:S=1
320 IF T>34 THEN T=34
330 RETURN
340 S=S-1:IFS<1 THEN T=T-1:S=18
350 IF T<0 THEN T=0
360 RETURN
370 X=1152
380 P=PEEK(X)
390 FORA=1TO 25
400 POKEX,207
410 T$=INKEY$:IFT$<>""THEN450 EL
SE NEXTA
420 FOR A=1 TO 25
430 POKEX,P
440 T$=INKEY$:IFT$<>""THEN460 EL
SE NEXTA
450 POKE X,P
460 IF T$=CHR$(8) THEN X=X-1 ELS
E IF T$=CHR$(9) THEN X=X+1
470 IF T$="]" THEN X=X+2 ELSE IF
 T$=CHR$(21) THEN X=X-2
480 IF T$="^" THEN X=X-32:IF X<1
152 THEN X=X+32
490 IF T$=CHR$(10) THEN X=X+32:I
F X>1407 THEN X=X-32
500 IF T$="E" THEN RETURN
510 IF T$=" " THEN GOSUB 570
520 IF T$="W"THEN GOSUB 620
530 IF X<1152 THEN X=1152 ELSE I
F X>1407 THEN X=1407
540 PRINT@416,"<SPACEBAR> TO MOD
IFY              ";
550 PRINT@448,"<E> TO EXIT, <W>
WRITES TO DISK";
560 GOTO 380
570 PRINT@448,STRING$(32,32);:PR
INT@448,"MODIFY ("HEX$(P)") TO "
;
580 LINEINPUTP$:P=VAL("&H"+P$)
590 IF P<0 OR P>255 THEN 570
600 POKE X,P
610 RETURN
620 PRINT@448,"WRITING TO DISK..
.PLEASE WAIT  ";
630 FORA=1152 TO 1279
640 A$=A$+CHR$(PEEK(A))
650 NEXTA
660 FORA=1280 TO 1407
670 B$=B$+CHR$(PEEK(A))
680 NEXTA
690 DSKO$0,T,S,A$,B$
700 PRINT@448,"HIT ANY KEY TO CO
NTINUE EDIT   ";
710 A$="":B$=""
720 IFINKEY$=""THEN720
730 RETURN
```

Program Listing. CC/ZAP

Coming Next Month

Next month's issue focuses on science and the part your Color Computer can play in it. In one feature by James Hardy you will see how the CoCo makes itself indispensable in the chemistry lab. Caitlin Dangler presents a surprising look at particle physics, and in "Are the Stars Random—Part I," the author looks at randomness and solutions to statistical problems.

A program called Snark will help young children understand graphing coordinates. May is also the month for Re:FLEX, where you will get a look at the Stylograph word processor for FLEX and OS-9. The Educated Guest tutors on Assembly-language programming, and J.J. Barbarello gives a business program called Financial Transactions Tracker.

Our Review section features the Speak-Up voice synthesizer by Classical Computing, a new book, *25 Graphics Programs in Microsoft Basic*, a look at the Master Writer word processor, and Scott Norman's review of the Super Stat graph program.

Just for fun, Elmer's Arcade goes to the Pits of Ganymede, and you'll find a Yahtzee program called Tricky Dice.

As usual, this issue of *HOT CoCo* gives you what's important, what you want to know, and ways to enjoy your Color Computer. ■

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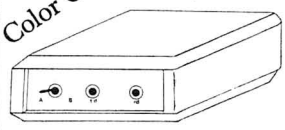

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BY MARK D. GOODWIN

JOURNEY TO THE CENTER OF THE ROM—PART VI

This month's installment of our ROM dissection covers locations A755 to AD46, and it includes routines such as the Color Basic MOTOR command, various cassette functions, graphics, SET and RESET commands, joystick functions, and the command mode.—eds.

A755–A75C Read-Bit-from-the-Cassette Routine

A755–A756	Read a bit
A757–A758	B = bit duration
A759	Decrement the duration
A75A–A75B	Carry = bit value
A75C	Return

A75D–A77B Cassette-Bit Routine

A75D–A75E	Duration = 0
A75F–A760	Test the sync value
A761–A762	Jump if it's set
A763–A764	Read a bit
A765–A766	Loop if it's high
A767–A768	Read a bit
A769–A76A	Loop if it's low
A76B	Return
A76C–A76D	Bump the duration
A76E–A770	Read the cassette input value
A771	Carry = cassette input value
A772	Return
A773–A774	Read a bit
A775–A776	Loop if it's low
A777–A778	Read a bit
A779–A77A	Loop if it's high
A77B	Return

A77C–A7BC Read-Cassette-Leader Routine

A77C–A77D	Disable the interrupts
A77E–A77F	Turn on the motor
A780–A781	Counter = 0
A782–A783	Read a bit
A784–A785	Read a high
A786–A787	Jump if not in sync
A788–A789	Read a low
A78A–A78B	Jump if not in sync
A78C–A78D	Decrement the counter
A78E–A78F	A = counter value
A790–A791	Leader done?
A792–A793	Loop until the leader is completely read
A794–A795	Save the sync value
A796	Return
A797–A798	Read a low
A799–A79A	Jump if not in sync
A79B–A79C	Read a high
A79D–A79E	Jump if not in sync
A79F–A7A0	Bump the counter
A7A1–A7A2	A = counter value
A7A3–A7A4	Set the flags for the counter value
A7A5–A7A6	Jump
A7A7–A7A8	Counter = 0
A7A9–A7AA	Read a low
A7AB–A7AC	Jump
A7AD–A7AE	Counter = 0
A7AF–A7B0	Read a high
A7B1–A7B2	B = counter value
A7B3–A7B4	Sync?
A7B5–A7B6	Jump if not in sync
A7B7–A7B8	Check for sync
A7B9	Return
A7BA–A7BB	Counter = 0
A7BC	Return

A7BD–A7C9 Color Basic MOTOR Command

A7BD–A7BE	B = current Basic character
A7BF–A7C0	Get the next Basic character
A7C1–A7C2	OFF token?
A7C3–A7C4	Jump if it's an OFF token
A7C5–A7C6	ON token?
A7C7–A7C9	End of the Basic statement?

A7CA–A7D2 Turn-On-the-Cassette-Motor Routine

A7CA–A7CC	A = control register A (PIA2) value
A7CD–A7CE	Set the motor bit
A7CF–A7C0	Turn on the motor
A7D1–A7D2	X = delay counter

A7D3–A7D7 Delay Routine

A7D3–A7D4	Decrement the delay counter
A7D5–A7D6	Loop until the delay is done
A7D7	Return

A7D8–A7E4 Write-Cassette-Leader Routine

A7D8–A7D9	Disable the interrupts
A7DA–A7DB	Turn on the motor
A7DC–A7DD	X = leader length
A7DE–A7DF	Write a leader byte
A7E0–A7E1	Leader done?

Listing continued

Listing continued

A7E2–A7E3	Loop until the leader is completely written
A7E4	Return

A7E5–A7E8 Cassette Routine

A7E5–A7E6	Write the leader
A7E7–A7E8	Write a block

A7E9–A7F3 Turn-Off-the-Cassette-Motor Routine

A7E9–A7EA	Enable the interrupts
A7EB–A7ED	A = control register A (PIA2) value
A7EE–A7EF	Clear the motor bit
A7F0–A7F2	Save the new control register A (PIA2) value
A7F3	Return

A7F4–A827 Write-Cassette-Block Routine

A7F4–A7F5	Disable the interrupts
A7F6–A7F7	B = block length
A7F8–A7F9	Save the block length
A7FA–A7FB	A = block length
A7FC–A7FD	Jump if it's equal to zero
A7FE–A7FF	X = start of the cassette buffer
A800–A801	Figure the checksum
A802	Decrement the block length
A803–A804	Loop until the checksum is computed
A805–A806	Add the block type to the checksum
A807–A808	Save the checksum
A809–A80A	X = start of the cassette buffer
A80B–A80C	Write a header byte
A80D–A80E	A = sync byte value
A80F–A810	Write the sync byte
A811–A812	A = Block type
A813–A814	Write the block type
A815–A816	A = block length
A817–A818	Write the block length
A819	Block length = 0?
A81A–A81B	Jump if it's equal to zero
A81C–A81D	Get a data byte
A81E–A81F	Write the data byte
A820–A821	Block done?
A822–A823	Loop until the block is completely written
A824–A825	A = checksum
A826–A827	Write the checksum

A828–A85B Write-Cassette-Byte Routine

A828–A829	A = byte to write
A82A–A82B	Save it
A82C–A82D	B = bit to write
A82E–A82F	A = last value written
A830–A832	Send it to the DAC
A833–A836	Y = start of the cassette sine table
A837–A838	Bit set?
A839–A83A	Jump if the bit is set
A83B–A83C	A = value to write
A83D–A840	End of the sine table?
A841–A842	Jump if it's the end of the sine table
A843–A845	Send the value to the DAC
A846–A847	Loop until all the sine values have been sent
A848–A849	A = value to write
A84A–A84D	End of the sine table?
A84E–A84F	Jump if it's the end of the sine table
A850–A852	Send the value to the DAC
A853–A854	Loop until all the sine values have been sent
A855–A856	Save the last value
A857	Shift the bit test value
A858–A859	Loop until all the bits have been written
A85A–A85B	Get the byte written and return

A85C–A87F Cassette Sine Table

A880–A8B0 Color Basic SET Command

A880–A881	Figure the memory location and the bit mask
A882–A883	Save the memory location
A884–A886	B = color
A887–A888	Get the memory location
A889–A88A	Color > 8?
A88B–A88C	Jump if the color > 8
A88D	Decrement the color value
A88E–A88F	Jump if it's equal to zero
A890–A891	A = color mask multiplier
A892	Figure the color mask
A893–A894	Jump
A895–A896	Get the video character
A897–A898	Jump if it's nongraphics
A899–A89A	Mask it for the color
A89B–A89C	Ignore
A89C	Zero the color mask
A89D–A89E	Save the color mask
A89F–A8A0	Check the syntax
A8A1–A8A2	Get the video character
A8A3–A8A4	Jump if it's graphics
A8A5	Blank the character
A8A6–A8A7	Mask the graphics bits
A8A8–A8A9	Set the pixel
A8AA–A8AB	Set the color
A8AC–A8AD	Make it a graphic character
A8AE–A8AF	Display the new character
A8B0	Return

A8B1–A8C0 Color Basic RESET Command

A8B1–A8B2	Figure the memory location and the bit mask
A8B3–A8B4	Check the syntax
A8B5	Zero A
A8B6–A8B7	B = video character
A8B8–A8B9	Jump if it's nongraphics
A8BA–A8BB	Invert the bit mask
A8BC–A8BD	Reset the pixel
A8BE–A8BF	Display the new character
A8C0	Return

A8C1–A8F4 Graphics Routine

A8C1–A8C3	Check the syntax
A8C4–A8C6	Call the Extended Color Basic link
A8C7–A8C9	B = x value
A8CA–A8CB	X value > 63?
A8CC–A8CD	Jump if the x value > 63
A8CE–A8CF	Save the x value
A8D0–A8D2	Check the syntax and B = Y value
A8D3–A8D4	Y value > 31?
A8D5–A8D6	Jump if the y value > 31
A8D7–A8D8	Save the y value
A8D9	Figure the number of video lines
A8DA–A8DB	A = number of characters per line
A8DC	Figure the line offset
A8DD–A8DF	X = start of video memory
A8E0–A8E1	Adjust it for the line offset
A8E2–A8E3	B = x value
A8E4	Figure the column offset
A8E5	X = video memory location
A8E6–A8E7	Get the x value and the y value
A8E8–A8E9	Mask the y value
A8EA	Adjust the x value
A8EB	Adjust the y value
A8EC–A8ED	Mask B for the bit mask
A8EE	Adjust the bit mask
A8EF	Bit mask done?
A8F0–A8F1	Loop until the bit mask is complete

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A8F2–A8F3	Save the bit mask
A8F4	Return

A8F5–A90F Color Basic POINT Command

A8F5–A8F6	Figure the memory location and the bit mask
A8F7–A8F8	B = −1
A8F9–A8FA	A = video character
A8FB–A8FC	Jump if it's nongraphics
A8FD–A8FE	Mask the graphics character
A8FF–A900	Jump if the pixel isn't set
A901–A902	B = video character
A903	Shift the color value
A904	Shift the color value
A905	Shift the color value
A906	Shift the color value
A907–A908	Mask the color value
A909	Bump the color value
A90A–A90C	Save B as the current result
A90D–A90F	Check the syntax and return

A910–A936 Color Basic CLS Command

A910–A912	Call the Extended Color Basic link
A913–A914	Jump if it's the end of the Basic statement
A915–A917	B = color
A918–A919	Color > 8?
A91A–A91B	Jump if the color > 8
A91C	Color = 0?
A91D–A91E	Jump if the color = 0
A91F	Decrement the color value
A920–A921	A = Color mask multiplier
A922	Figure the color mask
A923–A924	Set all the graphics bits
A925–A926	Make it a graphics character
A927–A929	Ignore
A928–A929	B = green graphics character
A92A–A92C	X = start of video memory
A92D–A92E	Save it as the new cursor position
A92F–A930	Display a graphics character
A931–A933	End of video memory?
A934–A935	Loop until the end of video memory is reached
A936	Return

A937–A93E CLS and Display Microsoft Message

A937–A938	Clear the screen
A939–A93B	X = Microsoft message pointer
A93C–A93E	Display the message

A93F–A94A Check the Syntax and Evaluate the Expression

A93F–A941	Check the syntax
A942–A944	Evaluate the expression and return with the 8-bit result in B
A945	B = 0?
A946–A947	Jump if B < > 0
A948–A94A	Display FC error message

A94B–A973 Color Basic SOUND Command

A94B–A94C	B = tone
A94D–A94E	Save the tone
A94F–A950	B = duration
A951–A952	A = duration multiplier
A953	D = adjusted duration
A954–A955	Save the duration
A956–A958	A = control register B (PIA1) value
A959–A95A	Set the 16.7 msec. IRQ bit
A95B–A95D	Save the new control register B (PIA1) value
A95E–A95F	Clear the flag

Listing continued

Listing continued

A960–A961	Turn on the sound from the DAC
A962–A963	Turn on the sound
A964–A965	Send a high
A966–A967	A = low value
A968–A969	Send a low
A96A–A96B	Send a high
A96C–A96D	A = value to send
A96E–A96F	Send it
A970–A971	X = duration counter
A972–A973	Loop until done

A974–A984 Sound-On/Off Routine

A974	A = sound-off mask
A975–A977	Ignore
A976–A977	A = sound-on mask
A978–A979	Save the mask
A97A–A97C	A = control register B (PIA2) value
A97D–A97E	Clear the sound-enable bit
A97F–A980	Mask the sound-enable bit
A981–A983	Save the new control register B (PIA2) value
A984	Return

A985–A98F Send-Value-to-DAC Routine

A985–A986	A = value to send
A987–A989	Send it to the DAC
A98A–A98B	A = tone counter
A98C	Bump the tone counter
A98D–A98E	Loop until the delay is done
A98F	Return

A990–A9A1 Color Basic AUDIO Command

A990–A991	B = current Basic character
A992–A993	Get the next Basic character
A994–A995	OFF token?
A996–A997	Jump if it's an OFF token
A998–A999	Adjust the character for an ON token
A99A–A99C	Check for an ON token
A99D	Bump B
A99E–A99F	Channel the sound from the cassette
A9A0–A9A1	Turn on the sound

A9A2–A9B2 4-1 MUX Routine

A9A2–A9A4	U = PIA1 pointer
A9A5–A9A6	Set the 4-1 MUX
A9A7–A9A8	A = control register value
A9A9–A9AA	Clear bit 3
A9AB	Reset?
A9AC–A9AD	Jump if reset
A9AE–A9AF	Set bit 3
A9B0–A9B1	Save the new control register value
A9B2	Return

A9B3–A9C5 IRQ Routine

A9B3–A9B5	Interrupt?
A9B6–A9B7	Jump if no interrupt
A9B8–A9BA	Reset the interrupt
A9BB–A9BD	X = sound duration counter
A9BE–A9BF	Jump if it's equal to zero
A9C0–A9C1	Decrement the duration counter
A9C2–A9C4	Save it
A9C5	Return from the interrupt

A9C6–A9DD Color Basic JOYSTK Command

A9C6–A9C8	B = joystick
A9C9–A9CA	Joystick > 3?
A9CB–A9CE	FC error if joystick > 3

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A9CF	Joystick = 0?
A9D0–A9D1	Jump if joystick < > 0
A9D2–A9D3	Scan the joysticks
A9D4–A9D6	X = start of the joystick storage area
A9D7–A9D8	B = joystick
A9D9–A9DA	B = joystick value
A9DB–A9DD	Save it as the current result

A9DE–AA19 Scan-Joysticks Routine

A9DE–A9DF	Turn off the sound
A9E0–A9E2	X = end of the joystick storage area
A9E3–A9E4	B = number of scans − 1
A9E5–A9E6	A = number of comparisons
A9E7–A9E8	Save the counters
A9E9–A9EA	Set the 4 − 1 MUX
A9EB–A9ED	D = counter and starting joystick value
A9EE–A9EF	Save the counter
A9F0–A9F1	Adjust the joystick value
A9F2–A9F4	Send it to the DAC
A9F5–A9F6	Adjust the joystick value
A9F7–A9F9	A = comparison input value
A9FA–A9FB	Jump if set
A9FC–A9FD	Adjust the joystick value
A9FE–AA00	Ignore
A9FF–AA00	Adjust the joystick value
AA01–AA02	A = counter
AA03	Shift it
AA04–AA05	Done?
AA06–AA07	Loop until done
AA08	Adjust the joystick value
AA09	Adjust the joystick value
AA0A–AA0B	Same as the last value?
AA0C–AA0D	Jump if match
AA0E–AA0F	Decrement the comparisons counter
AA10–AA11	Loop until the comparisons are done
AA12–AA13	Save the new joystick value
AA14–AA15	Get the counters
AA16	All joysticks done?
AA17–AA18	Loop until all the joysticks have been done
AA19	Return

AA1A–AA28 Part of Get-Next-Character Routine

AA1A–AA1B	Character > colon?
AA1C–AA1D	Return if it's > colon
AA1E–AA1F	Space?
AA20–AA21	Jump if it isn't a space
AA22–AA23	Bump to the next character
AA24–AA27	Set Carry for numeric characters
AA28	Return

AA29–AA50 Color Basic Commands Jump Table

AA51–AA65 Color Basic List of Precedence Values and Jump Addresses

AA66–AB66 Color Basic Reserved-Words List

AB67–ABAE Color Basic Commands Jump Table

ABAF–ABE0 Color Basic Error Messages

ABE1–ABE7 Color Basic ERROR Message

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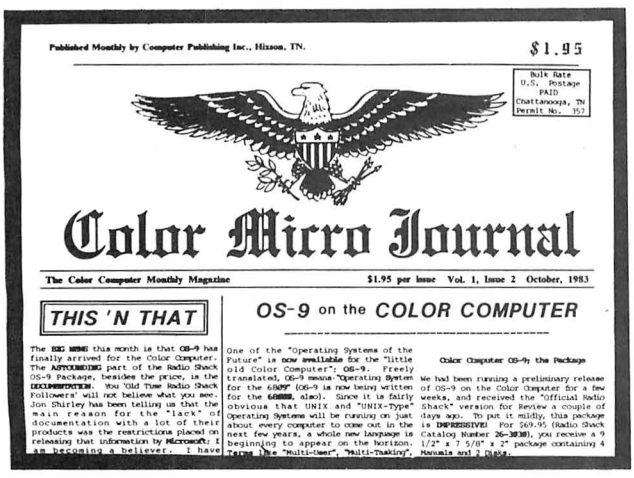
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The Color Computer Monthly Magazine — $1.95 per issue Vol. 1, Issue 2 October, 1983

THIS 'N THAT

OS-9 on the COLOR COMPUTER

The BIG NEWS this month is that OS-9 has finally arrived for the Color Computer. The ANTICIPATED part of the Radio Shack OS-9 Package, besides the price, is the DISAPPOINTMENT. You 'Old Time Radio Shack Followers' will not believe what you see. Jon Shirley has been telling us that the main reason for the "lack" of documentation with a lot of their products was the restrictions placed on releasing that information by Microsoft. I am becoming a believer. I have

One of the "Operating Systems of the Future" is now available for the "little old Color Computer"; OS-9. Freely translated, OS-9 means "Operating System for the 6809" (OS-9 is now being written for the 68000, also). Since it is fairly obvious that UNIX and "UNIX-Type" Operating Systems will be running on just about every computer to come out in the next few years, a whole new language is beginning to appear on the horizon. Terms like "multi-user", "multi-tasking",

Color Computer OS-9; the Package

We had been running a preliminary release of OS-9 on the Color Computer for a few weeks, and received the "Official Radio Shack" version for Review a couple of days ago. To put it mildly, this package is IMPRESSIVE! For $69.95 (Radio Shack Catalog Number 26-3038), you receive a 9 1/2" x 7 5/8" x 2" package containing 4 Manuals and 2 Disk.

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Listing continued

ABE8–ABEC Color Basic IN Message
ABED–ABF1 Color Basic OK Message
ABF2–ABF8 Color Basic BREAK Message
ABF9–AC1D Scan-Stack Routine

ABF9–ABFA	X = stack pointer plus 4
ABFB–ABFC	B = number of bytes to bump stack pointer
ABFD–ABFE	Save the stack memory pointer
ABFF–AC00	A = stack character
AC01–AC02	Adjust it
AC03–AC04	Jump if it's a SUB token
AC05–AC06	X = stack VARPTR
AC07–AC08	Save it
AC09–AC0A	X = VARPTR to locate
AC0B–AC0C	Jump if it's a NEXT default
AC0D–AC0E	Match?
AC0F–AC10	Jump if the VARPTRs match
AC11–AC12	X = stack memory pointer
AC13	Bump it past the NEXT frame
AC14–AC15	Loop until the proper NEXT frame is found
AC16–AC17	X = stack VARPTR
AC18–AC19	Save it as the current VARPTR
AC1A–AC1B	X = stack memory pointer
AC1C	Set the flags for the stack character
AC1D	Return

AC1E–AC32 Block-Move Routine

AC1E–AC1F	Do memory check
AC20–AC21	U = end of destination pointer
AC22–AC23	Bump it
AC24–AC25	X = end of source pointer
AC26–AC27	Bump it
AC28–AC29	Get a character
AC2A–AC2B	Move it
AC2C–AC2D	Block move done?
AC2E–AC2F	Loop until the block move is done
AC30–AC31	Save the start of the destination pointer
AC32	Return

AC33–AC45 Memory-Check Routine

AC33	Zero A
AC34	D = number of bytes to check for
AC35–AC36	Add in the start of the free-memory-area pointer
AC37–AC39	Add in 58 bytes for a little more room
AC3A–AC3B	Display OM error message if overflow
AC3C–AC3E	Save the stack pointer
AC3F–AC41	Overlay the stack?
AC42–AC43	Jump if the stack won't be overlayed
AC44–AC45	B = OM error code

AC46–AC72 Error Routine

AC46–AC48	Call the Extended Color Basic link
AC49–AC4B	Call the Extended Color Basic link
AC4C–AC4E	Turn off the cassette motor
AC4F–AC51	Turn off the sound
AC52–AC54	Reset the Basic pointers

Listing continued

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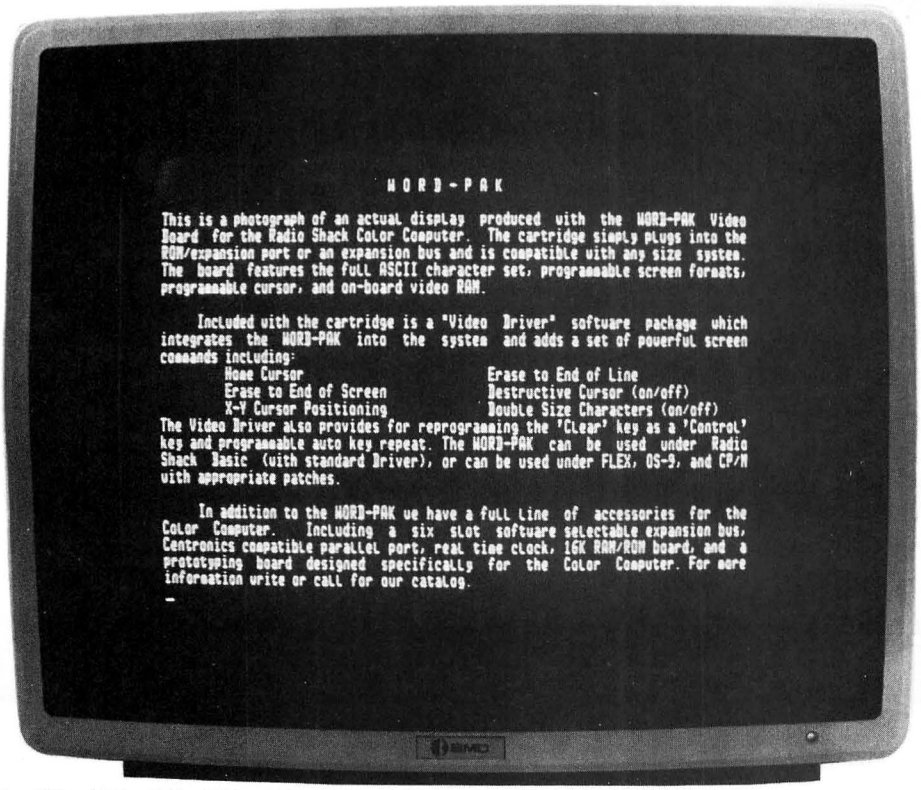

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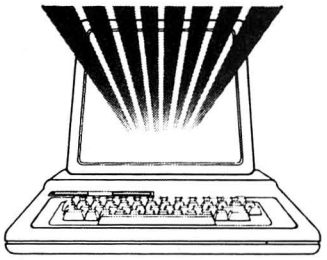

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PRINT @ IS FULLY IMPLEMENTED

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 1223! 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 power!

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AC55–AC56	Current device = Video display
AC57–AC59	Do a carriage return
AC5A–AC5C	Display a ?
AC5D–AC5F	X = start of the error messages
AC60	Point to the proper error message
AC61–AC62	Display the first character of the error message
AC63–AC64	Display the second character of the error message
AC65–AC67	X = ERROR message pointer
AC68–AC6A	Display the message
AC6B–AC6C	A = MSB of the current Basic line number
AC6D	Command mode?
AC6E–AC6F	Jump if it's the command mode
AC70–AC72	Display the current Basic line number

AC73–AC9F Command Mode

AC73–AC75	Do a carriage return
AC76–AC78	X = OK message pointer
AC79–AC7B	Display the message
AC7C–AC7E	Get the input
AC7F–AC81	U = command mode line number
AC82–AC83	Save it as the current Basic line number
AC84–AC85	Loop if break key was pressed
AC86–AC87	EOF?
AC88–AC8B	Jump if EOF
AC8C–AC8D	Save the start of the input as the new ESP
AC8E–AC8F	Get the next character
AC90–AC91	Loop if the buffer is empty
AC92–AC93	Jump if it's numeric
AC94–AC95	B = DS error code
AC96–AC97	Current device = keyboard?
AC98–AC98	Jump if it isn't the keyboard
AC99–AC9C	Tokenize the input
AC9D–AC9F	Jump to the Basic interpreter

ACA0–ACA4 Output Routine

ACA0–ACA1	A = character to display
ACA2–ACA4	Display it

ACA5–ACEE Insert Line into Basic Program

ACA5–ACA7	Evaluate the line number
ACA8–ACA9	X = line number
ACAA–ACAC	Save it in the buffer
ACAD–ACAF	Tokenize the input
ACB0–ACB1	Save the length of the tokenized input
ACB2–ACB3	Find the storage location
ACB4–ACB5	Jump if no matching line
ACB6–ACB7	D = storage location
ACB8–ACB9	D = storage location—next line pointer
ACBA–ACBB	Figure the new simple-variables pointer
ACBC–ACBD	Save the new simple-variables pointer
ACBE–ACBF	U = next line pointer
ACC0–ACC1	Get a character
ACC2–ACC3	Move it
ACC4–ACC5	Program move done?
ACC6–ACC7	Loop until the program has been moved
ACC8–ACCA	Just a line number input?
ACCB–ACCC	Jump if just a line number was input
ACCD–ACCE	D = simple-variables-area pointer
ACCF–ACD0	Save it as the end of the source pointer
ACD1–ACD2	Add in the length of the new line
ACD3–ACD4	Figure the new simple-variables pointer
ACD5–ACD6	Save it as the end of the destination pointer
ACD7–ACD9	Open up a hole for the new line
ACDA–ACDC	U = start of the tokenized line
ACDD–ACDE	Get a character
ACDF–ACE0	Move it
ACE1–ACE2	Line moved?

Listing continued

Listing continued

ACE3–ACE4	Loop until the line is completely moved
ACE5–ACE6	X = new simple-variables pointer
ACE7–ACE8	Save it
ACE9–ACEA	Reset the Basic pointers
ACEB–ACEC	Reset the Basic line pointers
ACED–ACEE	Jump to the command mode

ACEF–AD00 Reset-the-Basic-Line-Pointers Routine

ACEF–ACF0	X = start of the Basic program pointer
ACF1–ACF2	End of the Basic program?
ACF3–ACF4	Jump if it's the end of the Basic program
ACF5–ACF6	U = current memory pointer
ACF7–ACF8	Get the next character
ACF9–ACFA	Loop until the end of the Basic line
ACFB–ACFC	Save the next-line pointer
ACFD–ACFE	Update the memory pointer
ACFF–AD00	Loop until done

AD01–AD16 Locate-the-Basic-Line Routine

AD01–AD02	D = line number to locate
AD03–AD04	X = start of the Basic program pointer
AD05–AD06	U = next line pointer
AD07–AD08	Jump if it's the end of the Basic program
AD09–AD0B	Line numbers match?
AD0C–AD0D	Jump if match
AD0E–AD0F	Update the memory pointer
AD10–AD11	Loop until done
AD12–AD13	Set Carry to signal line not found
AD14–AD15	Save the memory pointer
AD16	Return

AD17–AD46 Color Basic NEW Command

AD17–AD18	Jump if it isn't the end of the Basic statement
AD19–AD1A	X = start of the Basic program pointer
AD1B–AD1C	Zero the MSB of the next-line pointer
AD1D–AD1E	Zero the LSB of the next-line pointer
AD1F–AD20	Save the memory pointer as the new simple-variables pointer
AD21–AD22	X = start of the Basic program pointer
AD23–AD25	Set the new ESP
AD26–AD27	X = start of the reserved-memory pointer
AD28–AD29	Save it as the next available location in string-space pointer
AD2A–AD2C	Reset the READ pointer
AD2D–AD2E	X = start of the simple-variables pointer
AD2F–AD30	Save it as the start of the array-variables pointer
AD31–AD32	Save it as the start of the free-memory pointer
AD33–AD35	X = start of the temporary string area
AD36–AD37	Save it as the next available location in the temporary string-area pointer
AD38–AD39	X = return address
AD3A–AD3C	Reset the stack pointer
AD3D–AD3E	Leave a hole on the stack
AD3F–AD40	Zero the BREAK ESP
AD41–AD42	Zero the BREAK ESP
AD43–AD44	Flag no FOR
AD45–AD46	Jump to the return address

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BY FRANCIS S. KALINOWSKI

REVERSE THOSE CHARACTERS

Try this brief utility for your CoCo to print reversed letters, numbers, punctuation, and symbols.

Neither Radio Shack's CoCo manuals nor their *Quick Reference Guide* tells how to print reversed (green on black) numbers and symbols on the display screen. While the Shift/0 mode provides for keyed-in reversed letters, it limits numbers, punctuation marks, and symbols to black on green.

You can also display all reversed letters and six reversed symbols by using CHR$(96) through CHR$(127) in a program's PRINT lines. You can display all letters, numbers, punctuations, and symbols by POKEing their assigned reverse-format ASCII codes into text screen memory locations. Text screen memory starts at location 1024 (upper left corner of display screen) and ends at 1535 (lower right corner).

