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ARTICLES

Graphics Builder — 28
If you find creating graphics code a chore, let your CoCo do it.
L.W. Gross

Let the Gypsy Lady Show You How — 36
Save your graphics screens on disk and call them as your programs need them.
Chris and Laura Petit

ROM Hacker—Part II — 42
This month build an IC tester.
James J. Barbarello

Mini-Graphics Fun — 52
Learn a little about graphics programming with these 13 short routines.
Wayne McArthur and Florence Abernethy

Mail-Bel — 56
This database mailing-list program does everything but lick the envelopes.
Joseph A. Ryan

Anatomy of an Assembly-Language Game—Part III — 64
Create the characters and make them move with this month's tutorial.
Mike Meehan

Journey to the Center of the ROM—Part X — 72
With this last installment, you'll know all the secrets of the Color Basic ROM.
Mark D. Goodwin

Cool that CoCo — 78
Three procedures to keep F board CoCos from overheating.
Chris Baran

Hurricane Tracker — 80
Follow along with the weather reports and track this year's tropical storms.
Roger Smith

Vol. 2 No. 3 August 1984

DEPARTMENTS

Digressions — 6
Has software outpaced hardware?
Michael E. Nadeau

Instant CoCo Listings — 8

Feedback — 12

The DOSsier — 84
More on 80-column screens and Dynacalc.
Scott Norman

The Educated Guest — 88
The argument for Assembly language.
Charles H. Santee

Doctor ASCII — 92
Answers to your questions.
Richard E. Esposito and Ralph E. Ramhoff

Product News — 110
edited by Cynthia Smith

REVIEWS

There's a New Basic on the Block — 19
Basic-09 is here, and it's an unusually powerful language.
Guier S. Wright

Six Smart Ways to Go On Line — 22
How do the smart-terminal programs stack up? This month we look at VIP Terminal, Colorcom/E, and The Color Connection.
William Banta

Reviews — 96
Magigraph, Disk Fix, TCE Math Package, Grafplot v1.1, Video Reverser, and Chess-007.
edited by Mark E. Reynolds

Gameware — 107
Waterloo, Mr. Dig, Time Bandit, and Willy's Warehouse.
Michael E. Nadeau

Cover art by Eric Ingraham

This symbol indicates the program's placement on the Instant CoCo loader, available on cassette. See our Instant CoCo ad for details.

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DIGRESSIONS

THE NEXT HARDWARE GENERATION

Color Computer software needs help. Since the inception of the Color Computer, programmers have worked to get the most out of the machine's hardware, taking advantage of its strengths and overcoming its faults. Those programmers have just about reached the limits of the CoCo's hardware. Now they need help in the form of meaningful enhancements.

Most of the changes required are obvious: a better screen display, better and more I/O ports, and the ability to address more memory. Other possible enhancements include better graphics and a "professional" style keyboard with function keys.

The average hobbyist would probably not need these improvements, though he would welcome them. But if the Color Computer is to meet the demands of the education, business, and professional markets, the changes listed above are mandatory.

At a recent computer show, I was attracted to a booth by a fascinating educational game running on an Apple computer. I asked the person at the booth if a Color Computer version was in the works. He replied that even with 64K, the CoCo did not have enough memory to accommodate this and other education programs produced by his company. He did express an interest in supporting the Color Computer, knowing its presence in the classroom.

We do have sophisticated spreadsheet, database, and financial analysis programs available for the Color Computer. But a spreadsheet on a 32-column screen is a nuisance at best. Database programs are severely limited by the CoCo's memory capacity, as are financial analysis programs. These programs are capable of handling greater capacity; it's the hardware that holds them back.

Word processing is perhaps the most important application a professional has for a microcomputer. And you can get a slick word-processing system with the Color Computer, if you also buy a monitor (not to mention a monitor driver), a replacement keyboard with function keys, and perhaps an 80-column card. These items should be standard, and the lack of them slows the Color Computer's entry into the offices of professional and business folk.

From all indications, the Color Computer is selling very well, due mainly to the public's interest in home computers and the "sleeper" quality that the machine enjoys as a good "bang for the buck" buy. Tandy has a wonderful little product, yet it could do so much more. With enhancements mentioned here, the Color Computer could easily compete with computers in a considerably higher price range, and it could enter markets that have snubbed it in the past. ■

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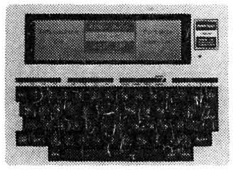

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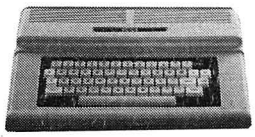

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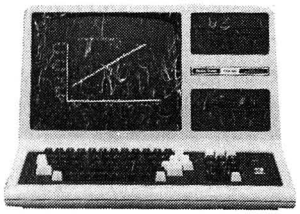

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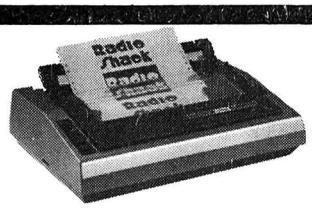

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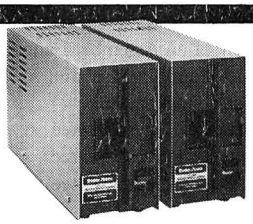

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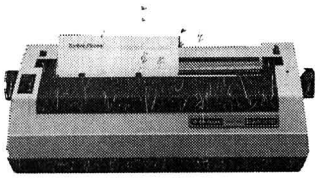

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Back Issues

Yes, back issues of *HOT CoCo* are available for all months. Here's a short list of some of the best of what we've published in the past:

June 1983—The CoCo Word Processor, a serial-to-parallel interface project, and a tutorial on tape reliability
July 1983—How to upgrade your CoCo to 64K
August 1983—Speech synthesis without hardware
September 1983—Disk utilities, character generator
October 1983—Animation techniques, build a biofeedback device
November 1983—Nuclear submarine simulation
December 1983—Education issue
January 1984—Programs for the investor and businessman
February 1984—Simulate Extended Color Basic on Color Basic CoCos
March 1984—How a disk stores information, create your own word-search puzzles
April 1984—Peripherals Buyer's Guide, how to shop for a disk drive
May 1984—OS-9 review, Financial Transactions Tracker program
June 1984—Simulations issue, how to build an Atari joystick interface
July 1984—Build your own lowercase modification

In each back issue, you'll also find our regular features, reviews of popular software and hardware, and dozens of useful programs that are yours for the typing in.

Each back issue costs $3.50 plus $1 shipping and handling. On orders of 10 or more back issues, there is a flat $7.50 shipping and handling fee. Send your orders to *HOT CoCo*, Attn.: Back-Issue Orders, 80 Pine St., Peterborough, NH 03458.

Instant CoCo

Instant CoCo Directory—August

SIDE A

ARTICLE NAME/AUTHOR	FILE	PAGE #	SYSTEM
Copyright Statement	TITLE	---	All
Graphics Builder/Gross	BUILDER	28	16K Ext.
	TRUCK	28	16K Ext.
Let the Gypsy Lady Show You How/Petit	GYPSY	36	16K Ext. Disk
" "	GYPSYG	36	16K Ext. Disk
" "	PICSAV	36	16K Ext. Disk
" "	GF	36	16K Ext. Disk
ROM Hacker—Part II/Barbarello	ICTEST	42	16K Ext.
ROM Hacker—Part II/Barbarello	AUTOTEST	42	16K Ext.

SIDE B

Mail-Bel/Ryan	MAIL-BEL	56	32K Ext.
Anatomy of an Assembly-Language Game—Part III/Meehan (m)	CROAKER3	64	32K
Hurricane Tracker/Smith	STORMTRK	80	16K Ext.
The Educated Guest/Santee	ANIMATE	88	16K Ext.
The Educated Guest/Santee	ANIMATE1	88	16K Ext.
The Educated Guest/Santee	ANIMATE2	88	16K 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.

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+.

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. ■

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.

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

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Feedback

Give Your Computer Even More Character

I enjoyed Thomas Rokicki's article, "Give Your Computer Some Character" (*HOT CoCo*, September 1983, p. 104) and use it in many programs. I've also discovered a few tips about it.

Changing line 1060 in the source program to LDA #$F8 will give you a brighter picture. If you've already assembled the program at location 31919, simply POKE 32021,248(POKE &H7D15,&HF8).

The following changes will display 21 bold characters per line:

(in the source program)	(or if assembled at location 31919)
1060 LDA #$D8	POKE 32021,216
1290 CMPA #21	POKE 32066,21
1710 LDA #21	POKE 32151,21

You can easily jump from one mode to the other with interesting possibilities.

Congratulations to Mr. Rokicki.

Francois Boucher
St. Jerome, Quebec

More Airport Control

A subscriber informed me of a bug in "Airport Controller" (*HOT CoCo*, June 1984, p. 66). As it is, the game ends after one plane has docked and one has crashed. The following two lines will correct the problem:

```
1010 IF (A(D,0)>=62 AND A(D,0)<=192
AND A(D,1)>=92 AND A(D,1)<=106) OR
(A(D,0)>=114 AND A(D,0)<=134 AND
A(D,1)>=58 AND A(D,1)<=134) THEN
A(D,4)=1 : C=0 : DA=0 : DB=0 : PLAY
"T6O2V10ABCP25V25DEFGP20O1AO2AO3
AO4AO5A" : GOSUB 2190 : RETURN
2200 FOR WE=1 TO NU : IF A(WE,4)=1 OR
A(WE,4)=2 THEN IH=IH+1 : NEXT WE
```

Rob Ainscough
Walnut Creek, CA

PEEKing for Adventure

There's a misprint I offered in the March 1984 issue that gives you a window on the memory in adventure games (Doctor ASCII, *HOT CoCo*, p. 135). The B in line 110 should be an up arrow.

Richard Esposito
Columbia, MD

A Second Opinion On Master Writer

I would like to add a few comments to the review of Master Writer (*HOT CoCo*, May 1984, p. 23). I think Mr. Bussell missed a point or two.

He is correct in his statement that the program is hampered by its standard 32-by-16 screen, but this leaves much more memory available than some larger word processors do. I found the small screen easy enough to get used to and worth the extra memory.

The F that sometimes appears on the screen after the find command occurs when you raise your finger from the clear key a fraction of a second before you raise your other finger from the F key.

Master Writer has several features not found in its competitors, including an autorepeat key, a pause feature that allows you to insert addresses and salutations in form letters, and a convenient method to load any ASCII file from the menu without losing great chunks of each paragraph.

This word processor does everything it's supposed to do on any CoCo no matter who did the upgrade. And I found that Pyramid Distributors gave the fastest, friendliest, and most complete support I have ever encountered.

I've found Master Writer to be one of the best buys on the market. It probably isn't suited to office use, but it has written literally thousands of form letters for my small business in the past year.

Sandra L. Willard
Chireno, TX

4NROW on 32K Disk

I've relocated the following machine-code subroutines in the 4NROW program ("New Life for an Old Game," *HOT CoCo*, April 1984, p. 80) to run it on my 32K disk machine. The changes are as follows:

```
10 CLEAR200,&H4BFF
110 LV=&H4C00:WO=LV+3:X1=WO+
1:X2=X1+1:VA=X2+2:WI=&H4C93:
MO=&H4DDF
330 AD=&H4C93
445 IF D=&H3C THEN D=&H4C
```

Michael D. Greene
Seattle, WA

CLS(9)

Once I mistakenly entered a CLS(9), which cleared the screen and printed the Microsoft logo. I checked further and found that any CLS from 9–255 will do the same.

The Microsoft message usually only appears during the startup message after you turn on your computer. Is the CLS(9) a bug in Extended Color Basic? All other operations seem to work just fine.

David Savadge
Orcutt, CA

String Math

I write math programs and presently am working on string math with numbers to 250 digits, but I can't find any literature on the subject. I'd like to hear from anyone who has done any work in this area.

Clayton G. Hess
515 Home St.
Sycamore, IL 60178

Uncovered

My son and I look forward to receiving your magazine each month. Your articles are right on target, whereas other publications seem to want to fill a defined amount of space with various rambling topics.

Our February and April issues arrived with the covers torn loose. The

March issue never came—I suspect the cover (and mailing label) was lost completely. Could you please send a March issue and consider using a mailing wrapper in the future?

Joseph A. Krom
Argos, IN

"Tape EDTASM+ to Disk" Fix

There seems to be a mistake in the loading instructions in the May Reader's Forum piece "Tape EDTASM+ to Disk" (*HOT CoCo*, p. 129). To load the short program, type CSAVEM "EDTASM+", &H1600, &H3DFF, &H1600. Evidently, the first &H1600 is missing in the original.

Kirk Thompson
White Rock, NM

Flying High

I have a 64K, cassette-based Color Computer and have been looking for a flight simulator that I can use with it.

Earl W. MacPherson, Jr.
Pennsville, NJ

Tom Mix Software (4285 Bradford N.E., Grand Rapids, MI 49506, 616-957-0444) has some very interesting programs out: Worlds of Flight, a view-oriented flight simulator; SR-71, which puts you in control of a sophisticated reconnaissance plane (see p. 32 of the April 1984 HOT CoCo *for a review of the program); and Space Shuttle, a space-flight simulator.*

You might also be interested in Tom Mix's Air Traffic Controller.

KRT Software (P.O. Box 41395, St. Petersburg, FL 33743, 813-321-2840) offers their F-16 Instrument Flight Simulator, which also has earned some favorable comments from flight enthusiasts.—eds.

Cold Start

I've found a way to clear all memory and cold-start the CoCo, as if it had been off for 45 minutes. Enter POKE 113,3 and then EXEC 40999. Hope it works for everyone.

Mike Backman
Chelmsford, MA

Golf, Anyone?

I have a 64K, Extended Color Basic machine. As a dedicated golfer, I've been searching unsuccessfully for a program that handicaps golfers according to the PGA method. Does anyone know where I can find one?

Gene Eggers
426 E Washington St.
Villa Park, IL 60181

Program Dictation

It isn't much fun typing in program listings, no matter how large the type is. I dictate them onto a tape and then play it back as I type. It's much easier and keeps me from always losing my place.

Woody Woodrum
Barrettsville, OH

Clubhouse

Have a Color Computer club? Let prospective members know about it through a letter to Feedback.

Correspondence Club

We are a correspondence club that exchanges ideas through a newsletter. The newsletter contains programs, articles, reviews, tips, and a feedback section for information exchange.

Mickey Zsoldos, Jr.
1371 White Oak Bottom Road
Toms River, NJ 08753

Pro-Color-File

The Pro-Color-File National User's Group exists to exchange information related to Pro-Color-File and its many and varied uses, hints and tips on using the system, and details on user-developed enhancements.

You can apply this powerful database system to most home and business applications, and our group will exchange systems we've established using Pro-Color-File.

Our library contains a database of all articles and programs published in *HOT CoCo*, in *Rainbow*, *Color Computer Magazine*, *Color Computer News*, *International Color Computer Club Newsletter*, and many of the programs in the CompuServe Color SIG. Dues are $10, and we communicate among members via direct mail or email.

For more information, send us an SASE.

Jorge Mir, Pres.
Pro-Color-File
National User's Group
12851 W. Balboa Drive
New Berlin, WI 53151

Fredericton, NB

We are organizing a CoCo information club in Fredericton. We will converse by mail and are not necessarily specific to Fredericton. Interested parties please write.

Fredericton CoCo
P.O. Box 248
Fredericton, NB
E3B 4Y9 Canada

Atlanta, GA

The Atlanta Area Color User's Group meets 10 months per year (due to school closings) at 7 p.m. at the Nash Middle School in Smyrna, GA. For more information, call me at 949-0369, Lee at 373-3216, or CBBS at 378-4410.

Gary McConville
Douglasville, GA

Harrisburg, PA

Hug-A-CoCo meets every Wednesday in the Motorola Office

Continued on p. 14

16K Stock Market Simulator

*Eds. note—To use the "Stock Market Simulator" (*HOT CoCo, *June 1984, p. 58) on 16K Extended Color Basic machines, type POKE25,6:NEW instead of PCLEAR1 before you load the program.*

Two Changes To Light Up Your Multi-Pak

In Fig. 2 of "You Light Up My Multi-Pak" (*HOT CoCo*, March 1984, p. 58), the SCS and CTS LEDs were numbered backwards. Instead of reading 4, 3, 2, 1 from left to right, both sets should read 1, 2, 3, 4.

John R. Kelty
Lincoln, NE

The text and schematics in the Multi-Pak article seem to be contradictory. The schematic indicates that you connect the resistors to the LED anodes, while the text says to connect them to the LED cathodes. Mr. Kelty told me that it doesn't matter. You can hook up the LEDs either way.

Hilton N. Wasserman
Little Neck, NY

Clubhouse

Continued from p. 13

Building, 3540 N. Progress Ave., Harrisburg, PA 17110, at 7 p.m. Contact me at 657-2789 for more information.

George Lurie

National MC-10 User's Group

The National MC-10 User's Group has formed to support MC-10 owners and to encourage software distributors and programmers to continue writing high-quality programs. We will be publishing what we hope will be the most comprehensive MC-10 software catalog available and will distribute it free to our members.

If you are interested, please send us your name and address (there are no membership fees). You will receive a monthly newsletter, to which you can submit comments and technical questions. It will also include MC-10 software reviews and updated program sources.

We also hope to start an MC-10 BBS.

Bill Gordons, Pres.
National MC-10 User's Group
906-A South Mariana
Tempe, AZ 85281

Petoskey, MI

The Petoskey Area CoCo Club meets at 7 p.m. on the first Tuesday and the third Wednesday of each month. Our emphasis is on information exchange and general computer edification.

Anyone have any ideas on BBS software (possibly an OS-9 BBS)?

Dennis Hoshield
Petoskey Area CoCo Club
670 Liegl Drive
Alanson, MI 49706
616-347-0607 (after 4 p.m.)

Toccoa, GA

The Toccoa Microcomputer Society meets on the second and fourth Tuesdays of each month at the Toccoa-Stephens County Library at 7 p.m. For more information, call me at 404-779-3472, or Steve Shields at 404-886-9718.

Terry Fleming
Route 2, Box 124
Eastanollee, GA 30538

Fort Rucker, AL

The CoCo SIG of the Wiregrass Microcomputer Society meets twice a month in the Fort Rucker, AL, area. We welcome all ages and interests and will swap newsletter subscriptions with other micro clubs.

We're also working on setting up a BBS.

CoCo SIG
WCMS
c/o Division of Computer Science
Enterprise St. Jr. College
P.O. Box 1300
Enterprise, AL 36330
205-393-3821

Providence, RI

We have a new, permanent address for our club:

New England CoCoNuts
P.O. Box 6604
Providence, RI 02940-6604

William D. Ferrante
Corresponding Secretary

Westerly, RI

We are forming a Color Computer club that presently meets at the Westerly YMCA every other Tuesday from 7–9:30 p.m. For more information, call 596-0957 or 596-1485.

Donald L. Campbell
Westerly, RI

Southbury, CT

I am interested in joining or forming a Color Computer club in the Southbury, CT, area. If you know of such a club or would like to start one, please phone or write.

Rob Johnson
209 Carriage Drive
Southbury, CT 06488
203-264-6357

Greenfield, MA

We're looking for new members in the Greenfield, MA, area.

Greenfield Color Computer Club
c/o Dave Chaplin
22 North St.
Erving, MA 01344

Continued on p. 16

1983 unit sales	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average	Best	Worst
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Feagan	105	94	127	115	157	97	61	132	113						174	61
Graham	135	135	183	116	151	104	86	149							183	63
Harpel	134	102	190	161	180	85										
Jordan	105	109	188	171	120											
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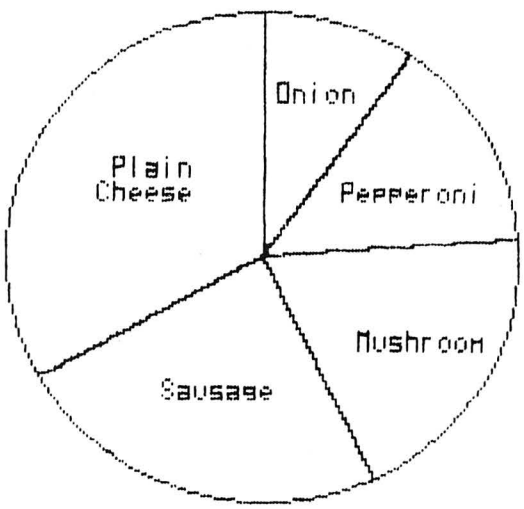

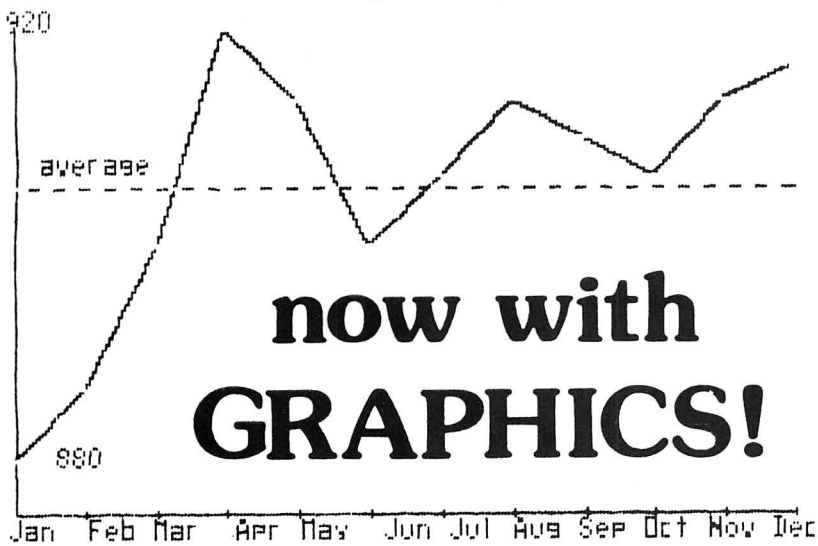

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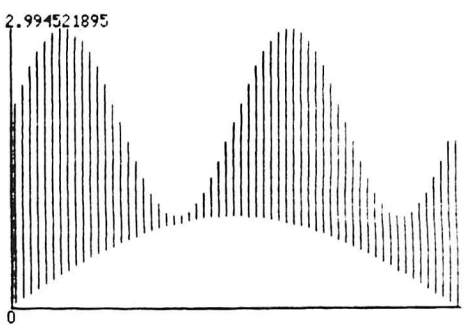

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See List of Advertisers on page 99

Clubhouse

Continued from p. 14

Lima, OH

I'd like to get in on a Color Computer club in Lima, OH.

Marlene John
657 S. Metcalf St.
Lima, OH 45804

Temple, TX

CoCo owners in the Temple, TX, area interested in starting a user's group can contact me.

Kathy Brisbin
209 Mitchell
Temple, TX 76501
817-778-8575

Wilmington, NC

The Greater Wilmington Color Computer User's Group meets at 7 p.m. on the third Tuesday of each month. For more information, phone me at 919-799-3886, or write.

Les Hewlett
814 Pine Forest Road
Wilmington, NC 28403

Orange County, CA

The Orange County chapter of Color America meets at 1 p.m. on the third Sunday of each month in the Hashinger Hall of Chapman College in Orange. We discuss such topics as OS-9, CP/M, and Graphicom. For more information, phone me at 714-847-4256, or write.

Steve Secord, Pres.
Orange County Color America
6600 Warner Ave.
Huntington Beach, CA 92647

Fargo, ND/ Moorhead, MN

The Fargo/Moorehead Color Computer User's Group meets at 7 p.m. on the second Thursday of each month. The meeting locations vary, so phone me at 701-282-0293 for information.

John Steiner
Fargo, ND

On-Line

Are you operating a BBS? Drop a note to Feedback and let our readers know about it.

St. Albans, WV

The West Virginia Color Computer Club meets at 7 p.m. on the second and fourth Wednesdays of each month. We have a newsletter, a private BBS, CoCo Nut T-shirts, and discounts at some local computer stores. For more information, contact me.

WVCC
Will Mucklow
949 Baier St.
St. Albans, WV 25177

Jackson, CA

The Gold Country BBS serves the Jackson, CA, area from 6 p.m.–8:30 a.m. Monday–Friday, and from 3:30 p.m. on Saturday–8:30 a.m. on Monday. It offers uploading, downloading, and email, and we'll try to answer any computer or electronic questions. The Gold Country BBS is sponsored by Sierra Pacific Sound, the Radio Shack dealer in Jackson.

Dean Perano, Sysop
Jackson, CA
209-223-3800 (BBS)

Port Moulton, NS

The Colorama of Port Moulton, Nova Scotia, is on line 24 hours a day, seven days a week. It is dedicated to the CoCo, but is open to all computers. We support full uploading and downloading, on-line games, and a fantastic message base, thanks to Peter Banz's BBS program. The download section is not restricted so even first-time callers can use it.

This could be the cheapest trip to Canada you'll ever make.

Jeff Pyne, Sysop
Port Moulton, NS
902-683-2086 (BBS)

Crawford, NE

The Colorama of Crawford is on line from 5 p.m.–8 a.m. Monday–Friday, and for 24 hours on both Saturday and Sunday. It supports uploading and downloading.

Rick Hungerford,
Crawford, NE
308-665-1526 (BBS)

Long Island, NY

Long Island Color Computer enthusiasts interested in joining the Local CoCo club can call the Color Channel BBS at 516-783-7582, or write Local CoCo, P.O. Box 901, Bellmore, NY 11710.

Chuck Martin
Club Secretary

Vancouver, BC

The Color Pacific BBS includes such functions as uploading, downloading, on-line games and graphics, as well as news about the Color Computer clubs in BC. It's on line 24 hours a day, seven days a week.

Debbie Cooper, Sysop
Vancouver, BC
604-738-2773 (BBS)

Continued on p. 17

On-Line

Continued from p. 16

Minneapolis/St. Paul

Those interested in starting a Color Computer user's group in the Minneapolis/St. Paul area can contact me.

Andrew Sazama
9934 Emerson Ave.
Bloomington, MN 55431

Northwest Coast

The Northwest Data BBS operates from 6 p.m.–6 a.m. daily. It features email, uploading, downloading, on-line games, club sections, and an electronic joke book.

Terry Thompson, Sysop
509-489-5133 (BBS)

Columbia, SC

The Midlands 80 Computer Club sponsors the Midlands 80 TBBS. We cater to all Radio Shack computers, but have special sections for the Color Computer. We are on line 24 hours a day and operate at both 300 and 1,200 baud.

Steve Nagasaki, Sysop
Columbia, SC
803-755-3414 (BBS)

Las Vegas, NV

The Las Vegas Color Computer User's Group meets at 4 p.m. on the first Saturday and third Sunday of the month. We help both beginners and advanced users. For more information, contact me.

Robert Petersen, Pres.
4775 S. Topaz #69
Las Vegas, NV 89121
451-0991

Sacramento, CA

The Sacramento CoCo Club operates a 24-hour BBS. It's primarily for club members, but all CoCo users are welcome to call. We'll soon have a help function to aid users with many of their CoCo problems.

Charles Doughty
Box 60511
Sacramento, CA 95860-0511
916-381-8788 (BBS)

Fargo, ND/ Moorhead, MN

A 24-hour Color Computer BBS is the only public-access BBS in the area. It supports both uploading and downloading.

John Steiner
Fargo, ND
701-280-1928 (BBS)

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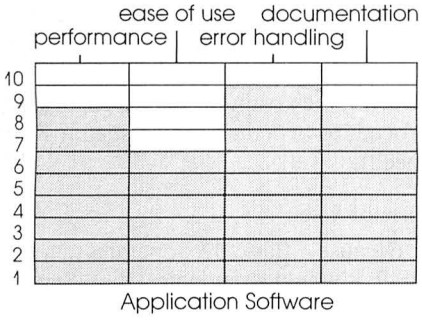
BY GUIER WRIGHT
HOT COCO STAFF

THERE'S A NEW BASIC ON THE BLOCK



Basic-09
Tandy/Radio Shack
1400 One Tandy Center
Fort Worth, TX 76102
Catalog no. 26-3036
OS-9, disk drive
$99.95

Basic-09 steps in as a grown-up Basic that taps the 6809's unique capabilities.