```
''''0 'PRINT AND POKE VALUES FOR
NORMAL AND REVERSED CHARACTERS.
10 CLS:PRINT"<--PRINT CHR$(32) -
 CHR$(63)--->":P=32:C=32:GOSUB10
0
20 PRINT@96,"<PRINT/POKE CHR$(64
) - CHR$(95)>":GOSUB100
30 PRINT@192,"<--PRINT CHR$(96)
- CHR$(127)-->":GOSUB100
40 PRINT@288,"<--POKE 1344,0 - P
OKE 1375,31-->":P=1344:C=0:GOSUB
110
50 PRINT@384,"<-POKE 1440,32 - P
OKE 1471,63-->":P=1440:GOSUB110
60 PRINT@448,"<-SEE READ/DATA LI
NES 70 & 80-->";
70 FORP=1504TO1535:READD:POKEP,D
:NEXT
80 DATA8,9,20,32,60,19,16,1,3,5,
2,1,18,62,32,20,15,32,18,5,22,5,
18,19,5,32,3,15,12,15,18,46
85 'Delete line 90 when using
    non-Extended Color BASIC.
90 EXEC44539:SCREEN0,1:EXEC44539
:SCREEN0,0:GOTO90
95 GOTO95
100 FORC=C TOC+31:PRINT@P,CHR$(C
):P=P+1:NEXT:P=P+64:RETURN
110 FORC=C TOC+31:POKEP,C:P=P+1:
NEXT:RETURN
```

Program Listing. Normal and Reversed Characters

The Program Listing displays all normal and reversed characters and their assigned PRINT and POKE ASCII values. The display's third double line, for example, shows the ASCII value range (96–127) for printing 26 reversed letters and six symbols, using CHR$(x) functions. The ASCII 96–127 range does not include a reversed space. You can get a solid black space with CHR$(128) or a reversed (greenish black) space with POKExxxx,32.

The display's fourth and fifth double lines show all the reversed characters that can be POKEd by using ASCII values 0–63. Line 70 displays the screen's bottom line instruction by sequentially reading ASCII values from DATA line 90 and POKEing them into text display memory.

CLS0 quickly provides a solid black screen background for reversed character text. But, the display could look patchy at high color levels. The characters' greenish-black background causes the patchy effect. You can eliminate the effect by using FORP = 1024TO1535: POKEP,32:NEXT to fill the screen with reversed spaces before printing or POKEing the text.

Extended Color Basic's SCREEN0,1 statement changes normal text characters to black on orange and reversed characters to orange on reddish black. However, the change lasts only until the microprocessor returns to Basic. You can temporarily block the return by diverting control to a delaying statement such as FOR-TO-NEXT, INPUT, INKEY$, EXEC44539, DRAW, or PLAY. ■

Address correspondence to Francis S. Kalinowski, 16 N. Alder Drive, Orlando, FL 32807.

System Requirements

4K RAM
Color Basic

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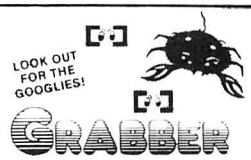

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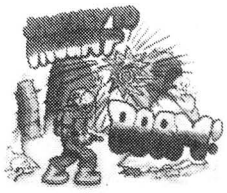

The Necromancer is about to wage war on earth. He needs his lost gold ring to acquire the power to do so. You must find the ring, take it to Mt. Doom and destroy it in the flames from which it came, thus eliminating the Necromancer's evil powers.

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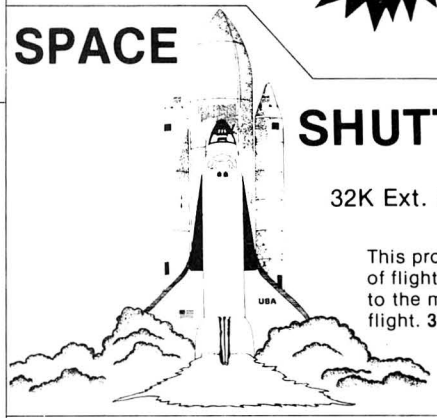

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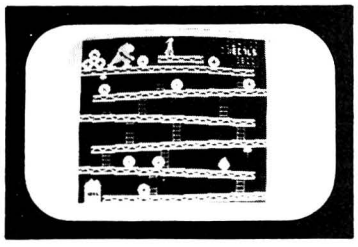

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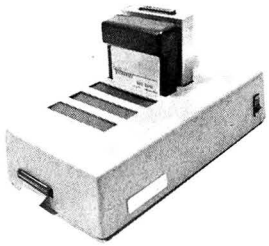

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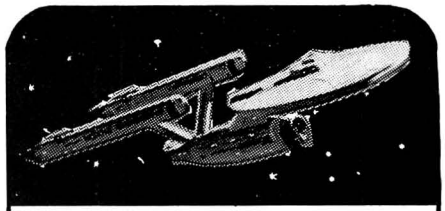

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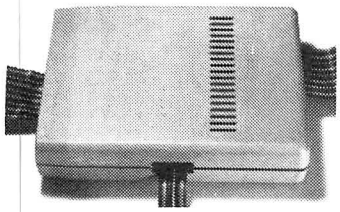

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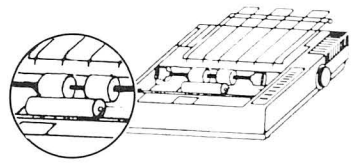

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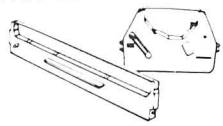

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BY MARTIN H. GOODMAN

I/O QUICK REFERENCE

The 6809E is a powerful little chip and its capabilities are only bound by the imagination of programmers. The programmer must be able to communicate instructions to the processor and, in turn, the processor must have ways of transmitting data to the programmer. Keyboards, joysticks, modems, and printers all have information the processor might use, and each peripheral needs certain signals and information from the processor in order to operate—input/output.

The following is a quick-reference guide to communicating with your CoCo through various channels. Input/output is the key to carrying out fruitful conversations with the CoCo. ■

Write to Marty Goodman at 1633 Bayo Vista Ave., San Pablo, CA 94806.

Disk Misc. Control Port (FF40)

Drive Select 0–3: When set to 1, that drive will be selected for use and its red LED will go on.

Motor On: When set to 1, the disk motors on all drives go on (wait 1.5 seconds before read/write).

Start Precompensation: Set to 1 when writing to tracks greater than 21. This improves reliability.

Double-Density Enable: Set for double density.

Wait Enable: Set to allow 1793 to stop the CPU when it doesn't have a data byte available.

1793 Commands Used in the CoCo:

03	Restore head of selected drive to track 0.
13	Position head of selected drive to track given in data register.
80	Read sector given in sector register.
A0	Write sector given in sector register.
F0	Write (format) track, used in DSKINI function.
D0	Terminate current function immediately.

To use these commands, store the byte in FF48.

Video Control Modes

Size		Number	FF22 Bits				SAM Bits		
X	Y	Colors	7-A/G	6-GM2	5-GM1	4-GM0	V2	V1	V0
256	192	2	1	1	1	1	1	1	0
128	192	4	1	1	1	0	1	1	0
128	192	2	1	1	0	1	1	0	1
128	96	4	1	1	0	0	1	0	0
128	96	2	1	0	1	1	0	1	1
128	64	4	1	0	1	0	0	1	0
128	64	2	1	0	0	1	0	0	1
64	64	4	1	0	0	0	0	0	1
ALPHA		2	0	0	0	0	0	0	0
64	32	8*	0	0	0	0	0	0	0
64	48	4	0	0	0	1	0	0	0
64	64	8*	0	0	0	0	0	1	0
64	96	8*	0	0	0	0	1	0	0
64	192	8*	0	0	0	0	1	1	0

Notes: FF22 bit 3 (CSS) selects between two color sets for the two- and four-color and ALPHA modes. ALPHA is available in eight-color graphics modes.
*The color can be set only for a group of pixels.

PIA 1 (A) Data Register

FF00
- Bit 0: Keyboard row 1 and right joystick button
- Bit 1: Keyboard row 2 and left joystick button
- Bit 2: Keyboard row 3
- Bit 3: Keyboard row 4
- Bit 4: Keyboard row 5
- Bit 5: Keyboard row 6
- Bit 6: Keyboard row 7
- Bit 7: Joystick comparator input

PIA 1 (A) Control Register

FF01
- Bit 0: 63.5 μs. IRQ enable (1 = enabled)
- Bit 1: 63.5 μs. IRQ polarity (1 = rising edge)
- Bit 2: FF00 data/direction select (1 = data)
- Bit 3: Analog mux select LSB
- Bit 4: Always 1
- Bit 5: Always 1
- Bit 6: Not used
- Bit 7: 63.5 μs. IRQ flag (1 = transition occurred)

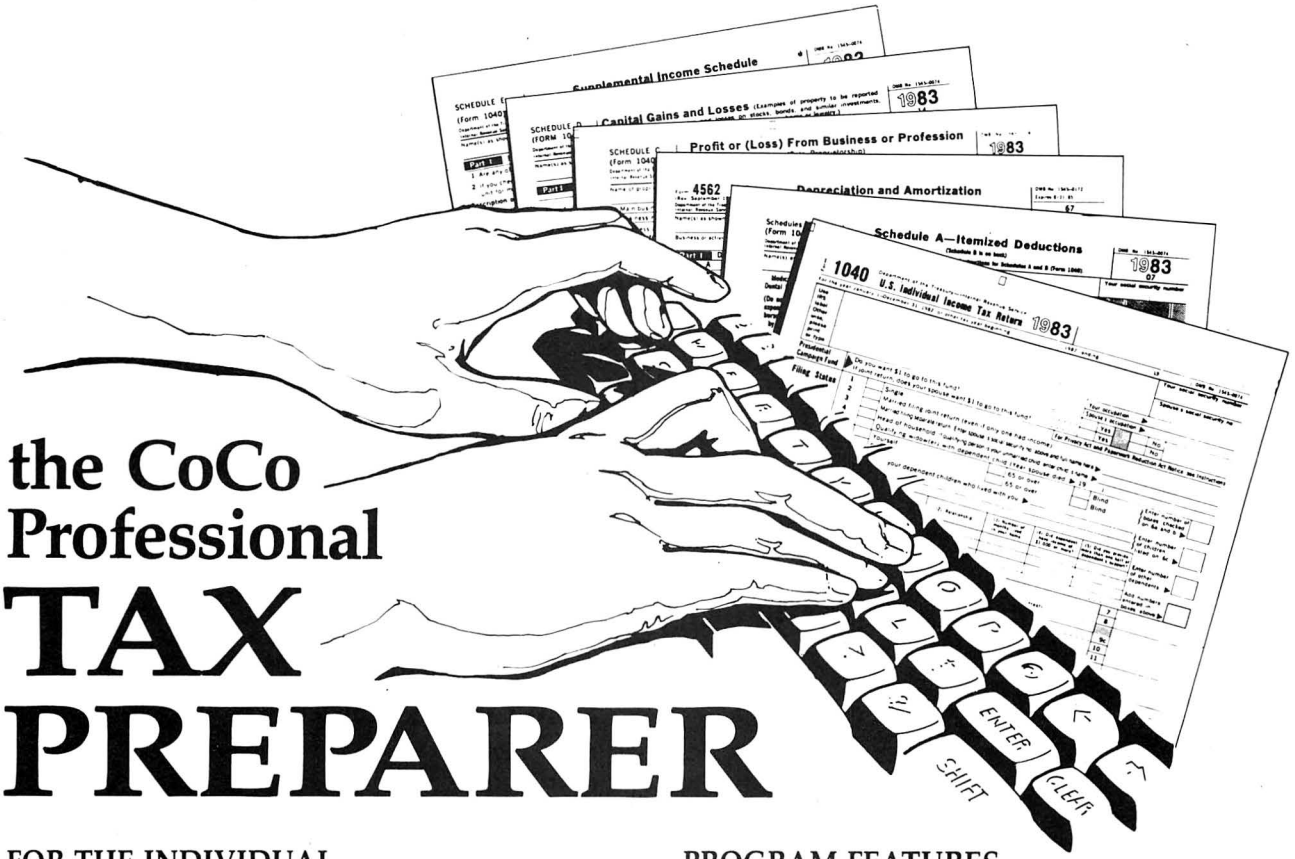
PIA 1 (B) Data Register

FF02
- Bit 0: Keyboard column 1
- Bit 1: Keyboard column 2
- Bit 2: Keyboard column 3
- Bit 3: Keyboard column 4
- Bit 4: Keyboard column 5
- Bit 5: Keyboard column 6
- Bit 6: Keyboard column 7
- Bit 7: Keyboard column 8

PIA 1 (B) Control Register

FF03
- Bit 0: 16.7 ms. IRQ enable (1 = enabled)
- Bit 1: 16.7 ms. IRQ polarity (1 = rising edge)
- Bit 2: FF02 data/direction select (1 = data)
- Bit 3: Analog mux select MSB
- Bit 4: Always 1
- Bit 5: Always 1
- Bit 6: Not used
- Bit 7: 16.7 ms. IRQ flag (1 = transition occurred)

Listing continued



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PIA 2 (A) Data Register

FF20
- Bit 0: Cassette data input (1 = input < −1.5V)
- Bit 1: RS-232 data output (1 = output at −10V)
- Bit 2: LSB
- Bit 3: LSB
- Bit 4: LSB — 6-bit D/A (digital to analog)
- Bit 5: LSB
- Bit 6: LSB
- Bit 7: MSB

PIA 2 (A) Control Register

FF21
- Bit 0: CD input FIRQ enable (1 = enabled)
- Bit 1: CD input FIRQ polarity (1 = rising edge)
- Bit 2: FF20 data/direction select (1 = data)
- Bit 3: Cassette motor control (1 = on)
- Bit 4: Always 1
- Bit 5: Always 1
- Bit 6: Not used
- Bit 7: CD input FIRQ flag (1 = transition)

PIA 2 (B) Data Register

FF22
- Bit 0: RS-232 data input (1 = input < +1V)
- Bit 1: Single-bit sound output (normally off)
- Bit 2: RAM size input (0 = 4K, 1 = 16K, TTSL = 32K)
- Bit 3: VDG color-set selection
- Bit 4: VDG GM0 and INT/EXT
- Bit 5: VDG GM1
- Bit 6: VDG GM2
- Bit 7: VDG ALHA/GRAPH

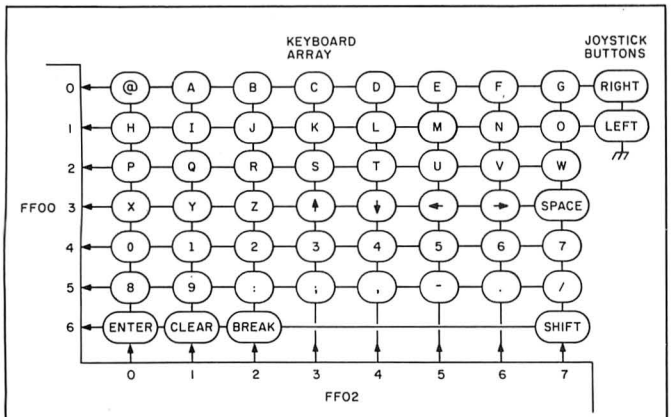

Fig. 1. The CoCo Keyboard Array

PIA 2 (B) Control Register

FF23
- Bit 0: CART FIRQ Enable (1 = enabled)
- Bit 1: CART FIRQ polarity (1 = rising edge)
- Bit 2: FF20 data/direction select (1 = data)
- Bit 3: 6-bit sound enable (1 = enabled)
- Bit 4: Always 1
- Bit 5: Always 1
- Bit 6: Not used
- Bit 7: CART FIRQ flag (1 = transition occurred)

Drive-Select/Misc. Control Port

FF40
- Bit 0: Drive select 0 (1 = drive 0 active)
- Bit 1: Drive select 1 (1 = drive 1 active)
- Bit 2: Drive select 2 (1 = drive 2 active)
- Bit 3: Motor on (1 = all drive motors on)
- Bit 4: Write precompensation (1 = active)
- Bit 5: Double density (1 = double density)
- Bit 6: Drive select 3 (1 = drive 3 active)
- Bit 7: Wait synchronization enable (1 = enabled)

FF48 1793 status/command register
FF49 1793 track register
FF4A 1793 sector register
FF4B 1793 data register

SAM Control Registers

Clear (0)	Set (1)		
FFDE	FFDF	(TY)	Map type (0 = 32K RAM, 1 = 64K RAM)
FFDC	FFDD	(M0)	Memory type
FFDA	FFDB	(M1)	00 = 4K, 01 = 16K, 10 = 64K
FFD8	FFD9	(R1)	Clock rate
FFD6	FFD7	(R0)	00 = .9MHz, 01 = address dependent
FFD4	FFD5	(P1)	Memory page (0 = paged, 1 = page 1)
FFD2	FFD3	(F6)	Display address offset
FFD0	FFD1	(F5)	in 512-byte ($200) steps
FFCE	FFCF	(F4)	
FFCC	FFCD	(F3)	
FFCA	FFCB	(F2)	
FFC8	FFC9	(F1)	
FFC6	FFC7	(F0)	
FFC4	FFC5	(V2)	Video mode
FFC2	FFC3	(V1)	(see video-display data)
FFC0	FFC1	(V0)	

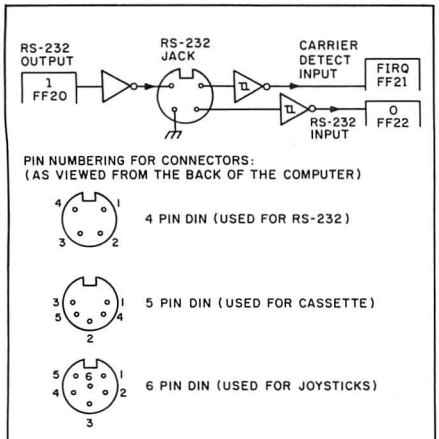

Fig. 2. CoCo Pin Configurations

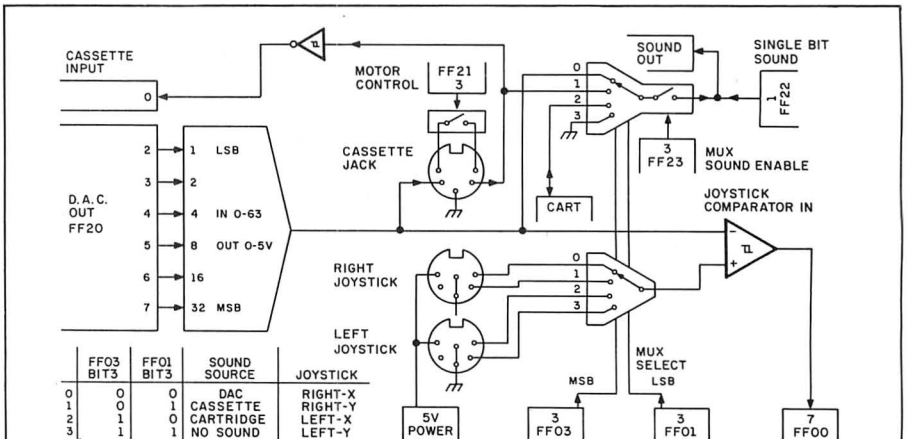

Fig. 3. CoCo PIA I/O Functions

Subroutines To Go

Help yourself to *Machine-Language Subroutines for the Color Computer*. It's a library of useful ready-to-use machine-language routines. Each subroutine is on the cassette that is included in the package. Many of the routines can be used in BASIC as well as machine-language programs. You'll find ROM subroutines, which are located in the interpreter ROMs of the Color Computer, and RAM subroutines, a collection of routines written by David McLeod.

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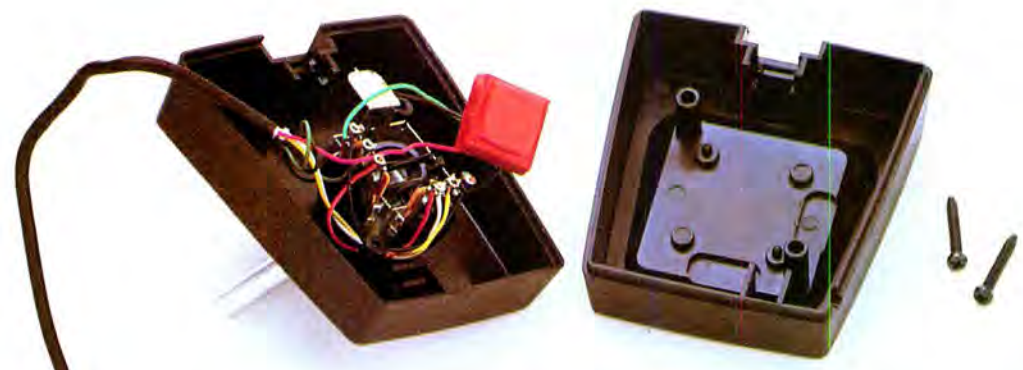

WHEN THE JOY GOES FROM YOUR JOYSTICK

Trouble with your joysticks?
You don't have to be a hardware expert to find and fix the problem.

Fortunately for computer owners who use joysticks, repair is easy and inexpensive. Here are some instructions on trouble-shooting joystick problems and how to replace a worn-out joystick potentiometer assembly. First, it is important to know how a joystick works.

How a Joystick Works

A Color Computer joystick is a pair of voltage dividers (see Fig. 1). Point A is equal to (5*R)/100,000, the value of R being directly proportional to the rotation of the wiper arm. The wiper arm is mechanically linked to the joystick arm, and this linkage converts the linear motion on the arm to rotational motion required by the potentiometer. A second potentiometer is mounted at right angles and also mechanically linked to the same arm. One potentiometer responds to up/down motion. The other responds to right/ left motion. Each sends a voltage to the Color Computer.

Once inside the Color Computer, the voltage from each potentiometer is sampled via an analog multiplexer. The sampled voltage is converted to a 6-bit digital word by a digital-to-analog converter. You use a software technique called successive approximation to determine whether a bit is a one or a zero. The 6-bit word is sent to a peripheral interface adapter (PIA) for eventual use by the computer. The JOYSTK(0), JOYSTK(1), JOYSTK(2), and JOYSTK(3) commands call up the digital word. The JOYSTK(0) command tells the PIA to start joystick voltage sampling. This is why this command must always appear first, even if the value of JOYSTK(0) isn't needed.

Six bits of information can only resolve the input voltage into bins that are 5/64 volts wide. This corresponds to about 1.7-percent accuracy. This is also why the values returned by the JOYSTK commands are in the range of zero to 63. The middle position of the joystick arm corresponds to the wiper being half on the resistor. This is why a centered joystick returns coordinates of 31 and 31 from the two JOYSTK calls.

The push-button control simply grounds either the PA0 or PA1 address lines of the PIA. This changes the value of the word in location 65280. Unfortunately, the same address lines are used to decode @ABCDEFG and HI JKLMNO keyboard values as well. This is why pressing a joystick button results in either of the above strings of characters being printed when a program isn't running. When a program is running and a push-button is depressed

any INKEY$ loop could pick up one of the above characters and proceed erroneously.

Joystick Inspection

You don't want to replace a good joystick. Other things can go wrong too. Burned out joystick interface ICs in the computer can make a joystick appear bad. The first step is to swap joysticks. If the second joystick works, then the problem is in the first joystick somewhere. If both joysticks don't work, the problem is probably in the channel (e.g., the right channel), meaning the multiplexer U9 is probably bad. If both channels are dead, probably both U9s are bad.

If the problem has been narrowed down to one joystick, there are only a few possibilities. The first is a broken wire. Depending upon the wire that's broken, the whole joystick might appear dead, or one motion might be dead. If the problem is of an intermittent nature or if a small motion produces large changes, then it is probably a bad potentiometer. In either case you need to open up the joystick.

To open, remove the two large screws on the bottom. You should see internals as in Fig. 2. Look for broken wires. Plug the joystick in and wiggle the cable. If the problem gets worse or better, then you have a broken wire somewhere. If the wiggling indicates a broken wire near the joystick head, turn off the computer and cut 6 inches off the head end. Strip back 4 inches of cable insulation. Note that the wires are color coded. In my joysticks the colors are as shown in Fig. 2. Strip each wire and replace each one at a time. Now turn on the CoCo and try it again. If the problem goes away, you're done.

Now, assume there is a problem at the plug end of the joystick. You'll have to disassemble the connector to look inside for a broken wire. You can also perform a continuity test to rule out a broken wire. This is a good first step.

If you don't have an ohmmeter, you can construct a continuity tester from a 9-volt battery, a resistor and light-emitting diode (LED) (see Fig. 3). Test the continuity tester first by shorting the probe leads together. If the LED lights, it's working. If not, reverse the battery leads.

"If none of these steps provide a cure, then the joystick head is bad."

To do a continuity test, first center the joystick arm, then touch one lead to R1, lug 1. Touch the other lead to pin 3 of the connector. See Fig. 2 for these places. If the LED lights (or the ohmmeter reads zero resistance), then there is no break in one of the cable wires. Repeat this continuity test for all five pins. If one or more pins fail this test, you'll have to open up the plug.

To open the plug, insert a small screwdriver under the tab and pry up. Slide the plastic sheath up the cable (see Fig. 4). A metal band might fall into your hand. Look at the pin that failed the test. The wire might be broken. If it is not broken, then the problem is somewhere between the connector and joystick head. The chances of this are very remote, unless you have slammed the cable in a door or your dog chewed it. Solder any broken wires and reassemble. Do the continuity test again. If everything is okay, plug in the joystick and test it.

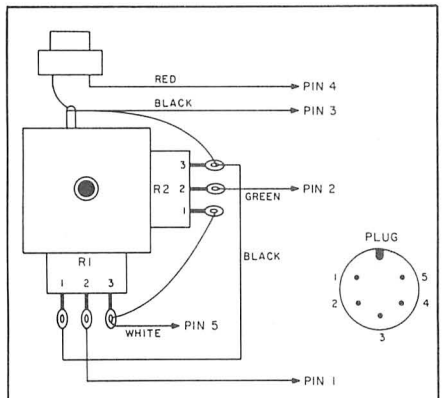

Fig. 2. Joystick Wiring

Joystick Mechanism Repair

If none of these steps provide a cure, then the joystick head is bad. Look at it for obvious mechanical problems. To replace it purchase a 100k-ohm joystick mechanism from Radio Shack (#271-1705) for $5. Be sure to get the 100k-ohm mechanism, since Radio Shack sells a 40k-ohm look-alike.

Remove the joystick top, unscrew the remaining two screws, and lift out the joystick assembly. If the wire colors are different from Fig. 2, record the color coding before proceeding. Replace the wires one at a time and solder in the jumper wires between various potentiometer lugs, the ground lug, and push-button. Plug in the joystick and test it. Recheck the wiring if it doesn't work. Chances are good you've fixed the problem.

PIA and Multiplexer Replacement

PIA U8 (6821) is the joystick interface as well as the keyboard interface. Chances are that you'll be having keyboard entry problems in addition to joystick problems if it's bad. To test U8,

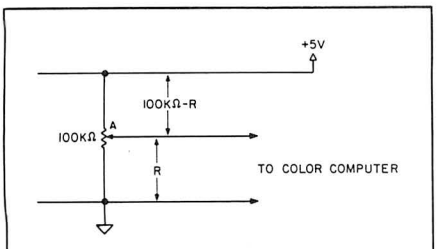

Fig. 1. Joystick Voltage Divider

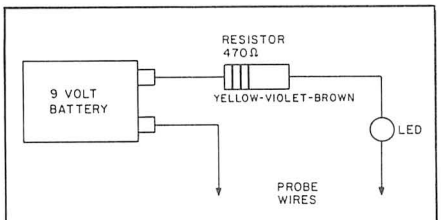

Fig. 3. Continuity Tester

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"Multiplexer replacement is indicated if both joysticks are dead or certain channels don't work. . . . A replacement might be hard to find, but it can be bought directly from Radio Shack National Parts in Texas."

remove it and swap it with U4. U4 is also a 6821. Be careful to reinsert the ICs in the proper direction. There is a notch indicated on the printed circuit board.

Make sure the end of the IC with a notch is in the same direction when reinserting. Turn on the computer and see if the joystick problem is gone. If U8 was bad you probably have some other problem because of the insertion of the bad 6821 into U4. The key is that the nature of the problem changed. Purchase a replacement for about $4 at mail-order stores.

Multiplexer replacement is indicated if both joysticks are dead or certain channels don't work (e.g., the up/down motion on the right joystick channel). The multiplexer is U9 and is an MC14529. Remove it and insert a replacement. A replacement might be hard to find, but it can be bought directly from Radio Shack National Parts in Texas.

Another part that could be bad is U14. This is the operational amplifier that interfaces the multiplexer to the PIA. It is a LM339 and costs less than a dollar.

None of the above operations are difficult, and they make it easy and satisfying to fix your own computer. ■

Address correspondence to Brian H. Alsop, 113 Boone Road, Trafford, PA 15085.

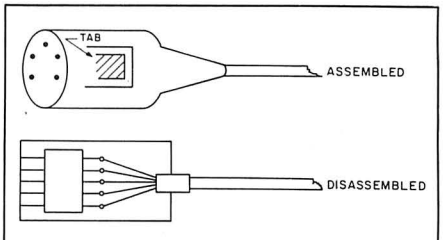

Fig. 4. Joystick Plug

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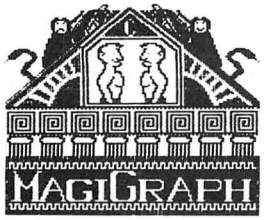

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BY JEREMY A. DONIMIRSKI

SAFE POWER FOR YOUR COMPUTER

Build this low-cost protected outlet strip that includes an EMI filter and transient protection.

If the multiple-outlet strip in Photo 1 looks a bit different from the one you saw at the Radio Shack store, that's because this one was retrofitted with an EMI (electromagnetic interference) filter *and* provides transient protection. The whole operation costs less than $10 worth of parts and an evening's work. Even with all new parts at list prices, the cost shouldn't exceed $15.

Why bother to "roll your own" when you can buy one ready made? The cost! While Radio Shack's prices for the standard and protected outlet strips are some of the best around, the protected model costs double the standard unit.

What is the purpose of protection? It is twofold: It prevents electrical interference from entering the computer from the power line (or entering the power line from the computer, for that matter), and it absorbs high-voltage transients.

The additional protection to your computer's power source is much like insurance. You may never need the protection, but you'll wish you had spent the money if a power-line transient destroys your computer.

Figure 1a shows the schematic diagram of a typical EMI filter. The capacitors provide an electrical short to high frequency, while the coils impede its path towards your computer. Since transients contain substantial high-frequency energy, this circuitry reduces much of the transient.

Figure 1b is a drawing of the same filter, but with metal oxide varistor (MOV) protection. A MOV absorbs and dissipates any high-voltage energy that may have slipped through the EMI filter. The values of all these components are selected to have maximum effect on noise and transients, but minimum effect on 60 Hz ac. They are quiet and inconspicuous, but are always ready to do their job.

Notice that there is a total of three varistors shown in Fig. 1b. MOV 1 is the primary protection device. It absorbs transients that are superimposed on the power line in common mode. This means that the transient propagates through your computer the usual way; the voltage difference is such that it causes current flow from one side of the line to the other.

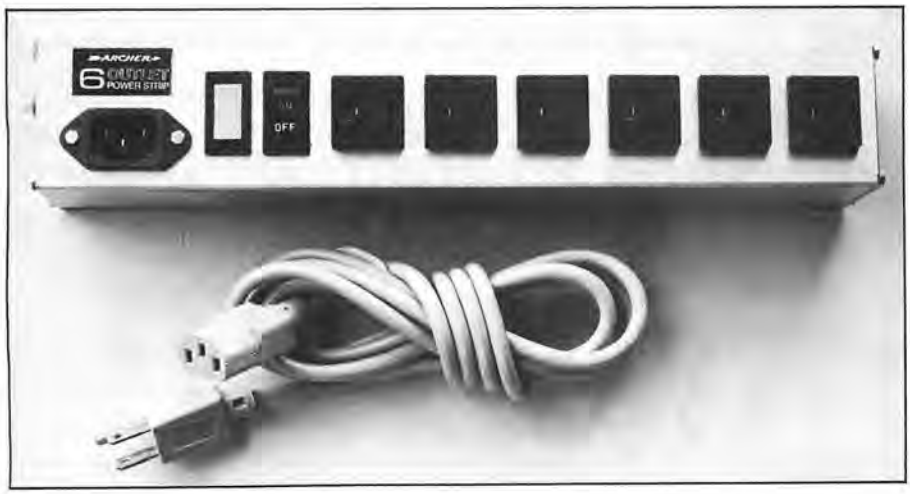

Photo 1. Multiple Outlet Strip Modified to Include Transient Protection

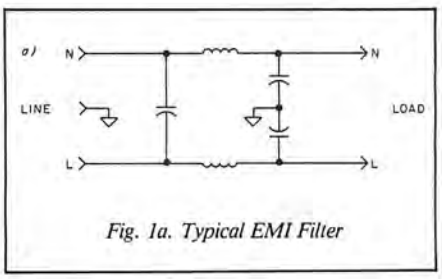

Fig. 1a. Typical EMI Filter

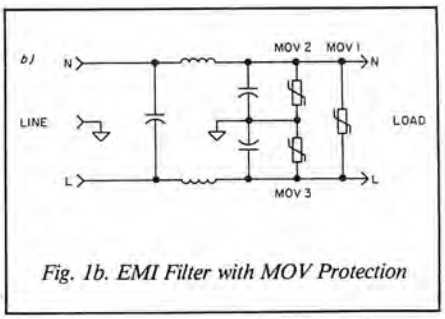

Fig. 1b. EMI Filter with MOV Protection

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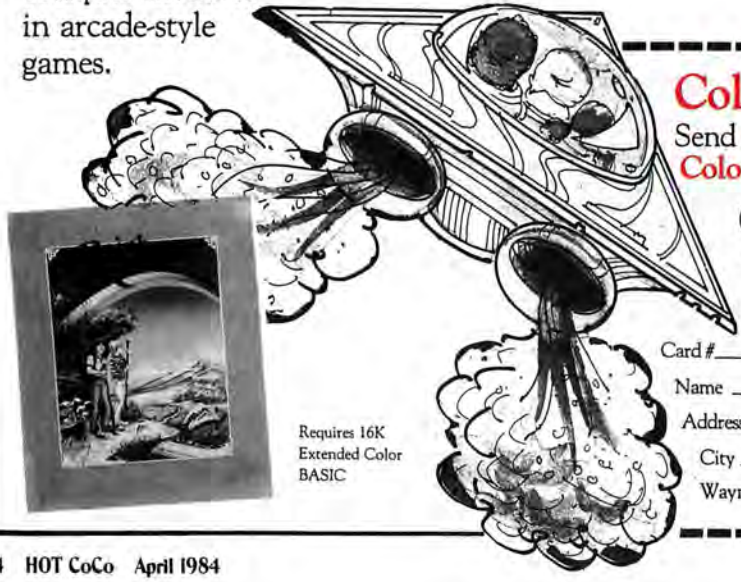

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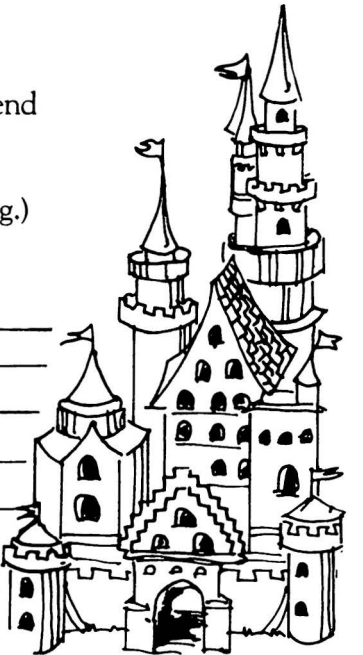

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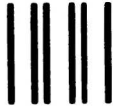

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The usual sources for this type of transient are compressors, contractors, and other large inductive loads that share your line. MOV 1 is usually sufficient protection.

MOVs 2 and 3 are optional devices that absorb transient energy in normal mode, meaning high voltage that has the same polarity on both sides of a power line. No current flows from one side of the line to the other. Rather, the current flows from power line to ground.

Lightning provides the usual source for this type of transient when it strikes both sides of a power line at once.

Notice that MOVs 2 and 3 are configured to divert the high-voltage transients to ground. Therefore, you need a good ground for them to function properly.

"If lightning is a problem in your area, and you have a good electrical ground available, you may want to add all three MOV devices."

Unfortunately, a good ground may not be available to you if you live in a house constructed prior to 1960. Lack of the third prong in the wall outlet is an indication of this. Sometimes the outlet's cover-plate holding screw is grounded, but you should check carefully before assuming that it is.

If lightning is a problem in your area, and you have a good electrical ground available, you may want to add all three MOV devices. They are available from Radio Shack as part #276–570.

The MOVs have a limited capacity for energy absorption. They can dissipate only so much power. If your house should happen to sustain a direct hit from a lightning bolt, do not expect these devices to survive the strike.

Photo 2 shows three EMI filters. The one on the left is similar to the model offered by Radio Shack (part #273–100). This is the one to use if your multiple-outlet box is short and square shaped. Such a box is often available through hardware stores.

Use the filter in the middle for the Radio Shack multiple-outlet strip. Unfortunately, it is not available from Radio Shack. It is, however, becoming a popular item and is often available from surplus dealers and commercial electronic supply houses. See the list of suitable filters and surplus supply dealers at the end of this article.

Keep in mind that the filter you buy should have at least a 6-amp rating. You'll also need a business-machine power cord with rectangular contacts, such as a Belden 17250 or 17255.

The construction of this project is not as difficult as it may seem. In fact, things went so quickly that it surprised even me.

The following is a list of tools you will need for the project:

- Electric drill and bits
- Nibbling tool (Radio Shack #64–823 or equal)
- Locking pliers
- Soldering iron and solder
- File to remove burrs
- Wire-cutters and strippers
- Ruler and pencil

If you have to buy these tools, you'll nullify the cost advantage of doing the job yourself.

The Modifications

To begin, start warming the soldering iron. Put it aside in a safe place. Next, remove the tamper-resistant screws from the end plate nearest the power cord. Use the locking pliers as shown in Photo 3.

Pull the plate away the best you can, despite the green wire attached to it. Slide the bottom cover off and put it aside for now.

Use the wire cutters to cut the three power-cord wires right at the black bushing. Use the locking pliers to remove the bushing and power cord. The three wires should be as long as possible, since they will connect to the EMI filter.

You now have an empty cavity to install the EMI filter. It should fit with

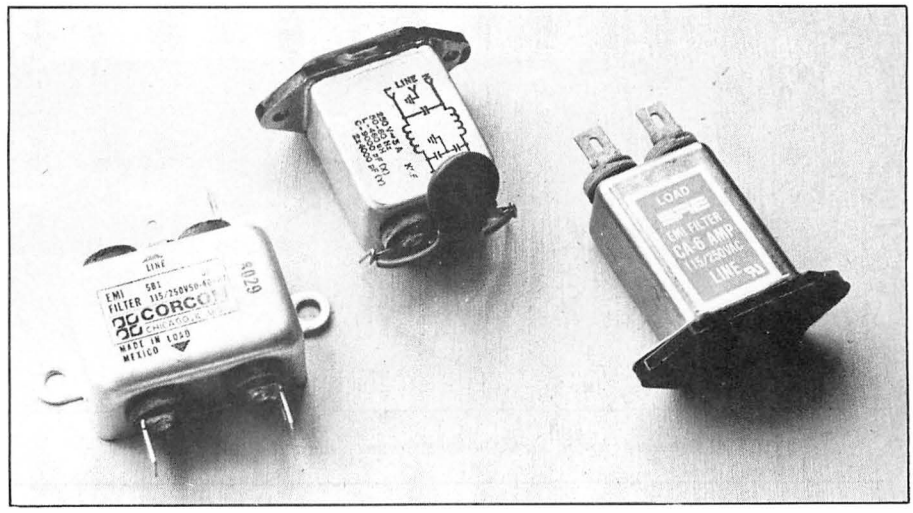

Photo 2. Various EMI Filters

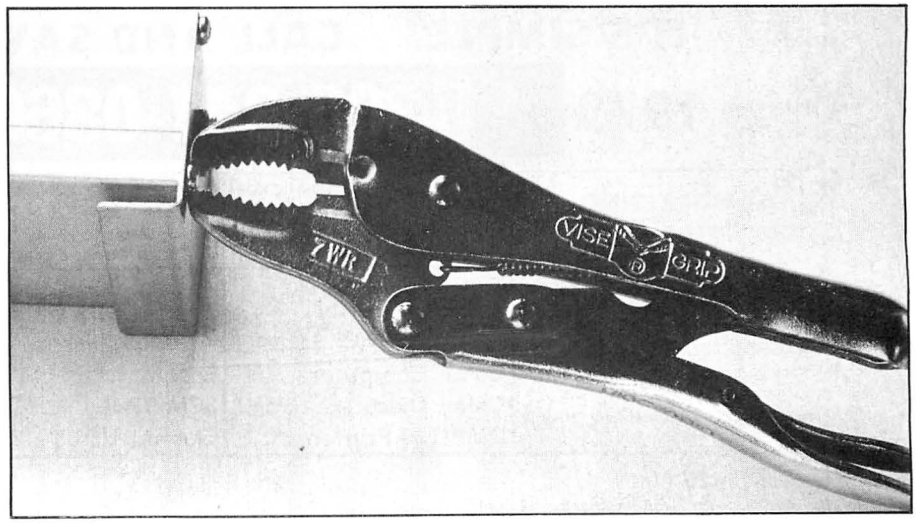

Photo 3. Removing Tamper-Resistant Screws with Locking Pliers

room all around it, as shown in Photo 4. Use your ruler and pencil to mark the outlet strip for a well-centered hole. If you make the hole just a tiny bit larger than the filter, there should be no problem with the fit.

Drill, nibble, and file the aluminum until it permits the filter to slip into place. Using the filter as a template, drill two mounting holes. Fasten it with two 4-40 screws and nuts. You are almost done.

The soldering iron should be warm by now. You will need to attach the MOVs at this time. Don't forget to place some insulating tubing on the exposed leads. The MOV is not sensitive to polarity. Either lead can be connected to neutral/ground.

Fasten the three leads to the appropriate filter tabs, keeping the colors correct. Green is ground, black is line hot, and white is line neutral. Solder them well, since these solder joints might sometimes carry substantial electrical current.

There are two optional safety-related tasks remaining at this point. First, insulate the solder connections so they cannot short to the lid. Tape is good for this but looks messy. If you prefer, glue some insulating material (fiberglass board or cardboard) to the lid in the area of the solder connections.

Second, put some heavy tape over the bushing hole. Metal tape is nice if available, but heat duct or adhesive tape will work.

All that remains is to check your connections, reinstall the lid, and reattach the end plate. You can reuse the tamper-resistant screws if you like, driving them with the locking pliers. The screw size is 6-32, should you prefer to purchase new ones.

Once you've reassembled the outlet strip, plug in the cord, test the unit, and verify proper operation. Your protected outlet strip is ready for service.

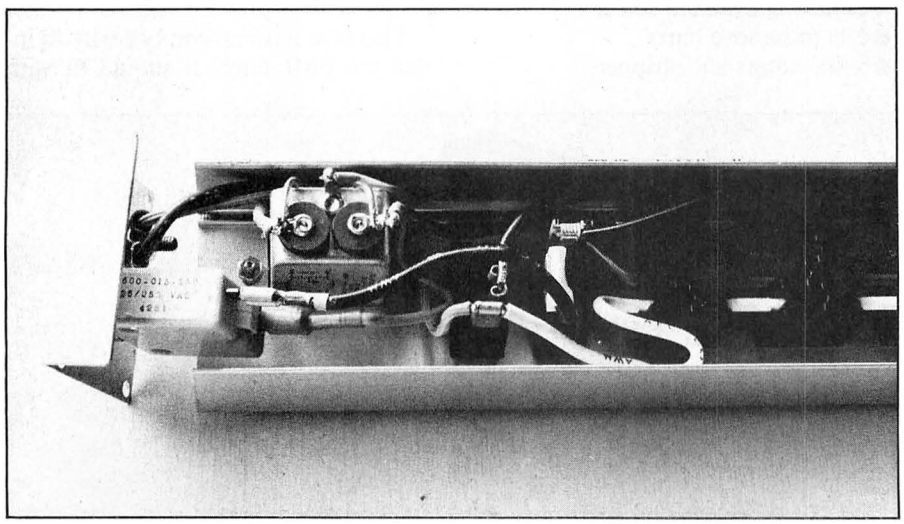

Photo 4. Inside View Showing Connections and MOV

Locating the Parts

You can purchase a CDE brand unit (#A7414) from:

Poly Paks
16-18 Del Carmine St.
Wakefield, MA 01880

It sells for under $6 and is displayed on page 5 of catalog 251.

Poly Paks also displays a line cord on page 14 of the same catalog, but does not describe it sufficiently. It is part #07297. If this cord mates with the filter, then you can purchase both for under $10.

I encourage you to investigate the electronics stores in your community. EMI filters are showing up in surplus stores and as regular stock at many electronics distributors. You should be able to find what you want and get some good ideas of other items that are available.

Regardless of where you acquire the necessary parts, you will enjoy the feeling of security your protected power source gives you. ■

Write to Jeremy A. Donimirski, P.O. Box 66369, Seattle, WA 98166.

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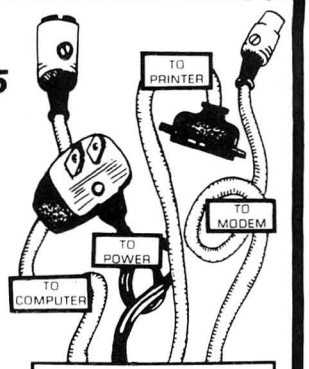

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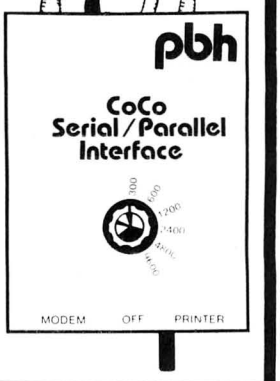

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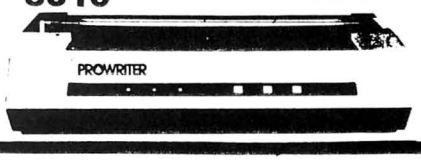

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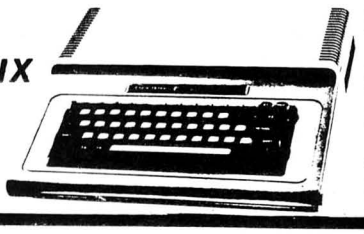

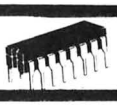

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Instant CoCo

by Amee Eisenberg

ROM Version Confusion

When Radio Shack created the first CoCo ROM (version 1.0), users noticed that the CoCo had some trouble with PCLEAR and PMODE commands. Since then, the ROM has gone through revisions that took care of the PCLEAR and PMODE problems, but left us with some different memory locations for keyboard input. What this means to Instant CoCo users is that some programs that work beautifully on the author's computer hang up on yours.

Use the command EXEC 41175 to discover which ROM version is in your computer. The computer responds with the message "Color Basic X.X (c) 198X Tandy," where X.X is either 1.0, 1.1, or 1.2.

If you have a 1.0 ROM, and your programs hang up at PCLEAR or PMODE statements, try this. Load the program from Instant CoCo. Before you run it, delete the PCLEAR and PMODE statements from the program. Execute the PCLEAR and PMODE statements from the immediate mode (that is, type and enter them without line numbers), then run the program.

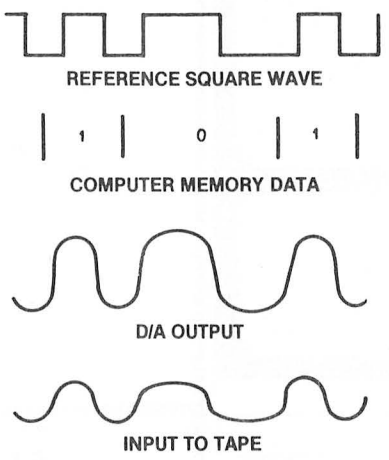

Fig. 1. Corrected CoCo Cassette-Loading Wave Form

The 1.1 ROM cleared up these 1.0 quirks. The 1.2 ROM adds a new twist; in its latest version, the CoCo ROM stores its keyboard information (the POLCAT routine) at a different memory location than the 1.0 or 1.1. This slows up keyboard response in many machine-language programs. This following one-liner will handle any problems that arise due to the difference between the 1.2 and earlier ROMs.

```
10 PRINT"WORKING":FORT=(PEEK(157)*256+PEEK(158))TO32766:IF PEEK(T)=161 AND PEEK(T+1)=193 THEN POKE T+1,203:NEXT:ELSE NEXT
```

To use this program, CLOADM your machine-language program but before you execute it, type in the one-liner. Run it, and then EXEC the machine-language program. This will speed up the 1.2 ROM's keyboard response.

Egg-on-My-Face Department

Oops. I didn't do my homework very well in February. My illustrations for ideal and real cassette-loading wave forms weren't accurate. Although the CoCo does refer its audio signal to a square wave, its timing is not done through a regular sync pulse, but through the actual speed of the wave. An audio signal completing one cycle of 1,200 Hz reads as a logical 0; a 2,400-Hz cycle reads as a logical 1. See improved Fig. 1. ■

SIDE A

ARTICLE NAME/AUTHOR	FILE	PAGE #	SYSTEM
Copyright Statement	TITLE	———	All
Color Lisp/Sievers PCLEAR 1 <enter> before loading on a 32K machine.	LISP	58	32K Ext.
COCO/FX-80 Connection/Eichman Use with Epson FX-80 Printer.	FXPRINT	64	16K Ext.
Sound Advice/Becker	CLIKBUZZ	74	16K Ext.
	WHOOPER	74	16K Ext.
	1BITNOIZ	74	16K Ext.
New Life for an Old Game/Tipp	4NROW	80	16K Ext.
SIDE B			
CC ZAP/Watson	CCZAP	88	16K Disk
Graphically Speaking/Searls	LIST1	132	16K
	LIST2	132	16K
Elmer's Arcade/Ramella	TANTRUM2	16	16K
Educated Guest/Santee	MAPGAME	120	32K Ext.

The symbol (m) in the Article Name column indicates the program is machine-language and must be loaded using the CLOADM command. Additional preparatory commands are listed under the article name where appropriate. CSAVEM addresses are listed for your use with the machine-language programs.

Instant CoCo Directory—April

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The Educated Guest

Simulations Or Drill And Practice

by Charles H. Santee

Which is better in educational software programs—drill and practice or simulations and problem solving? My goal for this month was to write a program demonstrating the Santee Method for developing educational games that gives a little of both.

As usual, I got a little carried away. You need 32K for my Mapgame program. If you have 16K, study the program and see if you can write a shorter one. The procedure outlined is still useful, and it has many applications beyond the ones I demonstrate.

The whole issue of drill and practice versus simulation and problem solving is a hot one in education. Educators and parents alike have a tendency to put educational computer programs in a hierarchy of quality with drill and practice on the bottom and simulations, problem solving, and inquiry in the superior position. They automatically assume that higher-level activities are better.

Granted, research proves that a student actively involved in a learning activity retains more information, but the same type of active involvement is possible in drill and practice.

In fact, it is difficult to prove the value of one type over the other. With simulations, for example, how can you prove that theoretically operating a business or running a nuclear power plant teaches skills needed for the real task?

The educational community needs to come up with some creative accountability. How do you prove that such programs enhance achievement or real-world accomplishments? That would, perhaps, put an end to the controversy.

My challenge for the month—tell me about some good simulations and higher-level programs. Simple. Then, tell me how you prove their success. Prove that they are better than drill and practice. Not so simple.

The Mapgame Program

Mapgame is a cross between a tutorial and a problem-solving game. If you disagree that it has educational value, let me hear from you. In Mapgame the student figures out how to move from state to state and in so doing learns about the state names and their relative locations. He also learns map-reading skills.

Creating a Map

Run the program and you receive a menu. The first option is to draw a map. Since you need this map for the game, press 1. You might as well go do something else for a while because drawing the map takes a long time. Next, you see a menu that asks you to:

```
Press:  D To Save To Disk
        T To Save To Tape
        R To Return Without Saving
```

Put in a new cassette or formatted disk and press the appropriate letter. This saves the map and with a good save you won't need to draw it again. The next time you use the program you can simply select option 2 to recall the map from disk or tape.

Playing the Game

If you press 4 from the main menu to play the Mapgame, you see the message, "I am moving to a new state."

You hear a series of tones and see a state drawn in low-resolution graphics. A cursor shows your present position in the state, and beneath the map is an instruction as to where you should go.

When you know where you are going, press the spacebar, and press N for north, S for south, E for east, or W for west. Type the number of miles you want to go in that direction. Finally, press enter to see a full map (hi-res) of the United States.

A cursor beeps across the states in the direction you indicated. When you have traveled the specified number of miles, the beeping cursor pauses in the new position. You return to a state map and give further instructions to move.

When you reach your destination the screen shows you how many moves you required. The program selects a new state to start and you are ready for a new journey. Successfully complete four journeys and you see how many moves you took.

After playing the game you might want to see a segment of the U.S. in larger scale. Select option 3 from the main menu. I have divided the United States into four horizontal sectors and four vertical sectors making 16 different parts you can view. Press a number between one and four to see the horizontal sector, and do it again for the vertical sector.

How the Program Works

Mapgame is based on a technique that I call Data Mapping. It was born out of a need to write an educational adventure. The ordinary adventure game uses a mapping strategy that is often deliberately confusing. You might go north and return to the same spot after only a few tries. South is not always the opposite of north.

I decided to draw an actual map using the DATA statement. Each character in it is a plot of land.

The northern boundary of the map is the first DATA statement and the southern boundary is the last one. Each DATA statement consists of one string of characters, with the first

System Requirements

32K RAM
Extended Color Basic
Disk and Printer (optional)

character of the strings forming the western boundary and the last forming the eastern boundary.

Moving from one character to the next constitutes a move of a given dimension (30 miles in this application). The character chosen for any location is an identifying feature of that location (state name in this instance). In this program, for example: R (ASCII 82) = Texas, and $ (ASCII 36) = Nevada.

Table 1 shows a complete list of states and their associated characters. If you printed out the DATA statements of this program on a 132-column printer, you would actually see the outline of the states in the DATA statements. When you type in Mapgame you can misplace one character or 10 in the DATA map without much problem. Just make sure there are 58 lines of data in the DATA map and each state character is used at least once.

You might want to improve on my map for more accuracy or for a more artistic effect. By using different numbers in lines 40, 570, 340, and 940 you can use more or fewer lines. Change 58 to the number of DATA statements you use for your map.

The DATA statements are read as a single-dimensional array. To move east across the map, you would use the MID$ function to select the next character in the string. To move south you would select the same numbered character in the next string.

Suppose you started in the middle of Illinois. (The location would be MID$(S$(24),60,1)). Table 2 shows a move of 30 miles in any direction.

The variable SS$ in line 20 defines the trips you will take in the game. It is set up in pairs of characters that define the starting state and destination state. For example, the program defines SS$ as SS$ = ".,M0?>".

Trip Number	Symbol Pair	Description
1	. ,	Start in Illinois and go to New Mexico
2	M 0	Start in Maryland and go to New York
3	? >	Start in Tennessee and go to Louisiana

To change which trips you use in the game, change the value of SS$. You can have as many trips as the pairs of characters that fit in this string variable (over 100). For example, change line 20 like this:

```
20 SS$=" "
   : FOR A = 1 TO 10
   : SS$ = SS$ + CHR$( RND(48) + 35)
   : NEXT A
```

Another technique I used often in this program involves the INSTR function. In lines 430–460 and 630–660 it defines the color of the map. In line 230, I used it with the ON...GOTO command to pick out the letters pressed. You might use this technique with an adventure game to GOTO a particular action based on some location within a DATA map.

This brings me to my second challenge. Can you think of an application for an adventure game format that has

35 # Water or Out of States

36	$ Nevada	37	% Missouri	38	& West Virginia	39	' South Dakota
40	(Oregon	41	) Montana	42	* Minnesota	43	+ Utah
44	, New Mexico	45	– Arkansas	46	. Illinois	47	/ Ohio
48	0 New York	49	1 New Hampshire	50	2 Rhode Island	51	3 Virginia
52	4 South Carolina	53	5 Alabama	54	6 Kansas	55	7 Washington
56	8 California	57	9 Wyoming	58	: North Dakota	59	; Nebraska
60	< Oklahoma	61	= Wisconsin	62	> Louisiana	63	? Tennessee
64	@ Indiana	65	A Pennsylvania	66	B Vermont	67	C Connecticut
68	D Delaware	69	E Florida	70	F Idaho	71	G Arizona
72	H Colorado	73	I Iowa	74	J Mississippi	75	K Kentucky
76	L North Carolina	77	M Maryland	78	N Massachusetts	79	O Maine
80	P New Jersey	81	Q Michigan	82	R Texas	83	S Georgia

Table 1. ASCII Value and Character for Each State

	North MID$(S$(23),60,1)	
West MID$(S$(24),59,1)	Present Location MID$(S$(24),60,1)	East MID$(S$(24),61,1)
	South MID$(S$(25),60,1)	

Table 2.

Line Numbers	Description
10–50	Initialize variables
60–80	Selection menu
90–210	Draw map
220–300	Save the map to disk or tape
310–510	Draw sections of the United States
330	Calculate starting vertical and horizontal location of the Northwest corner of the map segment
520–1170	Mapgame
520–550	Find starting location and destination
560–820	Show present state location
830–850	Get direction of move and number of miles to be moved
860–960	Check input and calculate new location
970–1060	Show movement on a large map
1070–1110	Reject invalid moves
1130–1150	Show the destination has been reached successfully
1160–1170	Show when all trips have been completed
1500–1520	DATA list of state names
2101–2158	DATA map of the United States

Table 3. Line Descriptions

Program Listing. Mapgame

```
10 CLEAR 5500:DIM MP$(30)
20 SS$=".,M0?>"
30 DIM S$(58),N$(49)
40 FOR A=1 TO 49:READ N$(A):NEXT
:FOR A=1 TO 58:READ S$(A):NEXT
50 G$="F:G.6>E4/012D":B$="#$9<I?
&":Y$="7=8'RJS3ACBOH%@":R$="()+,
;*QKL5MPN-"
60 CLS:PRINT"PRESS":PRINT:PRINT"
  1 TO DRAW MAP":PRINT"  2 TO GE
T MAP FROM TAPE/DISK":PRINT"  3
TO SHOW A SECTION":PRINT"  4 TO
PLAY
 MAP GAME"
70 X$=INKEY$:IFX$="" THEN 70 ELS
E X=VAL(X$):ON X GOTO 90,260,310
,520
80 GOTO 70
90 PMODE 3,1:SCREEN 1,0
100 PCLS 3
110 FOR A=1 TO 58
120 X$=S$(A)
130 X=X+LEN(X$)
140 FOR B=1 TO LEN(X$)
150 M$=MID$(X$,B,1)
160 IF INSTR(B$,M$)<>0 THEN COLO
R 3,1
170 IF INSTR(Y$,M$)<>0 THEN COLO
R 2,1
180 IF INSTR(G$,M$)<>0 THEN COLO
R 1,1
190 IF INSTR(R$,M$)<>0 THEN COLO
R 4,1
200 LINE(B*2+36,A*2+20)-(B*2+37,
A*2+21),PSET,BF
210 NEXT B,A
220 CLS:SCREEN 0,0:ZZ=PEEK(188)*
256+PEEK(189):PRINT"PRESS d TO S
AVE TO DISK":PRINT"PRESS t TO SA
VE TO TAPE":PRINT"PRESS r TO RET
URN
WITHOUT SAVING"
230 X$=INKEY$:IF X$="" THEN 230
ELSE V=INSTR("DdTtRr",X$):IF V=0
 THEN 230 ELSE ON V GOTO 240,240
,250,250,60,60
240 SAVEM "USA",ZZ+608,ZZ+4735,0
:GOTO 60
250 CSAVEM"USA",ZZ+608,ZZ+4735,0
:GOTO 60
260 CLS:PRINT"PRESS ":PRINT:PRIN
T" d TO GET MAP FROM DISK":PRINT
" t TO GET FROM TAPE":PRINT" r T
O RETURN WITHOUT MAP"
270 X$=INKEY$:IF X$="" THEN 270
ELSE V=INSTR("DdTtRr",X$):ON V G
OTO 290,290,300,300,60,60
280 GOTO 270
290 PMODE 3,1:PCLS:SCREEN 1,0:LO
ADM "USA":GOTO 60
300 PMODE 3,1:PCLS:SCREEN 1,0:CL
OADM "USA":GOTO 60
310 INPUT "H SECTOR";H:INPUT "VS
ECTOR";V
320 CLS 0
330 V=(V-1)*15:H=(H-1)*31
340 VE=V+14:IF VE>58 THEN VE=58
350 RESTORE:IF V>1 THEN FOR A=1
TO V-1:READ X$:NEXT
360 FOR A=V TO VE
370 READ X$
380 L=LEN(X$):IF H>L THEN PRINT
STRING$(32,128);:GOTO 490
390 IF H+31>L THEN LE=L ELSE LE=
H+31
400 FOR B=H+1 TO LE
410 M$=MID$(X$,B,1)
420 IF M$="#" THEN PRINT CHR$(12
8);:GOTO 470
430 IF INSTR(R$,M$)<>0 THEN PRIN
T CHR$(191);
440 IF INSTR(Y$,M$)<>0 THEN PRIN
T CHR$(159);
450 IF INSTR(G$,M$)<>0 THEN PRIN
T CHR$(143);
460 IF INSTR(B$,M$)<>0 THEN PRIN
TCHR$(175);
470 NEXT B
480 P=POS(0):IF P<>1 THEN PRINTS
TRING$(32-P,128);
490 NEXT A
500 X$=INKEY$:IF X$="" THEN 500
510 RUN
520 CLS:PRINT@258,"I AM MOVING T
O A NEW STATE":SCREEN 0,1:SX=SX+
1:IF SX=>LEN(SS$) THEN 1160
530 ZN=ASC(MID$(SS$,SX+1,1))-34
540 YY=1:S$=MID$(SS$,SX,1):N=ASC
(S$)-34:SX=SX+1
550 XX=INSTR(S$(YY),S$):IF XX=0
THEN YY=YY+1:GOTO 550
560 SV=96:EV=0
570 FOR A=1 TO 58
580 S=INSTR(S$(A),S$):IF S<>0 TH
EN CT=CT+1:MP$(CT)=S$(A): GOSUB
1080
590 IF S<> 0 AND S<SV THEN SV=S
600 IF A=YY THEN Y1=CT
610 PSET(XT,YT,CA):PLAY"L16T1603
C":PSET(XT,YT,CC)
620 NEXT A
630 IF INSTR(Y$,S$)<>0 THEN C=2
640 IF INSTR(G$,S$)<>0 THEN C=1
650 IF INSTR(R$,S$)<>0 THEN C=4
660 IF INSTR(B$,S$)<>0 THEN C=3
670 CLS0:SCREEN 0,0
680 FOR A=1 TO CT
690 PLAY"T16L1604G"
700 H=0
710 IF EV>LEN(MP$(A)) THEN EE=LE
N(MP$(A)) ELSE EE=EV
720 FL=16-INT((EE-SV)/2)
730 FOR B=SV TO EE
740 H=H+1
750 IF B=XX THEN X1=H
760 IF MID$(MP$(A),B,1)=S$ THEN
SET (H*2+FL,A+2,C):SET (H*2+FL+1
,A+2,C)
770 NEXT B,A
780 PRINT@0,"you";CHR$(128);"are
";CHR$(128);"in";CHR$(128);N$(N)
;
790 IF ZN=N THEN 1130
800 PRINT@448,"YOU ARE TO GO TO
";N$(ZN);:PRINT@480,"press";CHR$
(128);"key";CHR$(128);"to";CHR$(
128);"continue";
810 X$=""
820 X$=INKEY$:SET(X1*2+FL,Y1+2,8
):SET(X1*2+FL+1,Y1+2,8):PLAY"O2V
5T16L16C":SET(X1*2+FL,Y1+2,C):SE
T(X1*2+FL+1,Y1+2,C):PLAY"D":IF X
$=""
 THEN 820
830 PRINT@448,STRING$(63,32);:PR
INT@448,"WHICH DIRECTION (N S E
W) ? ";
840 X$=INKEY$:IF X$="" THEN 840
ELSE IF INSTR("NSEW",X$)=0 THEN
840 ELSE D$=X$:PRINTX$:PRINT"HOW
 MANY MILES ?";
850 X$=INKEY$:IF X$=CHR$(13) THE
N 860 ELSE IF X$>="0" AND X$<="9
" THEN MI$=MI$+X$:PRINT@498,MI$;
" ";:GOTO 850  ELSE 850
860 MI=VAL(MI$):TY=YY:TX=XX:MV=M
V+1
870 MM=INT(MI/30):MI$=""
880 ON INSTR("NSEW",D$) GOSUB 90
0,910,920,930
890 GOTO 940
900 YY=YY-MM:RETURN
910 YY=YY+MM:RETURN
920 XX=XX+MM:RETURN
930 XX=XX-MM:RETURN
940 IF XX< 1  OR YY<1 OR YY>58 T
HEN 1070
950 IF XX>LEN(S$(YY)) THEN 1070
960 S$= MID$(S$(YY),XX,1):IF S$=
"#" THEN 1070
970 CT=0
980 N=ASC(S$)-34
990 SCREEN 1,0:PMODE 3,1
1000 IF TY=YY THEN LL=XX-TX ELSE
 LL=YY-TY
1010 ST=SGN(LL)
1020 FOR A=0 TO LL STEP ST
1030 IF TY=YY THEN XT=(A+TX)*2+3
6:YT=YY*2+20 ELSE YT=(A+TY)*2+20
:XT=XX*2+36
1040 CC=PPOINT(XT,YT):CA=3+(CC=3
 OR CC=4)*1:PSET(XT,YT,CA):PLAY"
T4L8O5C":PSET(XT,YT,CC):PLAY"G"
1050 NEXT A
1060 GOTO 560
1070 PRINT@448,STRING$(63,32);:P
RINT@448,"YOU CAN'T GO OUT OF TH
E         united states OR ACROS
S WATER";:PLAY"T4L4O3BAGFEDC":YY
=TY:
XX=TX:GOTO 830
1080 ED=S
1090 ED=ED+1:IF INSTR(ED,S$(A),S
$)<>0 THEN 1090
1100 IF ED>EV THEN EV=ED
1110 RETURN
1120 PRINT"ENTER NUMBER"
1130 PRINT@448,STRING$(63,32);:P
RINT@448,"YOU DID IT IN";MV;"MOV
ES":SCREEN 0,1:PLAY"T4L4V20CEFGA
CEFGE":TM=TM+MV:MV=0
1140 PRINT"PRESS KEY TO CONTINUE
";
1150 X$=INKEY$:IF X$="" THEN 115
0 ELSE CT=0:GOTO 520
1160 CLS:PRINT"YOU FINISHED THE
GAME":PRINT"IN";TM;"MOVES":PRINT
:PRINT"PRESS KEY TO CONTINUE":X$
=""
1170 X$=INKEY$:IF X$="" THEN 117
0 ELSE SX=0:TM=0:GOTO60
1500 DATA WATER,NEVADA,MISSOURI,
WEST VIRGINIA,SOUTH DAKOTA,OREGO
N,MONTANA,MINNESOTA,UTAH,NEW MEX
ICO,ARKANSAS,ILLINOIS,OHIO,NEW Y
ORK,
NEW HAMPSHIRE,RHODE ISLAND,VIRGI
NIA,SOUTH CAROLINA,ALABAMA,KANSA
S
1510 DATA WASHINGTON,CALIFORNIA,
WYOMING,NORTH DAKOTA,NEBRASKA,OK
LAHOMA,WISCONSIN,LOUISIANA,TENNE
SSEE,INDIANA,PENNSYLVANIA,VERMON
T,CO
NNECTICUT,DELEWARE,FLORIDA,IDAHO
,ARIZONA,COLORADO,IOWA,MISSISSIP
PI,KENTUCKY
1520 DATA NORTH CAROLINA,MARYLAN
D,MASSACHUSETTS,MAIN,NEW JERSEY,
MICHIGAN,TEXAS,GEORGIA
2101 DATA "########7777#
2102 DATA "#####7##7777777######
##################################
##################################
######OO#"
2103 DATA "#####777777777777FF))
)##################################
##################################
#####OOOO#"
2104 DATA "#####777777777777FF))
)))))))##########################
##################################
#####OOOO#"
2105 DATA "#####777777777777FF))
))))))))))))))))###############*#
##################################
#####OOOO#"
2106 DATA "#####77777777777FFF))
))))))))))))))::::::::::*****
**##################################
#####OOOOO#"
2107 DATA "#####((777777777FFF))
))))))))))))))::::::::::*****
*****##############################
#####OOOOOO#"
```

Listing continued

"The real challenge is to go beyond the planning stage..."

educational value? My first application of a DATA map was to write a submarine adventure where students had to retrieve and fix parts of a Basic program to rescue the submarine. What can you come up with?

The real challenge is to go beyond the planning stage and actually write that adventure. Start with a relatively small map (say 10 characters by 10 lines). That gives you 100 possibilities. Plan a different, educationally sound activity for each location on the map. Use some characters as walls, halls, and corridors to make the game more interesting. If you are up to it, add graphics and sound. Please let me hear your plans and see your results. ■

Address correspondence to Charles Santee, c/o HOT CoCo, *80 Pine St., Peterborough, NH 03458.*

S$(58)	DATA map
N$(49)	State names
G$	Green colored states
R$	Red colored states
Y$	Yellow colored states
B$	Blue states and water
ZZ	Location of hi-res page 1
V	First line of DATA map in sector (northern-most)
H	First character of DATA map in sector (west)
VE	Last line of DATA map in sector (south)
LE	Last character of DATA map in sector (east)
M$	Character in DATA map presently selected
SS$	Trips in game (one character for each starting/ending location)
YY	Location of starting line in DATA map
XX	Location of starting character in DATA map
MP$(30)	State map string
XT,YT	Present location on graphics map of U.S.
TX,TY	Last location on graphics map of U.S.
LL	Distance of move
CC	Color of location on graphics map
ST	Direction of move
MV	Number of moves for present trip
TM	Total number of moves
ED	Last character of state in DATA map (east)
S	First character of state in DATA map (west)
FL	First location of pixel in low-res state map
SV	First character of state in DATA map to be drawn on the low-res map
EE	Last character of state in DATA map to be drawn on low-res map

Table 4. Variables

Listing continued