OS-9 is perhaps the ultimate operating environment for the Color Computer, but unless you are familiar with Unix-based systems, OS-9 alone probably won't do you much good.

One of OS-9's advantages is that it can accommodate almost any hardware or software configuration, including languages. Radio Shack wisely chose Basic-09 as the first language that would run under OS-9.

Basic-09 was originally designed to take advantage of the 6809 microprocessor's unique and powerful capabilities. Motorola commissioned Microware Systems Corporation to develop Basic-09. They first released it in February 1980, and a few people have since implemented it on 6809-based micros.

If you have been programming in Basic for a while and feel like it might be time to move on to something a bit more powerful and flexible, but find Assembly language a little too overwhelming, then Basic-09 should give you the kind of speed and power that Extended Color Basic lacks.

The manual states that Basic-09 is similar to Pascal. I also found it like other versions of Basic used on mainframes. This is not to say, however, that learning Basic-09 is simply a matter of memorizing a few new commands and some syntax differences. Mastering Basic-09 is like starting again to learn Basic. There are many commands that the Basic programmer will recognize, but just as many will be new.

Performance

Higher-level, control-structure commands add a great deal more flexibility than the old IF...THEN...ELSE. LOOP...UNTIL, WHILE...DO, and REPEAT, as well as the various exiting options such as EXITIF...THEN, ENDIF, ENDLOOP, and ENDWHILE give numerous variations to program flow. The ON ERROR GOTO, ERR, and ERROR functions are nice additions found in other versions of Basic.

Other functions are either new or are variations on Basic and Extended Color Basic. ACS(n) returns the arccosine of n, ASN(n) returns the arcsine of n. DEG and RAD let you change from angles stated in degrees or radians. LAND, LOR, LNOT, and LXOR perform logical and, or, not, and xor bit-by-bit Boolean operations on specified variables.

FIX and FLOAT convert variables to an integer or a real type. ADDR returns the absolute memory address of a variable, array, or structure. SISE returns the storage size, in bytes, of a variable, array, or structure.

LOG10 returns base 10 logarithms. MOD(n,m) returns the remainder of n divided by m (modulus). PI returns 3.14159265 (something I have sorely missed upon occasion), SQ(n) returns n squared, and SQRT returns the square root of a number.

SUBSTR$(s,t) returns position of string t in string s and TRIM$ removes trailing spaces.

Graphics functions, the highlight of the Color Computer, are of a very different flavor in Basic-09. You call all graphics from a single module, the Graphics Interface Module (GFX).

To use the various graphics commands within the GFX, you must run GFX with the first parameter passed to the module naming the desired function. For example, a simple program to draw a line from x1,y1 to x2,y2 might look like this:

```
RUN GFX("MODE",1,1)
RUN GFX("CLEAR")
RUN GFX("LINE",x1,y1,x2,y2)
```

There are two graphics modes in GFX, a 128-by-192 four color and a 255-by-

192 two color, with 16 possible color combinations. Most of the commands are much like graphics commands in Extended Color Basic, but the following are a few of the variations:

- MOVE changes the position of the "invisible" graphics cursor to a specified X,Y coordinate.
- LINE is the same as the Extended Color Basic command, except that there is no B option for drawing a box.
- CIRCLE is also a slightly abbreviated version of the Extended Basic command in which you can specify the center position, radius, and color, but there are no options for ellipses or partial circle drawing.
- ALPHA is a quick way to reenter text mode without destroying anything on the graphics screen, while QUIT permanently leaves the graphics mode and returns the 6K graphics memory (reserved after you issue the first graphics command, MODE) back to the system.
- GLOC returns the absolute memory address of the graphics screen. Since OS-9 allocates memory according to what is available at the time a particular procedure is called, no address is constant. You must modify POKEs and PEEKs at run time in order to access the graphics screen.

GFX also includes a machine-language routine for reading the joysticks. JOYSTK returns the status of the fire button and X,Y positions in the range 0–63.

While Extended Color Basic users might think GFX is a stripped down substitute for the numerous graphics commands usually available to the Color Computer, you must remember that GFX consists entirely of Assembly-language routines, and the speed increases will more than outweigh any inconveniences.

Issuing four separate GFX Assembly-language LINE commands to draw a box will still be much faster than a single LINE(X1,Y1)–(X2,Y2),PSET,B command in Extended Color Basic. Assembly-language programmers will also appreciate these graphics commands.

If you have ever tried to develop an algorithm for drawing circles or angled lines on a memory-mapped graphics display, then you will know that GFX is going to be a monumental time saver. The GFX program also means that more people will be able to use the power of Basic-09 without having to learn a completely alien system.

Besides the improvements in specific commands, there are operational differences between Basic-09 and any other Basic you may have worked with.

As mentioned earlier, Basic-09 has programming features that are reminiscent of Pascal. The manual, which is a clear, well-written improvement over the OS-9 manuals, mentions early on that line numbering is not critical in program writing. In fact, line numbering uses more memory and increases the compiling time considerably.

Initially, the idea of writing a Basic program without line numbers seems unnatural, but after looking over a few of the many examples and sample programs given in the manual, you begin to see that there are relatively few instances in a program in which line numbers are really necessary. GOTOs and GOSUBs do require line numbers, but since you can write most subroutines as separate modules and fine tune program flow with the control features (WHILE, WHEN, LOOP, etc.), most programs require only one or two distinct line numbers for branching.

Basic-09 also allows quite different variable types. It recognizes five distinct types (or data structures), and you can even create customized data structures if you wish. The manual refers to these as "atomic data types," because you can think of each type as atoms, and any new data structures that you might create using the five basic types as molecules.

You can define a variable, array, or structure in a program as containing a specific type of information, in much the same way as the name itself defines variables in Color Basic (A% being an integer, A$ being a string, A1 being a floating point variable).

DIM XX(5):INTEGER defines array XX as containing six integer values. (You could use BASE 1 to change the lowest subscript value to one, thus giving the array only five elements.)

By using the TYPE statement, you can define your own complex data structures using combinations of the five data types. The five atomic types are as follows:

- BYTE contains only whole numbers in the range of 0 to 255. A variable defined as BYTE type will only take up 1 byte of memory.
- INTEGER contains only whole numbers in the range –32768 to 32767. Integer variables use 2 bytes of memory.
- REAL, or floating-point variables, fall in the range –1*10↑38 to 1*10↑38 and always use 5 bytes of memory.
- STRING variables can contain almost any character, number, or punctuation and use a byte per character.
- BOOLEAN variables can be either true or false, nothing else, and they use 1 byte of memory.

Variable names are local to a given procedure (and, in fact, have meaning only to the programmer, as they are not used at the machine-language level), which means that you can use the same names in many procedures without changing variable values (this is also true of line numbers) unless desired.

You can pass variable values to called procedures in two ways: by reference or value. Variables passed to other procedures are called parameters and are included in the call or RUN command.

You must use the PARAM statement to define variables in order to prepare the called procedure for the incoming parameters. (PARAM is just like a DIM statement, except that it signals Basic-09 that defined variables are going to be sent from other procedures, and not defined within the module.) The called procedure can then act upon the variable without altering the value in the calling procedure (value), or it can pass any new values back to the calling procedure when it is finished (referenced).

Ease of Use

Because Basic-09 operates under OS-9, it would seem logical that there be ways to access OS-9 commands, and there are. This is perhaps the one feature of Basic-09 that pleased me the most, because, unlike the OS-9 manuals, descriptions, and convolutions, Basic-09 accesses OS-9 in a straightforward fashion.

In other words, if you wish to make use of the power of OS-9 while programming in Basic-09, you can do so easily. But if you wish to leave OS-9 all by itself, then Basic-09 is a complete, stand-alone programming environment. Access commands are simple and to the point:

- $ is a nondestructive way to call the OS-9 shell command interpreter to process an OS-9 command or run another program without disturbing Basic-09. You return to Basic-09 when you execute the command.
- BYE exits Basic-09 returning control to OS-9 or to the program that called Basic-09.
- CHD and CHX change the current OS-9 user Data or Execution Directory to a specified pathlist.
- CHAIN performs an OS-9 chain operation on the shell, exiting, unlinking, and returning Basic-09's memory to OS-9.

● SHELL allows Basic-09 programs to run any OS-9 command or program and then return to Basic-09.

Other nice features of Basic-09 are sure to enhance its usefulness. As you enter each line, the editor checks for syntax and other errors, telling you right away if you've created a problem somewhere (the screen usually displays the errant line with an arrow pointing up at the error).

As you enter each line, it is compiled into an intermediate stage called I code. The program passes the entire procedure through the compiler again when you exit the editor.

This intermediate compiling not only means that your programs will take up less storage space in memory (approximately 30 percent less), but also that you can decompile, list, and modify programs in I code while you retain valuable information like variable names and line numbers (unlike other compilers, with which you lose the easy editing ability once you've compiled the program).

When Basic-09 runs a procedure that has gone through this initial compiling, an I-code interpreter once again passes the program through the compiling operation, resulting in an obvious speed increase. (Initial testing showed an approximate 40 percent increase in speed on a simple graphics routine.)

Once you've thoroughly debugged a program, you can perform a final compile with the PACK command. Once you've PACKed a program, you can't go back to decompile, list, or otherwise change the code, because it is as close to machine language as you can get without writing it in Assembly language.

You use the editor not only to enter programs; it is a full-featured text editor that lets you search, list, and modify a program in memory. It is not a full-screen text editor, but it is close enough so that you shouldn't have too many frustrations in working with it once you understand all the commands.

Finally, Basic-09 has a comprehensive debug mode that allows such actions as the following:

● BREAK sets a break point in a program. This is similar to PAUSE, in that the program automatically passes a procedure control to the debug mode whenever it encounters a break or pause.

● DIR displays the current workspace directory.

● Q exits debug mode, terminates execution of all procedures, and returns to system mode.

● LET lets you assign new values to variables without interrupting program execution to that point.

● LIST displays a formatted source listing of the suspended procedure.

● PRINT displays the current variable values. You can also use the PRINT USING form of the command in debug mode to format the display.

● STATE gives a listing of the nesting or calling order of all active procedures.

● TRON and TROFF are similar to the Color Basic commands of the same name, except that they display the entire uncompiled line before the statement is executed.

● STEP lets you step through a procedure one line at a time (by pressing the return key) or a specified number of lines at a time (i.e., STEP 10 would step through the next 10 lines of the current procedure). If the trace mode is active, STEP can display each line as it is executed.

Documentation

Though only 130 pages long, the manual is very complete. It gives program examples in many instances to clarify vague areas. The language is clear without long passages of jargon.

The manual conveys the information in an orderly format without being condescending or assuming too much of the reader. I felt that the sections on debugging techniques and program optimization were especially valuable and well thought out.

The sample programs, while sometimes a bit obscure in their purpose (computing the first 10 Fibonacci numbers or expressing integers as Roman numerals), were valuable in providing examples of program structure and flow. After the poor OS-9 manuals, this was a welcome change.

There are two problems with the documentation. For one, it is nearly impossible to distinguish between a one and a lowercase L. This can be frustrating at times, but not impossible with a little care.

The second problem is somewhat more serious, depending on how much you know about the OS-9 operating system. The Basic-09 manual says that you only need to type BASIC09 from the OS-9 system prompt to enter Basic-09. However, they failed to mention that you must first copy Basic-09, GFX, RunB, and Inkey onto your OS-9 master disk.

The procedure for doing this is rather involved—it's definitely not something that many less experienced users will stumble upon when trying to use Basic-09. You must first use the DELDIR DEFS command to delete the DFS file on your OS-9 backup copy (or working disk). Unless you are going to be doing much Assembly-language programming, you don't really need the DEFS file.

When the OS-9 prompt appears, enter DELDIR DEFS. When prompted again, enter D and then enter LOAD COPY. If you have one disk drive, insert the Basic-09 master disk and enter

```
COPY /D0/BASIC09 /D0/CMDS/BASIC09 -S #20K
```

Be sure to include all spaces. Prompts will then lead you through a series of disk swaps as the file is copied onto your OS-9 disk under CMDS. Repeat this procedure for GFX, RunB, and Inkey.

Double disk drive users should enter the following copy format:

```
COPY /D1/BASIC09 /D0/CMDS/BASIC09
```

Once you have Basic-09 and the other files on your OS-9 master disk, simply type BASIC09 (from the OS-9 prompt) and you are ready to go. Why Radio Shack omitted this vital information from the manual is a puzzle that only they can answer. One of the technical people in Fort Worth told me that they assumed people familiar with OS-9 would realize that this copying would have to be done and how to do it.

But since the Basic-09 manuals are much simpler than the OS-9 manuals, it seems people will be using Basic-09 as an inroad to the complexities of OS-9. If this is true, then a new Basic-09 owner would not necessarily know these aspects of OS-9 file handling. The technician agreed that it was a mystery.

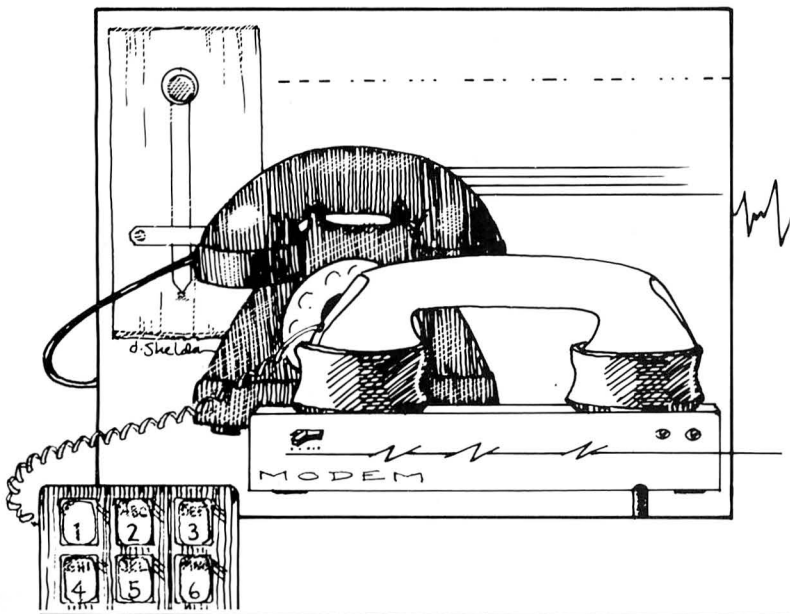
Basic-09 is worth the money if you are serious about programming but don't want to do everything in Assembly language. Basic-09 is a high-powered version of Basic and offers so many numerous variations that it could be considered an entirely new high-level programming language.

The manual is clear enough to make the transition from Extended Color Basic to Basic-09 easy enough, although it will still take time to fully understand Basic-09.

Basic-09 is an important step that opens the power of OS-9 to the average Basic programmer. C, Forth, and Assembly language now have a respectable competitor in Basic-09 and "written in Basic" should take on an entirely new meaning. ■

BY W.C. BANTA

SIX SMART WAYS TO GO ON LINE



Take a comprehensive look at the CoCo's six most important smart-terminal packages.

Eds. note—In this first of a two-part series comparing six smart terminals for the Color Computer, W.C. Banta looks at the tape and ROM-pack versions of Softlaw's VIP Terminal, Computerware's Color Connection, and Eigen Systems' Colorcom/E. Next month, he will review Cer Comp's Data Pack II, Double Density's Colorterm +Plus+, and PXE's Auto Term, and include a comprehensive table comparing the important features of all six packages.

Communications software lets you talk through your computer to other computers. There are thousands of telephone information services in the U.S., and more are added almost every day. Some are expensive to use—CompuServe and The Source are well-known, but cost enough to drive some enthusiasts away. But students at most colleges can speak to the campus computer for almost nothing, and specialty systems exist for the handicapped, computer user's groups, and many other purposes.

For me, computer communications turned my computer into a powerful business machine. It gave me ready access to a large mainframe with massive disk storage, statistical packages, word processors, and more.

Communications by telephone requires a minimum of about $100 worth of hardware—a modem and some connecting cables. Radio Shack, among others, can sell you all the stuff you need, and the instructions make it easy to install the hardware. You'll also need $30–$80 worth of software to convert the electrical signals from the outside computer into language your CoCo can understand.

You might want to avoid the Radio Shack communications software, because you can't use it to upload data, even though their terminal program costs as much as or more than better software from private companies.

The term upload means that you can store information in part of your computer's memory—called the buffer—and transmit it to the host machine while you go do something else. For example, you might write a program or some text for a paper, put it on tape, and later upload it to a mainframe computer to process. Or you might swap programs with a friend by telephone.

"Smart-terminal software" usually refers to those programs that let you upload data. They can save you money, because you don't have to type while you're on line, paying for a long-dis-

"There are essentially six smart-terminal programs to choose from, ranging in price from $32–$53."

tance call. As a bonus, you can also use the buffer to download, or store what the host computer sends you. You then can read through the buffer, print out the information (on most systems, at least), or save it to tape or disk.

There are essentially six smart-terminal programs to choose from, ranging in price from $32–$53. In general, all the programs available now are pretty good—a substantial improvement over the past year. However, that's not to say that just any old terminal program will suit your needs. There are almost as many reasons for wanting to access host computers as there are computer users. Software perfect for one user may be useless for another.

Some of the most important considerations in comparing these programs are as follows:

- Cost: The most expensive aren't always the best. I used the price advertized recently in computer magazines like *HOT CoCo* and included shipping and handling costs.
- Versatility: You can use some programs only with host computers that use the most common methods of telephone communications. Other programs allow more freedom. If you want to access many different kinds of computers, or if the one you use most is unusual or finicky, you need a terminal package with more selectable communication options.

I tested all the programs on at least two host computers: an "easy" system that all programs should be able to handle, and an eccentric half-duplex IBM system that would accept no transmissions over 72 characters long.

- Ease of use: That's subjective, but there are rules. The instruction manual should tell you everything you need to know, and after a little practice, you should be able to use the software without having to look at the instructions. Commands should be easy to remember and convenient. You should be able to look at the buffer any time to find what you want, quickly.
- Bugs, deficiencies, and needless inconveniences: These sometimes creep into the best commercial software. Fatal bugs are rare, but some can prevent you from doing what you want to do. Sometimes a software author forgets to add a line break. Sometimes a feature that works fine on one system fails on another because of some peculiarity of the host computer. Sometimes commands that work fine in uppercase won't work in lowercase. Little things like these make software harder to use than it ought to be.

The terminal-software authors I talked to were all responsive and anxious to make theirs the best. If you have problems, tell the manufacturer about it, and they're likely to offer a solution.

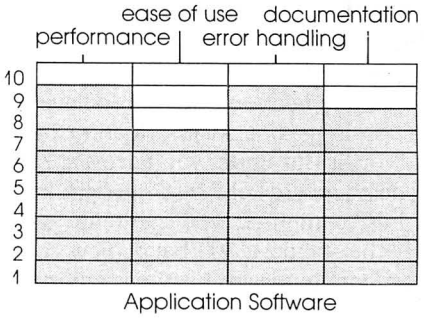
- Features: Here's where there's the most variation. Some let you change what's in the buffer; others don't. Some permit high speed communications; some don't. These are matters of preference—one user may adore what another thinks are electric tail-fins.

There's no way to evaluate features except to record their presence and presume that the more useful features there are, the better—as long as they don't get in your way or eat up too much RAM.

"Next month I'll have a big table that compares the main characteristics of each of the software packages. There'll also be a shorter chart to help you decide which terminal program is best for your applications."

Next month I'll have a big table that compares the main characteristics of each of the software packages. There'll also be a shorter chart to help you decide which terminal program is best for the applications you have in mind.

For the present, I'll consider only tape and ROM-pack versions of terminal programs. Most CoCo owners don't own disk drives, and the disk and non-disk versions of these programs usually don't differ much. There are exceptions. The Colorcom/E disk version is more elaborate than the tape version. Furthermore, disk versions need separate discussions of their operating systems, so I'll look at disk versions later.



The VIP Terminal
Softlaw Corporation
9072 Lyndale Ave. S.
Minneapolis, MN 55420
612-881-2777
$49.95 16K ROM Pack,
32K tape or disk

VIP Terminal is classy software, flawlessly designed and thoroughly debugged. It's so good overall, it makes a good benchmark with which to compare other packages.

The ROM-pack version has a memory-sense function that checks your machine for available memory. Memory sense seems like a nuisance, because it takes a long time to boot if you have over 16K. But it's time well spent. The software zeros out memory and rejects bad RAM. If you have 64K, and the extra memory chips have been properly installed, VIP Terminal lets you access the extra 32K.

VIP Terminal is almost entirely menu driven—and capably so. The instruction book is excellent, but you hardly need to look at it after you read it once, because the software menus tell you most of what you need to know to make it go. There are perhaps a dozen special commands not in menus that you have to remember, and a Help command summarizing them would be a welcome addition to the next update.

Like all terminal software, VIP Terminal has two main modes: the communications mode and the command mode. While you're in the communications mode, you're speaking to the host computer, and almost everything you type is sent over the telephone line to the host computer.

In the command mode, you ignore the host computer for a while and tell VIP Terminal what you want to do. For example, you might look at what's in the buffer, change settings, or load some information from tape into the buffer.

You are not likely to meet up with a host computer that VIP Terminal cannot handle. There are provisions for seven baud rates, from 110–9,600. The

baud rate measures how fast information is transmitted.

In general, the higher the baud rate, the better, because you don't have to wait so long to send information back and forth. But unless you have a special modem and are talking to the right kind of host computer, you can't use rates over the standard 300 baud. Few computer communication systems are made to operate over 1,200 baud.

You can use 7- or 8-bit words; any number of stop bits (1–9); odd, even, or no parity; and full or half duplex. You can use the host computer's line feed or add your own. These technical details are important, but all you really have to know to talk to a host computer is which values to set.

In most cases you won't have to worry about them; you can just use the default values, but it's good to have a large variety of possible settings so you can talk to odd computers that use unusual conventions.

Besides the normal set of printable characters such as letters, numbers, and punctuation marks, VIP Terminal can transmit or receive a large number of control characters, which communication systems use for various purposes: signalling the start of a line, for instance.

You can decide if you want control characters to be used, printed to the screen, or filtered out (discarded). VIP Terminal also lets you transmit one other symbol used commonly by host computers: the line break. For some computers, it's the only way to interrupt executing programs or to delete partly entered lines.

The screen display is so fine that it's reason enough to buy VIP Terminal. The default is a 51-character line, displayed with lowercase and true descenders. The characters are beautiful and varied—the same fonts are used in Softlaw's VIP Writer. It's far and away the most readable and versatile of the character sets available for the Color Computer.

Nice as this high-resolution character set is, VIP Terminal lets you turn it off and return to a 32-by-16 display. The software-generated letters form a good deal more slowly on VIP Terminal than on any of the competition—a significant deficiency. If you have a screen full of text, it will be a second or two before a full screen can scroll to make room for a new line at the bottom. Worse, you may lose information from the host computer, because a working buffer holds incoming data while the CoCo puts it up on the screen.

If data comes in faster than your machine can make the letters, it gets behind and the buffer fills up. From then on, anything that comes in from the host is likely to be lost. The faster information comes in (the higher the baud rate) the sooner the computer gets behind and the more information is lost. If you're using the hi-res character set, even 300 baud may be too fast for VIP Terminal to receive long passages of text.

"VIP Terminal comes with 10 programmable function (PF) keys that let you transmit one line of anything you please just by hitting two keys."

You can also choose not to use the word mode—a feature that brings down words to the next line if they are broken in two on the right margin of the screen. That speeds things up even more, because the whole screen won't have to scroll every time it encounters a split word.

If you like, you can delete the hi-res screen, freeing the RAM that's otherwise needed to make graphics letters. That means more room in the buffer for you. To get back the hi-res screen, you have to turn the computer off and reload.

Why then would you want a hi-res screen? You can use the graphics display to handle output from host computers that require line lengths longer than the limiting 32 columns. For example, a statistical package on a mainframe I use produces graphs using letters in lines at least 64 characters long. Normally the CoCo has to scroll everything from column 33 onto the next line, and you can't see the overall picture. VIP Terminal provides for line lengths of up to 85 columns, but because of the limitations of a television screen, characters printed in line lengths over about 65 are hard to read.

You have four color combinations to choose from to view hi-res text: two reversed (light on dark) and two dark on light. One of the color sets is sure to please your mood and produce a legible image. You can reverse the low-res screen, too.

One aggravation unique to VIP Terminal is the cursor: It's a horizontal line just under the letters. If you push the space bar repeatedly, you'll find that the cursor moves only on every other push, although the print position does move even though the cursor might not indicate so.

That makes it hard to decide exactly where the cursor is—a minor annoyance when you're entering data where the column number is important. I would have liked an optional, audible keystroke tone; we hunt-and-peck typists appreciate that.

VIP Terminal comes with 10 programmable function (PF) keys that let you transmit one line of anything you please just by hitting two keys. They are useful for words or phrases you use a lot—passwords, for example, or file commands. If you have an autodial modem, you can program PF keys to dial the host computer, and you can record the programmed functions on tape to speed your setup next time.

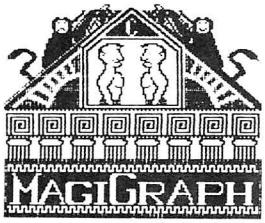
Once you hit the PF key, the message is sent and there is no way to modify it. That's too bad; it would have been easy for Softlaw to let you customize your line each time you use it. For example, sometimes I want to use a PF key to write out a complicated command for the host, like ROUTE DS=3,4 TO=, and then provide some extra information before I send the line.

Buffer operation is simple and reliable, but primitive compared to some of the competition. You use a "secret key" (shifted left arrow) in the command mode to open and close the buffer. This puts all the subsequent conversation between you and the host into the buffer until you close it. When you ask the host to transmit something, and you store it in your computer's buffer, you are downloading.

There are provisions for automatic downloading, whereby the host computer opens the Color Computer's buffer with a control character and closes it again when it's through. You can do it manually, if you prefer. You can also put information into the buffer by downloading to a tape and then reading the tape file. VIP also has a great feature that lets you skip over garbage on tape until the appearance of data opens the file. This saves endless I/O errors. The instruction book also gives a helpful method to help recover data from bad tapes.

You can clear the buffer from the menu, but otherwise you can't make any changes in what's there, nor can you select parts to transmit or save. You save it all, as is, or none of it.

You can choose the Display Buffer option from the main menu, but displaying the buffer is a slow process if you're using the hi-res graphics charac-



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Stop Waiting Around for the Printer! **CSPOOL** allows you to use your printer and computer concurrently, takes only 26 bytes of Color Basic's memory, and gives you 32K of print buffer. It's like having two computers in one! By intercepting characters sent to the printer and storing them in the upper 32K of RAM, **CSPOOL** allows you to run other programs while your printer is doing its job. **CSPOOL** is FREE with the purchase of a 64K RAM UPGRADE KIT from The Micro Works, or it may be purchased separately on cassette or diskette for **$19.95**. Requires 64K; not for FLEX or OS9.

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The MICRO WORKS COLOR FORTH is a Rompack containing everything you need to run Forth on your Color Computer. COLOR FORTH consists of the standard Forth Interest Group (FIG) implementation of the language plus most of FORTH-79. It has a super screen editor with split screen display. Mass storage is on cassette. COLOR FORTH also contains a decompiler and other aids for learning the inner workings of this fascinating language. It will run on 4K, 16K, and 32K computers. And COLOR FORTH contains 10K of ROM, leaving **your** RAM for **your** programs! There are simple words to effectively use the Hi-Res Color Computer graphics, joysticks, and sound.

Includes a 112-page manual with a glossary of the system-specific words, a full standard FIG glossary and complete source listing.

MICRO WORKS COLOR FORTH . . . THE BEST! From the leader in FORTH, Talbot Microsystems. **$109.95**

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

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

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

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PARALLEL PRINTER INTERFACE—Serial to parallel converter allows use of all standard parallel printers. PI80C plugs into the serial output port, leaving your Rompack slot free. You supply the printer cable. **PI80C: $59.95**

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6809 ASSEMBLY LANGUAGE PROGRAMMING, by Lance Leventhal, $18.95

TRS-80 COLOR COMPUTER GRAPHICS, by Don Inman, **$14.95**

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ters, because the letters take a while to form. There is no way to back up, nor can you skip pages. You have to list out the whole buffer if you need to see what went in last.

When you return to the communications mode from the menu, moreover, everything that was on the screen is gone, and the buffer is closed. These are needless restrictions that make it hard to take advantage of an important convenience in having a buffer: looking back to read what scrolled off the screen just a few moments ago.

There is no way to select a portion of the buffer to display. That's a disadvantage, because some output—graphs and tables, for example—is designed to be viewed as a whole. If the picture is cut in the middle by a page break, you'll have to print it to see it properly.

When you send the contents of the buffer to a printer, you disconnect the modem from the RS-232 port and connect the printer. You can specify printer baud rates from 110–9,600 and decide whether or not you want to show line feeds in the result. As with the buffer display, you must print the whole buffer or nothing.

VIP Terminal outclasses most of the competition in the uploading procedure. Many host computers accept almost endless data at a gulp, but some demand a carriage return after every 72 characters or so. The host then does something with the line and expects you to wait until it's ready again.

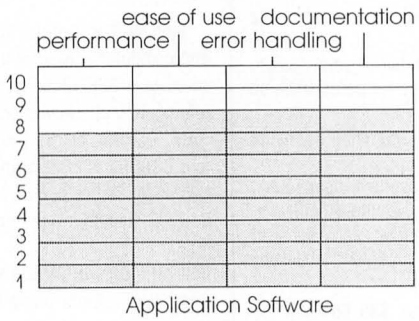
If your software doesn't know to do that and sends the next line before the host is ready, the host chokes up and expresses its displeasure in some unpleasant way, such as losing part of each line or dumping you off the system. The host tells the Color Computer it's ready for the next line by sending a prompt—usually a control character.

VIP Terminal gives you four options for uploading. You can send the whole buffer as one long string with no pauses, or you can select a delay between lines. You can also specify the control character the host computer sends when it's ready for the next line.

Your fourth choice is XON/XOFF uploading, which uses some common prompts to send lines. One of these choices is sure to please any host computer you're likely to encounter.

The 33-page instruction book is the finest and most detailed of any I've seen. If you read it carefully, you're not likely to have questions left over, but if you do have problems you're in luck there too; I found the folks at Softlaw to be responsive to phone calls and letters.

"The Color Connection lets you either program a delay of up to 25 seconds between lines or use a prompt character."



The Color Connection
Computerware
Box 668
Encinitas, CA 92024
619-436-3512
$34.95 16K tape
$39.95 16K disk

The Color Connection is menu driven, but there are 18 or so "secret keys" you'll have to find in the instructions until you get used to them.

The instruction manual is well organized, but short and sometimes hard to follow. Fortunately, it comes with some bonus software: a well-designed cassette tutorial on computer communications. It explains some of the more technical aspects of telephone data exchange in simple language. There's even a self-test at the end.

You can set most of the common parameters that you're likely to find among host computers and save that configuration to tape or disk. You can't change the baud rate, however—it's set at the standard 300 baud. There's a separate autodial buffer that dials the host computer, if you have a smart modem.

Lettering is beautiful and very readable software script on a 51-by-23 array. You can choose between light on dark or reverse video and you can prevent split words with word mode. Words more than 15 characters long are not split; I liked that feature. The response is faster than that of any other graphics-mode communication software I've seen, which makes it a pleasure to watch and use.

And you don't have to sacrifice the graphics letters to download long passages, as you sometimes have to do with VIP Terminal. You can't change the number of columns, however, so if you receive graphs or other patterns with line lengths over 51 characters, you still won't see the whole picture. Nor can you kill the graphics letters to get more buffer space—a minor disadvantage.

The buffer has its own menu. You view it a line at a time, but you can go up or down, or leap to the top or bottom of the buffer. I especially liked having the current buffer capacity displayed in the communications mode; you can tell you're running out of room before you run out.

You can type to the buffer, which is nice, because you can enter data off line (for free), then upload when you're on. You can't edit, though.

There are four PF keys, each programmable with up to 40 characters; you can save the PF macros along with the rest of the setup file (baud rate, duplex, and the like) to tape or disk. I liked the convenience of having to load only one setup file instead of the usual two.

You can also save the contents of the buffer on tape or disk, but you can only save or load ASCII files. You can save part of the buffer or all of it using a handy file-open and file-close command.

The Color Connection won't print the buffer, but the instructions give you a 15-line Basic program to print ASCII files from tape.

The Color Connection lets you either program a delay of up to 25 seconds between lines or use a prompt character—control characters included. You enter prompt characters in decimal ASCII format. Unfortunately, I never was able to make The Color Connection upload to the demanding IBM half-duplex system. Nor could I make either the delay or the prompt features work.

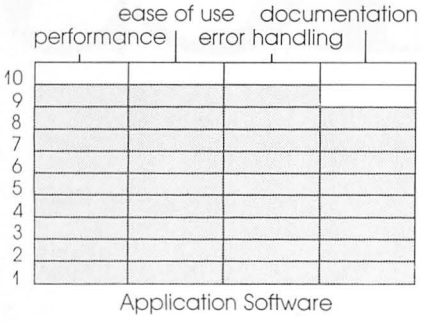
There are a few other problems with the program that annoyed me. The menu has an unnecessary "exit to Basic" command. Touch it by accident, and poof!—The Color Connection vanishes without so much as an "Are you sure?" prompt. It's a useful feature on a disk system, but the only thing it can do on a tape version is produce catastrophies.

The backspace doesn't erase characters on the screen, so you can't always tell what was in the line you just sent. There's a permanent line of text at the bottom of the screen that makes it hard to follow what the host computer is writing. That line belongs at the top of the screen.

If you have to load a file from tape

and can't remember the file name, you have to enter a space before you push enter. That's not mentioned in the documentation.

The Color Connection is quality software and may be just what you need, as long as you don't have to upload to host computers that demand special conditions. The new version is much better than the old, and Computerware has a generous update policy that makes it worthwhile to return your old Color Connection for a new one.



Colorcom/E v. 4
Eigen Systems
Box 10234
Austin, TX 78777
Distributor: Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807
$49.95 ROM pack or disk

Colorcom/E has much to recommend it: It's bugless and has an exceptionally convenient command and buffer-review system. It also comes as a convenient ROM pack, with better protected connectors than VIP Terminal.

Colorcom/E is not quite menu-driven, but it does offer a convenient mix of command keys and help features that work much like menus. A simple two-key press puts you into the command mode, and a command summary appears at the bottom of the screen. You can turn the summary off once you learn the commands.

Commands often lead you into a secondary menu. For example, entering L in the command mode lets you change communication parameters. There's a prompt for each change, and instructions to tell you which key does what. I found this to be among the handiest of all the terminal-command systems.

There are some annoyances, however. The help menu doesn't list all the commands, so you'll need to keep the instructions around until you learn the commands you use most often, and you'll always need the book in case you forget the less-used ones.

There's also no way to load a setup file from tape, and there's no way to tell what parameters are in effect—a minor disadvantage.

Colorcom/E comes with an automatic memory-sense feature. But with an empty buffer my 64K machine had 39,934 bytes available. Colorcom/E runs on 4K, so 39934 seems too low.

Colorcom/E is convenient to use with smart modems. A control key lets you change the parameters to those of the Radio Shack Modem II. Touch the key again and you're back to the original parameters.

"Colorcom/E is convenient to use with smart modems. A control key lets you change the parameters to those of the Radio Shack Modem II."

You will probably want to use the 51-column graphics screen letters. Uppercase letters are attractive and readable, but lowercase characters are blocky and crowded. The 64-column characters hold up well, especially in uppercase, and you can enter and read data on a TV screen. That's not the case with most of the packages I saw. There are no true descenders.

Unlike most other packages, you can't go readily back and forth to various line lengths. You have to reset and start over. Once you've killed the hi-res characters, there's about 4K more room in the buffer for data.

Response time on the graphics screen is very fast, so you don't lose while you're receiving, at least at normal baud rates. You can turn the word mode on and off, but there's no way to alter the color set or reverse the screen to light on dark—a minor disadvantage.

The cursor in hi-res is a horizontal line that moves each time you push the space bar, so you can easily use it to enter data in columns. However, the cursor doesn't erase when you backspace—an unnecessary annoyance. In low-res, the cursor is a reversed left arrow, which is a disadvantage because when you backspace over lowercase characters the cursor is hard to find. I also missed having an audible keystroke and PF keys.

Colorcom/E's buffer system is excellent, innovative, and easy to use. The buffer is partitioned into two parts: a transmit buffer and a receive buffer. You load the transmit buffer from tape or type data into it when you first sign on. This is the buffer that you can send to the host computer.

The host machine writes to the receive buffer, and you use this area primarily to review what's been said or to save downloaded information on tape. There's no simple way to move information from one buffer to another.

The receive buffer is open when you enter the communication mode, but you can close it whenever you like. It fills from bottom to the top, and when it's full, the oldest information is erased. That feature is unique to Colorcom/E, and I liked it a lot. When I use my 16K machine, I have a record of the most recent data, without having to worry constantly about the buffer filling up.

You see the bottom of the receive buffer automatically when you enter the command mode. A control key takes you to the top of the file or up or down the page. If you want, you can go up or down a line at a time, so you can choose where your page breaks are, which is essential in looking at complicated graphs and charts. You also can mark the start and end of the receive buffer to save selected parts to tape. You cannot edit or selectively delete parts, however.

Another control key displays the transmit buffer from top to bottom. You can only load or write ASCII files to tape. There is a provision to pass or filter out control characters when you write to tape.

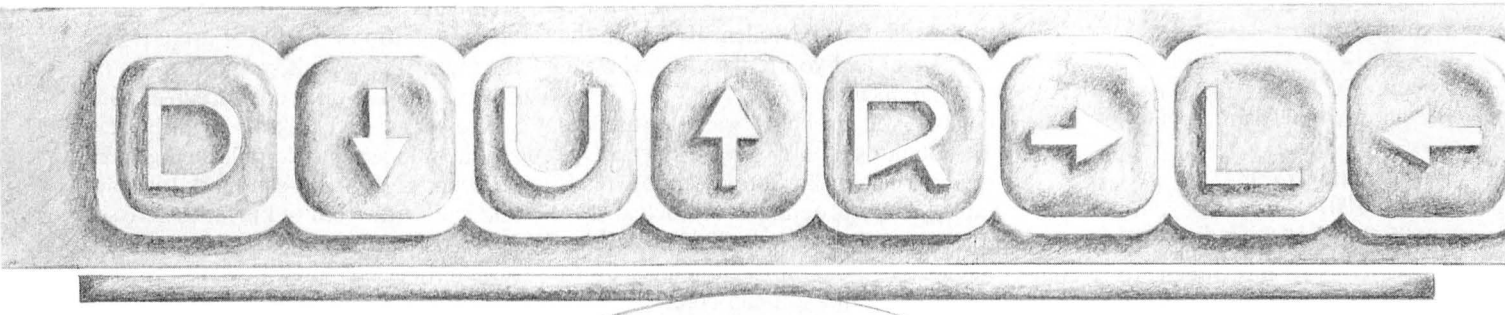
A second way to get data into the transmit buffer is to type it in before you go on line to the host computer. However, backspacing is the only way to edit its content.

You can only load the transmit buffer to the host. You can set a substantial delay between lines or use prompt characters, including control characters. Each line appears on the screen as it is uploaded. Everything worked well in my upload tests.

Colorcom/E can only print the receive buffer, but it can handle most kinds of printers. You can select to print a portion of the buffer and filter or pass control characters or line advances, but you don't get any other options for formatting printouts.

The instruction book is brief but adequate, and Spectrum Projects will help you with any technical problems by letter, phone, or email. ■

GRAPHICS



Save yourself time and tedium when you let your CoCo take the drudging out of plotting graphics.

by

L. W. Gross

Good graphics can be the calling card of any successful program. They can also be tedious and time consuming to create. Basic Builder takes the tedium out of programming graphics by putting the Color Computer to work writing code for you.

Basic-generated graphics have marked advantages over machine-language screen dumps. With shorter saves you stand less chance of losing your work because of a bit drop, and you can store five or more high-resolution screens in 16K. This is impossible with screen dumps.

The big problem with Basic graphics programming is the number crunching drudgery of plotting all those X,Y locations. Here is where Basic Builder (Program Listing 1) is effective, if not totally efficient.

Basic Builder

This program automatically generates a second Basic program that defines any image you draw on the screen. Put a blank tape in the recorder and press the play and record buttons. Basic Builder asks you to input a file name for your generated program, then clears the screen to PMODE4.

Using the arrow keys, you move a flashing pixel around the screen, placing it where you want it. Press the S key (start line), move the pixel again, and press F (finish line). You now have a line between points S and F.

At this point you have entered the file name and 100 PMODE4,1:PCLS: SCREEN1,1, and 110 LINE(5, 5) -(9, 9),PSET. (on tape). Again, press S, move the pixel, and press F. The next tape entry is 120 LINE(9 , 9)-(19, 9),PSET.

Here you see one of the inefficiencies I mentioned earlier. The line should read 120 LINE-(19, 9),PSET to save a minimum of 5 bytes or a maximum of 9. If you moved the pixel and pressed F without pressing S, you got 130 LINE(19, 9)-(29, 29), PSET.

To erase an incorrect line, press M (mistake) and L (line). The incorrect entry was printed to tape and nullified by decrementing the variable used to insert the line number. When you enter the next line (also numbered 130) to tape, and load the tape, the effect is the same as when you reenter a typed line.

In the circle mode, place a pixel at a desired center and press C (center), move it horizontally to a desired radius, and press O. You get a circle while the line 140 CIRCLE(100, 55),3 prints to

BUILDER

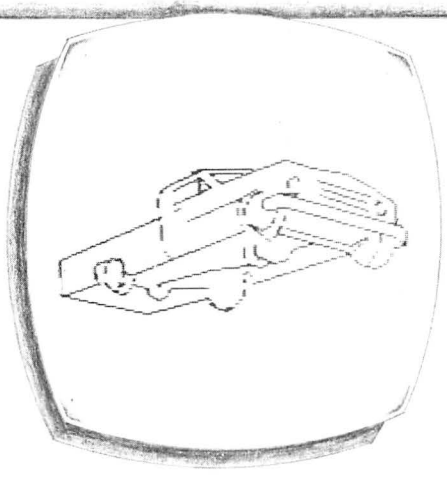
tape. If you make a mistake positioning the circle, press M followed by C to eliminate the circle and decrement the line number.

Unfortunately, there are no menu options available for the CIRCLE command, but if you forget which key does what, press the A (aid) key. Holding down a menu key displays all other options.

DRAW

The draw mode works differently from the line mode and has its own inefficiencies. Press D to call the mode, but be sure to release it because until you exit the mode, D denotes down. Draw mode function keys are U (up), D (down), R (right), and L (left), and 45-degree angle keys E, F, G, and H.

When you first press D the computer stores a line number, a DRAW command, and a start position as a string variable in 150 DRAW"BM 50, 55. Press another function key, R for example, and variable H is incremented leaving a lighted pixel to the left of the new location. This routine repeats until you release the R key.



Each time the program repeats this cycle it increments G, and with the release of R, it adds both R and the total number of passes (G) to the string variable, which now reads 150 DRAW"BM 50, 55R 30. The process of adding to the string continues until it is full, or you exit the draw mode by pressing X. Then a quotation mark is added to the string and printed to tape.

The variable Q set in line 20 determines the full length of the string, and you can edit to lengthen or shorten. When a string is full and has been printed, the program determines a new line number and position and enters them into a new string (still U$!).

The problem with this mode is that when a line must stop at a certain point, most users "sneak up on it" and the resulting program line reads 160 DRAW "BM 80, 55D 45D 1D 1D 2D 1, rather than a human generated 160 DRAW "BM 80, 55 D50". This is because consecutive Down entries are replaced by a

System Requirements

16K RAM
Extended Color Basic

Program Listing 1. Basic Builder

```
Ø '      BASIC BUILDER
5 ' (C)  BY L.W. GROSS
1Ø '     394 A SAN BRUNO AVE.
15 '    BRISBANE, CA. 94ØØ5
1ØØØ 'SETUP
1Ø1Ø CLEAR4ØØ,16Ø85
1Ø2Ø CLS:PRINT:PRINT:PRINT
1Ø3Ø LN=11Ø:Q=64
1Ø4Ø INPUT"PROGRAM NAME";F$
1Ø5Ø CLS
11ØØ 'PRINT MENU
111Ø PRINT"S=START (LINE)","F=FI
NISH (LINE)","A=AID (HOLD DOWN)"
,"E=END","P=PAINT"
112Ø PRINT:PRINT"C=CIRCLE MODE",
"O=DRAW CIRCLE"
113Ø PRINT:PRINT"D=DRAW MODE":PR
INT"R=RIGHT","L=LEFT","U=UP","D=
DOWN","E=UP-RIGHT","F=DOWN-RIGHT
"
114Ø PRINT"G=DOWN-LEFT","H=UP-LE
FT","B=BLANK LINE","X=X-IT (EXIT
)"
12ØØ 'SETUP TAPE
121Ø OPEN"O",#-1,F$
122Ø T$="1ØØPMODE4,1:PCLS:SCREEN
1,1"
123Ø PRINT#-1,T$;
124Ø H=96:V=96
125Ø FORTMR=1TO5ØØ:NEXT
13ØØ 'MAIN INKEY$
131Ø PMODE4,1:PCLS:SCREEN1,1
132Ø IFPEEK(341)=247THENV=V-1
133Ø IFPEEK(342)=247THENV=V+1
134Ø IFPEEK(343)=247THENH=H-1
135Ø IFPEEK(344)=247THENH=H+1
1355 GOSUB45ØØ
136Ø PSET(H,V,3):FOR TMR=1TO3Ø:N
EXT:PSET(H,V,4)
137Ø A$=INKEY$
138Ø IFA$="S"GOSUB147Ø
139Ø IFA$="F"THENGOSUB151Ø
14ØØ IFA$="A"THENGOSUB35ØØ
141Ø IFA$="P"GOSUB17ØØ
142Ø IFA$="E"THENLN=LN+1Ø:PRINT#
-1,STR$(LN)+"GOTO"+STR$(LN):CLOS
E#-1
143Ø IFA$="M"THEN LN=LN-1Ø:GOSUB
16ØØ
144Ø IFA$="C"THENGOSUB18ØØ
145Ø IF A$="D"GOSUB22ØØ
146Ø GOTO132Ø
147Ø HH=H:VV=V:RETURN
15ØØ 'LINES ROUTINE
151Ø LN=LN+1Ø:LINE(HH,VV)-(H,V),
PSET
152Ø U$=STR$(LN)+"LINE("+STR$(HH
)+","+STR$(VV)+")-("+STR$(H)+","
+STR$(V)+"),PSET"
153Ø PRINT#-1,U$
154Ø RETURN
16ØØ 'MISTAKS
161Ø A$=INKEY$:IFA$=""GOTO161Ø
162Ø IFA$="L"THENLINE(HH,VV)-(H,
V),PRESET
163Ø IFA$="C"GOSUB21ØØ
164Ø RETURN
17ØØ 'PAINT ROUTINE
171Ø PAINT(H,V),3,3
172Ø LN=LN+1Ø
173Ø U$=STR$(LN)+"PAINT("+STR$(H
)+","+STR$(V)+"),3,3"
174Ø PRINT#-1,U$
175Ø RETURN
18ØØ 'CIRCLE SETUP ROUTINE
181Ø X1=H:Y1=V
182Ø A$=INKEY$
183Ø IFPEEK(344)=247THENH=H+1
184Ø IFPEEK(343)=247THENH=H-1
1845 GOSUB45ØØ
185Ø X2=H:PSET(H,V,3):FORTMR=1TO
25:NEXT:PRESET(H,V)
186Ø IFA$="O"THENGOSUB2ØØØ:RETUR
N
192Ø GOTO182Ø
2ØØØ ' CIRCLE ROUTINE
2Ø1Ø CIRCLE(X1,Y1),(ABS(X1-H)):L
N=LN+1Ø
2Ø2Ø U$=STR$(LN)+"CIRCLE("+STR$(
X1)+","+STR$(Y1)+"),"+STR$(ABS(X
1-H))
2Ø3Ø PRINT#-1,U$
2Ø4Ø RETURN
21ØØ 'MISTAKEN CIRCLE
211Ø CIRCLE(X1,Y1),(ABS(X1-X2)),
2:LN=LN-1Ø:RETURN
22ØØ 'DRAW INKEY$ ROUTINE
221Ø A$=INKEY$:IFA$<>""GOTO221Ø
222Ø X2=H:Y2=V
223Ø LN=LN+1Ø:U$=STR$(LN)+"DRAW"
+CHR$(34)+"BM"+STR$(H)+","+STR$(
V)+";"
224Ø A$=INKEY$
225Ø IFA$="B"GOSUB24ØØ
226Ø IFA$="N"THEN255Ø
227Ø IFA$="U"GOSUB26ØØ
228Ø IFA$="D"GOSUB27ØØ
229Ø IFA$="R"THENGOSUB28ØØ
23ØØ IFA$="L"GOSUB29ØØ
231Ø IFA$="E"GOSUB3ØØØ
232Ø IFA$="F"GOSUB31ØØ
233Ø IFA$="G"GOSUB32ØØ
234Ø IFA$="H"GOSUB33ØØ
235Ø IFA$="X"THENU$=U$+CHR$(34):
PRINT#-1,U$:GOTO132Ø
236Ø IF W=1 GOTO223Ø
237Ø GOTO224Ø
24ØØ 'BLANK DRAW INKEY$ ROUTINE
241Ø W=1
242Ø A$=INKEY$
243Ø IFA$="U"GOSUB36ØØ
244Ø IFA$="D"GOSUB37ØØ
245Ø IFA$="R"THENGOSUB38ØØ
246Ø IFA$="L"GOSUB39ØØ
247Ø IFA$="E"GOSUB4ØØØ
248Ø IFA$="F"GOSUB41ØØ
249Ø IFA$="G"GOSUB42ØØ
25ØØ IFA$="H"GOSUB43ØØ
251Ø IFW=ØTHENRETURN
252Ø GOTO24ØØ
255Ø 'DRAW SUBROUTINES
26ØØ 'DRAW UP SUBROUTINE
261Ø G=Ø
262Ø V$="U"
263Ø IFPEEK(343)=251THENPSET(H,V
,3):POKE343,255:G=G+1:FORTMR=1TO
25:NEXT:V=V-1:GOSUB45ØØ:PSET(H,V
,2):GOTO263Ø
264Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
27ØØ 'DRAW DOWN SUB
271Ø G=Ø
272Ø V$="D"
273Ø IFPEEK(342)=254THENPSET(H,V
,3):POKE342,255:G=G+1:FORTMR=1TO
```

Listing continued

single Down entry that equals the sum of the generated entries.

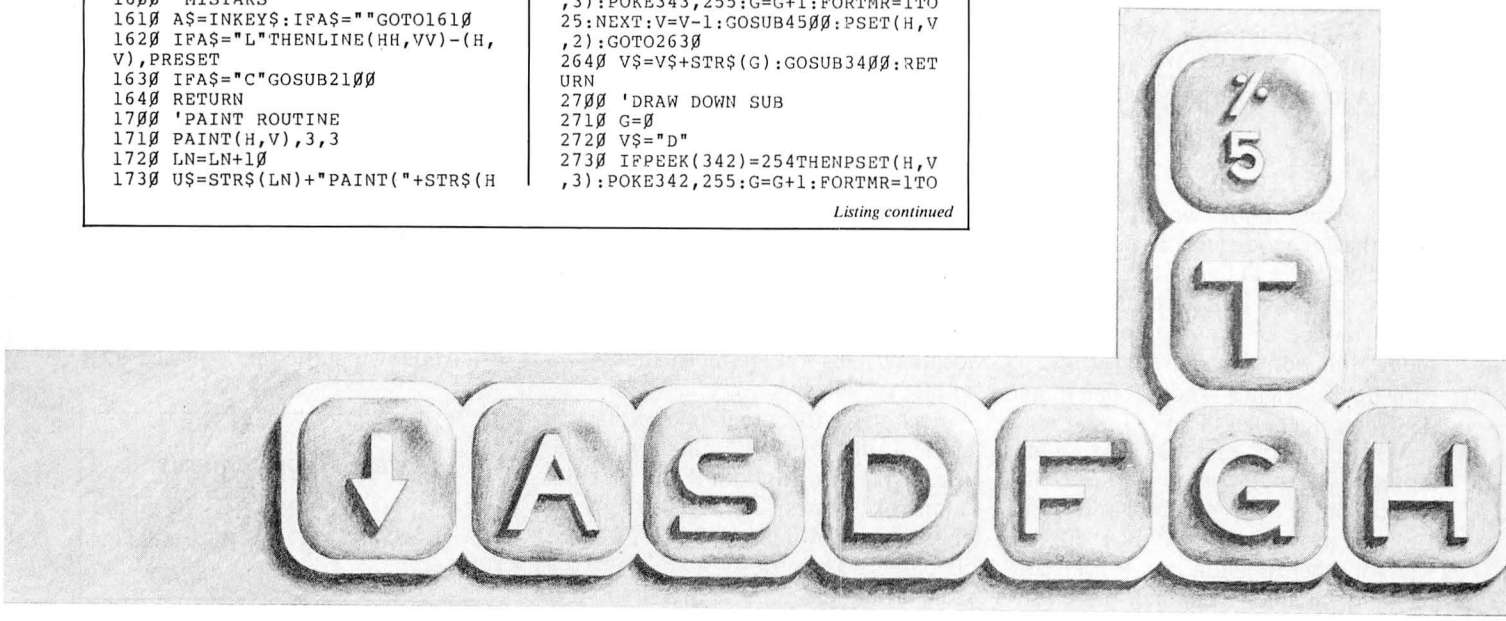
Line 160 is oddly spaced since the CoCo inserts a space before every printed variable and fills it with a minus sign if the variable is negative. The only way to get rid of them is to edit them out.

The draw mode's B function lets you draw blank lines, but be sure to release the B key when you do. Since R and B are PEEKed at the same location, if you hold B when you press R, that memory location remains unchanged. When nothing happens on the screen, a confused user often presses another key and draws a blank line to some undesirable location.

Moving the flashing pixel across a previously drawn line makes a hole in the line through which "paint" can "leak." Once this happens you cannot see where you have put lines, and so cannot continue. Changing line 1710 in Basic Builder to 1710 PSET(H,V):H = H+1:V = V+1 lights a pixel in the painted area and prevents "leakage" while the PAINT command prints to tape. On tape you can edit with no loss.

This program is actually a compilation of the work of others, and there is still plenty of room for new features and improvement. Repeating keys came from "The Poop On PEEK," by Steve Saisi (*80 Micro*, March 1983, p. 278).

Using a file to write a Basic program came from John Heusinkveld's "Datagen" (*80 Micro*, June/July 1982, p. 346). His system sets up the generated lines as an ASCII file that, when ac-



cessed with a CLOAD, fools the computer into thinking it has found a Basic program saved in the CSAVE "FILE"A format.

I did all my editing with a Scripsit ROM pack in this manner. For any Basic program, CSAVE"X",A, load your ROM pack, and load your program into Scripsit. Then you can press the break and nine keys to copy lines. Overtype line numbers and make changes, and when you have what you want, press the break, one, and six keys, and set the text width to 132.

Return to text checking for unwanted carriage returns or lines longer than 132 bytes since either results in a DS (direct statement) error. Finally, return to the menu, select 5 (print), and select 2 (tape).