```
2108 DATA "#####((777777777FFFF)
))))))))))))))):::::::::::*****
*****##############################
####OOOOOO#"
2109 DATA "####((((((((((((FFFF)
))))))))))))))):::::::::::*****
****##############################
###lOOOOO#"
2110 DATA "####((((((((((((FFFF)
))))))))))))))):::::::::::*****
***#####Q##QQQQQ################
#BBlOOOO#"
2111 DATA "###((((((((((((((FFFFF
))))))))))))))):::::::::::*****
***==QQQQQQQQ##################0
0BBllOO#"
2112 DATA "###((((((((((((FFFFFF
))))))))))))))):::::::::::*****
***====QQQQQ##QQ################00
0BBllll#"
2113 DATA "##((((((((((((FFFFFF
F))999999))))))'''''''''''''****
*========QQ##QQQQ###########0000
0BBlll#
2114 DATA "##((((((((((((FFFFFF
FFF9999999999999''''''''''''****
*==========Q##QQQQ#########00000
00Blln#"
2115 DATA "##88((((((((((FFFFFFF
FFF9999999999999''''''''''''****
*==========##QQQQ#########0000000
00NNNN#N#"
2116 DATA "##8888((((((((FFFFFFF
FFF9999999999999''''''''''''****
***=======###QQQQ#Q######0000000
00NNNNNN#"
2117 DATA "#88888888$$$$$FFFFFFF
FFF9999999999999''''''''''''****
****======###QQQQQQ######0000000
000CCCC2#"
2118 DATA "#88888888$$$$$$$$$FFF
FFF9999999999999''''''''''''IIIII
IIII======###QQQQQQ#####000000AA
000CCCC#"
2119 DATA "#88888888$$$$$$$$$++
+++999999999999;;;;;;;;;;;'IIIII
IIIII=====###QQQQQ#####A0AAAAAAA
AP0#"
2120 DATA "#88888888$$$$$$$$$++
+++999999999999;;;;;;;;;;;;IIII
IIIII......##QQQQQ###//AAAAAAAAA
PPP#"
2121 DATA "#8888888$$$$$$$$$+++
+++999999999999;;;;;;;;;;;;IIII
IIIIII.....##@@@///////AAAAAAAAA
PPP#"
2122 DATA "#8888888$$$$$$$$$+++
++++++HHHHH9999;;;;;;;;;;;;;III
IIIIII.....@@@@@///////AAAAAAAAA
APP#"
2123 DATA "#8888888$$$$$$$$$+++
++++++HHHHHHHHHHHH;;;;;;;;;;III
IIIII......@@@@@///////AAAAAAAAM
DPP#"
2124 DATA "##888888$$$$$$$$$+++
++++++HHHHHHHHHHHH;;;;;;;;;;%%%
%%%I.......@@@@@@/////&AAAAMMMMM
D#"
2125 DATA "##888888$$$$$$$$$+++
++++++HHHHHHHHHHHH;;;;;;;;;;%%
%%%%.......@@@@@@/////&&&MMM3MMM
DD#"
2126 DATA "##8888888$$$$$$$$$+++
+++++HHHHHHHHHHHHH666666666%%
%%%%.......@@@@@@/////&&&&&333MM
MM#"
2127 DATA "##88888888$$$$$$$$+++
+++++HHHHHHHHHHHHH666666666%%
%%%%......@@@@@@////&&&&&&3333M
MM#"
2128 DATA "##88888888$$$$$$$++++
+++++HHHHHHHHHHHH6666666666%%
%%%%......@@@@@KKKK&&&&&3333333
MM#"
2129 DATA "##888888888$$$$$$++++
+++++HHHHHHHHHHHH66666666666%%
%%%%%%....@@@@KKKKK&&&&&3333333
#"
2130 DATA "##88888888$$$$$GGG+
+++++HHHHHHHHHHHH66666666666%%
%%%%%%....@@@@KKKKK&&&33333333
33#"
2131 DATA "###888888888$$$$GGGGG
GGGGG,,HHHHHHHHHH6666666666%%
%%%%%%....KKKKKKKKK&&&3333333L
LL#"
2132 DATA "###888888888$$$$GGGGG
GGGG,,,,,,HHHHHHH6666666666%%
%%%%%%%..KKKKKKKKK333333LLLLLL
LL#"
2133 DATA "###888888888$$GGGGGG
GGGG,,,,,,,,,,<<<<<<<<<<<<<<<%%
%%%%%%%KKKKKKKK?????LLLLLLLLLL
LL#"
2134 DATA "#####88888888$$GGGGGG
GGGG,,,,,,,,,,<<<<<<<<<<<<<<<%%
%%%%%%KKK??????????LLLLLLLLLL
LL#"
2135 DATA "######888888888GGGGGG
GGGG,,,,,,,,,,RRRRRR<<<<<<<<<-
-----%%??????????LLLLLLLLLLL#
"
2136 DATA "######888888888GGGGGG
GGGG,,,,,,,,,,RRRRRR<<<<<<<<<-
-------???????????LLLL44LLLLLL#
"
2137 DATA "########888888GGGGGGG
GGG,,,,,,,,,,RRRRRR<<<<<<<<<-
-------???????????SS44444444LLL#
"
2138 DATA "########888888GGGGGGG
GGG,,,,,,,,,,RRRRRR<<<<<<<<<-
-------????55555SSSSS4444444444#"
2139 DATA "########888888GGGGGGG
GGG,,,,,,,,,,RRRRRR<<<<<<<<<-
-------JJJJ55555SSSSSS4444444#"
2140 DATA "##############8GGGGGGG
GGG,,,,,,,,,,RRRRRR<<<<<<<<<-
```

Listing continued

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Listing continued

```
------JJJJJ55555SSSSSSS444444#"
2141 DATA "################GGGGGG
GGG,,,,,,,,,,,,RRRRRRRRRRRRRRRR
------JJJJJ555555SSSSSSS444#"
2142 DATA "################GGGGG
GGG,,,,,,,,,,,,RRRRRRRRRRRRRRRR
------JJJJJ555555SSSSSSSS44#"
2143 DATA "##################GGG
GGG,,,,,,,,,,,,RRRRRRRRRRRRRRRR
------JJJJJ5555555SSSSSSSS#"
2144 DATA "####################GG
GGG,##RRRR,,,,RRRRRRRRRRRRRRRR
>>>>>>JJJJJ5555555SSSSSSSS#"
2145 DATA "######################
########RRRRRRRRRRRRRRRRRRRRRR
>>>>>>JJJJJ5555555SSSSSSSS#"
2146 DATA "######################
#########RRRRRRRRRRRRRRRRRRRRR
>>>>>JJJJJJ5555555SSSSSSSS#"
2147 DATA "######################
#########RRRRRRRRRRRRRRRRRRRRR
R>>>>JJJJJJ5555555SSSSSSEE#"
2148 DATA "######################
##########RRRRRRRRRRRRRRRRRRRR
R>>>>>>>>JJ55EEEEEEEEEEEEE#"
2149 DATA "######################
###########RRRRRRRRRRRRRRRRRR
R>>>>>>>>########EE###EEEEE#"
2150 DATA "######################
############RRRRRRRRRRRRRRRRR
>>>>>>>>>############EEEEEE#"
2151 DATA "######################
############RRRR###RRRRRRRRRRR
#####>>>>>############EEEEEE#"
2152 DATA "######################
############RR#####RRRRRRRRRR##
#########>############EEEEEE#"
2153 DATA "######################
####################RRRRRRRRR###
########################EEEEEE#"
2154 DATA "######################
####################RRRRRRR#####
########################EEEEEE#"
2155 DATA "######################
####################RRRRR#######
##########################EEEEE#"
2156 DATA "######################
####################RRRR########
##########################EEEEEE#
"
2157 DATA "######################
####################RRRR########
##########################EEEEE#
"
2158 DATA "######################
#####################RRR#########
########################EEE#"
```

END

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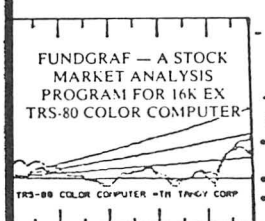

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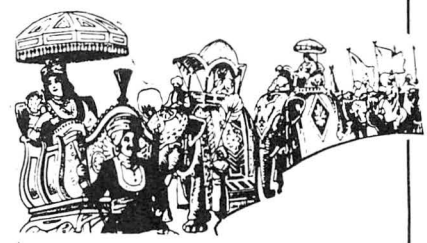

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Doctor ASCII

by Richard E. Esposito and Ralph E. Ramhoff

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

Q. After doing a 16–32K piggyback modification, my CoCo still responds as if it were a 16K machine. I have an old CoCo with a 1.0 ROM. Could this be the problem?

Jeff Friedman
Southampton, PA

A. The piggyback modification will work with all the ROMs. Check your solder joints. Check that all your jumpers are set to 16K, that the wire running from your piggybacked RAMs' pins 4 is connected to pin 35 of the 6883 SAM chip. If you used a resistor, check that it is 33 ohm, ¼ watt, and 10 percent. Make sure that the notches of the piggybacked chips line up with the notches on the chips underneath and with the sockets. Remember that all these chips are numbered counterclockwise from the notch. If anyone else is planning a piggyback mod, I suggest that you test the new RAMs first by substituting them in the appropriate sockets for the originals to make sure they are good before proceeding with the mod.

Q. Is it me or does your medicine for dumping a graphic page to a Gemini-10 or in my case a Gemini-10X printer (Doctor ASCII, September 1983) have a side effect? Everything works well except my screen comes out backwards. This would never show up when using a circle.

P.D. Frankenfield
Peterborough, NH

A. Oops, I borrowed a friend's printer to do that piece; I have an LP VIII. Hold it up to a mirror or better yet, change line 1020 from 1020 FOR R=0 TO 31 to read 1020 FOR R=31 TO 0 STEP −1.

Q. I have a 16K ECB CoCo and will probably not have a disk system for another year. Is there any way to chain programs from tape as can be done with Disk Basic's RUN"<name/ext>"?

Warren Hyde
Miami, FL

A. Sugar Software (2153 Leah Lane, Reynoldsburg, OH 43068) markets a program called Autorun, $19.95, that fixes your tape programs so that you can do this. It also allows you do add low-resolution title graphics that display while the program is loading.

Q. Is it possible to CSAVEM without Extended Color Basic?

Todd Underhill
Honolulu, HI

A. The Micro Works (P.O. Box 1110, Del Mar, CA 92014) markets CBug, $29.95, which among other things gives you that capability.

Q. I bought one of the earliest CoCos made. It was a 4K D board. I subsequently had it upgraded by Radio Shack to 32K ECB and a 1.1 ROM. Is this a 32K or a 64K machine?

Charles MacLeod
Taunton, MA

A. See my answer to Jack Thompson in last month's column. The Memory Test program in it will tell.

Q. I own a 16K CoCo and I would like to buy a digital-to-analog converter for my CoCo.

Weinberger Koby

A. You already have one. See Dane Weston's "Unlock Your Joyports and Open CoCo to the World" (*Rainbow*, December 1983, p. 56).

Q. I have read that the Extended Basic CoCo has "user-definable" keys. I use my 64K CoCo with a Gemini-10 printer and would find a key helpful for the PRINT#−2 command.

I use Master Control to cut down on my typing time. Is it possible to substitute the PRINT#−2 function for the one now activated by the K letter in Master Control program?

Sam Goldstein
Amityville, NY

A. The reference is to the INKEY$ function.

Yes, a program that allows you to reprogram Master Control by Larry Grady entitled "Review of Master Control" appeared in *Color Computer News*, September 1982, p. 29.

Q. Is there a short program available for the CoCo to simulate the auto-line-numbering feature available on the Model III?

Andy Birkhead
Mt. Vernon, IN

A. Master Control II—$17.95 (Selected Software, P.O. Box 32228, Fridley, MN 55432) has that feature along with single-key entry of Basic's reserved words.

Q. I have a 32K CoCo and a Plug'n Power Controller. I accidentally erased the tape that came with it. Where can I get replacement software?

Dave Jones
Iowa Falls, IA

A. A better program than your original appeared in an article by A.B. Trevor entitled "Let CoCo Control Your Home Power Units" (*Rainbow,* February 1983, p. 160).

Q. I purchased a CoCo with cassette recorder in May 1983. I would like to purchase a disk drive and a printer. What do you recommend for a good disk drive and a printer that do not cost an arm and a leg?

William E. Darden
Memphis, TN

A. If you plan to move up to FLEX or OS-9 at a future date, I would get a 5¼-inch drive with 40 tracks (double sided if you can afford it). Be sure that the price you are quoted is not for a bare drive but includes the power supply and case. As far as printers are concerned, I would look for a 9-by-9-pin or greater dot-matrix printer that has lowercase descenders, uses standard width sprocket-feed paper, and has ribbons that are readily available. Some of the low-cost (under $400 range) printers to investigate include the Epson, the Microline, the Gemini, and Radio Shack's DMP series.

A serial printer will hook up directly. If you choose a parallel version, add about $70 for a serial-to-parallel converter. If you plan to add a modem, consider a printer that will support 300 baud so that you can split your RS-232 output to get printed copy while on line.

Q. I am 7 years old and getting started with the Color Computer. I used to work with my dad's Model I. Can I hook up his drive to my Color Computer?

Maia L. Hyde
West Covina, CA

A. Yes, but you will also need a CoCo disk controller. P. S. Don't tell your dad too much about the CoCo or you might get stuck with his old Model I.

Q. I have a 32K CoCo with disk and I want to back up my machine-language programs to tape. Can this be done?

Randy Lehner
Youngstown, OH

A. You need to find out the start, end, and EXEC addresses of the programs. Then after loading them into memory, you can save them to tape by typing CSAVEM "<filename>",<start address>,<end address>,<EXEC address>. Program Listing 1 will read the disk from drive zero and tell you what the needed addresses are. For example, if it told you that the start, end, and EXEC addresses of a binary file called MLPROG were $1233, $5666, and $12FF, you would put the program on tape by first LOADing MLPROG and then typing CSAVEM"MLPROG", &H1233,&H5666,&H12FF.

Q. While typing in "Galaxy Trek Adventure," *HOT CoCo*, September 1983, p. 72, I discovered that my 32K disk CoCo will not accept the variable AS with the controller plugged in. It gives me a syntax error. Are there any other variables like this? If so, what are they, and what causes this?

Paul J. Keaton
Eiels AFB, AK

A. AS is a reserved word that is used in conjunction with the FIELD statement (*Color Computer Disk System Owner's Manual*, p. 49), so it is tokenized when you type it in. You get a syntax error because this reserved word does not make sense to Disk Basic without the reserved word FIELD in the proper context. You would have the same problems when attempting to use any other reserved word in Basic for a variable name. The list is quite long. It includes GOTO, FOR, IF, THEN, and DSKI$.

Q. I have tried (unsuccessfully) to get my computer to execute the following:

```
10 A = RND(10)*1000
20 GOSUB A
```

I want the computer to randomly select a subroutine and go there. I know I can do it with ON GOSUB if I list out all the subroutine line numbers, but since I'm making up a quiz for my students, there are a lot of subroutines to list. Is there a way I can modify my shorter version to make it work?

Lynn M. Hughes
Quakertown, PA

A. One alternative is to write a self-modifying program, such as Program Listing 2.

In this program, the variable S contains the location in memory where your Basic program begins. Depending upon the random number selected in line 20, the first two digits of the line number 10000 in line 30 are modified so that the branch is to the desired statement. The only real difficulty in writing code this way is that you must be able to locate the positions of the first two digits of 10000 in memory. In the sample program, the addresses are S+89

```
10 CLEAR1000
20 CLS
30 PRINT":::::: DISK ADDRESS PEEK
ER  ::::::
40 PRINT"     (C)1983 BY RALPH RA
MHOFF          AND RICHARD ESPOS
ITO":PRINT
50 REM GET FILENAME AND REFORMAT
 IT
60 INPUT"FILENAME";I$
70 PRINT
80 IF INSTR(1,I$,"/")+INSTR(1,I$
,".")=0 THEN I$=I$+"/BIN"
90 I=INSTR(1,I$,"/")+INSTR(1,I$,
".")):F$=LEFT$(I$,I-1):E$=RIGHT$(
I$,LEN(I$)-I)
100 IF LEN(F$)<8 THEN F$=F$+" ":
GOTO100
110 I$=F$+"/"+E$
120 FORI=1TO9
130 REM SEARCH DIRECTORY FOR REQ
UESTED FILENAME
140 DSKI$0,17,2+I,F$(1),F$(2)
150 FORF=1TO2
160 FORJ=1TO97STEP32
170 IF MID$(F$(F),J,1)=CHR$(255)
 THEN GOTO 240 ELSE IF MID$(F$(F
),J,1)=CHR$(32) THEN GOTO210
180 Q$=MID$(F$(F),J+8,3)
190 C$=MID$(F$(F),J,8)+"/"+Q$
200 IF C$=I$ THEN 280
210 NEXTJ
220 NEXTF
230 NEXTI
240 PRINT"FILE NOT FOUND"
250 END
260 REM FILENAME FOUND - OPEN AS
 DIRECT ACCESS FILE WITH RECORD
LENGTH OF ONE BYTE
270 REM THIS ALLOWS ACCESS OF AN
Y BYTE IN THE FILE DIRECTLY BY U
SE OF A GET #1,BYTE
280 OPEN "D",#1,I$,1
290 FIELD#1,1 AS B$
300 REM INITIALIZE START AND END
 ADDRESS VARIABLES TO UNATTAINAB
LE VALUES
310 S=65536:E=-1
320 REM INITIALIZE BYTE POINTER
TO THE FIRST BYTE OF THE FILE
330 B=1
340 REM READ THE FLAG BYTE - IF
ZERO : AT THE START OF A MODULE
- IF 255 : TRANSFER ADDRESS FOLL
OWS AND AT END OF FILE
350 GET#1,B
360 REM INCREMENT THE BYTE POINT
ER
370 B=B+1
380 REM IF FLAG BYTE NOT VALID -
 ERROR
390 IF (B$<>CHR$(0)) AND (B$<>CH
R$(255)) THEN PRINT"NOT A BINARY
 FILE.":END
400 REM IF FLAG BYTE=255 - REACH
ED END OF FILE
410 IF B$=CHR$(255) THEN 520
420 GET#1,B: T1=ASC(B$): GET#1,B
+1: T1=T1*256+ASC(B$): REM T1=LE
NGTH OF MODULE
430 GET#1,B+2: T2=ASC(B$): GET#1
,B+3: T2=T2*256+ASC(B$): REM T2=
START ADDRESS OF MODULE
440 REM UPDATE BYTE POINTER
450 B=B+T1+4
460 T1=T2+T1-1: REM T1=END ADDRE
SS OF MODULE
470 REM UPDATE START AND END ADD
RESSES IF NECESSARY
480 IF T1>E THEN E=T1
490 IF T2<S THEN S=T2
500 REM PROCESS NEXT LOAD MODULE
 - THIS IS NECESSARY BECAUSE A B
INARY FILE MAY CONSIST OF SEVERA
L LOAD MODULES
510 GOTO 350
520 GET#1,B+2: T=ASC(B$): GET#1,
B+3: T=T*256+ASC(B$): REM T=TRAN
SFER ADDRESS
530 PRINT"START ADDRESS","$";HEX
$(S)
540 PRINT"END ADDRESS","$";HEX$(
E)
550 PRINT"EXEC ADDRESS","$";HEX$
(T)
```

Program Listing 1. Routine to Find Start, End, and EXEC Addresses of Machine-Language Programs

and S+90. The 89 and 90 were arrived at using the following guidelines: The first character or tokenized reserved word in the first line is at address S+4. In this case, it is the letter "A" in line 10. Allow one address for each additional character or tokenized reserved word. Allow 6 bytes for the line number and the space that follows it at the start of each numbered line. Examples of tokenized reserved words are GO, TO, SUB, INPUT, READ, and STOP.

Q. I would like your opinion on the best keyboard for the money. I am looking at the new Radio Shack keyboard, the Super Pro by Mark Data Products, and the Premium by Micronix Inc.

What are definable keys used for and how are they programmed?

How are programs and data files saved on and loaded from disk? I am now an impatient cassette user.

Why do most other home computers have more ROM than the CoCo?

Why is the Motorola 6809 considered to be one of the fastest around?

Mark Eichman
Manteca, CA

A. First, I would delete the Radio Shack keyboard from your list since it is not full-travel, and second, I would add the HJL-57 by HJL Products Inc. (955 Buffalo Road, P.O. Box 24954, Rochester, NY 14624) to your list. Of the new three, Mark Data is less expensive, but does not have the extra function keys that the other two have. If you want the extra keys, then your choice is narrowed to the Premium or HJL. I have not seen the Premium or the Mark Data keyboards, but I have seen and been impressed by the HJL. (*HOT CoCo* reviewed the Mark Data keyboard in the August 1983 issue, p. 20. See this month's Reviews for a review of the Micronix Premium keyboard.—eds.)

By user-definable keys, they are talking about the INKEY$ function. Consider the following code:

```
10 A$=INKEY$: IF A$="" THEN 10
20 <next line>
```

When the computer executes the code on line 20, A$ will contain some character, and depending upon what it is, you can program the computer to perform some given task. The advantage to using this feature instead of INPUT is that nothing is echoed to the screen unless you want it and no cursor appears.

Programs and data files are saved on disk much the same way they are saved on tape. The chart that follows gives the equivalents.

Tape	Disk
CSAVE"<name>"	SAVE"<name>"
CSAVEM"<name>",s,e,x	SAVEM"<name>",s,e,x
CLOAD"<name>"	LOAD"<name>"
CLOADM"<name>"	LOADM"<name>"
OPEN"O",#-1,"<filename>"	
OPEN"O",#1,"<filename>"	
CLOSE#-1	CLOSE#1