Lacking a sketch pad and wanting to conduct a pilot's test, I took some plastic wrap, sketched a pickup truck, and traced it onto the plastic using a water-based marking pen. (A sharp, wax crayon and clear plastic food wrap will work just as well.)

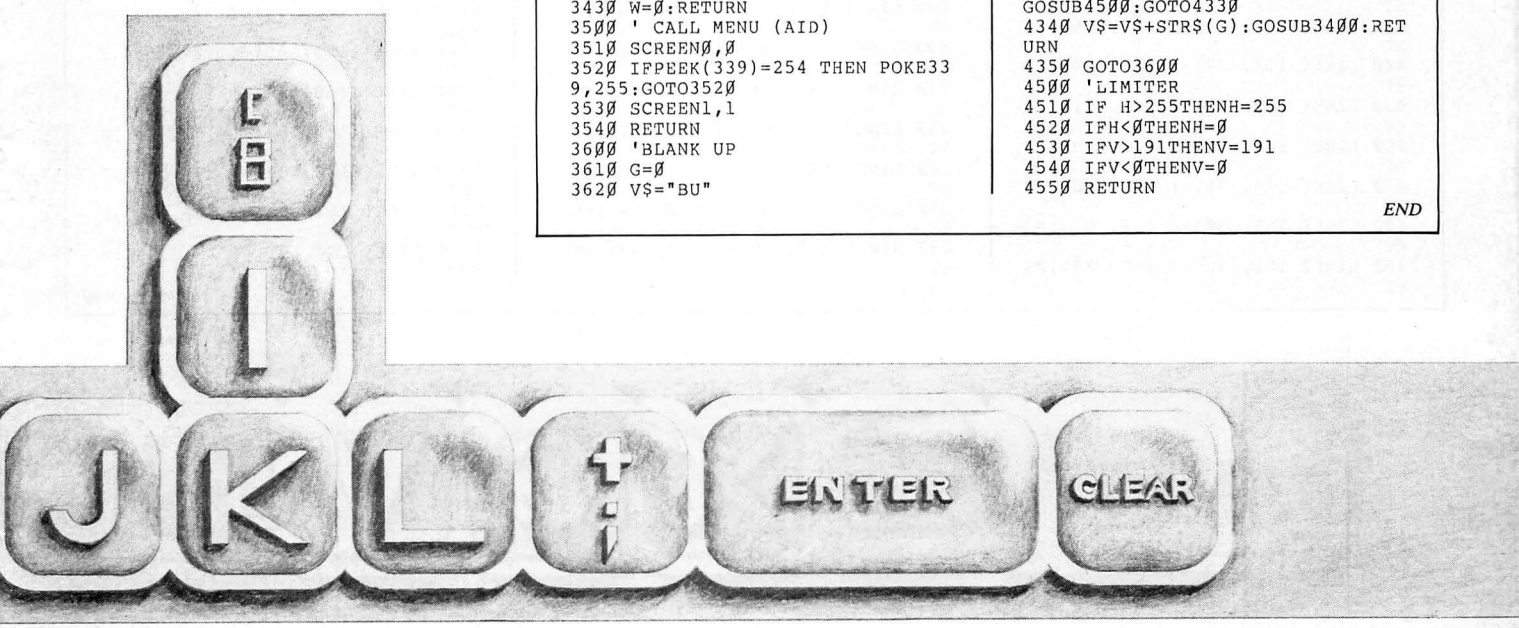
This plastic stayed in place against the screen while I followed the lines with the flashing pixel to generate the Basic program that draws a truck. After editing, it drew it in PMODE3 and assorted colors. With some heavy editing I shaved the generated Program Listing 2, Truck, by 1K. ■

Address correspondence to L.W. Gross, 394 A San Bruno Ave., Brisbane, CA 94005.

Listing continued

```
25:NEXT:V=V+1:GOSUB45ØØ:PSET(H,V
,2):GOTO273Ø
274Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
28ØØ 'DRAW RIGHT SUB
281Ø G=Ø
282Ø V$="R"
283Ø IFPEEK(34Ø)=251THENPSET(H,V
,3):POKE34Ø,255:G=G+1:FORTMR=1TO
25:NEXT:H=H+1:GOSUB45ØØ:PSET(H,V
,2):GOTO283Ø
284Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
29ØØ 'DRAW LEFT SUB
291Ø G=Ø
292Ø V$="L"
293Ø IFPEEK(342)=253THENPSET(H,V
,3):POKE342,255:G=G+1:FORTMR=1TO
25:NEXT:H=H-1:GOSUB45ØØ:PSET(H,V
,2):GOTO293Ø
294Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
3ØØØ '45 DEG SUB
3Ø1Ø G=Ø
3Ø2Ø V$="E"
3Ø3Ø IFPEEK(343)=254THENPSET(H,V
,3):POKE343,255:G=G+1:FORTMR=1TO
25:NEXT:H=H+1:V=V-1:GOSUB45ØØ:PS
ET(H,V,2):GOTO3Ø3Ø
3Ø4Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
31ØØ '135 DEG SUB
311Ø G=Ø
312Ø V$="F"
313Ø IFPEEK(344)=254THENPSET(H,V
,3):POKE344,255:G=G+1:FORTMR=1TO
25:NEXT:H=H+1:V=V+1:GOSUB45ØØ:PS
ET(H,V,2):GOTO313Ø
314Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
32ØØ '225 DEG SUB
321Ø G=Ø
322Ø V$="G"
323Ø IFPEEK(345)=254THENPSET(H,V
,3):POKE345,255:G=G+1:FORTMR=1TO
25:NEXT:H=H-1:V=V+1:GOSUB45ØØ:PS
ET(H,V,2):GOTO323Ø
324Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
33ØØ '315 DEG SUB
331Ø G=Ø
332Ø V$="H"
333Ø IFPEEK(338)=253THENPSET(H,V
,3):POKE338,255:G=G+1:FORTMR=1TO
25:NEXT:H=H-1:V=V-1:GOSUB45ØØ:PS
ET(H,V,2):GOTO333Ø
334Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
34ØØ 'LINE LENGTH LIMITER
341Ø U$=U$+V$
342Ø IFLEN(U$)>Q THEN U$=U$+CHR$
(34):W=1:PRINT#-1,U$:RETURN
3425 FOR T= 338 TO 345:POKE T,25
5:NEXT
343Ø W=Ø:RETURN
35ØØ ' CALL MENU (AID)
351Ø SCREENØ,Ø
352Ø IFPEEK(339)=254 THEN POKE33
9,255:GOTO352Ø
353Ø SCREEN1,1
354Ø RETURN
36ØØ 'BLANK UP
361Ø G=Ø
362Ø V$="BU"
363Ø IFPEEK(343)=251THEN PSET(H,
V,3):POKE343,255:G=G+1:FORTMR=1T
O25:NEXT:PSET(H,V,2):V=V-1:GOSUB
45ØØ:GOTO363Ø
364Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
37ØØ 'BLANK DOWN
371Ø G=Ø
372Ø V$="BD"
373Ø IFPEEK(342)=254THENPSET(H,V
,3):POKE342,255:G=G+1:FORTMR=1TO
25:NEXT:PSET(H,V,2):V=V+1:GOSUB4
5ØØ:GOTO373Ø
374Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
38ØØ 'BLANK RIGHT
381Ø G=Ø
382Ø V$="BR"
383Ø IFPEEK(34Ø)=251THEN PSET(H,
V,3):POKE34Ø,255:G=G+1:FORTMR=1T
O25:NEXT:PSET(H,V,2):H=H+1:GOSUB
45ØØ: GOTO 383Ø
384Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
39ØØ 'BLANK LEFT
391Ø G=Ø
392Ø V$="BL"
393Ø IFPEEK(342)=253THENPSET(H,V
,3):POKE342,255:G=G+1:FORTMR=1TO
25:NEXT:PSET(H,V,2):H=H-1:GOSUB4
5ØØ:GOTO393Ø
394Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
4ØØØ 'BLANK 45
4Ø1Ø G=Ø
4Ø2Ø V$="BE"
4Ø3Ø IFPEEK(343)=254THENPSET(H,V
,3):POKE343,255:G=G+1:FORTMR=1TO
25:NEXT:PSET(H,V,2):H=H+1:V=V-1:
GOSUB45ØØ:GOTO4Ø3Ø
41ØØ 'BLANK 135
411Ø G=Ø
412Ø V$="BF"
413Ø IFPEEK(344)=254THENPSET(H,V
,3):POKE344,255:G=G+1:FORTMR=1TO
25:NEXT:PSET(H,V,2):H=H+1:V=V+1:
GOSUB45ØØ:GOTO413Ø
414Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
42ØØ 'BLANK 225
421Ø G=Ø
422Ø V$="BG"
423Ø IFPEEK(345)=254THENPSET(H,V
,3):POKE345,255:G=G+1:FORTMR=1TO
25:NEXT:PSET(H,V,2):H=H-1:V=V+1:
GOSUB45ØØ:GOTO423Ø
424Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
43ØØ 'BLANK 315
431Ø G=Ø
432Ø V$="BH"
433Ø IFPEEK(338)=253THENPSET(H,V
,3):POKE338,255:G=G+1:FORTMR=1TO
25:NEXT:PSET(H,V,2):H=H-1:V=V-1:
GOSUB45ØØ:GOTO433Ø
434Ø V$=V$+STR$(G):GOSUB34ØØ:RET
URN
435Ø GOTO36ØØ
45ØØ 'LIMITER
451Ø IF H>255THENH=255
452Ø IFH<ØTHENH=Ø
453Ø IFV>191THENV=191
454Ø IFV<ØTHENV=Ø
455Ø RETURN
```

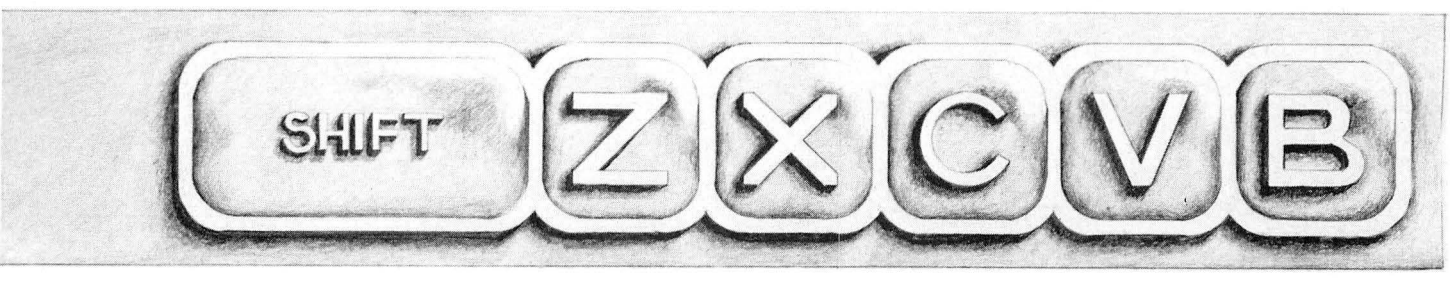
END



Program Listing 2. Truck, Generated by Basic Builder

```
10Ø PMODE4,1:PCLS:SCREEN1,1
12Ø LINE( 73, 97)-( 81, 98),PSET
13Ø LINE( 8Ø, 98)-( 144, 77),PSE
T
14Ø LINE( 144, 77)-( 141, 73),PS
ET
15Ø LINE( 141, 73)-( 14Ø, 66),PS
ET
16Ø LINE( 14Ø, 66)-( 143, 61),PS
ET
17Ø LINE( 143, 61)-( 111, 72),PS
ET
18Ø LINE( 143, 61)-( 149, 58),PS
ET
19Ø LINE( 15Ø, 57)-( 154, 58),PS
ET
2ØØ LINE( 154, 58)-( 156, 61),PS
ET
21Ø LINE( 154, 62)-( 154, 66),PS
ET
22Ø LINE( 154, 62)-( 16Ø, 6Ø),PS
ET
23Ø LINE( 16Ø, 6Ø)-( 164, 59),PS
ET
24Ø LINE( 164, 59)-( 169, 59),PS
ET
25Ø LINE( 164, 59)-( 23Ø, 76),PS
ET
26Ø LINE( 229, 75)-( 232, 78),PS
ET
27Ø LINE( 232, 78)-( 232, 84),PS
ET
28Ø LINE( 232, 84)-( 23Ø, 85),PS
ET
29Ø LINE( 23Ø, 84)-( 231, 83),PS
ET
3ØØ LINE( 23Ø, 84)-( 226, 81),PS
ET
31Ø LINE( 226, 81)-( 168, 66),PS
ET
32Ø LINE( 168, 66)-( 165, 66),PS
ET
33Ø LINE( 165, 66)-( 163, 66),PS
ET
34Ø LINE( 165, 66)-( 158, 67),PS
ET
35Ø LINE( 154, 66)-( 158, 67),PS
ET
36Ø LINE( 152, 59)-( 151, 59),PS
ET
37Ø LINE( 151, 59)-( 148, 6Ø),PS
ET
38Ø LINE( 148, 61)-( 146, 63),PS
ET
39Ø LINE( 148, 61)-( 144, 66),PS
ET
4ØØ LINE( 144, 66)-( 145, 73),PS
ET
41Ø LINE( 145, 73)-( 148, 75),PS
ET
42Ø LINE( 147, 74)-( 151, 77),PS
ET
43Ø LINE( 147, 74)-( 153, 76),PS
ET
44Ø LINE( 154, 77)-( 159, 74),PS
ET
45Ø LINE( 159, 74)-( 161, 71),PS
ET
46Ø LINE( 159, 74)-( 162, 68),PS
ET
47Ø LINE( 149, 76)-( 155, 8Ø),PS
ET
48Ø LINE( 155, 8Ø)-( 158, 82),PS
ET
49Ø LINE( 158, 82)-( 162, 79),PS
ET
5ØØ LINE( 162, 79)-( 163, 75),PS
ET
51Ø LINE( 162, 79)-( 165, 75),PS
ET
52Ø LINE( 162, 79)-( 166, 72),PS
ET
53Ø LINE( 166, 72)-( 167, 67),PS
ET
54Ø LINE( 167, 76)-( 2Ø2, 85),PS
ET
55Ø LINE( 2Ø2, 85)-( 2Ø9, 81),PS
ET
56Ø LINE( 21Ø, 81)-( 211, 81),PS
ET
57Ø LINE( 211, 81)-( 211, 84),PS
ET
58Ø LINE( 211, 81)-( 2Ø2, 89),PS
ET
59Ø LINE( 164, 79)-( 2Ø1, 88),PS
ET
6ØØ LINE( 2Ø1, 89)-( 2Ø5, 93),PS
ET
61Ø LINE( 2Ø1, 89)-( 2Ø7, 94),PS
ET
62Ø LINE( 2Ø7, 94)-( 215, 96),PS
ET
63Ø LINE( 215, 96)-( 221, 94),PS
ET
64Ø LINE( 221, 94)-( 225, 88),PS
ET
65Ø LINE( 225, 88)-( 225, 82),PS
ET
66Ø LINE( 218, 8Ø)-( 217, 87),PS
ET
67Ø LINE( 217, 87)-( 214, 9Ø),PS
ET
68Ø LINE( 217, 87)-( 211, 94),PS
ET
69Ø LINE( 232, 85)-( 226, 86),PS
ET
7ØØ LINE( 22Ø, 7Ø)-( 221, 69),PS
ET
71Ø LINE( 22Ø, 7Ø)-( 221, 67),PS
ET
72Ø LINE( 22Ø, 7Ø)-( 219, 65),PS
ET
73Ø LINE( 219, 65)-( 216, 63),PS
ET
74Ø LINE( 216, 63)-( 215, 66),PS
ET
75Ø LINE( 216, 63)-( 215, 68),PS
ET
76Ø LINE( 215, 68)-( 217, 71),PS
ET
77Ø LINE( 217, 71)-( 22Ø, 69),PS
ET
78Ø LINE( 212, 61)-( 184, 53),PS
ET
79Ø LINE( 21Ø, 64)-( 186, 57),PS
ET
8ØØ LINE( 211, 68)-( 185, 6Ø),PS
ET
81Ø LINE( 172, 6Ø)-( 175, 58),PS
ET
82Ø LINE( 175, 58)-( 175, 55),PS
ET
83Ø LINE( 175, 55)-( 173, 51),PS
ET
84Ø LINE( 173, 51)-( 171, 51),PS
ET
85Ø LINE( 171, 51)-( 168, 53),PS
ET
86Ø LINE( 168, 53)-( 168, 56),PS
ET
87Ø LINE( 168, 56)-( 17Ø, 59),PS
ET
88Ø LINE( 17Ø, 59)-( 173, 59),PS
ET
89Ø LINE( 226, 74)-( 226, 65),PS
ET
9ØØ LINE( 226, 65)-( 223, 62),PS
ET
91Ø LINE( 226, 65)-( 215, 58),PS
ET
92Ø LINE( 215, 58)-( 215, 57),PS
ET
93Ø LINE( 215, 58)-( 2ØØ, 5Ø),PS
ET
94Ø LINE( 2ØØ, 5Ø)-( 181, 47),PS
ET
95Ø LINE( 181, 47)-( 168, 43),PS
ET
96Ø LINE( 168, 43)-( 166, 43),PS
ET
97Ø LINE( 166, 43)-( 131, 54),PS
ET
98Ø LINE( 131, 54)-( 124, 49),PS
ET
99Ø LINE( 124, 49)-( 143, 49),PS
ET
1ØØØ LINE( 149, 47)-( 12Ø, 47),P
SET
1Ø1Ø LINE( 12Ø, 47)-( 113, 48),P
SET
1Ø2Ø LINE( 12Ø, 47)-( 97, 56),PS
ET
1Ø3Ø LINE( 97, 56)-( 94, 61),PSE
T
1Ø4Ø LINE( 94, 61)-( 97, 86),PSE
T
1Ø5Ø LINE( 97, 86)-( 1Ø1, 9Ø),PS
ET
1Ø6Ø LINE( 74, 97)-( 74, 92),PSE
T
1Ø7Ø LINE( 74, 92)-( 72, 9Ø),PSE
T
1Ø8Ø LINE( 74, 92)-( 68, 9Ø),PSE
T
1Ø9Ø LINE( 68, 9Ø)-( 59, 93),PSE
T
11ØØ LINE( 59, 92)-( 58, 96),PSE
T
111Ø LINE( 58, 96)-( 58, 1ØØ),PS
ET
112Ø LINE( 58, 96)-( 6Ø, 1Ø3),PS
ET
113Ø LINE( 58, 1Ø3)-( 39, 1Ø9),P
SET
114Ø LINE( 39, 1Ø9)-( 38, 1Ø8),P
SET
115Ø LINE( 39, 1Ø9)-( 38, 91),PS
ET
116Ø LINE( 38, 91)-( 96, 7Ø),PSE
T
117Ø LINE( 1Ø3, 64)-( 1Ø3, 57),P
SET
118Ø LINE( 1Ø3, 57)-( 118, 51),P
SET
119Ø LINE( 118, 51)-( 118, 58),P
SET
12ØØ LINE( 118, 51)-( 125, 56),P
SET
121Ø LINE( 125, 56)-( 1Ø3, 64),P
SET
122Ø LINE( 1Ø3, 68)-( 1Ø7, 66),P
SET
123Ø LINE( 15Ø, 84)-( 15Ø, 89),P
SET
124Ø LINE( 15Ø, 89)-( 152, 91),P
SET
125Ø LINE( 15Ø, 89)-( 161, 93),P
SET
126Ø LINE( 161, 93)-( 168, 91),P
SET
127Ø LINE( 168, 91)-( 171, 86),P
SET
```

Listing continued



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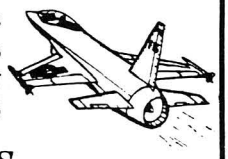

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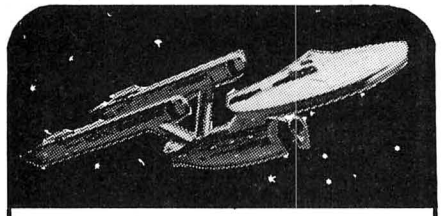

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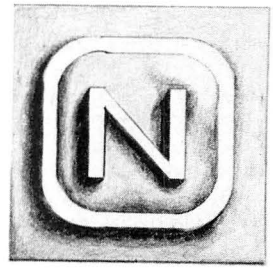
Listing continued

```
128Ø LINE( 171, 86)-( 181, 84),P
SET
129Ø LINE( 2ØØ, 89)-( 149, 1Ø3),
PSET
13ØØ LINE( 149, 1Ø3)-( 149, 1ØØ)
,PSET
131Ø LINE( 149, 1ØØ)-( 146, 97),
PSET
132Ø LINE( 146, 97)-( 143, 99),P
SET
133Ø LINE( 143, 99)-( 145, 1Ø4),
PSET
134Ø LINE( 145, 1Ø3)-( 144, 1Ø9)
,PSET
135Ø LINE( 144, 1Ø9)-( 138, 115)
,PSET
136Ø LINE( 138, 115)-( 133, 117)
,PSET
137Ø LINE( 138, 115)-( 129, 116)
,PSET
138Ø LINE( 129, 116)-( 124, 113)
,PSET
139Ø LINE( 129, 116)-( 123, 11Ø)
,PSET
14ØØ LINE( 123, 11Ø)-( 87, 118),
PSET
141Ø LINE( 87, 118)-( 41, 1Ø9),P
SET
142Ø LINE( 67, 91)-( 64, 94),PSE
T
143Ø LINE( 64, 95)-( 63, 1Ø1),PS
ET
144Ø LINE( 63, 1Ø1)-( 65, 1Ø5),P
SET
145Ø LINE( 63, 1Ø1)-( 69, 1Ø7),P
SET
146Ø LINE( 69, 1Ø7)-( 71, 1Ø5),P
SET
147Ø LINE( 71, 1Ø5)-( 75, 1Ø2),P
SET
148Ø LINE( 71, 1Ø5)-( 75, 97),PS
ET
149Ø LINE( 8Ø, 1ØØ)-( 79, 1Ø4),P
SET
15ØØ LINE( 79, 1Ø4)-( 75, 1Ø8),P
SET
151Ø LINE( 75, 1Ø8)-( 69, 1Ø7),P
SET
152Ø LINE( 123, 1Ø5)-( 1Ø1, 1Ø5)
,PSET
153Ø LINE( 1Ø1, 1Ø5)-( 99, 1Ø9),
PSET
154Ø LINE( 99, 1Ø9)-( 94, 111),P
SET
155Ø LINE( 94, 111)-( 88, 1Ø8),P
SET
156Ø LINE( 88, 1Ø8)-( 88, 1Ø5),P
SET
157Ø LINE( 88, 1Ø5)-( 8Ø, 1Ø3),P
SET
158Ø LINE( 93, 1Ø3)-( 93, 1Ø3),P
SET
159Ø LINE( 93, 1Ø3)-( 95, 1Ø4),P
SET
16ØØ LINE( 93, 1Ø3)-( 125, 96),P
SET
161Ø LINE( 125, 96)-( 147, 94),P
SET
162Ø LINE( 144, 85)-( 144, 9Ø),P
SET
163Ø LINE( 144, 9Ø)-( 146, 93),P
SET
164Ø LINE( 146, 93)-( 153, 95),P
SET
165Ø LINE( 158, 93)-( 153, 95),P
SET
166Ø GOTO 166Ø
```

END



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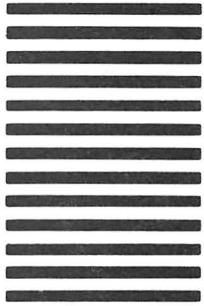

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Don't limit yourself to the 14K of RAM that Disk Basic leaves you with in a 16K machine. You can take advantage of the more than 150K of storage on each disk by storing parts of your programs there and recalling them as they are needed.

Examine Program Listing 1 and notice the LOADM"GYPSYP" command in line 160 that generates the graphics. Lines 30–60 set up the computer to use the two data files the program needs. I use these and other programming tricks in the following programs to free up more RAM space.

A picture generated in PMODE 3 or 4 uses one-third to one-half of a Basic program. As an alternative to constant regeneration of pictures, store them on disk and recall them as necessary with a LOADM command minus the EXEC option.

Program Listing 2, Gypsy G, uses the special colors a PMODE 4:SCREEN 1,1:PMODE 3 routine generates. In this PMODE the red and blue sometimes swap places, but the reset button quickly returns them to the proper order.

Save the picture generated by Gypsy G using the SAVEM"GYPSYP", 3584,9728,3584 command, or load and run Program Listing 3, PICSAV, which you can use in other applications. With the disk system attached, the starting and ending locations of the four graphics pages in PMODE 3 or 4 are 3584–9727. PICSAV finds the start and end of the graphics for you by using some PEEKs and allowing you to change the PMODE until the picture fills the screen. Before you can save it, the picture has to fill the screen or the start and ending locations found by PICSAV are incorrect and the picture is not saved properly.

A picture generated in PMODE 1, saved in PMODE 1 (graphic pages 1 and 2 only, memory locations 3584–6656) and reloaded in PMODE 3 or 4 fills only the top half of the displayed screen. This is helpful if you need to save the bottom half of the screen. Radio Shack's Sands of Egypt game demonstrates this effect. Since you recall and store the picture as needed, you can save as much detail as you want without losing RAM space.

The gypsy lady needs additional information stored in data files that are created and filled by Program Listing 4, GF. GF was written for Gypsy, but you can modify it for other uses. GF also contains features such as disk-to-tape

Program Listing 1. Gypsy

```
1Ø 'LAURA & CHRIS PETIT MARCH '8
3
2Ø PCLEAR4:PMODE4:FILES2,256
3Ø OPEN"D",#1,"ANSNUM",68
4Ø FIELD #1,17 AS E$,17 AS B$,17
 AS C$,17 AS D$
5Ø OPEN "D",#2,"COMPAT",68
6Ø FIELD #2,17 AS F$,17 AS G$,17
 AS H$,17 AS I$
7Ø DIM A$(28),N$(1Ø),E(Ø,2)
8Ø F=Ø
9Ø FOR I=Ø TO 28:READ A$(I):NEXT
I
1ØØ FOR I=1 TO 9:READ N$(I):NEXT
 I
11Ø SCREEN1,1:PMODE3:PCLS8:T=Ø
12Ø X$="YOUR":DRAW"BM1ØØ,2Ø;C5S1
2":GOSUB3ØØ:X$="FORTUNE":DRAW"BM
7Ø,7Ø":GOSUB3ØØ:X$="IN":DRAW"BM1
11,12Ø":GOSUB3ØØ:X$="NUMEROLOGY"
:DRAW"BM3Ø,17Ø":GOSUB3ØØ
13Ø PLAY"FFDBG#GFEGGC"
14Ø R=RND(TIMER):FOR I=1 TO 9:X=
RND(216)+2Ø:Y=RND(88)+52:S=RND(5
4)+8:C2=RND(2)+5:DRAW"BM"+STR$(X
)+","+STR$(Y)+";S"+STR$(S)+"C"+S
TR$(C2)+N$(I):GOSUB9ØØ:NEXT I
15Ø PLAY"FFDBG#GFEGGC"
16Ø LOADM"GYPSYP":GET(125,34)-(1
35,42),E,G
17Ø IFF=2THEN2ØØ ELSEC1=PPOINT(1
9Ø,18Ø):GOSUB87Ø:X$="YOUR NAME P
LEASE?":DRAW"BM4,111;C5S8":GOSUB
3ØØ
18Ø DRAW"BM4,14Ø"
19Ø A$=INKEY$:IF A$="" THEN A$="
@" ELSE X$=A$
2ØØ IF A$="@" THEN 19Ø ELSE IF A
SC(A$)=13 THEN 28Ø ELSE IF ASC(A
$)=12 THEN89Ø
21Ø IF ASC(A$)=32 THEN DRAW"BR6"
:GOTO19Ø
22Ø IF ASC(A$)<65 THEN 19Ø ELSE
IF ASC(A$)>9Ø THEN 19Ø
23Ø X$=A$:GOSUB3ØØ
24Ø IF ASC(A$)<65 OR ASC(A$)>9Ø
THEN 19Ø
25Ø IF ASC(A$)<74 THEN T=(ASC(A$
)-64)+T:GOTO19Ø
26Ø IF ASC(A$)<83 THEN T=ASC(A$)
-73+T:GOTO19Ø
27Ø IF ASC(A$)<95 THEN T=(ASC(A$
)-82)+T:GOTO19Ø
28Ø IF T>9 THEN G=T:GOTO34Ø
29Ø GOTO36Ø
3ØØ FOR Y=1 TO LEN(X$):X=ASC(MID
$(X$,Y,1))-65:IF X=-2 THEN X=26E
LSE IF X=-26 THEN X=27 ELSE IF X
=-2Ø THEN X=28
31Ø IF X=-33 THEN DRAW"BR6":NEXT
 Y
32Ø IF X=-33 THEN RETURN ELSE IF
 ASC(X$)=13 THEN 17Ø
33Ø DRAW A$(X):NEXT Y:RETURN
34Ø A=INT(G/1ØØ):B=INT(((G/1ØØ-A
)+.ØØØ5)*1Ø):C=INT(((G/1Ø-INT(G/
1Ø))+.ØØØ5)*1Ø)
35Ø T=A+B+C:IF T>9 THEN G=T:GOTO
34Ø
36Ø PUT(116,26)-(126,34),E,PSET:
PUT(132,26)-(142,34),E,PSET
37Ø PLAY"V7L1E":CIRCLE(12Ø,3Ø),4
,5:CIRCLE(136,3Ø),4,5:PAINT(12Ø,
3Ø),5,5:PAINT(136,3Ø),5,5
38Ø DRAW"BM128,87;"+N$(T)
39Ø IF F=1 THEN 5ØØ ELSE IF F=2
THEN T=T+9
4ØØ GET #1,T
41Ø GOSUB87Ø:X$=E$:DRAW"BM4,111;
C5S8":GOSUB3ØØ
42Ø X$=B$:DRAW"BM4,131":GOSUB 3Ø
Ø
43Ø X$=C$:DRAW"BM4,151":GOSUB 3Ø
Ø
44Ø X$=D$:DRAW"BM4,171":GOSUB 3Ø
Ø
45Ø FOR Z=1 TO 15ØØ:NEXT Z:IF F=
2 THEN 83Ø
46Ø GOSUB 87Ø:X$="COMPATIBILITY?
":DRAW"BM35,111;C5":GOSUB3ØØ
47Ø GOSUB88Ø:IF A$="Y" THEN 48Ø
ELSE IF A$<>"N" THEN 47Ø ELSE 78
Ø
48Ø T1=T
49Ø DRAW"BM128,87;C8"+N$(T):T=Ø:
X$="FRIEND'S NAME?":GOSUB87Ø:DRA
W"BM7,111;C5":GOSUB3ØØ:F=1:GOTO1
8Ø
5ØØ ON T1 GOTO 51Ø,52Ø,53Ø,54Ø,5
5Ø,56Ø,57Ø,58Ø,59Ø
51Ø ON T GOTO 6ØØ,61Ø,62Ø,63Ø,64
Ø,65Ø,63Ø,66Ø,67Ø
52Ø ON T GOTO 61Ø,68Ø,62Ø,65Ø,69
Ø,68Ø,7ØØ,69Ø,7ØØ
53Ø ON T GOTO 62Ø,62Ø,71Ø,61Ø,72
Ø,68Ø,62Ø,61Ø,69Ø
54Ø ON T GOTO 63Ø,65Ø,61Ø,65Ø,6Ø
Ø,63Ø,65Ø,63Ø,7ØØ
55Ø ON T GOTO 64Ø,69Ø,72Ø,6ØØ,72
Ø,62Ø,63Ø,63Ø,67Ø
56Ø ON T GOTO 65Ø,68Ø,68Ø,63Ø,62
Ø,68Ø,64Ø,7ØØ,63Ø
57Ø ON T GOTO 63Ø,7ØØ,62Ø,65Ø,63
Ø,64Ø,71Ø,69Ø,65Ø
58Ø ON T GOTO 66Ø,69Ø,61Ø,63Ø,63
Ø,7ØØ,69Ø,66Ø,6ØØ
59Ø ON T GOTO 67Ø,7ØØ,69Ø,7ØØ,67
Ø,63Ø,65Ø,6ØØ,71Ø
6ØØ GET #2,4:GOTO73Ø
61Ø GET #2,6:GOTO73Ø
62Ø GET #2,3:GOTO73Ø
63Ø GET #2,1Ø:GOTO73Ø
64Ø GET #2,13:GOTO73Ø
65Ø GET #2,2:GOTO73Ø
66Ø GET #2,7:GOTO73Ø
67Ø GET #2,5:GOTO73Ø
68Ø GET #2,9:GOTO73Ø
69Ø GET #2,12:GOTO73Ø
7ØØ GET #2,8:GOTO73Ø
71Ø GET #2,1:GOTO73Ø
72Ø GET #2,11
73Ø GOSUB 87Ø:X$=F$:DRAW"BM4,111
;C5":GOSUB3ØØ
74Ø X$=G$:DRAW"BM4,131":GOSUB 3Ø
Ø
75Ø X$=H$:DRAW"BM4,151":GOSUB 3Ø
Ø
76Ø X$=I$:DRAW"BM4,171":GOSUB 3Ø
Ø
77Ø FOR Z=1 TO 15ØØ:NEXT Z
78Ø DRAW"BM128,87;C8"+N$(T):T=Ø:
GOSUB 87Ø:F=2:X$="DESTINY?":DRAW
"BM8Ø,111;C5":GOSUB3ØØ
79Ø GOSUB 88Ø:IF A$="Y" THEN 8ØØ
 ELSE IF A$="N" THEN 83Ø ELSE 79
Ø
8ØØ T=Ø:GOSUB87Ø:X$="INITIALS PL
EASE?":DRAW"BM2Ø,111;C5":GOSUB3Ø
Ø:DRAW"BM11Ø,14Ø":GOTO19Ø
81Ø IF T>9 THEN T=1 ELSE IF ASC(
A$)=13 THEN 83Ø
82Ø IF F=1 THEN 49Ø
83Ø GOSUB87Ø:GOSUB1ØØØ:X$="NEXT?
":DRAW"BM94,13Ø;C5":GOSUB3ØØ
84Ø IF F=2 AND T>9 THEN T=T-9
85Ø DRAW "BM128,87;C8"+N$(T):F=Ø
:T=Ø:GOSUB88Ø
86Ø IF A$="Y" THEN 17Ø ELSE IF A
$<>"N" THEN 85Ø ELSE CLS1:STOP
87Ø COLOR C1,7:LINE(Ø,98)-(256,1
92),PSET,BF:RETURN
88Ø A$=INKEY$:IF A$="" THEN 88Ø
ELSE RETURN
89Ø T=Ø:IF F=Ø THEN 17Ø ELSE IF
F=1 THEN 49Ø ELSE IF F=2 THEN 8Ø
Ø
9ØØ ON I GOTO 91Ø,92Ø,93Ø,94Ø,95
Ø,96Ø,97Ø,98Ø,99Ø
91Ø PLAY"G":RETURN
92Ø PLAY"A":RETURN
93Ø PLAY"G":RETURN
94Ø PLAY"E":RETURN
95Ø PLAY"G":RETURN
96Ø PLAY"C":RETURN
97Ø PLAY"D":RETURN
98Ø PLAY"E":RETURN
99Ø PLAY"F":RETURN
1ØØØ PLAY"L4V15FFDBG#GFEGGC":RET
URN
1Ø1Ø DATA "U4E2F2D2NL4D2BR3"
1Ø2Ø DATA "U6R3F1D1G1NL3F1D1G1L3
BR7"
1Ø3Ø DATA "BR1H1U4E1R2F1BD4G1L2B
R6"
1Ø4Ø DATA "U6R3F1D4G1L3BR7"
1Ø5Ø DATA "NR4U3NR2U3R4BR3BD6"
1Ø6Ø DATA "U3NR2U3R4BR3BD6"
1Ø7Ø DATA "BR1H1U4E1R2F1BD2NL1D2
G1L2BR6"
1Ø8Ø DATA "U3NU3R4NU3D3BR3"
1Ø9Ø DATA "BR1R1NR1U6NL1R1BR4BD6
"
11ØØ DATA "BU1F1R1E1U5NL1R1BR3BD
6"
111Ø DATA "U3NU3R1NE3F3BR3"
112Ø DATA "NU6R4U1BR3BD1"
113Ø DATA "U6F3E3D6BR3"
114Ø DATA "U6F6NU6BR3"
115Ø DATA "BR1H1U4E1R2F1D4G1L2BR
6"
116Ø DATA "U6R3F1D1G1L3BR7BD3"
117Ø DATA "BR1H1U4E1R2F1D3G1NH1N
F1G1L1BR6"
118Ø DATA"U6R3F1D1G1L2NL1F3BR3"
119Ø DATA "BU1F1R2E1U1H1L2H1U1E1
R2F1BR3BD5"
12ØØ DATA "BR2U6NL2R2BR3BD6"
121Ø DATA"BU1NU5F1R2E1U5BR3BD6"
122Ø DATA "BU6D2F1D1F1ND1E1U1E1U
2BR3BD6"
123Ø DATA "NU6E2NU1F2U6BR3BD6"
124Ø DATA "U1E4U1BL4D1F4D1BR3"
125Ø DATA"BU6D2F2ND2E2U2BR3BD6"
126Ø DATA "NR4U1E4U1L4BR7BD6"
127Ø DATA "BU5E1R2F1D1G2BD1D1BR5
"
128Ø DATA "BR1BU5E1BR4BD6"
129Ø DATA "BU3R4BR3BD3"
13ØØ DATA "BL1BD2R1NR1U6G1"
131Ø DATA "BD1BL2NR4U1E1R1E2U1H1
L2G1"
132Ø DATA"BL2BD1F1R2E1H2E2H1L3"
133Ø DATA "BR1BD2U2NR1L3U1E3D4"
134Ø DATA "BD1BL2F1R2E1U2H1L3U2R
4"
135Ø DATA "BR2BU3H1L2G1D4F1R2E1U
1H1L3"
136Ø DATA "BL2BD2U1E4U1L4"
137Ø DATA "BL1BD2H1U1E1H1U1E1R2F
1D1G1NL2F1D1G1L2"
138Ø DATA "BD1BL2F1R2E1U4H1L2G1D
1F1R3"
```

END

and tape-to-disk. The files needed for Gypsy are called ANSNUM (answers) and COMPAT (compatibility).

Table 1 contains the selection of responses for numbers calculated by the program. Though this is the information you put in the two data files, you can substitute your own ideas.

Now you are ready to type in Gypsy, which retrieves picture Gypsy P and uses data files ANSNUM and COMPAT without operator input. The gypsy lady asks "Your Name Please?" The name can be longer than the 17 characters allowed on the screen, but the additional ones are drawn on the right edge of the screen. This does not affect the results of the computation. On the questions labeled Compatibility, Destiny, and Next, the program looks for a Y or an N. If you make a typing error during the entries of "Your Name Please," "Friend's Name," or "Initials Please,"

System Requirements

16K RAM
Disk Basic

Program Listing 2. Gypsy G

```
10 REM GYPSYG
20 PMODE4:SCREEN1,1:PMODE3:PCLS
7
30 FOR Y=2TO100STEP 10
40 FOR I=10 TO 250 STEP 20
50 DRAW"BM"+STR$(I)+","+STR$(Y)+
"S4C8;R4G4H4BD4R4H4G4"
60 NEXT I
70 NEXT Y
80 COLOR 5
90 LINE(0,78)-(115,78),PSET:LINE
(143,78)-(256,78),PSET
100 LINE(20,0)-(20,78),PSET:LINE
(236,0)-(236,78),PSET
110 CIRCLE(128,84),15,5:PAINT(12
8,84),8,5
120 PAINT(10,1),6,5:PAINT(250,1)
,6,5:PAINT(128,190),6,5
130 REM CREATE GYPSY LADY
140 CIRCLE(128,28),25,5:PAINT(12
8,42),8,5
150 DRAW"BM123,50;S4C5D10G2L33G5
D10;BM134,50;D10F2R33F5D10"
160 CIRCLE(128,62),10,5,.4,0,.5
170 PAINT(130,55),8,5:LINE(123,5
7)-(134,57),PSET
180 PAINT(110,70),6,5
190 LINE(127,37)-(130,39),PSET,B
F:REM NOSE
200 REM EYES
210 CIRCLE(120,30),4,5:CIRCLE(13
6,30),4,5
220 PAINT(120,30),5,5:PAINT(136,
30),5,5
230 REM MOUTH
240 CIRCLE(128,43),8,5,.4,0,.5
250 REM HAIR
260 LINE(128,12)-(106,32),PSET:L
INE(128,12)-(151,32),PSET:PAINT(
120,10),5,5
270 REM HAT
280 COLOR 6:LINE(132,6)-(102,29)
,PSET
290 CIRCLE(124,20),30,6,.55,.43,
.8
300 CIRCLE(98,30),6,6,1,0,.8
310 PAINT(98,30),6,6
320 REM ARMS
330 COLOR 5:LINE(96,72)-(96,78),
PSET:LINE(160,72)-(160,78),PSET
340 REM DOTS
350 FOR I=1 TO 18
360 READ A,B:PSET(A,B,5)
370 NEXT I
380 REM TRIANGLES
390 FOR I=1 TO 6
400 READ A,B:DRAW"BM"+STR$(A)+",
"+STR$(B)+"C5S3R4G4H4R2"
410 NEXT I
420 REM ADD SIGNS
430 FOR I=1 TO 5
440 READ A,B:DRAW"BM"+STR$(A)+",
"+STR$(B)+"C5S2NU4ND4NR4NL4"
450 NEXT I
460 REM HEAD NECKLACE
470 COLOR6:LINE(128,21)-(140,9),
PSET:LINE(120,15)-(128,21),PSET
480 REM EARRINGS
490 LINE(153,31)-(153,40),PSET:L
INE(102,31)-(104,40),PSET
500 DATA 92,66,100,69,152,75,156
,66,144,66,144,72,104,75,112,66,
124,69,164,69,96,30,104,24,100,2
1,104,15,112,18,112,12,116,12,12
8,6,112,72,136,69,168,72,120,9,1
08,18,88,69,100,66,148,69,100,30
,104,12,120,6,116,15
510 GOTO510
```

END

Table 1. COMPAT and ANSNUM Data Files

(COMPAT Data Files)

```
RECORD NUMBER: 1
1 LOVE AT
2 FIRST SIGHT
3
4

RECORD NUMBER: 2
1 BUDDIES FOR LIFE
2
3
4

RECORD NUMBER: 3
1 FRIENDS NOT
2 LOVERS
3
4

RECORD NUMBER: 4
1 ONLY IF YOU ARE
2 THE LAST TWO
3 PEOPLE ON EARTH
4

RECORD NUMBER: 5
1 ONLY WHEN NO ONE
2 ELSE IS AROUND
3
4

RECORD NUMBER: 6
1 YOU GO TOGETHER
2 LIKE A HORSE AND
3 CARRIAGE - ONE
4 LEADS ONE FOLLOWS

RECORD NUMBER: 7
1 NOT EVEN IF YOU
2 ARE THE LAST TWO
3 PEOPLE ON EARTH
4

RECORD NUMBER: 8
1 YOU ARE AS
2 COMPATIBLE AS A
3 DOG AND CAT
4

RECORD NUMBER: 9
1 A WINNING
2 COMBINATION
3
4

RECORD NUMBER: 10
1 SOMETIMES FRIENDS
2 SOMETIMES ENEMIES
3 SOMETIMES LOVERS
4
RECORD NUMBER: 11
1 A WILD AND CRAZY
2 RELATIONSHIP
3
4

RECORD NUMBER: 12
1 THE BEST OF
2 FRIENDS
3 THE WORST OF
4 ENEMIES

RECORD NUMBER: 13
1 YOUR RELATIONSHIP
2 IS LIKE A YOYO
3 IT HAS ITS UPS
4 AND DOWNS
```

(ANSUM Data Files)

```
RECORD NUMBER: 1
1 STRONG-WILLED
2 AND INDEPENDENT
3 EITHER A BORN
4 LEADER OR BULLY

RECORD NUMBER: 2
1 TACTFUL AND
2 CONSIDERATE BUT
3 UNRELIABLE
4 NATURE LOVER

RECORD NUMBER: 3
1 WITTY AND POPULAR
2 SELF-INDULGENT
3 AND LOOSE SPENDER
4

RECORD NUMBER: 4
1 HARD-WORKING AND
2 RELIABLE BUT
3 STUBBORN AND A
4 PENNY PINCHER

RECORD NUMBER: 5
1 IMPULSIVE AND
2 QUICK ACTING
3 BUT NERVOUS WITH
4 TERRIBLE TEMPER

RECORD NUMBER: 6
1 SOLID AND
2 DEPENDABLE
3 EASY TO TAKE
4 ADVANTAGE OF

RECORD NUMBER: 7
1 ANALYTICAL AND
2 SHY
3 A LONER AND A
4 PUSHOVER

RECORD NUMBER: 8
1 LOVES TO DOMINATE
2 A WILL OF IRON
3 BUT CAN NOT STAND
4 TO LOSE

RECORD NUMBER: 9
1 INTUITIVE AND
2 MYSTERIOUS
3 MAKES A GOOD
4 FORTUNE TELLER
RECORD NUMBER: 10
1 DESTINED TO SEEK
2 NEW ADVENTURES
3
4

RECORD NUMBER: 11
1 DESTINED TO
2 SEARCH FOR LOVE
3 AND FRIENDSHIP
4

RECORD NUMBER: 12
1 DESTINED TO
2 SEEK GOOD THINGS
3 IN LIFE
4

RECORD NUMBER: 13
1 DESTINED TO WORK
2 LONG AND HARD
3
4

RECORD NUMBER: 14
1 DESTINED TO BE
2 A FREE SPIRIT
3
4

RECORD NUMBER: 15
1 DESTINED TO BE
2 CONSERVATIVE
3
4

RECORD NUMBER: 16
1 DESTINED TO SEEK
2 PERFECTION
3
4

RECORD NUMBER: 17
1 DESTINED TO
2 FOLLOW YOUR
3 AMBITIONS
4

RECORD NUMBER: 18
1 DESTINED TO SEEK
2 OUT THE FUTURE
3
4
```

END

use the clear key to erase the screen and start over.

The number of bytes you save by using these techniques comes to 1,468 (Gypsy G) and 1,573 (ANSNUM and COMPAT) giving a total close to 3K. Another way to save space is to save the DRAW command instructions instead of saving the words in the data files, thereby eliminating lines 90, 100, and 1010–1380 in Gypsy. This saves another 1,000 bytes. ■

Address correspondence to Chris and Laura Petit, Route 3, 135 Davis Drive, Luling, LA 70070.

```
1Ø CLS
2Ø VERIFY ON
3Ø PRINT
4Ø PRINT"CURRENT PMODE ";PEEK(18
2)
5Ø PRINT"START GRAPHICS ";:SG=PE
EK(186)*256+PEEK(187):PRINTSG
6Ø PRINT"GRAPHICS END ";:GE=PEEK
(183)*256+PEEK(184):PRINTGE
7Ø PRINT:PRINT"MAX MEMORY IN SYS
TEM ";PEEK(116)*256+PEEK(117)
8Ø PRINT"DISPLAY PIC";:INPUTA$:I
FA$="Y"THEN SCREEN1,1:FORI=1TO8Ø
Ø:NEXTI
9Ø PRINT"CHANGE PMODE ";:INPUTA$
:IFA$="N"THEN1ØØELSEA=VAL(A$):PM
ODE A:GOTO1Ø
1ØØ PRINT"SAVE PICTURE ";:INPUT
A$:IF A$="Y"THEN 11Ø ELSE END
11Ø PRINT"NAME";:INPUTA$:VERIFY
ON:SAVEM A$,SG,GE,SG:STOP
```

Program Listing 3. PICSAV

Program Listing 4. GF

```
1Ø CLS:PRINT@198,"ENTER THE FILE
 NAME"
2Ø PRINT @33Ø,;:INPUT Z$
3Ø OPEN "D",#1,Z$,68
4Ø FIELD #1,17 AS A$,17 AS B$,17
 AS C$,17 AS D$
5Ø CLS
6Ø PRINT @1Ø6,"SELECTIONS:"
7Ø PRINT@168,"1) EDIT RECORD"
8Ø PRINT@2ØØ,"2) ENTER NEW RECOR
D"
9Ø PRINT@232,"3) END JOB"
1ØØ PRINT @264,"4) PRINT FILE"
11Ø PRINT@296,"5) SAVE TO TAPE"
12Ø PRINT@328,"6) TAPE TO DISK"
13Ø PRINT @36Ø,"7) ENTER NEW FIL
E"
14Ø PRINT @392,"8) KILL THE FILE
"
15Ø AN$=INKEY$:IF AN$="" THEN 15
Ø
16Ø IF VAL(AN$)<1 OR VAL(AN$)>8
THEN 5Ø
17Ø ON VAL(AN$) GOSUB 19Ø,45Ø,57
Ø,58Ø,68Ø,81Ø,18Ø,97Ø
18Ø CLOSE#1:CLOSE#-1:GOTO1Ø
```

Listing continued

```
19Ø FOR I=1 TO LOF(1)
2ØØ IF LOF(1)=Ø THEN PRINT@456,"
FILE IS EMPTY":FOR Z=1TO5ØØ:NEXT
Z:GOTO5Ø
21Ø GET#1,I
22Ø CLS
23Ø PRINT@32,"RECORD NUMBER:";I
24Ø PRINT@96,"1 ";A$
25Ø PRINT @128,"2 ";B$
26Ø PRINT @16Ø,"3 ";C$
27Ø PRINT @ 192,"4 ";D$
28Ø PRINT @388,"EDIT THIS RECORD
? (Y/N)"
29Ø AN$=INKEY$:IF AN$="" THEN 29
Ø
3ØØ IF AN$="Y" THEN 32Ø ELSE NEX
T I
31Ø GOTO5Ø
32Ø PRINT @42Ø,"WHICH LINE? (1-4
)";:INPUT L
33Ø CLS:PRINT@65,"ENTER THE NEW
LINE"
34Ø AA$=A$:BB$=B$:CC$=C$:DD$=D$
35Ø PRINT "  *****************"
36Ø ON L GOTO 37Ø,38Ø,39Ø,4ØØ
37Ø INPUT AA$:GOTO41Ø
38Ø INPUT BB$:GOTO41Ø
39Ø INPUT CC$:GOTO41Ø
4ØØ INPUT DD$:GOTO41Ø
41Ø GOSUB92Ø
42Ø PUT #1,I:GOTO22Ø
43Ø CLOSE #1
44Ø RETURN
45Ø I=LOF(1)
46Ø CLS
47Ø PRINT @1Ø,"RECORD #";I+1
48Ø PRINT @32,"ENTER THE 4 LINES
"
49Ø PRINT "  *****************"
5ØØ INPUT AA$
51Ø INPUT BB$
52Ø INPUT CC$
53Ø INPUT DD$
54Ø GOSUB92Ø
55Ø PUT #1,I+1
56Ø GOTO 5Ø
57Ø CLOSE #1:END
58Ø FOR I=1 TO LOF(1)
59Ø GET#1,I
6ØØ PRINT#-2,"RECORD NUMBER:";I
61Ø PRINT#-2,"1 ";A$
62Ø PRINT #-2,"2 ";B$
63Ø PRINT #-2,"3 ";C$
64Ø PRINT #-2,"4 ";D$
65Ø PRINT #-2,""
66Ø NEXT I
67Ø GOTO5Ø
68Ø CLS:PRINT"THIS SECTION COPIE
S FILES FROM  DISK TO TAPE"
69Ø PRINT"PRESS ANY KEY WHEN REA
DY"
7ØØ ZZ$=INKEY$:IFZZ$=""THEN7ØØ
71Ø OPEN"O",#-1,Z$
72Ø PRINT@266, "SAVING ";Z$
73Ø FOR I=1 TO LOF(1)
74Ø GET #1,I
75Ø PRINT#-1,I
76Ø PRINT#-1,A$
77Ø PRINT#-1,B$
78Ø PRINT#-1,C$
79Ø PRINT#-1,D$
8ØØ NEXT I:CLOSE#-1:GOTO5Ø
81Ø CLS:PRINT"THIS SECTION READS
 THE TAPE FILE TO THE DISK"
82Ø OPEN"I",#-1,Z$
83Ø PRINT@266, "LOADING ";Z$
84Ø IF EOF(-1) THEN 5Ø
85Ø INPUT#-1,I
86Ø INPUT#-1,AA$
87Ø INPUT#-1,BB$
88Ø INPUT #-1,CC$
89Ø INPUT#-1,DD$
9ØØ GOSUB92Ø
91Ø PUT#1,I:GOTO84Ø
92Ø LSET A$=AA$
93Ø LSET B$=BB$
94Ø LSET C$=CC$
95Ø LSET D$=DD$
96Ø RETURN
97Ø CLOSE#1:KILL Z$+"/DAT":PRINT
 @456,"FILE ";Z$;" IS GONE":FOR
Z=1 TO 5ØØ:NEXT Z:GOTO1Ø
```

END

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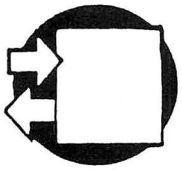

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BY JAMES J. BARBARELLO

ROM HACKER—PART II

Last month's "ROM Hacker" promised you an IC tester. Let's get going and build it. Along with the hardware (Table 1), you will find two programs. The first, ICTest, allows you to "single step" the IC under test (which we'll call UUT from now on).

Single stepping lets you change the state of a single input and see how it affects all the other pins. With this program, you can quickly test a single UUT. This single step approach also helps you understand the operation of a particular IC, since you can see exactly what happens when you change inputs.

To make the project even more useful, a second program, Autotest, lets you use the results of the first to automatically test any number of UUTs. Autotest performs up to 100 single-step operations on a UUT in under five seconds. If the observed response differs from that expected, it stops and produces a pin-by-pin display of expected versus observed results. Both programs are device independent; they accommodate any device up to 16 pins. The hardware interface, however, is device-family dependent; a separate interface is required for TTL and CMOS.

System Requirements

16K RAM
Extended Color Basic
Soldering Required

You've finished the interface; now you can build this IC tester. Next month: the CoCo Mouse.

Digital Integrated Circuits

Regardless of family or type, all standard digital ICs have some common characteristics. They all have inputs, outputs, ground reference (Vss or V−), and positive voltage reference (V+ or Vdd). Most digital ICs are either 14- or 16-pin devices housed in a DIP (dual in-line package).

CMOS ICs are denoted by a 4xxx series number. The numbering of TTL ICs starts with a 74, and can be four to seven characters long (for example, 7400, 74193, 74L02 (low power), 74LS193 (low power Schottky)). When you buy any device with a 4xxx or 74xxxxx number, you are assured that the device meets minimum standards agreed to by the electronics industry. These minimum standards are available in the form of product data sheets and can be found in many device reference books, or provided/purchased with the IC.

The product data sheet usually contains a connection diagram, block diagram, timing diagram, and truth table. The block diagram provides a functional picture of what the IC does. The connection diagram identifies each pin with a symbol (such as Vdd, CLK) that corresponds to the block diagram. The timing diagram shows the time-dependent response of the IC to better explain how it works. The truth table explains how changes in inputs affect outputs.

An IC state test changes the state (voltage level) of a pin and then checks to see what happened to other pins as a result. It can be performed in a semistatic mode (up to 2,500 state changes per second) or in a truly dynamic mode (states changing at the switching limit of the device). Each has its advantages and disadvantages.