```
10 S=256*PEEK(25)+PEEK(26)
20 A=RND(10): POKE S+89,INT(A/10
)+48: POKE S+90,A-INT(A/10)*10+4
8
30 GOSUB 10000
40 PRINT"FINISHED":END
1000 PRINT1000
1001 RETURN
2000 PRINT2000
2001 RETURN
3000 PRINT3000
3001 RETURN
4000 PRINT4000
4001 RETURN
5000 PRINT5000
5001 RETURN
6000 PRINT6000
6001 RETURN
7000 PRINT7000
7001 RETURN
8000 PRINT8000
8001 RETURN
9000 PRINT9000
9001 RETURN
10000 PRINT10000
10001 RETURN
```

Program Listing 2. A Self-Modifying Program

Most computers do not have more ROM than the CoCo, and even if you come across one that does, the CoCo has a more efficient instruction set, which requires less machine language instructions to accomplish a given task.

The 6809 is the fastest 8-bit microprocessor due to the fact that it has a real multiply instruction, which is 100 times faster than a typical software one. Its many addressing modes and 16-bit registers allow a machine-language programmer to write faster, shorter code.

Q. What are the differences between the original CoCo and the CoCo 2?

The Radio Shack salesman sold me a computer cassette (26-302, $1.79) for my CoCo with the claim that it was needed for program and data storage. Will the cheaper sale cassettes work?

Fred Baker
Brooklyn, NY

A. There are obvious physical differences such as the smaller case and the new keyboard, but I assume that you want to know what is different inside. The only major difference aside from the physical layout of the components is that the power supply puts only +5 volts out to the edge connector of the ROM-pack port. Since the disk ROM pack requires 12 volts, the CoCo 2 disk controller gets its 12 volts from the disk drive's power supply. If you have an

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331	Rainbow Quest	114
*	Shelf Boxes	117
170	Wayne Technology	71
156	York 10	92
111	Young Horizons	119

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My vote for the best advertisement in this issue goes to _____ (company) whose Reader Service number is _____.

A. How many articles do you actually read in each issue of HOT CoCo?
- ☐ 1. 1–3
- ☐ 2. 4–7
- ☐ 3. 8–11
- ☐ 4. 11–15
- ☐ 5. Just the ads
- ☐ 6. Nothing

B. What type of program would you most like to see on an instant CoCo cassette? Check one only.
- ☐ 1. Music/Sound
- ☐ 2. Graphics
- ☐ 3. Games
- ☐ 4. Utilities
- ☐ 5. Education
- ☐ 6. Home/Personal
- ☐ 7. Science
- ☐ 8. Business
- ☐ 9. Other

C. Which of the following is most important to you in a $10 cassette loader? Check one only.
- ☐ 1. Number of programs
- ☐ 2. Selection of programs
- ☐ 3. Quality of programs
- ☐ 4. Technical support
- ☐ 5. Customer service
- ☐ 6. Other

D. Which of the following models do you own? Check all that apply.
- ☐ 1. 4K
- ☐ 2. 16K
- ☐ 3. 32K
- ☐ 4. 64K
- ☐ 5. MC-10
- ☐ 6. TDP 100
- ☐ 7. Dragon 64K
- ☐ 8. Extended Basic
- ☐ 9. Standard Basic

E. What peripherals and accessories do you plan to purchase during the next 12 months?
- ☐ 1. Printer
- ☐ 2. Modem
- ☐ 3. Plotter
- ☐ 4. Joystick/Paddles/Graphic Tablet
- ☐ 5. Voice Synthesizer
- ☐ 6. Program Recorder
- ☐ 7. Expansion Bus
- ☐ 8. Disk Drive
- ☐ 9. Furniture/Storage

F. What types of software do you plan to purchase during the next 12 months?
- ☐ 1. Business
- ☐ 2. Education: Preschool-3rd
- ☐ 3. Education: 4th-8th
- ☐ 4. Education: High School +
- ☐ 5. Hobby/Game
- ☐ 6. Home Management/Finance
- ☐ 7. Utility/Programming
- ☐ 8. Scientific/Other Technical
- ☐ 9. Other

G. Which of the following publications do you read monthly?
- ☐ 1. HOT CoCo
- ☐ 2. 80 Micro
- ☐ 3. Rainbow
- ☐ 4. Color Computer Magazine
- ☐ 5. Micro
- ☐ 6. Computer User
- ☐ 7. Color Micro Journal

H. Do you own a cassette recorder (VCR)?
- ☐ 1. Yes
- ☐ 2. No

I. Do you think HOT CoCo is geared to: (check 3)
- ☐ 1. Novices
- ☐ 2. Moderately skilled programmers
- ☐ 3. Assembly-language programmers
- ☐ 4. Hardware buffs
- ☐ 5. Game players
- ☐ 6. Disk users
- ☐ 7. Extended basic users
- ☐ 8. Color basic users

J. On a scale of 1 (no interest) to 5 (great interest) rate your interest in the following HOT CoCo columns:
- _ 1. The Basic Beat
- _ 2. Elmer's Arcade
- _ 3. Digressions
- _ 4. Reviews
- _ 5. Reader's Forum
- _ 6. Doctor ASCII
- _ 7. Product News
- _ 8. Graphically Speaking
- _ 9. Re:FLEX
- _ 10. The Educated Guest

K. If you are not a subscriber circle 500.

Reader Service: Return this card to receive full information on the products advertised in this issue. Refer to the ad. You will find numbers near the logo of each advertiser. Each represents the advertiser's individual Reader Service number. Circle the corresponding numbers on the card on this page. Include your name, address & zip, and drop in a mailbox. In 4–6 weeks you'll hear from the advertiser directly.

1	6	11	16	21	151	156	161	166	171	301	306	311	316	321	451	456	461	466	471
2	7	12	17	22	152	157	162	167	172	302	307	312	317	322	452	457	462	467	472
3	8	13	18	23	153	158	163	168	173	303	308	313	318	323	453	458	463	468	473
4	9	14	19	24	154	159	164	169	174	304	309	314	319	324	454	459	464	469	474
5	10	15	20	25	155	160	165	170	175	305	310	315	320	325	455	460	465	470	475
26	31	36	41	46	176	181	186	191	196	326	331	336	341	346	476	481	486	491	496
27	32	37	42	47	177	182	187	192	197	327	332	337	342	347	477	482	487	492	497
28	33	38	43	48	178	183	188	193	198	328	333	338	343	348	478	483	488	493	498
29	34	39	44	49	179	184	189	194	199	329	334	339	344	349	479	484	489	494	499
30	35	40	45	50	180	185	190	195	200	330	335	340	345	350	480	485	490	495	500
51	56	61	66	71	201	206	211	216	221	351	356	361	366	371	501	506	511	516	521
52	57	62	67	72	202	207	212	217	222	352	357	362	367	372	502	507	512	517	522
53	58	63	68	73	203	208	213	218	223	353	358	363	368	373	503	508	513	518	523
54	59	64	69	74	204	209	214	219	224	354	359	364	369	374	504	509	514	519	524
55	60	65	70	75	205	210	215	220	225	355	360	365	370	375	505	510	515	520	525
76	81	86	91	96	226	231	236	241	246	376	381	386	391	396	526	531	536	541	546
77	82	87	92	97	227	232	237	242	247	377	382	387	392	397	527	532	537	542	547
78	83	88	93	98	228	233	238	243	248	378	383	388	393	398	528	533	538	543	548
79	84	89	94	99	229	234	239	244	249	379	384	389	394	399	529	534	539	544	549
80	85	90	95	100	230	235	240	245	250	380	385	390	395	400	530	535	540	545	550
101	106	111	116	121	251	256	261	266	271	401	406	411	416	421	551	556	561	566	571
102	107	112	117	122	252	257	262	267	272	402	407	412	417	422	552	557	562	567	572
103	108	113	118	123	253	258	263	268	273	403	408	413	418	423	553	558	563	568	573
104	109	114	119	124	254	259	264	269	274	404	409	414	419	424	554	559	564	569	574
105	110	115	120	125	255	260	265	270	275	405	410	415	420	425	555	560	565	570	575
126	131	136	141	146	276	281	286	291	296	426	431	436	441	446	576	581	586	591	596
127	132	137	142	147	277	282	287	292	297	427	432	437	442	447	577	582	587	592	597
128	133	138	143	148	278	283	288	293	298	428	433	438	443	448	578	583	588	593	598
129	134	139	144	149	279	284	289	294	299	429	434	439	444	449	579	584	589	594	599
130	135	140	145	150	280	285	290	295	300	430	435	440	445	450	580	585	590	595	600

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older CoCo disk controller, you can modify it by cutting lands and adding jumpers so that the power comes from the drive. The CoCo 2 can also be upgraded to 64K in very much the same fashion as the F board CoCo.

```
        ORG   $3768
MAP0    EQU   $FFDE
MAP1    EQU   $FFDF
START   ORCC  #$50          INHIBIT INTERRUPTS
        LDX   #$8000
LOOP    LDA   0,X           64K ROUTINE
        STA   MAP1
        STA   0,X+
        STA   MAP0
        CMPX  #$FF00
        BLT   LOOP
        STA   MAP1
        LDA   #$7E          SKIP SAM PROGRAMMING
        STA   $A051         (PATCH TO BASIC)
        LDD   #$A072
        STD   $A052
        LDD   #$8E9F        SKIP SCAN FOR RAM SIZE
        STD   $A084         (PATCH TO BASIC)
        LDD   #$FE7E
        STD   $A086
        LDD   #$A093
        STD   $A088
        CLR   $8000         KILL EXTENDED BASIC
        CLR   $71           FORCE HARD START
        LDA   #$F0          GREEN SCREEN
        STA   $2FDF
        LDA   #41           1,200-BAUD RATE
        STA   $30D2
        ANDC  #$AF
        LDA   #$7E
        STA   $A0CB         JUMP TO TELEWRITER 1.0
        LDD   #$1E2E        (PATCH TO BASIC)
        STD   $A0CC
        JMP   $A027         JUMP TO BASIC
        END   START
```

Program Listing 3. Patch to Clear More RAM for Telewriter 1.0 Files

To tell you the truth, I've never used a Radio Shack computer cassette tape, but have always shopped for el-cheapo cassettes as long as they had screws to hold their shells together. You can hide the fact that you paid so little by putting Radio Shack labels on them (cat. no. 26-304, a package of 60 costs $1.95). I always start a program CSAVE after using MOTORON to advance the tape until the tape counter has reached eight to skip past the leader and then some, since bad spots are usually at the beginning of the tape near the splice. This is also a good idea with the leaderless tapes because fingerprints and creases tend to occur at the beginning of those tapes, leading to a loss of data or the program.

Instead of typing MOTOROFF to stop the tape advance, I hit any key followed with the enter key. This causes a syntax error (which in this case can be ignored), but it does the job with less typing. Since I always buy the tapes with screws, if I do get a tape with a bad spot, I can open the cartridge and cut that piece out. Even if you don't trust the el cheapos, you can buy a quality audio tape such as a Maxell UD C-90 and use the tape that comes inside it to make your own high-quality leaderless C-10 tapes using only the plastic shells of the el-cheapo cassettes.

Q. How can I achieve more than 32K on my 64K machine? I would like the extra space when using Telewriter 1.0.

Mark Eichman
Manteca, CA

A. If you are willing to forego Extended Basic (with Telewriter 1.0, this is no problem), "40K Color Basic" (*80 Micro*, May 1983, p. 212) will give you 8K extra. Using this principle, you can combine the 40K program and Telewriter into one program (Program Listing 3). Spectrum Projects (93-15 86th Drive, Woodhaven, NY 11421) markets 40K, $9.95, that relocates Extended Basic to give you an extra 8K without losing Extended Basic.

Since Telewriter does not use Extended Basic, as with the 40K Color Basic program, you can free up that space for RAM. This increases the text buffer from 18,500 to 26,692 bytes, an increase from 9 to 13 pages. I did not like the white screen display because of the color fringing on my TV, so I changed it to green with this program. I also set the default baud rate to 1,200 for my LP VIII. After you load Telewriter 1.0 and the object-code version of the following Assembly-language patch into memory, you can save the revised program by typing CSAVEM"TELEWR64", &H1E28,&H37BA,&H3768.

For those of you who do not have an assembler, use the Basic POKE routine in Program Listing 4. The last number, 41, in line 130 is the baud-rate constant. If you do not normally print at 1,200 baud, change it to the appropriate value. If you have Extended Basic, first PCLEAR1, then run this program, and finally save the revised version of Telewriter 1.0 to tape with CSAVEM"TELEWR64", &H1E28,&H37BA,&H3768 as before. ■

```
10 FOR I= 14184  TO  14266
20 READ X
30 POKE I,X
40 NEXT I
60 DATA  26, 80, 142, 128, 0, 16
6, 132, 183
70 DATA  255, 223, 167, 128, 183
, 255, 222, 140
80 DATA  255, 0, 45, 241, 183, 2
55, 223, 134
90 DATA  126, 183, 160, 81, 204,
 160, 114, 253
100 DATA  160, 82, 204, 142, 159
, 253, 160, 132
110 DATA  204, 254, 126, 253, 16
0, 134, 204, 160
120 DATA  147, 253, 160, 136, 12
7, 128, 0, 15
130 DATA  113, 134, 240, 183, 47
, 223, 134, 41
140 DATA  183, 48, 210, 28, 175,
 134, 126, 183
150 DATA  160, 203, 204, 30, 46,
 253, 160, 204
160 DATA  126, 160, 39, 255, 255
, 255, 255, 255
```

Program Listing 4. Basic Version of Listing 3

Graphically Speaking

Two-Dimensional Drawing

by Delmar E. Searls

Using the right techniques, you can create graphics with exciting applications in science, business, and mathematics. Schematics, illustrations, and pictographs can add emphasis and clarify ideas. This month's column deals with the graphics techniques of scaling, translation, rotation, clipping, and covering.

Transformations

February's Graphically Speaking considered graphing functions on a rectangular-coordinate system. I developed a simple clipping routine and explained the transformations of scaling and translation using an image of a fixed plane. The graph was drawn on this plane and you viewed it from above by a remote-control camera. As you moved the camera nearer or farther from the plane, scaling occurred. As you moved laterally, you got translation.

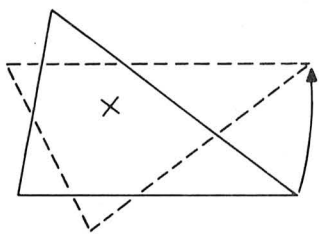

Fig. 1. The rotation of an object when the origin, or pivot point, is within the boundaries of the object.

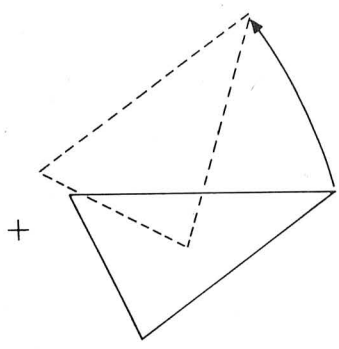

Fig. 2. The rotation of an object when the origin is not within the boundaries of the object.

Imagine now that the screen-coordinate system is a fixed drawing board on which you can move two-dimensional objects. Since you are only concerned with the object's screen coordinates, you do not need to keep track of two coordinate systems as you did before.

With the screen-coordinate system fixed, use the following conversions for scaling and translation:

Scaling: X = X*XS, Y = Y*YS

Translation: X = X + XT, Y = Y + YT

XS and YS are the scaling factors and XT and YT are the translation distances. You can describe an object by identifying the coordinates of its vertices. To scale the object, you must transform each vertex by multiplying the original coordinates by the scaling factors. In a similar fashion, if you add the translation distances to the original coordinates, you can move the object laterally (or translate it).

To look at the transformation of rotation, consider the object in Fig. 1. As initially described (solid lines), the vertices show that its origin (indicated by +) is centered within the object. Because rotations are performed relative to the origin, this object is rotated about its central point (dotted lines).

Now, consider Fig. 2. This object is initially described as using vertices that place its origin some distance from the center (solid lines). When Fig. 2 is rotated, you get unexpected results (dotted lines). Usually, when describing objects, you place the origin at or near its center.

Figure 3 shows the transformations needed for rotation; they are based on trigonometry. You can express rectangular coordinates in terms of the corresponding polar coordinates by the formulas X = R*COS(T) and Y = R*SIN(T), where R is the distance from the point to the origin, and T is the angle made with respect to the positive x axis. The rest of the derivation is based on the formulas for the sine and cosine of the sum of two angles:

SIN(T + A) = SIN(T)*COS(A) + COS(T)* SIN(A),

COS(T + A) = COS(T)*COS(A) – SIN(T)* SIN(A).

If the original point has coordinates (X,Y), then the transformed point has coordinates (X*COS(A) – Y*SIN(A), Y*COS(A) + X*SIN(A)), where A is the angle of rotation.

The order in which you perform transformations is important since the same transformations applied in different orders produce different results. Although you can write each transformation as a separate subroutine and call them in any order, I chose to perform the transformations in these programs by rotation, translation, and scaling.

Clipping

You previously performed clipping

System Requirements

16K RAM
Extended Color Basic
Dot-Matrix Printer

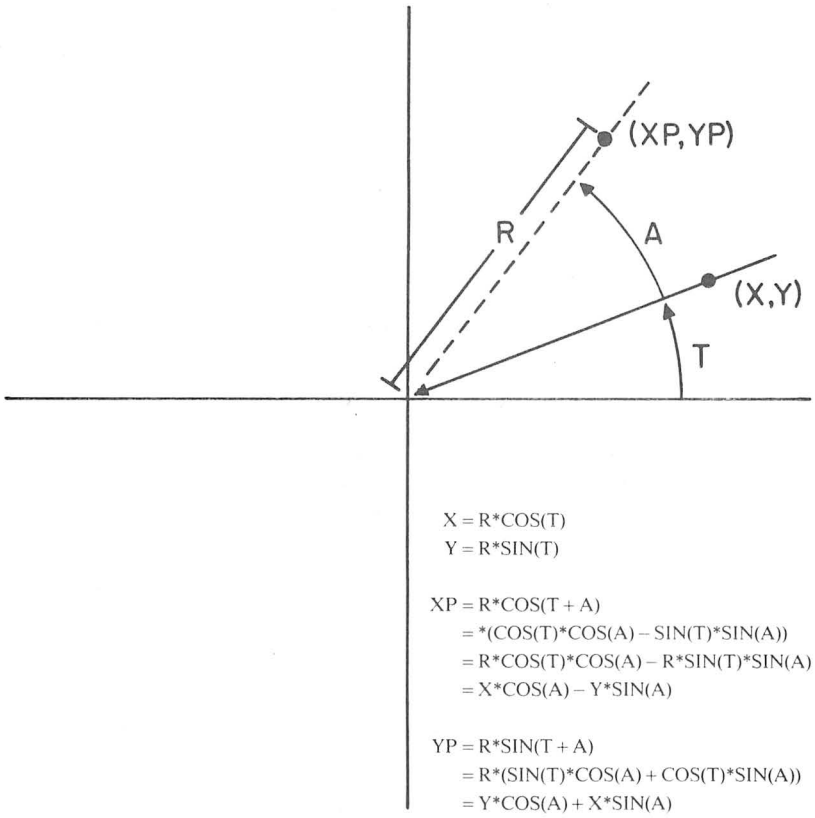

Fig. 3. These rotation transformation equations are based on trigonometry. (X, Y) is the original point and (XP, YP) is the transformed point.

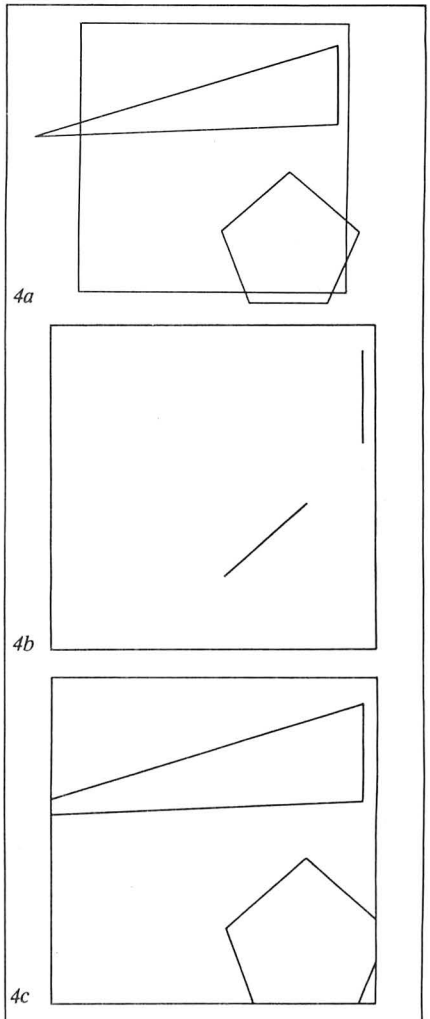

Fig. 4. A triangle and a pentagon as viewed through a square window. The crude clipping algorithm used earlier for drawing graphs is inadequate here (4b). You need a clipping routine that removes only those portions of line segments actually beyond the borders of the viewing window (4c).

by discarding any line having either endpoint outside the viewing area. When graphing functions made up of many short line segments, this was no real problem. With drawings, however, the situation is different. In Fig. 4a, you see a triangle and a pentagon (the two-dimensional objects), and a square representing the window or viewing area. If you clip the objects using the old method, the result resembles Fig. 4b. This is unsatisfactory. A better clipping scheme produces the result shown in Fig. 4c.

Let's look at a common clipping algorithm. A rectangular window is defined having sides parallel to the coordinate axes (see Fig. 5). Each side extends in both directions dividing the plane into nine regions. Each drawn line must lie within the middle region, which is the window. (The window's boundaries are considered part of the window.)

Think of the eight outer regions as walls that hide the view. When you create a drawing, its line segments are handled one at a time. You classify the endpoints according to their location relative to the nine regions.

Use XC to denote the classification of the x coordinate of a point, and YC to denote the classification of the y coordinate. If a point lies to the left of the window then XC = –1, between the vertical sides then XC = 0, and to the right of the window then XC = +1. Similarly, if a point lies below the window then YC = –1, between the horizontal sides then YC = 0, and above the window then YC = +1.

If you classify the coordinates in this manner it is easier to deal with the cases that arise, which Fig. 5 illustrates. If both endpoints lie in the window then XC(0) = 0, YC(0) = 0, XC(1) = 0, and YC(1) = 0 (line CD in Fig. 6). The endpoints and the corresponding classifications are stored in arrays using the subscripts zero and one. A pair of endpoints with the same nonzero classification for either the x or y coordinates form a line segment totally outside the window (line AB in Fig. 6). You can immediately discard them. This condition occurs if either XC(0)*XC(1) = 1 or YC(0)*YC(1) = 1. (Remember, (–1)*(–1) = 1.) Cases

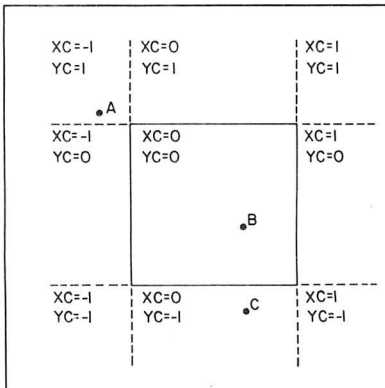

Fig. 5. A common clipping algorithm is based on classifying each of the two endpoints using the scheme shown (or one similar). For point A: XC = –1, YC = 1. For point B: XC = 0, YC = 0. For point C: XC = 0, YC = –1.

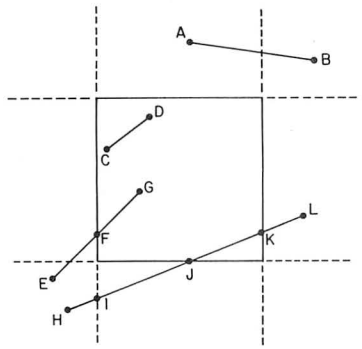

Fig. 6. Points A and B both have a y classification (YC) of +1. Thus the entire line segment AB lies outside the viewing window (see text). For line segment CD, the classifications are all zeros, indicating that the entire line segment lies within the window. Segment EG would be clipped to FG. Segment HL would be clipped to IL, then to JL, and finally to JK.

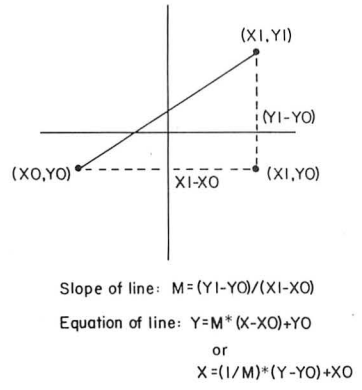

Fig. 7. You can determine the slope of a line (or line segment) by using any two distinct points on the line.

other than these two require additional processing.

The procedure is the same for each endpoint. If the point is to the left of the window it is moved to the extended left border and reclassified. Otherwise, if the point is to the right of the window, it is moved to the extended right border and reclassified. If the point is above the window, it is moved down to the top border and reclassified, and if the point is below the window it is moved up to the bottom edge and reclassified.

Following each reclassification the new endpoint is checked to see if it lies within the window (in which case the next endpoint is processed), or if a line segment extends outside of the window. If neither case is true, the endpoint reenters the procedure outlined above.

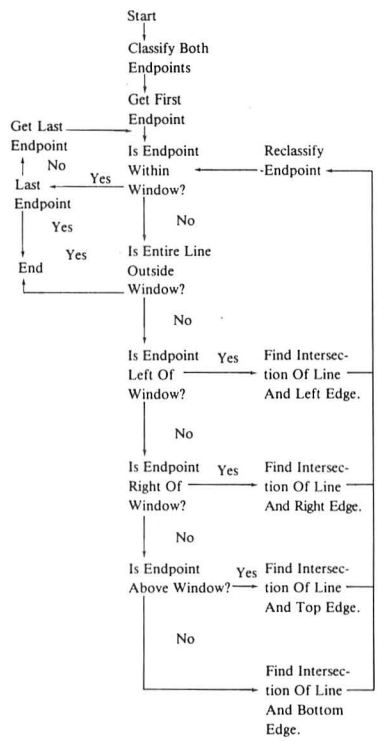

Table 1. The Clipping Algorithm

The flowchart in Table 1 illustrates this procedure, and Fig. 6 provides examples. Notice that the clipping routine determines the points (if any) at which a line segment intersects the perimeter of a rectangle.

In algebra, a line is the graph of any equation of the form $A*X+B*Y+C=0$, where only one variable, either A or B, equals zero. You can write this equation in two more useful forms:

$Y = M*(X-X0)+Y0$, and
$X = (1/M)*(Y-Y0)+X0$.

In these equations M represents the slope of the line (see Fig. 7), and (X0, Y0) is any point on the line, possibly one of the endpoints. By using the endpoints to determine the slope of a line you obtain:

$M = (Y(1)-Y(0))/(X(1)-X(0))$, and
$1/M = (X(1)-X(0))/(Y(1)-Y(0))$.

If you incorporate these results into the previous equations, you get the following:

$Y = (Y(1)-Y(0))/(X(1)-X(0))*(X-X(0))+Y(0)$,
and
$X = (X(1)-X(0)/(Y(1)-Y0))*(Y-Y(0))+X(0)$.

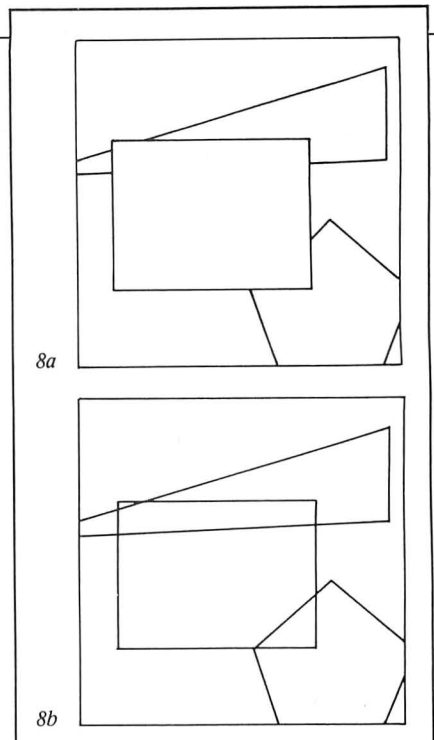

Fig. 8. Covering involves the removal of all portions of a figure within a rectangular cover.

Lines 75 and 90 of Program Listing 1 use the first equation to find the point at which the line segment crosses the left side (X = LX) or the right side (X = RX) of the window. Similarly, lines 105 and 115 use the second equation to determine where the line segment crosses the bottom (Y = BY) or the top (Y = TY) of the window.

Covering

While clipping eliminates everything outside a rectangular window, covering eliminates everything inside a rectangular cover (see Fig. 8). The net effect of the clipping routine was to determine at which points, if any, a line segment intersects the perimeter of a rectangle. You need precisely the same kind of information now. What you do with this information, however, is different.

The flowchart in Table 2 outlines the steps involved in covering. The covering subroutine includes lines 200–275 in Listing 1 and starts by storing the coordinates of the endpoints for later reference (they will probably be altered by the clipping subroutine, so store them first). The clipping subroutine is called in line 205 in order to classify the endpoints and to find any intersections with the rectangle.

If the original endpoints formed a line segment entirely outside the rec-

tangular cover, then the whole line segment is drawn (lines 210–225). The flag in line 210 is equal to one if this condition holds. Otherwise, if the first endpoint has been moved, indicating that it was originally outside the rectangle, the program draws a line between the original point and the point of intersection with the rectangular cover (lines 235–250). Similarly, if the second endpoint has been moved, the program draws a line segment from the original point to the point of intersection with the cover (lines 255–270). If neither endpoint has been moved, both endpoints were within the rectangle and a line segment is not drawn.

Putting It Together

Listing 1 incorporates all the features you have seen. Here is an outline of the program:

I. Gather the data
  A. The coordinates of the points
  B. The dot sequences (connecting points)

II. Gather user input
  A. Clipping (yes or no?)
    1. Get window boundaries
    2. Draw boundaries if desired
  B. Covering (yes or no?)
    1. Get cover boundaries
    2. Draw boundaries if desired
  C. Get rotation angle
  D. Get translation distances
  E. Get scaling factors

III. Create drawing
  A. Transform point coordinates
  B. Call clipping, if necessary
  C. Call covering, if necessary
  D. Draw line segments

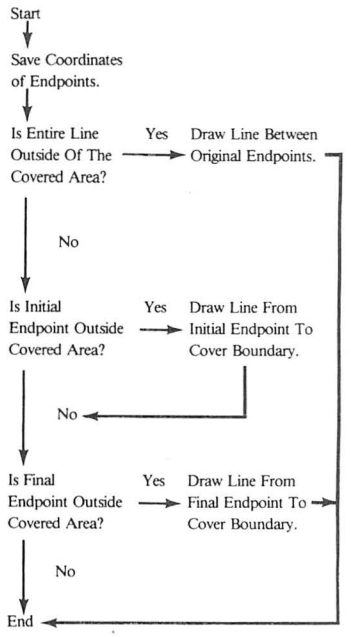

Table 2. The Covering Algorithm.

Program Listing 1. This program draws two-dimensional objects on the high-resolution graphics screen of the Color Computer. These features: clipping, covering, rotation, translation, and scaling, are included. The coordinates of the points, and the dot-to-dot sequences are stored in DATA statements starting at line 4000.