The dynamic mode ensures that the IC operates properly under all conditions, and at the functional operating frequency. It is, however, difficult and costly. The semistatic mode ensures that the device meets its logic requirements (such as an inverter output being the opposite of its input), but cannot ensure flawless operation as its functional speed (often many megahertz). The semistatic mode, though, is easy to perform and requires only inexpensive equipment. For your purposes, the semistatic mode of state testing is more than adequate.

IC Testing

To define your needs for semistatic mode state testing, your hardware must identify which pins are inputs, which are outputs, which provide power, and which are not used. It should also apply

power and ground to the proper pins, apply inputs where desired, and read the state of each pin to determine if the state change has produced the proper result. It should also provide a current path (load) to the pins to comply with the ICs' design requirements.

To specify a proper test, your software should initialize each IC so that it always starts in the same condition as any other. Then it should perform a sufficient number of state changes on all inputs in a proper sequence such that the function of the IC is verified.

Don't panic; this sounds much more complicated than it is. The hardware and software of this project already take care of most of these requirements. Let's look at a step-by-step list of what you have to do to perform a test.

- Insert the UUT into the UUT socket on the interface.
- Connect the positive lead to the V+ pin on the UUT.
- Connect the negative lead to the V− pin on the UUT.
- Run the ICTest program.
- Identify each pin as input (I), output (O), positive, negative, or not used (N).
- Determine the state changes necessary to initialize the UUT. Execute these state changes as explained by the program.
- Determine the state changes necessary to test all functions. Execute them as explained by the program, and note if the results are what they should be.

The first five steps are straightforward, though you'll need a product data sheet to know which pins are which. The last two require some thought on your part, but the necessary information is also contained in the product data sheet in the form of the block diagram and truth table (or timing diagram). You have to know what the UUT does before you can test it.

Constructing the IC Tester

Since the IC tester tests in the semistatic mode, layout is not critical. You can put the IC tester together using a modular IC breadboard socket (like Radio Shack's part #276-175), some solid wire, and 16 resistors (see Fig. 1). If you want a more permanent unit, you can make a printed circuit board (PCB) per the layout of Fig. 2.

If you choose the breadboard approach, note that in Fig. 1 the CoCo master interface's DIP connector has pin 1 towards the left, and the UUT is inserted with its pin 1 towards the right. Use #20 or #22 solid wire to make the connections. Strip about ¼-inch of insulation from each end of each wire to ensure that it mounts securely in the breadboard. Also, use the same solid wire for the power connections. (Use a red wire for the +5 volts, and a black wire for ground.)

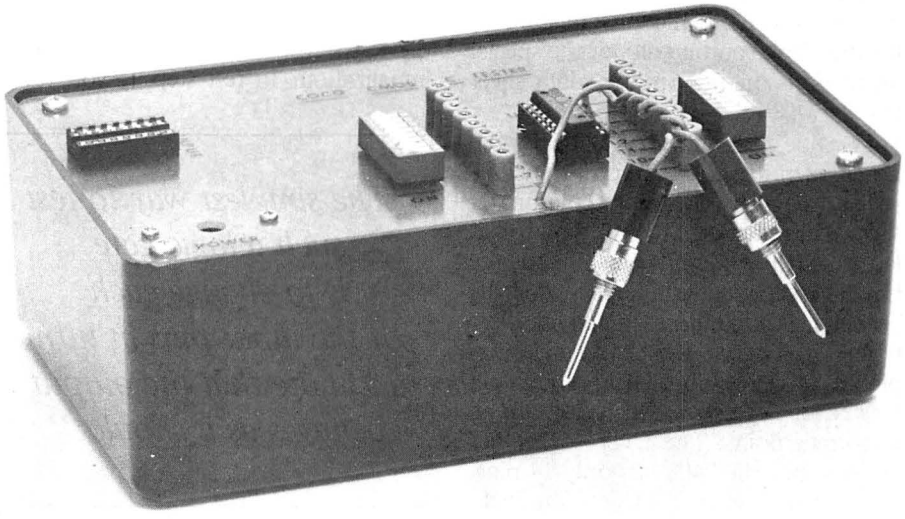
If you choose the PC board approach, use the case's aluminum cover as a template to size the PC blank and locate the four mounting holes. Then make the PC board as in Fig. 2. When you have etched and drilled it, mark the board using dry transfer lettering (such as Radio Shack part #270-201) or felt-tip pen.

To make the lettering more permanent, give the marked side of the board a light coat of clear lacquer. When the lacquer has dried, mount the DIP sockets, DIP switches, power connector, and PC test points on the PCB as shown in Fig. 3, being sure to mount the test points straight and flush to the board. Now, get 16 ¼-watt resistors of either 2,200 ohms (TTL version) or 10,000 ohms (CMOS version). For each resistor, bend one lead and tack solder it to the PCB as shown in Fig. 3. Connect the other lead of each of the 16 resistors. For the TTL version, connect this common point to V+. For the CMOS version, connect this common point to ground.

Next, tack solder the end of a 4-inch-to-6-inch length of red stranded wire to the V+ point. Pass it through the hole shown in Fig. 3 and connect it to the red solderless phone tip. Then tack solder one end of a 4-inch-to-6-inch length of black stranded wire to the V− point. Pass it through the hole shown in Fig. 3 and connect it to the black solderless phone tip. Finally, secure the PCB to the case using the four screws that formerly held the aluminum cover.

The Programs

Type in Program Listing 1 and save it using the name ICTest. Then type NEW and enter Program Listing 2. Get another cassette tape and save the program using the name Autotest. Save this program on the beginning of one side of the cassette. Autotest uses data files you create with ICTest. By placing Autotest on a different cassette, you can record those data files immediately after Autotest. You can then run Autotest and immediately begin searching your data files.



The IC Tester

While it's not necessary to understand the programs' operation to use them, knowing how they work helps if you want to change or expand them. Table 2 is a line description for ICTest. Table 3 is a line description for Autotest.

Using the IC Tester

Now that you have the necessary hardware and software completed, look at two examples of their use. The first example is a TTL quad 2-In AND gate (7408); the second a CMOS decade counter (4017). Although you could hook up the hardware, insert the IC, and run the program, it's advisable to do a little planning first.

The IC Tester Programming Sheet is a good mechanism for producing a well planned, complete test sequence. Review the programming sheet completed

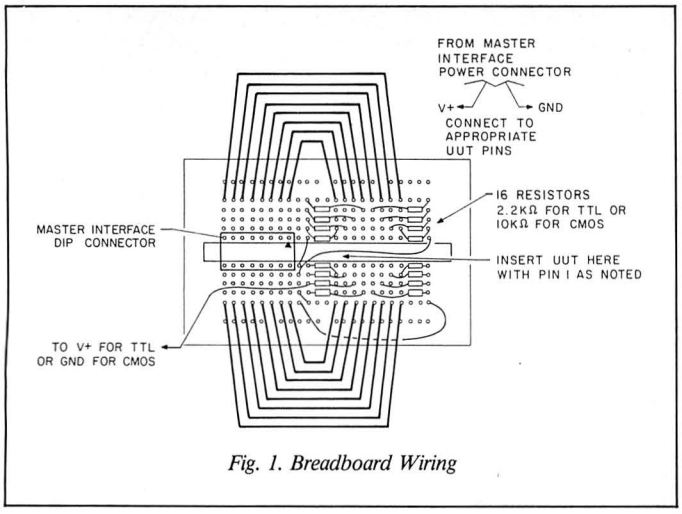


Fig. 1. Breadboard Wiring

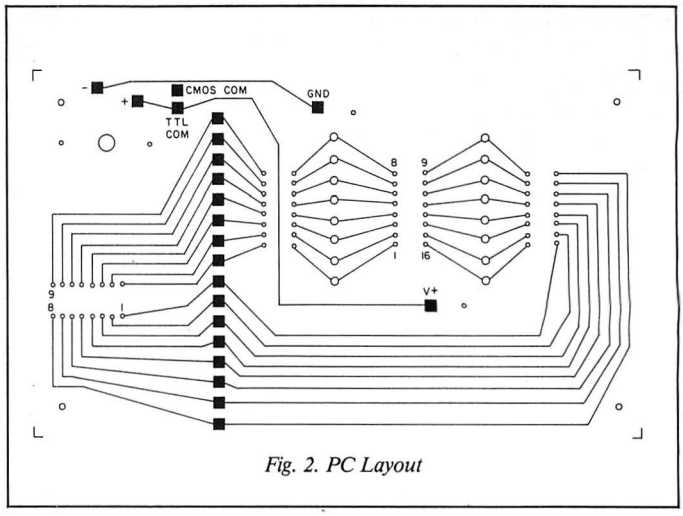


Fig. 2. PC Layout

for our first example (Fig. 4). The upper portion (header) contains important information about the IC to be tested, as well as special instructions relating to the test. You can find all but the special instructions on the product data sheet for the 7408 IC.

The title row immediately below the header identifies the 16 pins of the UUT socket, with the rightmost column reserved for remarks. The first data row is labeled DEFN (define pins). Note the UUT socket pin definitions versus the header's input/output pin identification. For instance, the header identifies pin 8 as an output, but DEFN shows pin 8 as N (or not used). This brings up an important point. The UUT socket has 16 pins, but the 7408 has only 14 pins. When you insert the 7408 into the socket, pins 7 and 8 (at the bottom of the socket) will be empty.

This means that pin 8 of the 7408 will be in pin 10 of the UUT socket (an offset of two). When you define pins, you are indicating which of the UUT *socket* pins, not the IC pins, are inputs and outputs. For an IC with fewer than 16 pins, you must take this into consideration and define the UUT socket pins properly.

Below the DEFN legend, the rows are numbered starting from one. These are the test steps, the first of which will be initialization. In test step 1, you force pin 1 high (1). Test step 2 forces pin 2 high and so on until all input pins have been forced high (step 8). As indicated in the remarks column, this completes the initialization phase. The function of this IC is four identical AND gates. You have made all the inputs equal to one. This forces all the outputs low (0), setting up a condition that is the same for any 7408 you attempt to test.

"The simplest way to test such a logic gate is to change each of the input pins in turn and note that the output behaves as it should."

Step 9 begins the actual test. The simplest way to test such a logic gate is to change each of the input pins in turn and note that the output behaves as it should. Steps 9–24 accomplish this. With all necessary possibilities checked, the remarks column of step 24 indicates that the test sequence is completed. With just 24 steps, you have ensured that each of the four AND gates has been functionally exercised.

Figure 5 shows the programming sheet for our second example, the 4017 CMOS decade counter. Since this is a 16-pin IC, no pin offset applies; pin 1 of the UUT is pin 1 of the IC, and pin 16 of the UUT is pin 16 of the IC. A review of the 4017's product sheet indicates that pin 13 is the enable, pin 14 is the clock, and pin 15 is the reset. The 4017 also has 10 count outputs and a carry output.

If you raise the level on the reset pin to one, the 4017 resets (its first output (0) goes to one, all other outputs go to zero, and the carry goes to one). The 4017 remains in this state until both the reset and enable pins are reset to zero.

If you provide a positive transition to the clock pin, the count increments (the zero output will go low and the one output will go high). This process continues for subsequent positive transitions of the clock. If at any time you raise the enable pin to a one level, the clocking is disabled. After half the total count is completed, the carry output goes low.

Now that you know how the 4017 works, you can test it. Steps 1 and 2 of Fig. 5 reset the enable and clock pins. Steps 3 and 4 provide a positive pulse to reset the IC. With this initialization completed, you proceed to pulse the clock input 10 times (steps 5–24).

Reference	Description	RS Part number
R1–R16	2.2k ohm, ¼-watt resistor (TTL version) or	271-1325
	10k ohm, ¼-watt resistor (CMOS version)	271-1335
DS1, DS2	8-position, SPST DIP switch	275-1301
TJ1–TJ16	Printed circuit board test jack	274-728
PT1, PT2	Solderless phone tip	274-723
SO1, SO2	16 pin DIP socket	276-1998
J1	Chassis mount jack (5mm OD, 2.1mm ID)	274-1549
CASE	6¼-inch-by-3¾-inch-by-2-inch experimentor box	270-627
PJ1	Chassis mount power jack (2.1mm ID)	274-1549

Miscellaneous: Printed circuit board, stranded hookup wire, dry transfer lettering (RS part #270-201 or equal), solder, etc.

Table 1. IC Tester List of Materials

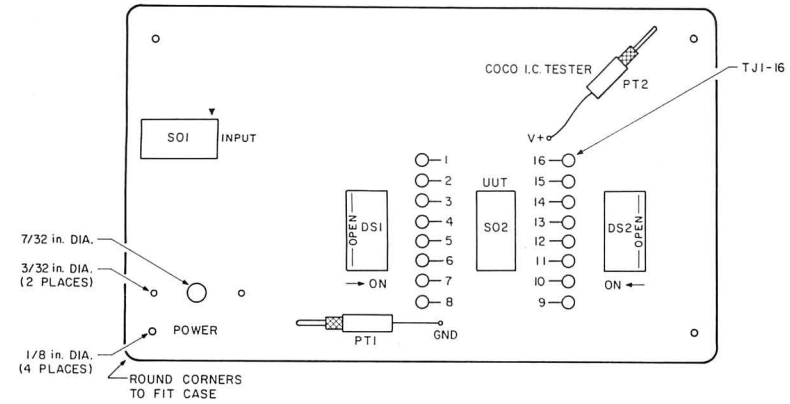


Fig. 3. Component Placement

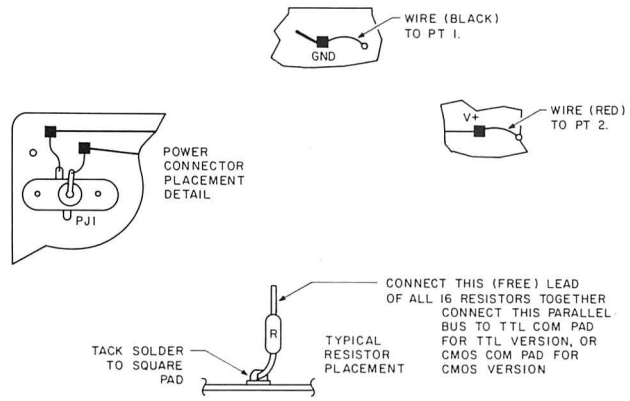


Fig. 3a. Component Placement (cont.)

Then in step 25, you bring the enable pin high and test to see that IC operation is disabled (steps 26–29). After resetting the enable pin in step 30, you cycle through another five outputs to again check that the carry bit changes (steps 31–40). Finally, steps 41 and 42 reset the IC to complete the test.

This second example shows the need for knowing how the IC works in order to test it properly. With your programming sheets in order, you can proceed to the use of the IC tester and the programs.

Program Listing 1. ICTest

```
1 REM** ICTESTER
2 REM** V2.Ø, FEB 17 1983
3 REM** (C) 1984,J.J.BARBARELLO
4 REM** AUTO TEST VERSION
5 REM
1Ø CLS:CLEAR 1ØØØ:P=129:DO$=STRI
NG$(16,"N"):DIM I1(1ØØ),I2(1ØØ),
O1(1ØØ),O2(1ØØ)
2Ø DIMC$(22):C$(Ø)="Ø Ø Ø Ø":C$(
1)="1 Ø Ø Ø":C$(2)="Ø 1 Ø Ø":C$(
3)="1 1 Ø Ø":C$(4)="Ø Ø 1 Ø":C$(
5)="1 Ø 1 Ø":C$(6)="Ø 1 1 Ø":C$(
7)="1 1 1 Ø":C$(8)="Ø Ø Ø 1":C$(
9)="1 Ø Ø 1"
3Ø C$(17)="Ø 1 Ø 1":C$(18)="1 1
Ø 1":C$(19)="Ø Ø 1 1":C$(2Ø)="1
Ø 1 1":C$(21)="Ø 1 1 1":C$(22)="
1 1 1 1"
4Ø FORI=ØTO7:P(I)=INT(2↑I):NEXT
5Ø PRINT"SETUP PHASE: I.C. PIN D
EFINITION"
6Ø PRINT@264,"SETUP COMMANDS:":P
RINT" I=INPUT PIN"TAB(18)"O=OUTP
UT PIN":PRINT" -=VSS (GND)"TAB(1
8)"+=VDD (PWR)":PRINT" N=NOT USE
D"TAB(18)"E=END DEFINE":PRINT:PR
INT" LEFT/RIGHT ARROWS MOVE CURS
OR":PRINT@32,;
7Ø L$=" Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø 1 1 1
1 1 1 1 1 2 3 4 5 6 7 8 9 Ø 1 2
3 4 5 6 - - - - - - - - - - - - -
- - - -":PRINTL$
8Ø PRINT@P-1,CHR$(2Ø7);:FORJ=1TO
5Ø:NEXT:PRINT@P-1,">";
9Ø A$=INKEY$:IFA$=""THEN9ØELSEA=
ASC(A$)
1ØØ IF A$="E"THEN16Ø
11Ø IFA$="N"ORA$="-"ORA$="+"THEN
15Ø
12Ø IF A=8ANDP>129THENPRINT@P-1,
" ";:P=P-2:GOTO8Ø
13Ø IFA=9ANDP<159THENPRINT@P-1,"
 ";:P=P+2:GOTO8Ø
14Ø IF A$<>"I" AND A$<>"O" THEN
8Ø
15Ø MID$(DO$,(P-127)/2,1)=A$:PRI
NT@P,A$;:GOTO9Ø
16Ø CLS:PRINT@238,"wait"
17Ø FORI=1TO8:IF MID$(DO$,I,1)<>
"O" THEN N=N+P(I-1)
18Ø NEXT:PA=N:POKE&HCØØ1,Ø:POKE&
HCØØØ,PA:POKE&HCØØ1,4:N=Ø
19Ø FORI=9TO16:IFMID$(DO$,I,1)<>
"O"THENN=N+P(I-9)
2ØØ NEXT:PB=N:POKE&HCØØ3,Ø:POKE&
HCØØ2,PB:POKE&HCØØ3,4
21Ø CLS:PRINT" testing phase: IN
ITIALIZE I.C.":PRINT L$:PH$="I":
STP=Ø
22Ø PRINT@256," ":PRINTTAB(1Ø)"
DIRECTIONS:":PRINT" MOVE CURSOR
 WITH LEFT OR RIGHTARROWS. CHAN
GE INPUTS BY TYPING1 OR Ø. BRIN
G IC TO INITIALIZEDSTATE. TO END
 IC INITIALIZATION,PRESS "CHR$(3
4)"E"CHR$(34)"."
23Ø PRINT@128,;:FORI=1TO16:PRINT
" ";MID$(DO$,I,1);:NEXT
24Ø FORI=1TO16:IFMID$(DO$,I,1)="
I"THENPRINT" ";CHR$(94); ELSE PR
INT" ";
25Ø NEXT:FORP=193TO223STEP2:IFPE
EK(P+992)<>94THENNEXT
26Ø PRINT@192,;:N=PEEK(&HCØØØ):G
OSUB5ØØ:N1=N:PRINTN$;:N=PEEK(&HC
ØØ2):GOSUB5ØØ:N2=N:PRINTN$;:PRIN
T@266," "
265 IF PH$="I"THEN I1(STP)=999:I
2(STP)=999 ELSE I1(STP)=N1:I2(ST
P)=N2
267 STP=STP+1:PRINT@488,USING"ST
EPS LEFT: ###";1Ø1-STP;
27Ø PRINT@P-1,">";
28Ø A$=INKEY$:IFA$=""THEN28ØELSE
A=ASC(A$)
29Ø IFA<>8THEN32ØELSEIFP=193THEN
27Ø
3ØØ FORI=P-1TO193STEP-2:IFPEEK(I
+991)<>94THENNEXT:GOTO27Ø
31Ø PRINT@P-1," ";:P=I-1:GOTO 27
Ø
32Ø IFA<>9THEN35Ø
33Ø FORI=P+2 TO223STEP2:IFPEEK(I
+992)<>94THENNEXT:GOTO27Ø
34Ø PRINT@P-1," ";:P=I:GOTO27Ø
35Ø IFA$="E"THEN4ØØELSEIFA<>48AN
DA<>49THEN28Ø
36Ø N=PEEK(P+1Ø24):N=VAL(A$)+112
-N
37Ø PRINT@P,A$;:PRINT@266,"**wor
king**";:PA=(P-193)/2
38Ø IFPA>7THENN2=N2+N*P(PA-8) EL
SE N1=N1+N*P(PA)
39Ø POKE&HCØØØ,N1:POKE&HCØØ2,N2:
O1(STP)=N1:O2(STP)=N2:GOTO26Ø
4ØØ IF PH$="I" THEN PH$="O":PRIN
T@16,"ic excitation":PRINT@393,"
PRESS e TO END TESTING PHASE.":P
RINT:GOTO 27Ø
41Ø CLS:PRINT"   TEST SEQUENCE S
TORAGE PHASE"
42Ø PRINT@64,"SAVE TEST SEQUENCE
 (Y/N)...";
43Ø A$=INKEY$:IF A$<>"Y" AND A$<
>"N" THEN 43Ø ELSE IF A$="N" THE
N 49Ø
44Ø PRINT@64,"ENTER IC TYPE (EX:
 4Ø16,74LS183) ":PRINT@96,;
45Ø LINE INPUT TY$:FORI=1TOLEN(T
Y$):IF ASC(MID$(TY$,I,1))<48 OR
ASC(MID$(TY$,I,1))>9Ø THEN 44Ø E
LSE NEXT:PRINT@96,"*"TY$"*"
46Ø PRINT"FREE FORM TEXT (END WI
TH enter).";:LINE INPUT TXT$:TXT
$=LEFT$(TXT$,24Ø)
48Ø CLS:PRINT"    TEST SEQUENCE
STORAGE PHASE":PRINT:PRINT"  PRE
PARE CASSETTE RECORDER TO  STOR
E ";TY$;" FILE.  PRESS enter  W
HEN READY..."
482 A$=INKEY$:IF A$=""THEN482 EL
SE PRINT:PRINT"SAVING FILE...";
484 OPEN"O",#-1,TY$:PRINT#-1,DO$
:PRINT#-1,TXT$:PRINT#-1,STP-1:FO
RI=1TOSTP-1:PRINT#-1,I1(I),I2(I)
,O1(I),O2(I),:NEXT:CLOSE:PRINT"D
ONE"
49Ø PRINT:PRINT:PRINT"PROGRAM EN
DED.":PRINT:END
5ØØ N$="Ø"+HEX$(N):N$=" "+C$(ASC
(RIGHT$(N$,1))-48)+" "+C$(ASC(MI
D$(N$,LEN(N$)-1,1))-48):RETURN
1ØØØ OPEN"I",#-1,"4Ø16":INPUT#-1
,DO$:INPUT#-1,TXT$:INPUT#-1,STP:
FORI=1TOSTP:INPUT#-1,I1(I),I2(I)
,O1(I),O2(I):NEXT:CLOSE
```

END

Program Listing 2. Autotest

```
1 REM** AUTOTEST
2 REM** V1.Ø, FEB 17 1983
3 REM** (C) 1984, J.J.BARBARELLO

4 REM** AUTO TEST VERSION
5 REM
1Ø CLS:CLEAR 1ØØØ:DIM I1(1ØØ),I2
(1ØØ),O1(1ØØ),O2(1ØØ):BL$=STRING
$(32,128)
2Ø DIMC$(22):C$(Ø)="Ø Ø Ø Ø":C$(
1)="1 Ø Ø Ø":C$(2)="Ø 1 Ø Ø":C$(
3)="1 1 Ø Ø":C$(4)="Ø Ø 1 Ø":C$(
5)="1 Ø 1 Ø":C$(6)="Ø 1 1 Ø":C$(
7)="1 1 1 Ø":C$(8)="Ø Ø Ø 1":C$(
9)="1 Ø Ø 1"
3Ø C$(17)="Ø 1 Ø 1":C$(18)="1 1
Ø 1":C$(19)="Ø Ø 1 1":C$(2Ø)="1
Ø 1 1":C$(21)="Ø 1 1 1":C$(22)="
1 1 1 1"
4Ø FORI=ØTO7:P(I)=INT(2↑I):NEXT
5Ø PRINT"  *** AUTO TEST SEQUENC
ER ***":PRINTBL$
6Ø LINE INPUT"ENTER FILE NAME (D
EVICE TYPE)... ";TY$:PRINT
8Ø PRINT"  PREPARE CASSETTE RECO
RDER.":P=226:GOSUB6ØØ
87 PRINT@29Ø,"LOADING FILE "TY$"
...";
9Ø OPEN"I",#-1,TY$:INPUT#-1,DO$:
INPUT#-1,TXT$:INPUT#-1,STP:FORI=
1TOSTP:INPUT#-1,I1(I),I2(I),O1(I
),O2(I):NEXT:CLOSE
1ØØ CLS:PRINT@9,"test parameters
":PRINTBL$;:PRINT"DEVICE TYPE: "
;TY$:PRINT"# STEPS IN TEST:";STP
:PRINTBL$;:PRINTTXT$
11Ø P=484:GOSUB6ØØ
13Ø CLS:PRINT@7,"<<< TEST PHASE
>>>":PRINTBL$:PRINT"PREPARE INTE
RFACE AND INSERT IC.":P=131:GOSU
B 6ØØ
16Ø PRINT@96,"TESTING...":PRINT"
 ":N=Ø
17Ø FORI=1TO8:IF MID$(DO$,I,1)<>
"O" THEN N=N+P(I-1)
18Ø NEXT:PA=N:POKE&HCØØ1,Ø:POKE&
HCØØØ,PA:POKE&HCØØ1,4:N=Ø
19Ø FORI=9TO16:IFMID$(DO$,I,1)<>
"O"THENN=N+P(I-9)
2ØØ NEXT:PB=N:POKE&HCØØ3,Ø:POKE&
HCØØ2,PB:POKE&HCØØ3,4
21Ø FORI=1TOSTP:IF I1(I)=999 OR
I2(I)=999 THEN POKE &HCØØØ,O1(I)
:POKE &HCØØ2,O2(I):NEXT
22Ø S=I:FORI=S TO STP:POKE &HCØØ
Ø,O1(I):POKE &HCØØ2,O2(I)
23Ø IF PEEK(&HCØØØ)<>I1(I) OR PE
EK(&HCØØ2)<>I2(I) THEN 25Ø ELSE
NEXT
24Ø PRINT@96,"PASS. IC PERFORMS
AS EXPECTED.":P=484:GOSUB 6ØØ:GO
TO 13Ø
25Ø PRINT@71,"IC FAILS AT STEP";
I:PRINTBL$;:PRINT"    PIN # (I=I
NPUT, O=OUTPUT)":PRINT" Ø Ø Ø Ø
Ø Ø Ø Ø Ø 1 1 1 1 1 1 1 2 3 4
5 6 7 8 9 Ø 1 2 3 4 5 6 - - - -
- - - - - - - - - - -";
27Ø FORJ=1TO16:PRINT" ";MID$(DO$
,J,1);:NEXT
28Ø PRINTTAB(8)"EXPECTED RESPONS
E"
29Ø N=I1(I):GOSUB5ØØ:PRINTN$;:N=
I2(I):GOSUB5ØØ:PRINTN$;
3ØØ PRINTTAB(8)"OBSERVED RESPONS
E"
31Ø N=PEEK(&HCØØØ):GOSUB5ØØ:PRIN
TN$;:N=PEEK(&HCØØ2):GOSUB5ØØ:PRI
NTN$;
49Ø P=484:GOSUB6ØØ:GOTO13Ø
5ØØ N$="Ø"+HEX$(N):N$=" "+C$(ASC
(RIGHT$(N$,1))-48)+" "+C$(ASC(MI
D$(N$,LEN(N$)-1,1))-48):RETURN
6ØØ PRINT@P,"PRESS enter WHEN RE
ADY...";
61Ø A$=INKEY$:IF A$=""THEN61ØELS
EIFASC(A$)<>13THEN61ØELSERETURN
1ØØØ OPEN"I",#-1,"4Ø16":INPUT#-1
,DO$:INPUT#-1,TXT$:INPUT#-1,STP:
FORI=1TOSTP:INPUT#-1,I1(I),I2(I)
,O1(I),O2(I):NEXT:CLOSE
```

END

Use

Begin by connecting your Master Interface and then powering up your CoCo. Now connect the IC Test interface by inserting the Master Interface's DIP jumper into the IC tester's input DIP socket, and the Master Interface's power plug into the IC tester's power jack. Now CLOAD and run the ICTest program. The screen clears with the title "Setup Phase: IC Pin Definition." Below the title are 16 numbered pin col-

Table 2. Line Description for ICTest

10—Defines the string DO$ (device input/output definition). Each character in the string is initially set to N (not used). Line 10 also dimensions four numeric arrays (I1, I2, O1, and O2) that store the input changes and resultant output responses.

20-30—Define strings that correspond to the binary representation of their array elements. For instance, C$(3) is defined as 1 1 0 0, the binary representation of three, if you reverse the normal order of presentation (least-significant bit first, most-significant bit last). These array elements are used later to quickly convert between a decimal number and its binary representation. To accommodate this conversion routine, seven is added to the array element numbers in line 30 (i.e., C$(17) is actually the representation for decimal 10).

40—Fills the P (power) array so that the array element holds the corresponding power of two. For example, P(4) contains eight, or two raised to the third power.

50-80—Produce the initial screen presentation.

90—Waits for a single-key input. (The definition of the allowed input is contained in line 60.)

100—Checks for an E (end of the define phase) and passes execution to line 160 if found.

110—Checks for an N, a minus, or a plus sign, and if it finds them, passes execution to line 150.

120-130—Executes a back or forward cursor command movement. The last inputs allowed are I (define pin as an input) or O (define pin as an output). If neither is found, execution loops back to line 80.

150—Modifies the appropriate character in DO$ to reflect your pin definition (I, O, N, negative, or positive). For instance, if you define the first seven pins as outputs, the eighth as negative, the ninth through twelfth as inputs, the sixteenth as positive, and don't define the rest, the DO$ string would contain OOOOOOO – IIIINNN + .

160—Asks you to wait.

170—Begins converting your pin definitions into a number between zero and 255. Remember, an output from the UUT is actually an input to the CoCo. So for all pins defined other than UUT outputs, you want the Master Interface lines configured as outputs (or inputs to the UUT). For the first eight pins (side A of your Master Interface's PIA), you calculate the number N needed to properly configure the PIA lines.

180—Performs the necessary POKEs for the configuration.

190-200—Repeat this procedure for PIA side B (UUT pins 9-16).

210-240—Format the testing-phase screen. If a pin is defined as an input, a down arrow (CHR$(94) in line 240) appears below it.

250—Gets the current status of the UUT and displays it. The testing phase has two subphases: initialization and IC excitation. The variable PH$ identifies which phase (I or O). During the initialization phase, only state changes (O1(STP) and O2(STP)) are stored.

265—Sets the UUT responses (I1(STP) and I2(STP)) to the default number 999.

267—Increments the number of steps executed (STP) and displays the number of available steps remaining (up to 100).

280-350—Perform a cursor movement and single-key input similar to that of the setup phase. However, cursor movement is limited to pins defined as inputs, since those are the only ones that you will be changing.

Table 2 continued

Table 2 continued

360–390—Execute when you change one of the input lines (1 to 0 or 0 to 1). In this instance, the values of N1 and N2 are updated accordingly. Then these values are POKEd to the PIA (line 390). Execution then returns to line 260. If you are in the IC excitation phase, the resulting response is retrieved (PEEKed) and placed in the I1 and I2 array. This process continues until you exit the IC excitation phase by pressing E.

400—Resets PH$ to O to denote a change to the output (or IC excitation) subphase, updates the screen, and passes execution to line 270.

410—Gives you the option to store the test sequence just completed. A Y response jumps execution to line 450, an N to line 490.

450—Eliminates any characters with ASCII values less than 48 or greater than 90.

460—Allows you to enter up to 240 characters of free-form text. Pressing enter completes the text entry.

480–484—Store the data.

60—Lets you enter the file name (device type) you want to test.

90—Loads the data displayed in line 100.

160—Begins the test phase.

170–200—Set up the PIA to conform to your file's pin definitions (DO$).

210–230—Perform the initialization and test sequences contained in the file.

240—Informs you that the UUT has passed and returns execution to line 130, where you can perform the test again on the same or another UUT.

250–310—Identify at which step the UUT failed and display the pin definitions, the expected response, and the observed response.

490—Lets you loop back to line 130 for another test.

Table 3. Line Description for Autotest, Which is Similar to ICTest

IC Tester Programming sheet for device type: 7408
(Page 1 of 1)

Function: TTL Quad 2-In AND Gate
Number of Pins: 14 V− = Pin 7 V+ = Pin 14
Input pins: 1, 2, 4, 5, 9, 10, 12, 13
Output pins: 3, 6, 8, 11
Special Instructions: 14 Pin DIP. IC Pins 8, 9...are UUT
Socket pins 10, 11...

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	REMARKS
DEFN	I	I	O	I	I	O	−	N	N	O	I	I	O	I	I	+	
1	1																
2		1															
3				1													
4					1												
5											1						
6												1					
7														1			
8															1		INIT Done
9	0																First Test Step
10	1																
11		0															
12		1															
13				0													
14				1													
15					0												
16					1												
17											0						
18											1						
19												0					
20												1					
21														0			
22														1			
23															0		
24															1		Test Done

Fig. 4. IC Tester Programming Sheet for Device Type 7408

umns and a list of setup commands. The last line indicates that the left and right arrows move the cursor (which is now at pin 1). Test cursor movement by pressing the left and right arrows.

You can now define the pins as indicated on your programming sheet (Fig. 5 for the 4017 CMOS decade counter). Bring the cursor to pin 1 and press letter O. An O appears in the pin 1 column. Move the cursor to the next pin and press O. Repeat this procedure for pins 3–12. A review of Fig. 5 shows that you wanted pin 8 to be a minus, not an output. No problem; simply move the cursor back to pin 8 and press the minus key. Then move the cursor to pin 13 and press I. Repeat for pins 14 and 15. Finally, move the cursor to pin 16 and press plus (remember to use the shift key). Check the pin definitions. When they're correct, press E to end the define phase.

The screen now clears and a similar presentation appears. This time, however, the title indicates "Testing Phase: Initialize IC." The pin definitions appear with an up arrow pointing to the inputs. The cursor appears at pin 13 (the first defined input). Press the right and left arrow keys and note the cursor only moves between the defined inputs. Below the pin definitions are the current status of each pin (zero or one). A set of directions tells you to change inputs by pressing one or zero, and to press E to end the initialization phase. At the very bottom of the screen you see the message "Steps Left: 100."

Starting with step 1 on your programming sheet, bring the cursor to pin 13 (if not there now) and press zero. The "Steps Left" changes to 99. Move the cursor to pin 14 and press zero. Move the cursor to pin 15. Press one and then

IC Tester Programming sheet for device type: 4017
(Page 1 of 2)

Function: CMOS Decade Counter
Number of Pins: 16 V− = Pin 8 V+ = Pin 16
Input Pins: 13, 14, 15
Output Pins: 1–7, 9–12
Special Instructions: Reset (HI) = Pin 15, Enable (LO) = Pin 13
Clock = Pin 14. Carry = Pin 12

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	REMARKS
DEFN	O	O	O	O	O	O	O	−	O	O	O	O	I	I	I	+	
1													0				Reset Enable
2														0			Reset CLK
3															1		Force IC Reset
4															0		INIT Done
5														1			
6														0			
7														1			
8														0			
9														1			
10														0			
11														1			
12														0			
13														1			
14														0			
15														1			
16														0			
17														1			
18														0			
19														1			
20														0			
21														1			
22														0			
23														1			
24														0			Cycle all 10 outputs,
25													1				check for
26														1			disabling of
27														0			IC with Enable
28														1			set to 1. Then
29														0			reset
30													0				Enable,
31														1			cycle thru
32														0			5 outputs to
33														1			check carry
34														0			bit.
35														1			
36														0			
37														1			
38														0			
39														1			
40														0			
41															1		Reset IC.
42															0		Test Done

Fig. 5. IC Tester Programming Sheet for Device Type 4017

zero. You now have 96 steps left. The pins might have already shown zero, but you shouldn't skip initialization because not all UUTs start at this condition.

To ensure that each UUT starts in the same condition, the initialization must be performed. With initialization completed, you press E. This changes the title from "Initialize IC" to "IC Excitation." Also, the definition has changed slightly, indicating that you should press E to end the testing phase. Beginning at step 5, execute the test, ending at step 42 (make sure that you move the cursor to the proper pin as necessary). When done, "Steps Left" should indicate 58. Now press E to end the test phase.

"This project provides a convenient way to learn about the operation of individual ICs and test more than one individual type of IC automatically."

The screen clears and now indicates "Test Sequence Storage Phase. Save Test Sequence (Y/N)?" Press Y and the message "Enter IC Type (EX: 4016, 74LS183)" appears. Enter 4017. Now the message "Free-Form Text (End with Enter)" appears. You might want to type the programming sheet header here. Whatever you type, *don't* press enter at the end of each line. To move to a new line use the space bar until the cursor moves to the new line. When finished typing in all text, press enter. "Prepare Cassette Recorder to Store 4017 File. Press Enter when Ready..." appears. Ready your cassette recorder and press enter. The message "Saving File..." will appear. When completed, you will see "Done" and "Program Ended."

To try the autotest feature, CLOAD and run Autotest. The title "Autotest Sequencer" appears with the question "Enter File Name (Device Type)." Enter 4017. You are then asked to prepare the cassette recorder and press enter when ready. Position the tape before the 4017 file and press enter. You will be advised "Loading File 4017."

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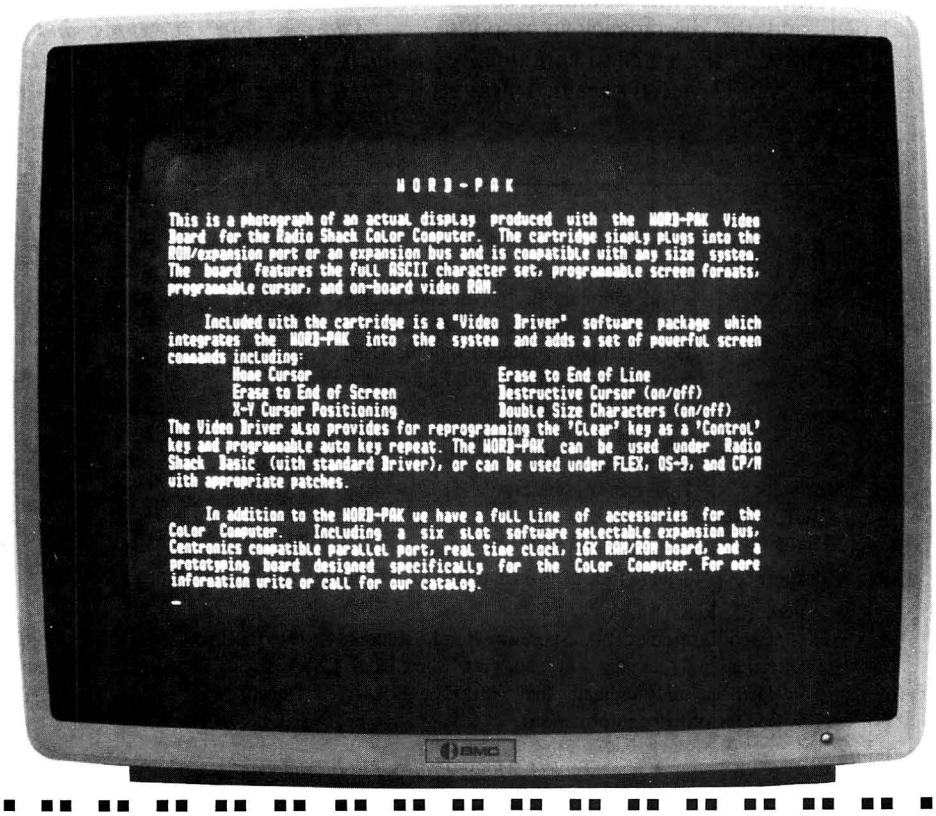

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When the file load has been completed, a new screen presentation shows the device type, number of test steps, and the free-form data you entered. As the bottom of the screen advises, press enter when ready. You are now advised to prepare the interface, insert the IC to be tested, and press enter when ready.

When you press enter, the message "Testing" appears. After a few seconds (if the IC tests correctly), you will see "Pass. IC Performs as Expected." Again the press-enter-to-continue message appears. When you press enter, you are brought back to the point where you are asked to prepare the interface and insert an IC. Here you can insert another IC for test.

To see what happens when something goes wrong, disconnect pin 13 on the interface (using the DIP switch, or disconnecting the wire to pin 13 if you have the IC breadboard-type interface). After you press enter, the testing message again appears. This time, however, the screen clears and states "IC Fails at Step 26." Below this you see the pin definitions, the expected response (the response from your 4017 data file), and the observed response (that produced by the UUT). Note that pin 3 is high in the expected response and pin 4 is high in the observed response. When you disconnected pin 13 (enable), the clock was not disabled as it should have been (step 25 placed pin 13 at a one. But since pin 13 was not connected, the IC was not disabled). Thus, the counting continued, and the discrepancy in response was noted. Press enter to continue, reconnect pin 13, and try again. This time the IC passes.

This project provides a convenient way to learn about the operation of individual ICs and test more than one individual type of IC automatically. It also shows you how to use the Master Interface's peripheral lines for both input and output. You can extend the program to keep records of IC quality, print out failure reports, and incorporate other automated functions.

Next Month

You are about to enter the world of external device control. For your next project, you are going to build a mouse, a two-wheeled, motorized vehicle. Your mouse will get its movement instructions through the Master Interface using a specially designed program. If you have ever seen Logo, you know that it accepts commands that tell a small rectangle (turtle) where and how far to move.

The turtle draws a line as it moves and thus creates a graphics pattern on the screen. Your mouse accepts direction and distance commands, but moves about in the real world. You'll even be able to attach a pen to it and create a drawing on a large sheet of paper.

This project will require a minimal amount of woodworking, and components from sources other than Radio Shack. If you're going to build the mouse, I suggest you order the parts listed (Table 4) as soon as possible. ■

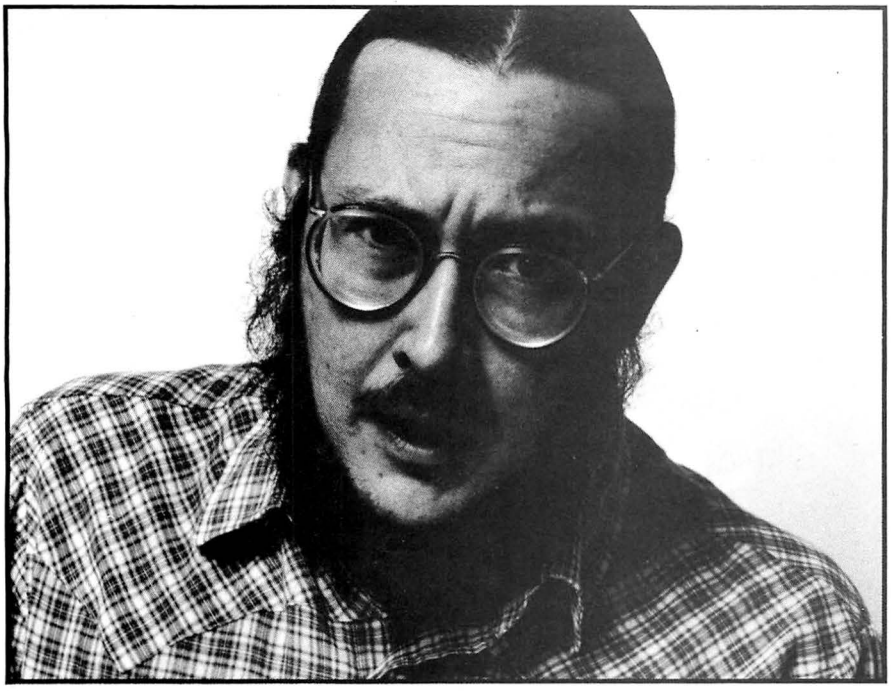
Address your questions and comments to J.J. Barbarello, RD#1, Box 241H, Tennent Road, Englishtown, NJ 07726.

Reference	Description	Part number	Source
R1–R4	2.2k ohm, ¼-watt resistor	271-1325	RS
C1, C2	1.0 μF tantalum electrolytic capacitor	272-1434	RS (JA)
IC1	7805 +5 volt regulator (T0200 Case)	276-1770	RS (JA)
IC2–IC5	IRFD-1Z3 power MOSFET (4-pin DIP)	276-2073	RS
K1–K4	SPDT Microminiature PC Relay	275-240	RS
SO1, SO2	16-pin DIP socket	276-1998	RS (JA)
PP1	9-volt dc power-pak adaptor	273-1651	RS (JA)
J1	⅛-inch phono jack	274-251	RS
M1	Dual motor assembly	TM22K638	H/R
WH1, WH2	Wheel	TM22K677	H/R
TS1	5-lug terminal strip	274-688	RS

Miscellaneous: 1 square foot of ¼-inch plywood, PC board, wire, suitable case, solder, etc.

Sources: RS: Radio Shack
JA: Jameco Electronics, 1355 Shoreway Road, Belmont, CA 94002. 415-592-8097. Call for ordering information. (Alternate source for parts where cited. Check catalog for part numbers.)
H/R: Herbach and Radman, Inc., 401 East Erie Ave., Philadelphia, PA 19134. 215-426-1700. Call for ordering information.

Table 4. Mouse Project List of Materials



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So how can it be good if it's so inexpensive? First of all, you can only get a Color Burner from Green Mountain Micro. No dealers are adding to its price. Second, it isn't fancy. No high-tech power supplies are in sight. You've got to add three homely, low-tech 9-volt batteries to get it going. Finally, it won't set new standards of complexity. It's simple, hardworking and reliable.

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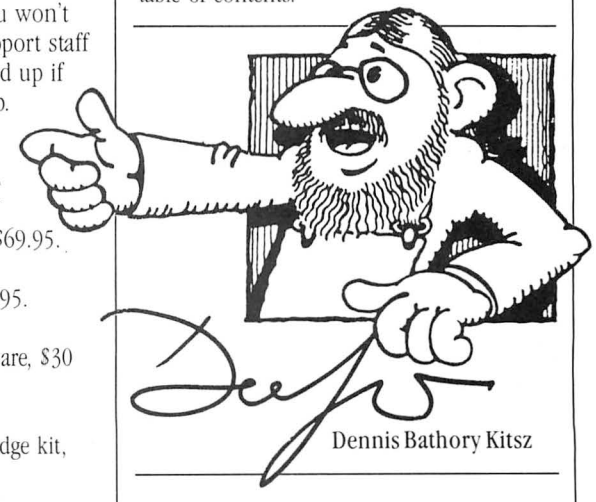

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Play with these programs change lines, delete lines, put programs together, or put programs inside one another to create your own pictures.

Program Listings 1 to 10 are pattern makers: flowers, circles within other patterns, borders in colors, and "Broadway Flashing Lights" for framing and showing off your own productions. Listings 11 to 13 are solid drawings: a heart, an ice-cream cone, and a screen that rolls off and back on for you.

In Listing 1, line 20 chooses print characters (A). These characters cannot be less than 143 (lines 10 and 70) or greater than 256 (line 20). B changes the print location (lines 10 and 30) if the character length is larger than 256 (line 30).

Listing 2 is similar to the previous one. However, only solid colored characters are chosen (lines 60 and 70). They are not random choices.

The result of Listing 3 yields a pretty effect. It uses high-resolution graphics (line 10). A changes values (lines 20, 50, and 90) and draws lines (lines 30 and 60) and a series of circles (line 100).

Listing 4 draws a series of lines from a central point (126,96) to a changing point on the edge of the screen (A,B). If you notice lines 30–60 are changing the values of A and B, which govern the ex-

BY WAYNE MCARTHUR
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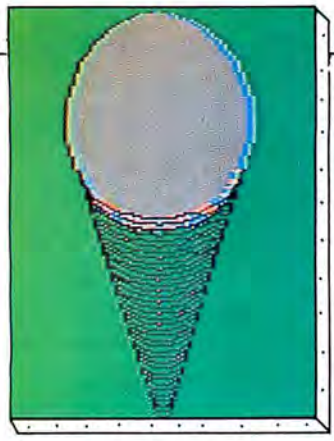

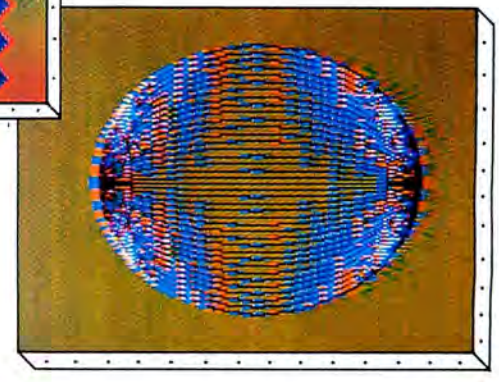

System Requirements

16K RAM
Extended Color Basic

tent of their growth and set up loops with line 20. Line 20 draws the lines. Q in line 70 allows three different displays to be drawn by looping back to line 10, thus increasing X's value.

Listing 5 uses the CIRCLE command to make an interesting series of circles. The Y variable changes the size of ovals in lines 20 and 50.

Listing 6 uses PRESET to draw lines on a white background and PSET to erase the lines. The same procedure at the end makes the circle and erases it.

In Listing 7, watch for the little line drawn at the top of your screen (line 20). This stops, or puts a cap on the top of an opening. Try putting a remark after the 4 in line 20.

Playing with numbers can be fun, and Listing 8 uses SET and a bit of fooling around with variables to produce blue and white lights. A changes the X and Y coordinates, "X"ing the colors.

Listing 9 is similar to Listing 8 in that it produces a border of lights. This program uses the PRINT command and more colors.

In Listing 10, line 10 gives A$ its value and draws it repeatedly to produce a frame. Notice that lines 10, 30, 50, and 70 set a starting point for the DRAW command. A in lines 20, 40, 60, and 80 governs the number of times A$ is drawn. Lines 20, 40, 60, and 80 change continually where A$ is drawn by using BM + or −.

Listing 11 gives some "food for thought." Try changing 1.999 in line 80 to 2. The color produced on my CoCo differs from time to time.

Listing 12 uses simple DRAW and CIRCLE statements so you can send a Valentines CoCo Card. If you like, you can add your sweetheart's favorite song to this program.

Last but not least, Listing 13 is a simple demonstration of color in PMODE 4. It made the background for the ice-cream cone (Listing 11). ■

Write to the authors at 1105–204 Fairmont Drive, Saskatoon, Saskatchewan, Canada S7M 4P5.

```
10 CLS0:A=143:B=31
20 A=A+RND(16):IFA>=256THEN70
30 B=B+1:IFB=256THENB=31:GOTO20
40 PRINT@B,CHR$(A);
50 PRINT@479-B,CHR$(A);
60 GOTO30
70 A=143:GOTO30
```

Program Listing 1.

```
10 CLS0:Z=143:Y=159:GOTO60
20 FORA=0TO510STEP2
30 PRINT@A,CHR$(Z);:NEXT
40 FORA=0TO510STEP3
50 PRINT@A,CHR$(Z);:NEXT:RETURN
60 Z=Z+16:IFZ>=256THENZ=143
70 Y=Y+16:IFY>=256THENY=159
80 GOSUB20:GOTO60
```

Program Listing 2.

```
10 PMODE4,1:PCLS1:SCREEN1,1
20 FORA=70TO184STEP2
30 LINE(0+A,50)-(254-A,150),PRES
ET
40 IFA<=250THENNEXT
50 FORA=50TO151STEP2
60 LINE(70,200-A)-(185,0+A),PRES
ET
70 IFA<=190THENNEXT
80 PAINT(2,2),0,0
90 FORA=80TO90
100 CIRCLE(128,100),A,1
110 NEXT
120 GOTO120
```

Program Listing 3.

```
10 PMODE4,1:PCLS1:SCREEN1,1:X=X+
2:GOTO30
20 LINE(126,96)-(A,B),PRESET:RET
URN
30 A=A+X:GOSUB20:IFA>=255THEN40E
LSE30
40 B=B+X:GOSUB20:IFB>=191THEN50E
LSE40
50 A=A-X:GOSUB20:IFA<=0THEN60ELS
E50
60 B=B-X:GOSUB20:IFB<=0THEN70ELS
E60
70 Q=Q+1:IFQ>=3THEN70ELSE10
```

Program Listing 4.

```
10 PMODE4,1:PCLS1:SCREEN1,1:X=90
:PLAY"P1
20 FORY=.000101TO1STEP.04
30 CIRCLE(126,96),X,0,Y
40 NEXT:PLAY"P1P1
50 FORY=1TO.000STEP-.02
60 CIRCLE(126,96),X,1,Y:NEXT:GOT
O10
```

Program Listing 5.

```
10 PMODE4,1:PCLS1:SCREEN1,1
20 X=0:Y=Y+3
30 LINE(255,191)-(X,0),PRESET
40 LINE(0,191)-(255-X,0),PRESET
50 LINE(0,0)-(255-X,191),PRESET
60 LINE(255,0)-(0+X,191),PRESET
70 X=X+Y:IFX>=250THEN80ELSE30
80 X=0
90 LINE(255,191)-(X,0),PSET
100 LINE(0,191)-(255-X,0),PSET
110 LINE(0,0)-(255-X,191),PSET
120 LINE(255,0)-(0+X,191),PSET
130 X=X+Y:IFX>=250THEN20
140 IFX+Y>=253THEN150ELSE90
150 PCLS1:Y=0
160 Y=Y+3:CIRCLE(126,96),Y,0
170 IFY>=90THEN180ELSE160
180 Y=Y-3:CIRCLE(126,96),Y,1
190 IFY<=3THEN190ELSE180
```

Program Listing 6.

```
10 PMODE4,1:PCLS1:SCREEN1,1:A =
-1
20 X=X+4:DRAW"BM126,0;C0D5
30 CIRCLE(126,96),X,0,1,.25,.75
40 CIRCLE (126,100),X,0,1,.75,.2
5
50 IFX>=95THEN60ELSE20
60 PAINT(126,94),0,0
70 A=A+1:IFA>=4THENA=A+3
80 IFA>=189THENA=A-3
90 LINE(0,A)-(255,A),PRESET
100 IFA>=191THEN110ELSE70
110 GOTO110
```

Program Listing 7.