```
10 PI=3.141592:GOSUB11:GOTO1000:
11 INPUT"SCALE FACTOR <1.25>";SF
:PMODE4,1:PCLS:IF SF=0 THEN SF=1
.25
12 RETURN
17 :
18 REM - FIND NUMBER OF NEXT POI
NT IN SEQUENCE
19 :
20 PN=VAL(LEFT$(A$,2)):A$=RIGHT$
(A$,LEN(A$)-2):RETURN
30 LINE(RX,BY)-(RX,TY),PSET
31 LINE -(LX,TY),PSET
32 LINE -(LX,BY),PSET
33 LINE -(RX,BY),PSET
34 RETURN
37 :
38 REM - FIND STATUS OF POINT RE
LATIVE TO BOUNDARIES
39 :
40 IF X(J)<LX THEN XC(J)=-1 ELSE
 IF X(J)>RX THEN XC(J)=1 ELSE XC
(J)=0
41 IF Y(J)<BY THEN YC(J)=-1 ELSE
 IF Y(J)>TY THEN YC(J)=1 ELSE YC
(J)=0
42 RETURN
47 :
48 REM **** CLIPPING SUBROUTINE
****
49 :
50 FOR J=0 TO 1:GOSUB 40:NEXT J
55 FOR J=0 TO 1
60 :  IF XC(J)=0 AND YC(J)=0 THE
N 125
65 :  IF XC(0)*XC(1)=1 OR YC(0)*
YC(1)=1 THEN F3=1:GOTO 135
70 :  IF XC(J)<>-1 THEN 85
75 :  Y(J)=(Y(1)-Y(0))/(X(1)-X(0
))*(LX-X(0))+Y(0)
80 :  X(J)=LX:GOSUB 40:GOTO 60
85 :  IF XC(J)<>1 THEN 100
90 :  Y(J)=(Y(1)-Y(0))/(X(1)-X(0
))*(RX-X(0))+Y(0)
95 :  X(J)=RX:GOSUB 40:GOTO 60
100 :  IF YC(J)<>-1 THEN 115
105 :  X(J)=(X(1)-X(0))/(Y(1)-Y(
0))*(BY-Y(0))+X(0)
110 :  Y(J)=BY:GOSUB 40:GOTO 60
115 :  X(J)=(X(1)-X(0))/(Y(1)-Y(
0))*(TY-Y(0))+X(0)
120 :  Y(J)=TY:GOSUB 40:GOTO 60
125 NEXT J
130 F3=0
135 RETURN
197 :
198 REM **** COVERING SUBROUTINE
 ****
199 :
200 T1=X(0):T2=Y(0):T3=X(1):T4=Y
(1)
205 GOSUB 50
210 IF F3<>1 THEN 235
215 X0=128+INT(SF*T1+.5):Y0=96-I
NT(T2+.5)
220 X1=128+INT(SF*T3+.5):Y1=96-I
NT(T4+.5)
225 LINE(X0,Y0)-(X1,Y1),PSET
230 GOTO 275
235 IF X(0)=T1 AND Y(0)=T2 THEN
255
240 X0=128+INT(SF*X(0)+.5):Y0=96
-INT(Y(0)+.5)
245 X1=128+INT(SF*T1+.5):Y1=96-I
NT(T2+.5)
250 LINE(X0,Y0)-(X1,Y1),PSET
255 IF X(1)=T3 AND Y(1)=T4 THEN
275
260 X0=128+INT(SF*T3+.5):Y0=96-I
NT(T4+.5)
265 X1=128+INT(SF*X(1)+.5):Y1=96
-INT(Y(1)+.5)
270 LINE(X0,Y0)-(X1,Y1),PSET
275 RETURN
997 :
998 REM **** READ DATA ****
999 :
1000 READ NP:DIM P(1,NP),T(1,NP)
1010 FOR I=1 TO NP
1020 :  READ P(0,I),P(1,I): REM
- READ COORDINATES
1030 NEXT I
1040 READ NS:DIM S$(NS)
1050 FOR I=1 TO NS
1060 :  READ S$(I): REM - READ D
OT SEQUENCES
1070 NEXT I
1997 :
1998 REM **** GET USER INPUT ***
*
1999 :
2000 CLS:INPUT "DO YOU WANT CLIP
PING <Y>";A$
2010 IF A$="N" THEN F1=0:GOTO 21
60 ELSE F1=1
2020 CLS:PRINT"INPUT WINDOW BOUN
DARIES"
2030 PRINT:PRINT"THE DEFAULT WIN
DOW IS THE ENTIRE"
2040 PRINT"SCREEN.  DO YOU WANT
THE DEFAULT"
2050 INPUT "WINDOW <Y>";A$
2060 IF LEFT$(A$,1)="N" THEN 208
0
2070 LS=-100:RS=100:BS=-95:TS=95
:GOTO 2120
2080 PRINT:INPUT "LEFT SIDE";LS
2090 PRINT:INPUT "RIGHT SIDE";RS
2100 PRINT:INPUT "BOTTOM";BS
2110 PRINT:INPUT"TOP";TS
2120 PRINT:INPUT "DRAW WINDOW BO
UNDARIES <Y>";A$:IF A$="N" THEN
2160
2130 LX=128+INT(SF*LS+.5):RX=128
+INT(SF*RS+.5)
2140 BY=96-BS:TY=96-TS
2150 GOSUB 30
2160 CLS:INPUT "DO YOU WANT COVE
RING <Y>";A$
2170 IF A$="N" THEN F2=0:GOTO 22
60 ELSE F2=1
2180 PRINT:INPUT "LEFT SIDE";LC
2190 PRINT:INPUT "RIGHT SIDE";RC
2200 PRINT:INPUT "BOTTOM";BC
2210 PRINT:INPUT "TOP";TC
2220 PRINT:INPUT "DRAW COVER BOU
NDARIES <Y>";A$:IF A$="N" THEN 2
260
2230 LX=128+INT(SF*LC+.5):RX=128
+INT(SF*RC+.5)
2240 BY=96-BC:TY=96-TC
2250 GOSUB 30
2260 CLS:INPUT "DEGREES ROTATION
 <0>";A
2270 A=PI*A/180:CA=COS(A):SA=SIN
(A)
2280 PRINT:INPUT "HORIZONTAL TRA
NSLATION <0>";XT
2290 PRINT:INPUT "VERTICAL TRANS
LATION <0>";YT
2300 PRINT:INPUT "SCALE FACTOR,
X-AXIS <1>";XS:IF XS=0 THEN XS=1
2310 PRINT:INPUT "SCALE FACTOR,
Y-AXIS <1>";YS:IF YS=0 THEN YS=1
2320 SCREEN1,0
2330 POKE 65495,0
2995 :
2996 REM **** DRAW FIGURE ****
2997 :
2998 REM - TRANSFORM POINT COORD
INATES
2999 :
3000 FOR I=1 TO NP
3010 :  T(0,I)=((P(0,I)*CA-P(1,I
```

Listing 1 continued

Listing 1 continued

```
)*SA)+XT)*XS
3020 :  T(1,I)=((P(1,I)*CA+P(0,I
)*SA)+YT)*YS
3030 NEXT I
3037 :
3038 REM - MAIN DRAWING LOOP
3039 :
3040 FOR I=1 TO NS
3050 :  A$=S$(I)
3060 :  GOSUB20:IP=PN: REM - # O
F FIRST POINT IN CURRENT LINE
3070 :  GOSUB20:FP=PN: REM - # O
F SECOND POINT
3077 :
3078 REM - GET COORDINATES OF EN
D POINTS
3079 :
3080 :  X(0)=T(0,IP):X(1)=T(0,FP
):Y(0)=T(1,IP):Y(1)=T(1,FP)
3090 :  IF F1=0 THEN 3130: REM -
 CLIPPING IN EFFECT ?
3100 :  LX=LS:RX=RS:BY=BS:TY=TS:
 REM - GET WINDOW BOUNDARIES
3110 :  GOSUB 50: REM - CLIPPING
 SUBROUTINE
3120 :  IF F3=1 THEN 3200: REM -
 WHOLE LINE OUTSIDE WINDOW ?
3130 :  IF F2=1 THEN 3180: REM -
 COVERING IN EFFECT ?
3140 :  X0=128+INT(SF*X(0)+.5):Y
0=96-INT(Y(0)+.5)
3150 :  X1=128+INT(SF*X(1)+.5):Y
1=96-INT(Y(1)+.5)
3160 :  LINE(X0,Y0)-(X1,Y1),PSET
3170 :  GOTO 3200
3180 :  LX=LC:RX=RC:BY=BC:TY=TC:
 REM - GET COVER BOUNDARIES
3190 :  GOSUB 200: REM - COVERIN
G SUBROUTINE
3200 :  IF A$="" THEN 3220: REM
- FINISHED THE SEQUENCE ?
3210 :  IP=FP:GOTO 3070: REM - F
INAL PT. BECOMES NEW INTIAL PT.
3220 NEXT I
3230 POKE 65494,0
3240 SOUND 150,2
3250 A$=INKEY$:IF A$="" THEN 325
0
3260 CLS
3270 INPUT "DRAW ANOTHER <Y>";A$
3280 IF A$<>"" AND A$<>"Y" THEN
3320
3290 PRINT:INPUT "ERASE SCREEN <
Y>";A$
3300 IF A$<>"N" THEN PCLS
3310 GOTO 2000
3320 END
3995 :
3996 REM **** DATA ****
3997 :
3998 REM - NUMBER OF POINTS
3999 :
4000 DATA 10
4007 :
4008 REM - POINT COORDINATES
4009 :
4010 DATA 40,0,20,35,-20,35,-40,
0,-20,-35,20,-35,45,5,45,-5,35,-
5,35,5
4097 :
4098 REM - NUMBER OF DOT SEQUENC
ES
4099 :
4100 DATA 7
4107 :
4108 REM - DOT SEQUENCES STORED
AS STRINGS
4109 :
4110 DATA 01020304050601
4120 DATA 01030501
4130 DATA 02040602
4140 DATA 0104
4150 DATA 0205
4160 DATA 0306
4170 DATA 0708091007
```

END

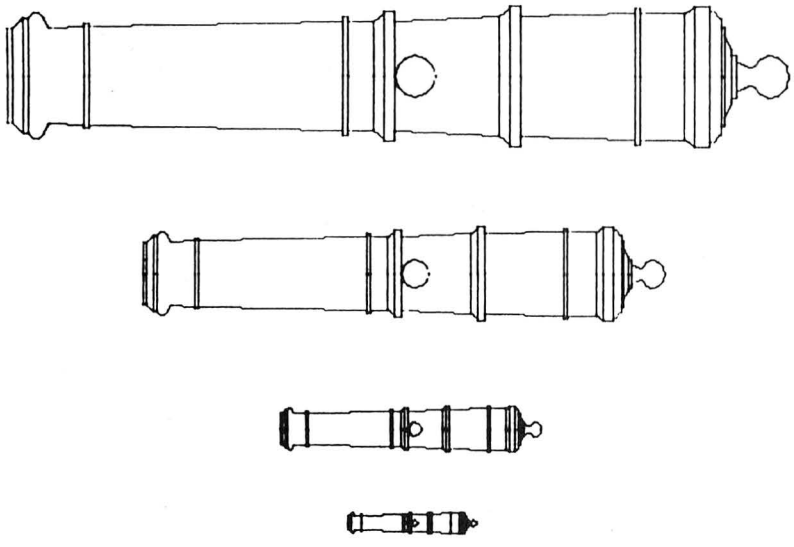

Fig. 9. These cannons were drawn on the Color Graphics Printer by taking advantage of symmetry. The data values were determined for the upper half of the cannon and placed in DATA statements. The bottom half of the cannon is drawn by modifying the program to go through the data list a second time and negating all of the y coordinates. Scaling was used to vary the size of the cannons.

In order to make the program run as fast as possible, I deviated from my practice of using a PLOT subroutine to draw line segments, and instead incorporated the LINE command. The main program starts at lines 1000–1070, which read the data stored at lines 4000 and beyond. User input is obtained in lines 2000–2310. Default values are included wherever appropriate. Clipping and covering are optional.

If you do not use clipping and your drawing exceeds the screen area, you get a function-call (FC) error when you try to draw to a point off the screen. It is possible to call points below the screen, up to a certain limit, without getting an FC error. This program uses a common speedup technique that is turned on in line 2330 and turned off in line 3230. (You might not want to include these lines until you have verified that the program has been correctly entered and is running properly.)

Lines 3000–3030 transform the coordinates of every point and store the transformed coordinates in arrays T(0,N) (the x coordinates) and T(1,N) (the y coordinates). N is the number of points. Each point is numbered in the same order as listed in the DATA statements. The dot sequences are strings consisting of two-digit numbers identifying the corresponding point. For example, the string 010412150801 denotes a figure drawn by connecting points in the following sequence: 1–4–12–15–8–1.

Line 3050 reads the dot sequences one at a time. Lines 3060 and 3070 strip the numbers of the first two points from the string and call them the initial point (IP) and the final point (FP) of the first line segment of that sequence. The subroutine in line 20 returns the value of the first two characters in the string as PN (point number) and strips those characters from the string in preparation for a subsequent call.

Line 3080 stores the coordinates of the points numbered IP and FP at X(0),Y(0) and X(1),Y(1) respectively. If you want clipping, the window boundaries are set and the clipping subroutine called. If the resulting line segment is totally outside the window, the next line segment is processed (line 3120). Otherwise, the program determines whether covering is desired (line 3130). If so, the cover boundaries are

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Program Listing 2. You can use this program, adapted from Listing 1, for drawing two-dimensional objects on the Color Graphics Printer.

```
10 PI=3.141592:GOSUB11:GOTO1000:
11 PRINT#-2,CHR$(18):PRINT#-2,"A
":PRINT#-2,CHR$(18):PRINT#-2,"M2
40,-240":PRINT#-2,"I"
12 RETURN
17 :
18 REM - FIND NUMBER OF NEXT POI
NT IN SEQUENCE
19 :
20 PN=VAL(LEFT$(A$,2)):A$=RIGHT$
(A$,LEN(A$)-2):RETURN
27 :
28 REM - DRAW WINDOW OR COVER BO
UNDARIES
29 :
30 PRINT#-2,"M";RX;",";BY
31 PRINT#-2,"D";RX;",";TY;",";LX
;",";TY;",";LX;",";BY;",";RX;","
;BY
34 RETURN
37 :
38 REM - FIND STATUS OF POINT RE
LATIVE TO BOUNDARIES
39 :
40 IF X(J)<LX THEN XC(J)=-1 ELSE
 IF X(J)>RX THEN XC(J)=1 ELSE XC
(J)=0
41 IF Y(J)<BY THEN YC(J)=-1 ELSE
 IF Y(J)>TY THEN YC(J)=1 ELSE YC
(J)=0
42 RETURN
47 :
48 REM **** CLIPPING SUBROUTINE
****
49 :
50 FOR J=0 TO 1:GOSUB 40:NEXT J
55 FOR J=0 TO 1
60 :  IF XC(J)=0 AND YC(J)=0 THE
N 125
65 :  IF XC(0)*XC(1)=1 OR YC(0)*
YC(1)=1 THEN F3=1:GOTO 135
70 :  IF XC(J)<>-1 THEN 85
75 :  Y(J)=(Y(1)-Y(0))/(X(1)-X(0
))*(LX-X(0))+Y(0)
80 :  X(J)=LX:GOSUB 40:GOTO 60
85 :  IF XC(J)<>1 THEN 100
90 :  Y(J)=(Y(1)-Y(0))/(X(1)-X(0
))*(RX-X(0))+Y(0)
95 :  X(J)=RX:GOSUB 40:GOTO 60
100 :  IF YC(J)<>-1 THEN 115
105 :  X(J)=(X(1)-X(0))/(Y(1)-Y(
0))*(BY-Y(0))+X(0)
110 :  Y(J)=BY:GOSUB 40:GOTO 60
115 :  X(J)=(X(1)-X(0))/(Y(1)-Y(
0))*(TY-Y(0))+X(0)
120 :  Y(J)=TY:GOSUB 40:GOTO 60
125 NEXT J
130 F3=0
135 RETURN
197 :
198 REM **** COVERING SUBROUTINE
 ****
199 :
200 T1=X(0):T2=Y(0):T3=X(1):T4=Y
(1)
205 GOSUB 50
210 IF F3<>1 THEN 235
215 X0=INT(T1+.5):Y0=INT(T2+.5)
220 X1=INT(T3+.5):Y1=INT(T4+.5)
225 GOTO 270
235 IF X(0)=T1 AND Y(0)=T2 THEN
255
240 X0=INT(X(0)+.5):Y0=INT(Y(0)+
.5)
245 X1=INT(T1+.5):Y1=INT(T2+.5)
250 PRINT#-2,"M";X0;",";Y0:PRINT
#-2,"D";X1;",";Y1
255 IF X(1)=T3 AND Y(1)=T4 THEN
275
260 X0=INT(T3+.5):Y0=INT(T4+.5)
265 X1=INT(X(1)+.5):Y1=INT(Y(1)+
.5)
270 PRINT#-2,"M";X0;",";Y0:PRINT
#-2,"D";X1;",";Y1
275 RETURN
997 :
998 REM **** READ DATA ****
999 :
1000 READ NP:DIM P(1,NP),T(1,NP)
1010 FOR I=1 TO NP
1020 :  READ P(0,I),P(1,I): REM
- READ COORDINATES
1030 NEXT I
1040 READ NS:DIM S$(NS)
1050 FOR I=1 TO NS
1060 :  READ S$(I): REM - READ D
OT SEQUENCES
1070 NEXT I
1997 :
1998 REM **** GET USER INPUT ***
*
1999 :
2000 CLS:INPUT "DO YOU WANT CLIP
PING <Y>";A$
2010 IF A$="N" THEN F1=0:GOTO 21
60 ELSE F1=1
2020 CLS:PRINT"INPUT WINDOW BOUN
DARIES"
2030 PRINT:PRINT"THE DEFAULT WIN
DOW IS THE ENTIRE"
2040 PRINT"SCREEN.  DO YOU WANT
THE DEFAULT"
2050 INPUT "WINDOW <Y>";A$
2060 IF LEFT$(A$,1)="N" THEN 208
0
2070 LS=-230:RS=230:BS=-230:TS=2
30:GOTO 2120
2080 PRINT:INPUT "LEFT SIDE";LS
2090 PRINT:INPUT "RIGHT SIDE";RS
2100 PRINT:INPUT "BOTTOM";BS
2110 PRINT:INPUT"TOP";TS
2120 PRINT:INPUT "DRAW WINDOW BO
UNDARIES <Y>";A$:IF A$="N" THEN
2160
2130 LX=LS:RX=RS
2140 BY=BS:TY=TS
2150 GOSUB 30
2160 CLS:INPUT "DO YOU WANT COVE
RING <Y>";A$
2170 IF A$="N" THEN F2=0:GOTO 22
60 ELSE F2=1
2180 PRINT:INPUT "LEFT SIDE";LC
2190 PRINT:INPUT "RIGHT SIDE";RC
2200 PRINT:INPUT "BOTTOM";BC
2210 PRINT:INPUT "TOP";TC
2220 PRINT:INPUT "DRAW COVER BOU
NDARIES <Y>";A$:IF A$="N" THEN 2
```

Listing 2 continued

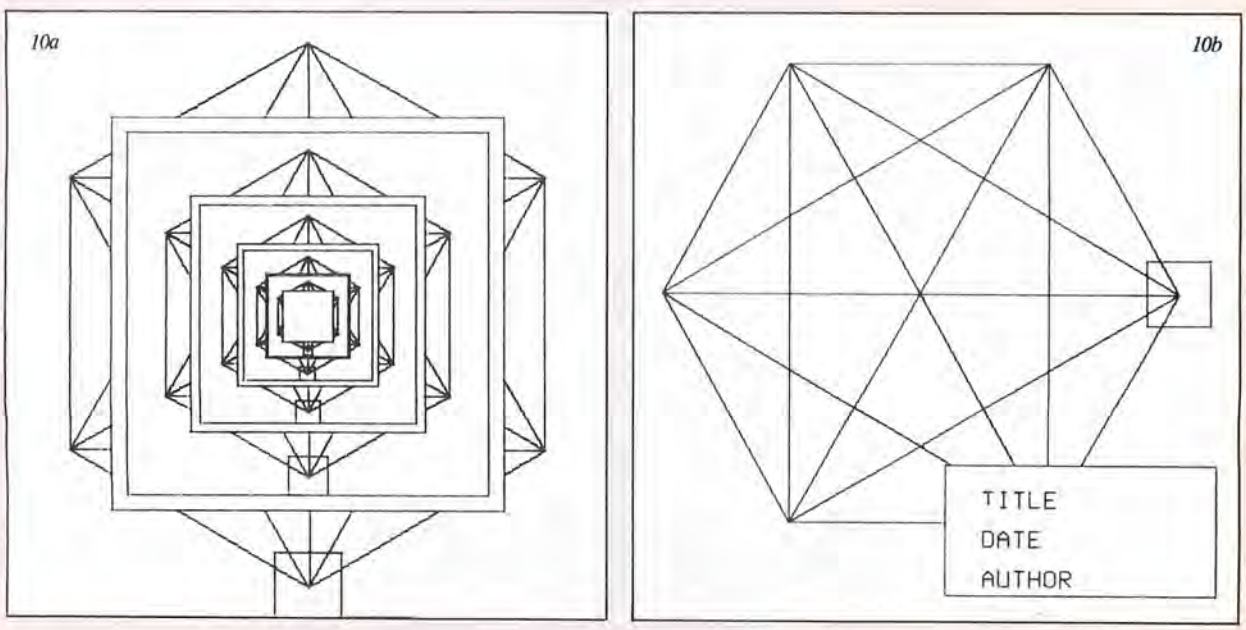

Fig. 10. Here are two examples from Program Listing 2. In Fig. 10a, covering was used to provide a clear area for drawing successively smaller images of the same design. Covering can also be used to provide space for text as in Fig. 10b.

of the hill!

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11a *11b*

Fig. 11. by slightly modifying Listing 2, you can draw contour maps. The hill at the upper-right of Fig. 11a is shown enlarged in Fig. 11b. This required translation (to center the hill) and scaling. The data was calculated by hand (a boring task) which accounts for the relatively crude contour lines.

set and the covering subroutine is called (lines 3180 and 3190). If not, the clipped line is drawn (lines 3140–3160).

Line 3200 checks to see if the current dot sequence has been completed. If so, A$ will have been stripped until nothing remains and the program goes to the next dot sequence (line 3220). Otherwise, the current final point becomes the new initial point (line 3210) and the number of the new final point is determined in line 3070 where the whole process repeats. The clipping subroutine (lines 50–135) and the covering subroutine (lines 200–275) I discussed earlier. The subroutine at lines 40–42 is the classification subroutine.

Some Final Comments

There are a few idiosyncracies in Listing 1. The clipping and covering subroutines work on one line segment at a time. The only data sent to these subroutines are the coordinates of the two endpoints. Consequently, the rest of the program is arbitrary and reflects my attempt at a program that illustrates the concepts of clipping and covering. There is certainly a variety of ways to get the necessary data besides using DATA statements.

Also, you do not need to transform every vertex at once and store the results in an array. You can transform the vertices as needed before calling the subroutines, and you can store the dot sequences as regular data, separated by commas, instead of strings of two-digit numbers.

You might use symmetry to reduce the number of vertices specified in the data. For example, if an object has symmetry about the x axis (see Fig. 9), you need only specify those points on or above the x axis. You can modify the program to loop through the drawing routine twice, taking the negative of each y coordinate on the second pass. This draws the lower half of the object without requiring additional data.

Several books dealing with computer graphics contain the algorithm presented here. It is simple and the resulting subroutine is short. Because it relies solely on the endpoint classifications to perform its task, it is also slow. An algorithm that takes into account both endpoint classification and line-segment classification (depending primarily on the slope of the line) can run 25 to 30 percent faster. The subroutine, however, is a little longer and the logic less obvious. Perhaps I'll consider such an alternative clipping subroutine in a future column.

You can modify Listing 1 to work on the Radio Shack Color Graphics Printer (see Program Listing 2) by replacing the LINE commands with the appropriate plotter commands. A LINE (X0,Y0)–(X1,Y1),PSET command can be replaced with PRINT #–2,"M";X0;",";Y0:PRINT#–2, "D";X1;",";Y1. In addition, you must include a short setup routine for the plotter in order to get it into graphics mode with the origin in the center of the paper. See Figs. 10 and 11 for some examples.

Looking Ahead

June's Graphically Speaking considers "wire-frame" two-dimensional representations of simple three-dimensional objects. See you then. ■

Write Delmar Searls c/o HOT CoCo, *Pine St., Peterborough, NH 03458.*

Listing 2 continued

```
260
2230 LX=LC:RX=RC
2240 BY=BC:TY=TC
2250 GOSUB 30
2260 CLS:INPUT "DEGREES ROTATION
 <0>";A
2270 A=PI*A/180:CA=COS(A):SA=SIN
(A)
```

Listing 2 continued

Listing 2 continued

```
2280 PRINT:INPUT "HORIZONTAL TRA
NSLATION <0>";XT
2290 PRINT:INPUT "VERTICAL TRANS
LATION <0>";YT
2300 PRINT:INPUT "SCALE FACTOR,
X-AXIS <1>";XS:IF XS=0 THEN XS=1
2310 PRINT:INPUT "SCALE FACTOR,
Y-AXIS <1>";YS:IF YS=0 THEN YS=1
2995 :
2996 REM **** DRAW FIGURE ****
2997 :
2998 REM - TRANSFORM POINT COORD
INATES
2999 :
3000 FOR I=1 TO NP
3010 :  T(0,I)=((P(0,I)*CA-P(1,I
)*SA)+XT)*XS
3020 :  T(1,I)=((P(1,I)*CA+P(0,I
)*SA)+YT)*YS
3030 NEXT I
3037 :
3038 REM - MAIN DRAWING LOOP
3039 :
3040 FOR I=1 TO NS
3050 :  A$=S$(I)
3060 :  GOSUB20:IP=PN: REM - # O
F FIRST POINT IN CURRENT LINE
3070 :  GOSUB20:FP=PN: REM - # O
F SECOND POINT
3080 :  X(0)=T(0,IP):X(1)=T(0,FP
):Y(0)=T(1,IP):Y(1)=T(1,FP)
3090 :  IF F1=0 THEN 3130: REM -
 CLIPPING IN EFFECT ?
3100 :  LX=LS:RX=RS:BY=BS:TY=TS:
 REM - GET WINDOW BOUNDARIES
3110 :  GOSUB 50: REM - CLIPPING
 SUBROUTINE
3120 :  IF F3=1 THEN 3200: REM -
 WHOLE LINE OUTSIDE WINDOW ?
3130 :  IF F2=1 THEN 3180: REM -
 COVERING IN EFFECT ?
3140 :  X0=INT(X(0)+.5):Y0=INT(Y
(0)+.5)
3150 :  X1=INT(X(1)+.5):Y1=INT(Y
(1)+.5)
3160 :  PRINT#-2,"M";X0;",";Y0:P
RINT#-2,"D";X1;",";Y1
3170 :  GOTO 3200
3180 :  LX=LC:RX=RC:BY=BC:TY=TC:
 REM - GET COVER BOUNDARIES
3190 :  GOSUB 200: REM - COVERIN
G SUBROUTINE
3200 :  IF A$="" THEN 3220: REM
- FINISHED THE SEQUENCE ?
3210 :  IP=FP:GOTO 3070: REM - F
INAL PT. BECOMES NEW INTIAL PT.
3220 NEXT I
3240 SOUND 150,2
3250 A$=INKEY$:IF A$="" THEN 325
0
3270 INPUT "DRAW ANOTHER <Y>";A$
3280 IF A$<>"" AND A$<>"Y" THEN
3320
3310 GOTO 2000
3320 PRINT#-2,"A":END
3995 :
3996 REM **** DATA ****
3997 :
3998 REM - NUMBER OF POINTS
4000 DATA 10
4007 :
4008 REM - POINT COORDINATES
4010 DATA 40,0,20,35,-20,35,-40,
0,-20,-35,20,-35,45,5,45,-5,35,-
5,35,5
4097 :
4098 REM - NUMBER OF DOT SEQUENC
ES
4100 DATA 7
4107 :
4108 REM - DOT SEQUENCES STORED
AS STRINGS
4110 DATA 01020304050601
4120 DATA 01030501
4130 DATA 02040602
4140 DATA 0104
4150 DATA 0205
4160 DATA 0306
4170 DATA 0708091007
```

END

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CONIX OS-9

Advanced Unix type Disk Operating System with Multi-level filing system that allows for user creation of index directories for special types or file classifications. CONIX OS-9 is a Multi-User, Multi-Tasking OS that allows the 32/64K CoCo and CoCo 2 access from more than a single terminal and possesses the powerful programming ability to allow each user to relegate the running of a program or other processes to the "background" while writing & editing another program in the "foreground". CONIX allows multiple I/O functions for device independence. Using CONIX OS-9 is as easy for the beginner using LEARN COS-9* and on-line MANUAL access to master as it is for the experienced "hacker". Editor and assembler included. Basic CONIX OS-9 package with manuals $79.99

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C-PAK (allows Merging RS DOS Files w/OS-9 . . . . . $59.99

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CONIX OS-9

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PRODUCT NEWS

edited by Cynthia Smith

The information used in the Product News section is supplied through manufacturers' press releases. *HOT CoCo* has not tested or reviewed these products and cannot guarantee any manufacturer's claim.

CoCo Pottery

For Color Computer users who happen to be potters, Color-Glaze II is a program that handles the mathematics involved in calculating the composition of ceramic glazes. The program enables you to do things like substituting ingredients in a glaze recipe while keeping the overall chemical composition the same so temperature range and surface characteristics do not change.

Written in Basic, the program can be backed up freely, and is easy to use with self-prompting dialog that contains all necessary information in its Data section.

Color-Glaze II comes on 32K cassette with optional use of a printer, and sells for $15. Program listings are available for $10 from Color Glaze, 4233 North 8th St., Kalamazoo, MI 49009.

Reader Service ✓570

First Edition

The recently published *Microcomputer Software Directory* contains software for the commercial, industrial, administrative, and educational environment and is aimed at both the current computer user, and those looking for software solutions before they buy their computers.

The directory emphasizes the major, original, and specialized packages including detailed descriptions of over 3,600 packages and 1,000 suppliers.

Products are easy to locate since the directory is broken down into 100 functional categories, with each listing indexed in five ways: by software function, hardware, name, industry, and vendor. There is also a special matrix that helps the user match operating systems to hardware.

The directory is available on a 15 day, money-back trial, and can be ordered by writing or phoning Computing Publications Inc., Princeton-Forrestal Center, 101 College Road East, Princeton, NJ 08540. 609-452-8090.

Reader Service ✓567

Mobile Computer Station

The EC10 is a new mobile computer table with a 6-foot work surface adjustable to different heights, and an adjustable, slotted top shelf to hold a television monitor or other equipment.

The table includes a three-outlet electrical unit with a 20-foot, three-wire cord and grounded plug. A cord organizer/modesty panel keeps loose connectors and electrical cords out of the way. It moves on 4-inch casters, two with locking brakes. The EC10 has heavy gauge steel construction and a high-impact baked enamel finish in putty beige.

Optional accessories for the table include an equipment lock and a mini-printer stand with paper guides.

For more information, call or write Bretford Manufacturing Inc., 9715 Soreng Ave., Schiller Park, IL 60176. 312-678-2545.

Reader Service ✓566

The EC10 Mobile Computer Station

Potential Picasso?

Now you can paint virtually any shape created with the Basic LINE, CIRCLE, and DRAW commands using Ultrapaint, a machine-language paint utility designed for use with PMODE4 graphics.

With Ultrapaint you can select colors from blue, white, and red, as well as textured colors such as violet, orange, brown, yellow, and green. You can see all these colors and more at the same time on any hi-res screen.

You can use Ultrapaint with both Basic and Assembly-language programs, and it allows hi-res multicolor, real-time graphics in Basic since it operates at 150 times the speed of Basic's PAINT command. It requires only 430 bytes of memory.

Ultrapaint is available on cassette (transferrable to disk), for 16K, 32K, and 64K CoCos with Extended Color Basic or Disk Basic. It includes a Basic tutorial/display program, all for $9.95 plus $1.50 for shipping, from Spectacular Software, P.O. Box 363, Mansfield Center, CT 06250.

Reader Service ✓565

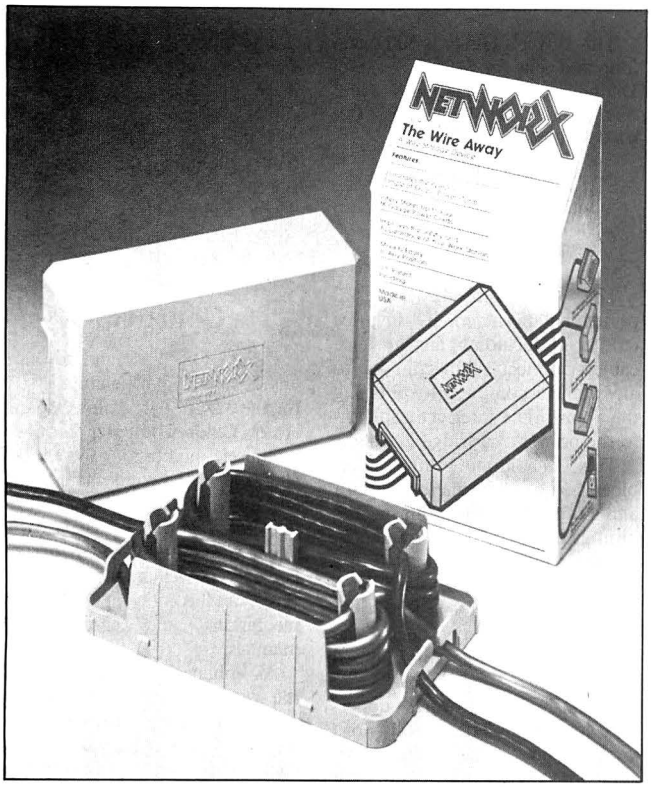
Screen Machine Plus

Rainbow Screen Machine is the improved version of the Rainbow-Writer screen enhancer. It features machine-language extension of Basic that loads on top of 16K, 32K, or 64K machines to enable mixture of hi-res graphics and text.

The user-definable, 224 character set features lowercase descenders, Greek characters, cars, tanks, and planes, and interfaces with all keys, commands, and PMODEs. Two character sets automatically switch for sharp lettering featuring underline, sub- and superscript, reverse video, top and bottom scroll-protect, double width, colored characters in PMODE4, and help screen.

Rainbow Screen Machine includes a demo program, character-generator program, and manual. 16K Extended Basic is required, 32K is recommended. Price is $29.95 for cassette and $32.95 for disk.

Super Screen Machine from Rainbow Connection Software has all the features of Screen Machine plus variable smooth scroll,



Wire Away cable storage from Networx

variable volume key click, and EDTASM+ command for compatibility with Radio Shack editor/assembler cartridge.

You also find Superpatch+ command for compatibility with disk EDTASM, true break-key disable and recognition, 10 user-definable commands to activate your drivers or subroutine, and Dynamic Screen Dump command for use with Custom Software Engineering's Graphics Screen Print program for printer "snapshots" of your screen during program execution.

Super Screen Machine sells for $44.95, cassette and $47.95, disk. Contact Rainbow Connection Software, 3514 6th Place NW, Suite D, Rochester, MN 55901. 507-288-4424.

Reader Service ✓564

New OS-9 Compiler

Lloyd I/O has recently released K-Basic Basic Language Compiler Level I for OS-9 or FLEX. K-Basic is a Basic to machine-language compiler that supports sequential files, floating point, three sizes of integers, and string variables and arrays.

This one-pass compiler generates Assembly-language source-code statements that can be defined by the user for any CPU supported by the CRASMB cross-assembler series. It comes with the 6809 run-time package and OSM assembler. Conditional assembly is used to reduce the size of the run time package.

Assembly-language source code can be imbedded within the Basic program for inclusion in the compiler output.

K-Basic sells for $199 from Lloyd I/O 6809 Computer Software, 19535 N.E. Gilsan, Portland, OR 97230. 503-666-1097.

Reader Service ✓562

Tidy Up With Networx

The Wire Away storage unit helps you organize your work area and prevents damages that can be caused by loose cable. This is a hand-size unit that holds up to four 18-gauge power cords, or 14 feet of excess wire. Its snap-on lid conceals the cord and you can attach the whole unit to the underside of a table or desk.

Wire Away sells for $12.95.

Also from Networx is The Wire Tree, a four-outlet filtered power source engineered for protection against voltage surges, spikes, and RFI. It is UL listed and organizes the 9-foot power cord and four peripheral cords. The Wire Tree is protected by an 8-amp fuse and covered by a one-year warranty. It sells for $69.95.

For more information on both products, contact Networx, 203 Harrison Place, Brooklyn, NY 11237. 212-821-7555.

Reader Service ✓558

New Games From Mark Data

Mark Data has announced four new games for the Color Computer. They combine high-res graphics and machine-language speed with elements of text adventure games, and do not require a disk system.

- Calixto Island is a puzzle with an occasional twist of humor. You'll visit a secret laboratory, a Mayan pyramid, and you'll meet crazy Trader Jack.
- Black Sanctum lets you encounter the forces of black magic as you roam around an 18th century monastery. Watch out for the black-hooded figures.
- In Sea Quest get your shark repellant and scuba tanks ready to search for treasures. You'll run into a pirate, a mermaid, and hungry sharks in this adventure.

All three games are available on 32K cassette for $24.95 each, and 32K disk for $27.95 each.

Also from Mark Data comes Time Fighter, a new arcade-action game for 16K CoCos. Pilot your MD-64 fighter through a hazardous time tunnel. Your mission is to destroy the Time Guardian who threatens the natural order of the universe.

Time Fighter requires joysticks and is available on 16K cassette for $24.95, and 32K disk for $27.95.

Contact your favorite dealer or order from Mark Data Products, 24001 Alicia Parkway, #207, Mission Viejo, CA 92691. 714-768-1551.

Reader Service ✓561

New For OS-9 Users

- The new OS-9 Utility Command Toolbox is designed for those who do file manipulation. The package is a collection of 12 OS-9 command programs, most of which are useful as filters using the OS-9 pipeline facilities. The tr program transliterates all occurrences of text patterns within a file to a specified substitution pattern and prints matching lines. Count counts words, lines, or characters within a text file, and d is an unformatted directory listing with wild-card matching.

Expand and Compress character compression and decompression utilities can reduce the size of text files. Split breaks a file into smaller files, Space indents lines and spaces lines in a text file, and Xmode alters terminal port operational mode.

- Entertainment Pack I is a collec-

The Networx Wire Tree

tion of programs written in Basic-09 for the OS-9 operating system. It consists of games and programs that are both entertaining and educational, and they all include complete Basic-09 source files that can be run on standard alphanumeric or graphics terminals.

● The RMA (Relocatable Macro Assembler and Linkage Editor) is designed to process both manually written and compiler-generated Assembly-language programs. Sections of these programs can be independently assembled to relocatable object files. The linkage editor takes any number of relocatable object files or library sections, and combines them into a single executable OS-9 program. The linker can optionally generate a detailed load-map listing.

RMA has facilities for generation of position-independent and reentrant programs. The macro facility permits commonly used instruction sequences to be defined once and used within the program as often as desired with automatic parameter substitution. Conditional assembly functions permit only specified sections of the program to be assembled. This can be used to produce various customized versions of a program for single master source file.

For further information on all these products, contact Microware Systems Corporation, 5835 Grande Ave., Box 4865, Des Moines, IA 50304. 515-279-8844.

Reader Service ✓559

Decisions Decisions!

Have you ever wished for wisdom when faced with important life decisions? Armadillo International Software proposes an answer in the Decision Maker program. It helps you decide a course of action by asking questions and weighing your responses. Housewives and corporation presidents will benefit equally from this method of organizing your thoughts.

Decision Maker sells for $24.95 (cassette) plus $2.50 shipping, and requires 32K Extended Basic. Contact Armadillo International Software, P.O. Box 7661, Austin, TX 78712.

Reader Service ✓560

Moonshot Number-Kruncher

Moonshot Acres Software has a program that works with any financial program to give you on-screen calculations. Number-Kruncher adds, subtracts, multiplies, and divides, plus has a memory and does chain calculations on a portion of your screen while you run the main program.

Adding Number-Kruncher to your financial programs lets you number-crunch without a handheld calculator, allowing you to do checking, banking, tax calculations, budgeting, investments, and record keeping more efficiently.

Available on cassette for 16K Extended Basic, Number-Kruncher sells for $7.95 from Moonshot Acres Software, Route 1, Box 423, Rockfield, KY 42274.

Reader Service ✓569

Beat Buyer Befuddlement

Computers For Everybody 1984 Buyer's Guide is a single source for up-to-date information on microcomputers. The book describes in detail 143 computer models for the quality of keyboard design to the type of software available for them. It includes a color section with photos that show the computers' features, and information on what you can expect in terms of repairs, service, and support for each computer model reviewed.

The authors discuss the 12 Greatest Computer Lies and what you can do about them.

This Buyer's Guide is 300 pages long and sells for $19.95. Contact Dilithium Press, 8285 SW Nimbus, Suite 151, Beaverton, OR 97005. 800-547-1842.

Reader Service ✓556

Printer Price Drops

The Alphacom 42 universal printer has been reduced in price to $99.95 including an interface cable. Connect Alphacom 42 to any popular computer by plugging the appropriate interface cable into the printer's cartridge-like slot.

This 40-column printer combines a single-chip microprocessor and a proven Olivetti print mechanism using advanced thermal technology. The unit is packaged in a lightweight, impact-resistant plastic housing that covers the paper roll. It operates at two lines a second, and features bit-mapped graphics.

Alphacom 42 features upper- and lowercase letters and word wraparound, and recognizes standard ASCII control codes for changing the printing mode. Codes include carriage return, line feed, right-justification, form feed, graphics control, and multiline feed. Use with a CoCo requires a serial-to-parallel converter.

The printer can be purchased separately at a suggested retail price of $79.95, with interface cables available at $20 each. Contact the Consumer Sales Department, Alphacom Inc., 2323 South Bascom Ave., Campbell, CA 95008. 408-559-8000.

Reader Service ✓550

Conix OS-9

Conix OS-9 is an advanced UNIX-type disk operating system for the 32K or 64K Color Computer, or Color Computer 2. It is a multiuser, multitasking system that allows at least two-terminal access, and up to an entire network of office users.

Conix OS-9 provides a host language as well as two versions of Basic, and comes with full documentation and programming manuals.

As enhancements are made on the system, Thundersoft will keep users updated and provide support services. Conix is packaged with a back-up disk and a working disk, and Thundersoft will replace both if damaged. This and other support services are detailed in the system literature.

The Conix OS-9 DOS package will be priced at $99.99 during an introductory period, and the full network system is priced at $299.

Contact Thundersoft Software, Route 8, Box 300, Cottage San Road, Silver City, NM 88061. 505-388-6345.

Reader Service ✓557

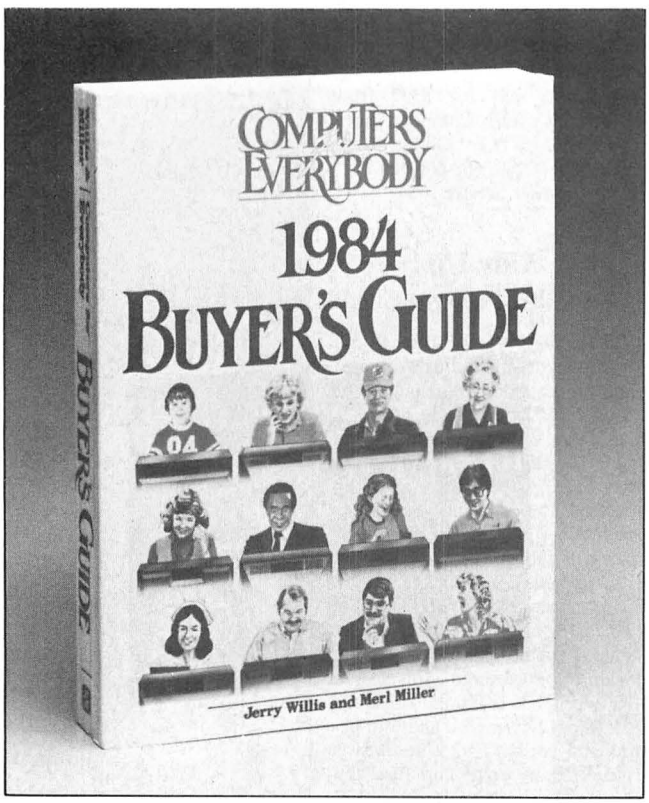
Scan-Out

Scan-Out is the latest in peripheral switching with a built-in RS-232C analyzer. This unit can switch any of your CoCo peripherals to another CoCo peripheral (modem, printer, or plotter) without disconnecting any of the line plugs. Scan-Out is designed for any Color Computer including the MC-10, and is compatible with any type of software.

It also monitors ingoing and outgoing data (tx, rx). In case of a malfunction, Scan-Out is helpful in troubleshooting hardware problems.

Scan-Out comes assembled in a sturdy plastic enclosure with three line cords included. National Research Group Inc. offers a one-year warranty on parts and labor. The unit sells for $24.95 plus $2 for shipping (Florida residents add 5 percent sales tax). COD orders are welcomed. Contact National Research Group Inc., 11580 Oakhurst Road, Largo, FL 33544. 813-595-2853.

Reader Service ✓552



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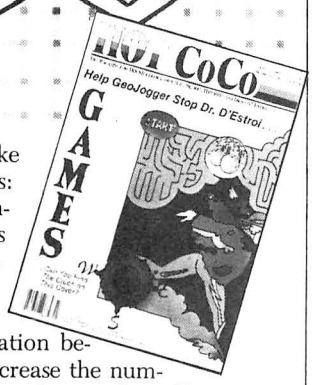

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SOFTWARE

All **OS-9/FLEX** systems allow you to software select either operating system.

Also included is the **GMXBUG** monitor and, in systems with 128K or more of RAM, **GMX-VDISK** for **FLEX**.

All **GIMIX OS-9** systems include **Microware's Editor, Assembler, Debugger, Basic09,** and **Runb**; and the GMX versions of **RMS** and **DO** for **OS-9**.

All **GIMIX** versions of **OS-9** can read and write RS color computer format OS-9 disks, as well as the Microware/GIMIX standard format.

New and exclusive with **OS-9 GMX III** systems is the **GMX OS-9 Support ROM**, a monitor for **OS-9** that includes memory diagnostics and allows the system to boot directly from either hard disk or floppy.

A wide variety of languages and other software is available for use with either **OS-9** or **FLEX**.

OS-9 GMX III/FLEX SYSTEMS (#79)

The **#79** super system now includes (in addition to the above): the **GMX 6809 CPU III**, a **256K CMOS Static RAM Board (#72)**, and a **3-port Intelligent Serial I/O Processor (#11)**.

The **GMX 6809 CPU III** can perform high-speed DMA transfers from memory to memory and uses memory attributes and illegal instruction trapping to protect the system and users from program crashes. If a user program crashes, only that user is affected; other users are unaware of the problem.

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OS-9 GMX II / FLEX SYSTEMS #39

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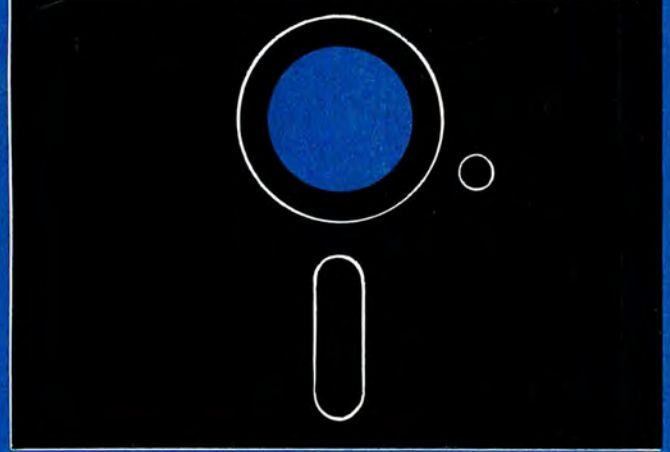

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