Program Listing 8.

```
10 CLS0
20 A=A+9:IFA>=63THENA=0:X=X+2:IF
X>=6THENX=3
30 SET(A,0,X):SET(63,A-A/2,X)
40 SET(0,32-A/2-1,X):SET(63-A,31
,X):GOTO20
```

```
10 CLS0:A=143
20 A=A+16:IFA>=256THENA=143
30 B=B+1:IFB>=32THENB=0
40 PRINT@B,CHR$(A);
50 PRINT@31-B,CHR$(A);
60 PRINT@479-B,CHR$(A);
70 PRINT@448+B,CHR$(A);
80 C=C+32:IFC>=479THENC=0
90 PRINT@448-C,CHR$(A);
100 PRINT@0+C,CHR$(A);
110 PRINT@31+C,CHR$(A);
120 PRINT@479-C,CHR$(A);
130 GOTO20
```

Program Listing 9.

```
10 DRAW"BM7,15;":A$="C2E10F10G10
H10;":PMODE1,1:PCLS3:SCREEN1,0
20 A=A+1:IFA<13THENDRAWA$:DRAW"B
M+20,0;":GOTO20
30 DRAW"BM-20,0
40 A=A+1:IFA<23THENDRAWA$:DRAW"B
M+0,+20;":GOTO40
50 DRAW"BM+0,-17
60 A=A+1:IFA<36THENDRAWA$:DRAW"B
M-20,0;":GOTO60
70 DRAW"BM+6,-20
80 A=A+1:IFA<45THENDRAWA$:DRAW"B
M+0,-20;":GOTO80
90 PAINT(2,2),1,2:PAINT(20,22),4
,2:GOTO90
```

Program Listing 10.

```
10 PMODE4,1:PCLS:SCREEN1,1
20 GOTO60
30 FORA=0TO121STEP3:X=X+1
40 CIRCLE (126,191-A),X,0,.5,0,.
5
50 NEXT:RETURN
60 CIRCLE(126,50),47,1
70 PAINT(126,52),1,1
80 FORA=0TO256STEP1.999
90 LINE(0+A,0)-(0+A,191),PSET
100 NEXT:GOSUB30
110 GOTO110
```

Program Listing 11.

```
10 PMODE3,1:PCLS1:SCREEN1,0
20 DRAW"BM126,56;C4H4F4E4G4C1D11
0C4H80C1R160C4G80E80U5R3
30 CIRCLE(88,80),45,4,1,.48,.92
40 CIRCLE(164,80),45,4,1,.6,1
50 PAINT(125,100),4,4
60 GOTO60
```

Program Listing 12.

```
10 PMODE4,1:PCLS1:SCREEN1,1
20 GOSUB80
30 FORA=0TO256STEPX
40 LINE(0+A,0)-(0+A,191),PRESET:
NEXT
50 FORA=0TO256STEPX
60 LINE(0+A,0)-(0+A,191),PSET:NE
XT
70 GOTO20
80 B=B+1:IFB=2THEN X=2:B=0:RETUR
N
90 IFB=1THENX=1.999:RETURN
```

Program Listing 13.

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BY JOSEPH A. RYAN

MAIL-BEL

Not just another label-making/mailing-list database program. Mail-Bel offers a big difference.

You've seen it before—a mailing-list/label-making, database management program—ho hum. But, before you turn the page, look at the differences that set this program apart. Mail-Bel has no fields to label, no record lengths to set, and it stores and retrieves data from either cassette or disk. It allows you to transfer data from one storage medium to the other.

You can sort all data alphabetically by last name, state, city, and numerically by zip code or telephone number. You can also search for any given name, number (or portion thereof), in the entire file, and return the result to screen or printer (or both).

Mail-Bel prints one- or two-column labels and lets you presort data to print labels or lists alphabetically or numerically.

After sorting according to some prechosen pattern, you can pre-select the starting and ending record numbers that you want to label. You can, for example, re-sort the list according to zip code. Then, by inspecting the screen listing, you can determine the starting and ending records that have the same zip code.

Input these record numbers and they will be the only labels printed. Mail-Bel lets you search for a common factor and print only data that meets the search criteria, complete with a heading text, date, and an optional ending text.

The program has a telephone number entry following the asterisk after the state and zip code that might also serve as an account number, membership number, or similar entry.

As written, Mail-Bel requires up to 12 digits for the telephone entry. If you don't need it, enter the asterisk. If you don't insert anything after the asterisk, the program automatically adds 12 spaces to the record after you press the enter key. If you need more than 12, you'll have to change several values within the program. (See the remark statements.)

The CHR$( ) and other special printer-control routines are for use with the Star Micronics (Gemini) model 10-X printer. Users of Epson, Okidata, and Radio Shack printers need to make some slight modifications. Those with a Radio Shack LP VII/DMP-100 printer must delete all these printer-control calls and, in the areas of auto-line feeding or skip-to-top-of-next-page commands, must insert dummy PRINT#-2 FOR...NEXT loop routines. This is especially true in the label-making subroutine where the program allows you to set the vertical spacing between labels.

Apart from these modifications, the program does, with all printers, all the optional capabilities, except the selection of type font/size modes (see lines 141–142). The Listing is documented with REM statements to guide you in your printer control-code modifications. This should help in customizing the program for your use.

System Requirements

32K RAM
Extended Color Basic
Disk and Printer (optional)

Using the Program

The PCLEAR0 and POKE 25,6: NEW commands prior to loading gives maximum string storage for the 32K CoCo. (Disk users type PCLEAR1.) I have left out the "vitamin E" POKE (POKE 65495,0) since some cannot use it. If you do use it, be sure to insert the slow-down POKE (POKE 65494,0), prior to any print routine.

After you type in and debug the program, you see a menu of 10 selections. The first is Input Data. The program prompts you for entry, with lines across the top of the screen indicating the inputs and their order. Each input (last name, first name and initial, address, city, state, and zip code) is separated by a comma.

The entry after the state and zip code is an asterisk followed by the telephone number or code. If you enter nothing after the asterisk and hit enter, the program automatically adds 12 spaces. If you enter fewer than 12 characters after the asterisk, it fills in the balance of 12 spaces.

You need this in one of the sort routines. As you enter each character, a line immediately above the entry line indicates the number of characters already entered in that particular record (L=), and the total characters entered so far in the entire file (LL=). To exit this mode, hit enter when prompted for the next record.

The second menu item, Replace Items, prompts you for the item number to be replaced. You might have to use menu number 5 to read the file if you don't know its number. After entering the item number to be replaced you see the existing record, as on file, and enter the new data. Input the item again, com-

pletely, because you cannot edit the data.

The third item, Add to List, is used in place of item 1 after the list has been started or loaded from storage media, for addition. It operates the same as item 1.

The fourth menu item, Delete Items, again prompts you for the item number to be deleted. Entry of this number causes a repeat of the same question. Remember as you delete an item, the program decrements all items with higher numbers by one number. If you are deleting more than one item, start from the higher numbers and work toward the lower numbers.

The fifth item, Print All Items, presents a submenu asking if you want the output to screen, printer, or both.

- If you choose Screen, the program prompts you as to whether the list is a "mailist," or a "shortlist." (A mailist is a complete record and the shortlist contains entries of only a portion of data such as last name only, first name only, and a telephone number.) This is merely to determine how many items should be displayed on the screen.
- If you choose the printer output, you receive prompts for the printed format. In the screen output, a tone signals you to hit enter to return to menu. This is automatic in the printer mode.

The sixth item, Save Items, asks the name of the file to be saved (eight characters for tape, plus three extension characters for disk) followed by a tape or disk prompt. If you choose the tape, you hear a tone when the items are saved. Hit enter to return to menu. If you choose disk, the return is automatic.

The seventh item, Load Items, is a reverse of Save Items and allows loading from either tape or disk. You can go from one to the other and move files from one medium to the other.

Item 8, Make Address Labels, gives you the option of printing one label or duplicates. You can set the spacing vertically, between labels. Setting the horizontal tabs for double labels can be done in the program. (See lines 162–164.) You can also set the type size.

Item 9, Search 6 Sort Routines, has the following submenu:

1. Sort by Last Name
2. Search
3. Sort by State/Zip/Other
4. Done

The first is a simple bubble sort of the entire list alphabetically by last name. The second is a global-search routine that prompts you for the output media (screen or printer). If you select printer you are asked if you want to add a heading text to the printout. If so, you are asked for a date and if you want a following text. The leading and following are optional. If you don't want them, hit enter to start the search and printout.

Item 3 lets you sort by state, zip code, or telephone number. Without the "vitamin E" POKE, a typical list of 200 names, addresses, and telephone numbers (about the limit for a 32K CoCo) could take up to 14 minutes for a full resort. An average sort takes between three and six minutes.

Done, the last item, is a return to the main menu call. When you return to the main menu, the last item, Print List Heading, is a repetition of the heading printer routine used in the Search subroutine, but it is for a printout to printer for the entire list.

Modifications

REM statements indicate modifications for printer differences.

If you plan to use the telephone number portion of the record for other data, you must determine the maximum number of characters and change the number 12 in lines 40, 70, and 238.

Other than these modifications, you are on your own as far as improving and adding features. ■

Address correspondence to Joseph A. Ryan, P.O. Box 622, Florence, MS 39073.

Program Listing. Mail-Bel

```
Ø 'MAIL-BEL - VER. 5.1-1Ø/8/83-J
.A.RYAN
1 CLS
2 CLEAR 15ØØØ:DIM S$(21Ø):DIM LN
$(5)
3 POKE15Ø,87:'SET THIS POKE TO P
RINTER SPEED. SEE R.S.MANUALS
4 LL=Ø
5 CLS
6 PRINT@8,"MAILING LIST"
7 GOSUB241:PRINT@39,"SPACE LEFT"
;P5
8 PRINT @64,STRING$(4,CHR$(128))
;"PRINTER TO 6ØØ BAUD";STRING$(8
,CHR$(128)):'IF YOUR PTR. IS SET
 FASTER, CHANGE 6ØØ TO YOUR SPEE
D
9 PRINT@134,"(1) INPUT ITEMS"
1Ø PRINT @166,"(2) REPLACE ITEMS
"
11 PRINT@198,"(3) ADD TO THE LIS
T"
12 PRINT@23Ø,"(4) DELETE ITEMS"
13 PRINT@262,"(5) PRINT ALL ITEM
S"
14 PRINT@294,"(6) SAVE ITEMS"
15 PRINT@326,"(7) LOAD ITEMS"
16 PRINT@358,"(8) MAKE ADDRESS L
ABELS"
17 PRINT@39Ø,"(9) SEARCH & SORT
ROUTINES"
18 PRINT@422,"(1Ø) PRINT LIST HE
ADING"
19 PRINT@459,"(1-1Ø)";
2Ø INPUT M
21 IF M<Ø OR M>1Ø THEN 4
22 ON M GOSUB 24,5Ø,27,74,87,1Ø9
,12Ø,135,165,21Ø
23 GOTO 5
24 'INPUT/ADD
25 IF Y>1 THEN RETURN
26 Y=1
27 L=Ø:CLS:PRINT"LN, FN, ST, CY,
 STZP *ACPHCODE"
28 PRINT@32,"put * at end of eac
h entry w/o  tele.#"
29 PRINT@1ØØ,"PRESS <RETURN> WHE
N DONE"
3Ø PRINT "ITEM" Y;
31 S$(Y)=""
32 A$=INKEY$:IF A$=""THEN 32
33 IF PEEK(343)<>247 THEN 37
```

Listing continued

Listing continued

```
34 L=L-1: IF L<Ø THEN 27
35 S$(Y)=LEFT$(S$(Y),L)
36 GOTO 42
37 IF A$=CHR$(13) THEN 46
38 S$(Y)=S$(Y)+A$:GOTO 42
39 P=INSTR(S$(Y),"*")
4Ø IF LEN(MID$(S$(Y),P+1))<12 TH
EN S$(Y)=S$(Y)+STRING$(12-LEN(MI
D$(S$(Y),P+1))," ")
41 RETURN
42 L=LEN(S$(Y))
43 PRINT@161,"LL=";LL;"L=";L:PRI
NT @193,S$(Y)
44 IF L=Ø THEN 27
45 GOTO32
46 IF S$(Y)="" THEN RETURN
47 GOSUB39:Y=Y+1
48 LL=LL+L:GOTO27
49 '
5Ø 'REPLACE
51 N=Ø:L=Ø
52 CLS:PRINT@9,"REPLACE ITEMS"
53 PRINT@34,"PRESS <ENTER> WHEN
FINISHED"
54 PRINT:INPUT "ITEM NO. TO REPL
ACE";N
55 PRINT"OLD ITEM WAS: ";S$(N):L
L=LL-LEN(S$(N)):S$(N)=""
56 IF N=Ø THEN RETURN
57 PRINT"REPLACEMENT";
58 A$=INKEY$:IF A$="" THEN 58
59 IF A$=CHR$(13) THEN 73
6Ø IF PEEK(343)<> 247 THEN 64
61 L=L-1:IF L<Ø THEN 51
62 S$(N)=LEFT$(S$(N),L)
63 GOTO 65
64 S$(N)=S$(N)+A$
65 L=LEN(S$(N))
66 PRINT@224,"LL=";LL;"L=";L:PRI
NT@256,S$(N)
67 IF L=Ø THEN 58
68 GOTO 72
69 P=INSTR(S$(N),"*")
7Ø IF LEN(MID$(S$(N),P+1))<12 TH
EN S$(N)=S$(N)+STRING$(12-LEN(MI
D$(S$(N),P+1))," ")
71 RETURN
72 GOTO 58
73 GOSUB69:LL=LL+L:GOTO51
74 'DELETE SUBROUTINE
75 N=Ø
76 CLS:PRINT@9,"DELETE ITEMS"
77 PRINT@34,"PRESS <ENTER> WHEN
FINISHED
78 PRINT:INPUT "ITEM TO DELETE";
N:IF N<1 THEN GOTO 5
79 IF N>Y-1 THEN 78
8Ø IF N=Ø THEN RETURN
81 FOR X=N TO Y-2
82 S$(X)=S$(X+1)
83 NEXT X
84 S$(X)=""
85 Y=Y-1
86 GOTO 74
87 'PRINT SUBROUTINE
88 CLS
89 PRINT@134,"1. SCREEN ONLY"
9Ø PRINT@166,"2. PRINTER ONLY"
91 PRINT@198,"3. SCREEN & PRINTE
R"
92 INPUTM:IF M<1 OR M>3 THEN 89
93 ON M GOTO 94,1Ø4,94
94 CLS:INPUT"IS THIS A MAIL.LIST
(1) OR A LIST WITH SHORTLINES(2)
 ";G
95 IF G=1 GOSUB 219 ELSE IF G=2
GOSUB22Ø
96 FOR X=1 TO Y-1 STEP D
97 FOR Z=X TO X+DD
98 PRINT Z;S$(Z)
99 NEXT Z
1ØØ INPUT"PRESS <ENTER> TO CONTI
NUE";C$
1Ø1 NEXT X
1Ø2 IF M<>3 THEN 1Ø8
1Ø3 IF H$="Y" THEN GOSUB 217 ELS
E 1Ø4
1Ø4 PRINT#-2,CHR$(27);CHR$(78);C
HR$(5);:FOR X=1 TO Y:'PTR.SKIP-O
VER-PERFORATION FEATURE
1Ø5 IF S$(X)<>"" THEN PRINT#-2,X
;S$(X)
1Ø6 NEXT X
1Ø7 IF T$="Y" OR TX$="Y"  THEN P
RINT#-2:PRINT#-2:PRINT#-2,TT$
1Ø8 IF M=1 THEN RETURN ELSE IF M
>1 THEN PRINT#-2,CHR$(12):RETURN
:'PTR.ADV. TO TOP OF NEXT PGE.
1Ø9 INPUT"SAVE TO DISK(D) OR TAP
E(T):";L2$:IF L2$="T" THEN 246 E
LSE 11Ø
11Ø CLS:PRINT@135,"SAVE ITEMS ON
 DISK"
111 INPUT"DISK FILE NAME";FF$
112 OPEN "O",#1,FF$
113 FOR X=1 TO Y-1
114 WRITE#1,S$(X)
115 NEXTX:'PUT#1,Y:NEXT X
116 CLOSE#1
117 CLS:PRINT"FILENAME IS: ";FF$
118 PRINT"HIT <ENTER> WHEN READY
":INPUTR$
119 RETURN
12Ø INPUT"LOAD FROM DISK(D) OR T
APE(T)";L1$:IF L1$="T" THEN GOTO
 258 ELSE 121
121 CLS:PRINT@136,"LOAD ITEMS FR
OM DISK"
122 INPUT"DISK FILE NAME";FF$
123 OPEN "I",#1,FF$
124 Y=1
125 IF EOF(1)=-1 THEN 131
126 INPUT#1,S$(Y)
127 PRINTS$(Y)
128 LL=LL+LEN(S$(Y))
129 Y=Y+1
13Ø GOTO 125
131 CLOSE #1
```

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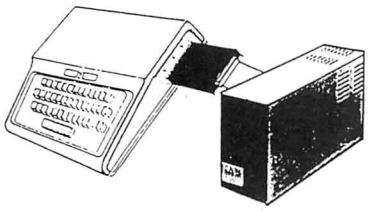

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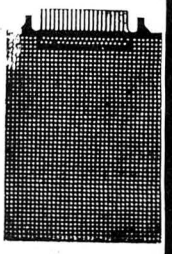

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Listing continued

```
132 PRINT"FILE ";FF$;" HAS BEEN
LOADED     LL=";LL
133 PRINT"HIT <ENTER> FOR MENU":
INPUTR$
134 RETURN
135 CLS:PRINT@2,"THIS IS THE ARE
A FOR ADDRESS LABELS"
136 INPUT"FIRST RECORD,LAST RECO
RD TO BE PRINTED";I1,I2
137 INPUT"Ø FOR SCREEN 2 FOR PRI
NTER";U:IF U=1 OR U>2 OR U<Ø THE
N 137
138 IF U=Ø THEN GOTO 141
139 PRINT"WHAT CHARACTER MODE? (
DEFAULT IS STANDARD ASCII)":PRIN
T"1=ITALIC":PRINT"2=PICA":PRINT"
3=COND.":PRINT"4=ELITE":GOSUB18Ø
14Ø PRINT"INSERT LABEL PAPER HER
E-":INPUT"ENTER # OF COLUMNS (1
OR 2)";CC:IF CC<1 OR CC>2 THEN 1
4Ø
141 INPUT"SPACING BETWEEN LABELS
 IN LINES";NX
142 FOR I=I1 TO I2:R$=S$(I)
143 FOR J=1 TO 5
144 P=INSTR(1,R$,",")
145 IF J=5 THEN P=INSTR(1,R$,"*"
)
146 IF P=Ø THEN 15Ø
147 L=P-1
148 LN$(J)=LEFT$(R$,L)
149 R$=MID$(R$,P+1)
15Ø NEXTJ
151 LN$(1)=LN$(2)+" "+LN$(1):LN$
(5)=LN$(4)+","+LN$(5)
152 ON CC GOTO 153,158
153 PRINT#-U,TAB(1)LN$(1)
154 PRINT#-U,TAB(1)LN$(3)
155 PRINT#-U,TAB(1)LN$(5)
156 PRINT#-2,CHR$(27);CHR$(97);C
HR$(NX):'SETS GEMINI 1Ø-X PTR. T
O AUTO LINEFEED NX LINES FOR NEX
T LABEL
157 GOTO 163
158 PRINT#-U,TAB(1)LN$(1);TAB(41
)LN$(1)
159 PRINT#-U,TAB(1)LN$(3);TAB(41
)LN$(3)
16Ø PRINT#-U,TAB(1)LN$(5);TAB(41
)LN$(5)
161 PRINT#-2,CHR$(27);CHR$(97);C
HR$(NX):'PTR.AUTOLINEFEED OF NX
LINES
162 IF U<1 THEN FOR J=1 TO 999:N
EXT J
163 NEXT I:PRINT#-2,CHR$(27);CHR
$(53):'SET PTR.TO STAND.ASCII CH
AR.SET
164 RETURN
165 CLS:PRINT@5,"SEARCH AND SORT
 AREA"
166 '
167 PRINT@166,"1-SORT BY LAST NA
ME"
```

Listing continued

```
168 PRINT@23Ø,"3-SEARCH"
169 PRINT@198,"2-SORT BY STATE/Z
IP/OTHER":PRINT@416,"OTHER=ANY #
 OR CHR UP TO 12 CHRS LONG"
17Ø PRINT@262,"4-DONE"
171 INPUTM:IF M<Ø OR M>5 THEN 16
5
172 ON M GOTO 174,222,186,221
173 'SORT BY LAST NAME
174 CLS:PRINT"SORTING - WAIT"
175 FOR X=1 TO Y-2
176 FOR I= X+1 TO Y-1
177 IF S$(I)<S$(X) THEN R$=S$(X)
:S$(X)=S$(I):S$(I)=R$
178 NEXTI:NEXTX
179 FOR X2=1 TO 5:SOUND128,1:SOU
ND158,1:NEXTX2:GOTO165
18Ø INPUTCH:'PRINTER COMMANDS-SE
T FOR STAR GEMINI 1Ø/1Ø-X CHANGE
 FOR YOUR PRINTER
181 IF CH<1 THEN PRINT#-2,CHR$(2
7);CHR$(53):RETURN:'PTR STD.ASCI
I.CHAR.SET
182 IF CH=1 THEN PRINT#-2,CHR$(2
7);CHR$(52):RETURN:'PTR.ITALIC C
HAR.SET
183 IF CH=2 THEN PRINT#-2,CHR$(1
8):RETURN:'PTR.PICA SIZED PT.MOD
E
184 IF CH=3 THEN PRINT#-2,CHR$(1
5):RETURN:'PTR.CONDENSED PITCH P
T.MODE
185 IF CH=4 THEN PRINT#-2,CHR$(2
7);CHR$(66);CHR$(2):RETURN
186 'SEARCH ITEMS
187 CLS:INPUT"SEARCH LIST FOR";S
S$
188 INPUT"IS OUTPUT FOR SCREEN(Ø
) OR PRINTER(1)";OT
189 IF OT=Ø THEN U=Ø:GOTO 194
19Ø IF OT=1 THEN U=2:GOTO 191
191 INPUT"WANT A HEADING ON THE
PRINTOUT  <Y/N>";HW$:IF HW$="Y"
THEN GOSUB 2Ø4 ELSE 192
192 PRINT:INPUT"ADD TEXT<Y/N>";T
$
193 IF T$="Y" THEN GOSUB 2Ø2 ELS
E GOTO 194
194 FOR S=1 TO Y-1
195 R$=S$(S)
196 P=INSTR(1,R$,SS$)
197 IF P>Ø THEN PRINT#-U,R$
198 NEXT S
199 IF OT=Ø THEN SOUND 128,5:INP
UT"PRESS <ENTER> TO CONTINUE";C$
:GOTO165
2ØØ IF T$="Y" THEN PRINT#-2:PRIN
T#-2:PRINT#-2,TT$
2Ø1 IF OT=1 THEN PRINT#-2,CHR$(1
2):GOTO 165 ELSE FOR X2=1 TO 1Ø:
SOUND133,1:SOUND163,1:NEXTX2:GOT
O 165
2Ø2 PRINT:LINEINPUT" TEXT: ";TT$
2Ø3 RETURN
2Ø4 INPUT"HEADING";HL$
2Ø5 LINEINPUT"DATE: ";DL$
2Ø6 NN=INT(LEN(DL$))
2Ø7 PRINT#-2,CHR$(27);CHR$(66);C
HR$(2);CHR$(14);HL$;:PRINT#-2,TA
B(4Ø-NN);DL$:'SET PTR.TO ELITE T
YPE-ENLARGED PRNT.
2Ø8 PRINT#-2,CHR$(18);:PRINT#-2:
PRINT#-2:RETURN:'RETURN PTR.TO P
ICATYPE MODE
2Ø9 FOR X2=1 TO 1Ø:SOUND 15Ø,1:S
OUND175,1:NEXTX2GOTO 174
21Ø 'PRINT LIST HEADING
211 CLS:PRINT"THIS GIVES THE SAM
E PRINTOUT AS MODE 5/2 EXCEPT YO
U CAN ADD A   HEADING AND DATE A
ND FOLLOWING  TEXT TO THE LISTIN
G:":INPUT"DO YOU WANT A HEADING
ON YOUR   LISTING<Y/N>";H$:IF H$
<>"Y" THEN GOTO 5
212 INPUT"HEADING";HH$
213 LINEINPUT"DATE? ";DD$
214 INPUT"DO YOU WANT FOLLOWING
TEXT<Y/N>";TX$:IF TX$="Y" THEN G
OSUB 2Ø2 ELSE 215
215 NN=INT(LEN(DD$))
216 GOTO1Ø3
217 PRINT#-2,CHR$(27);CHR$(66);C
HR$(2);CHR$(14);HH$;:PRINT#-2,TA
B(4Ø-NN);DD$
218 PRINT#-2,CHR$(18):RETURN
219 D=5:DD=4:RETURN
22Ø D=15:DD=14:RETURN
221 RETURN
222 'SORT BY ZIP CODE/STATE SUBR
OUTINES
223 CLS:INPUT"SORT BY STATE(S) O
R ZIP CODE(Z) OR 'PHONE #[OR OTH
ER](T)";Z$
224 IF Z$="Z" THEN GOTO 23Ø ELSE
 IF Z$="S" THEN GOTO 225 ELSE IF
 Z$="T" THEN GOTO 236
225 FOR X=1 TO Y-2:'SORT BY STAT
E
226 FOR I=X+1 TO Y-1
227 IF RIGHT$(S$(I),21)<RIGHT$(S
$(X),21) THEN R$=S$(X):S$(X)=S$(
I):S$(I)=R$
228 NEXTI:NEXTX
229 FOR X2=1 TO 1Ø:SOUND1Ø5,1:SO
UND145,1:NEXTX2:GOTO 165
23Ø PRINT"SORTING BY ZIP CODE":'
SORT BY ZIP CODE ONLY
231 FOR X=1 TO Y-2
232 FOR I=X+1 TO Y-1
233 IF RIGHT$(S$(I),18)<RIGHT$(S
$(X),18) THEN R$=S$(X):S$(X)=S$(
I):S$(I)=R$
234 NEXTI:NEXTX
235 FOR X2=1 TO 1Ø:SOUND 122,1:S
OUND148,1:NEXTX2:GOTO 165
236 PRINT"SORTING BY TELE.# OR O
```

Listing continued

Listing continued

```
THER":FOR X=1 TO Y-2:'TELE.SORT
237 FOR I=X+1 TO Y-1
238 IF RIGHT$(S$(I),12)<RIGHT$(S
$(X),12) THEN R$=S$(X):S$(X)=S$(
I):S$(I)=R$
239 NEXTI:NEXTX
24Ø FORX2=1 TO 1Ø:SOUND 1ØØ,1:SO
UND18Ø,1:NEXTX2:GOTO 165
241 M=PEEK(&H23)*256+PEEK(&H24):
'SUBROUTINE TO GIVE STNG.SP. REM
AINING
242 N=PEEK(&H21)*256+PEEK(&H22)
243 O=PEEK(&H27)*256+PEEK(&H28)
244 P5=M-N:Q=O-M
245 RETURN
246 'TAPE LOAD
247 CLS:PRINT@135,"SAVE TO TAPE"
248 INPUT"TAPE FILE NAME";FF$
249 MOTOR OFF:AUDIO OFF
25Ø PRINT@356,"PRESS PLAY AND RE
CORD"
2z1 PRINT@388,"PRESS <ENTER> WHE
N READY";R$
252 OPEN"O",#-1,FF$
253 FOR X=1 TO Y-1
254 PRINT#-1,S$(X)
255 NEXTX
256 CLOSE#-1
257 PRINT"FILE NAME IS: ";FF$:IN
PUT"HIT <ENTER> FOR MENU";R$:RET
URN
258 'TAPE LOAD
259 CLS:PRINT@136,"LOAD FROM TAP
E"
26Ø INPUT"TAPE FILE NAME";FF$
261 PRINT@388,"PRESS PLAY THEN <
ENTER> WHEN READY":INPUTR$
262 OPEN"I",#-1,FF$
263 Y=1
264 IF EOF(-1) THEN 269
265 INPUT#-1,S$(Y)
266 LL=LL+LEN(S$(Y))
267 Y=Y+1
268 GOTO 264
269 CLOSE#-1
27Ø PRINT"FILE ";FF$" HAS BEEN L
OADED  LL= ";LL
271 PRINT"STOP RECORDER & HIT <E
NTER> FOR MENU":INPUTR$
272 RETURN
```

END

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

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

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

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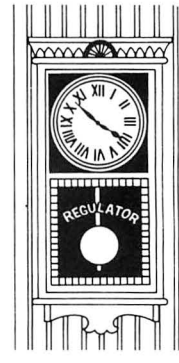
CoCo 32k ECB . . . . . Tape: $16.95

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.

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TUTORIAL

BY MIKE MEEHAN

ANATOMY OF AN ASSEMBLY-LANGUAGE GAME—PART III

Congratulations. You have made it to part 3 of your exploration of an Assembly-language game. By now you are probably beginning to find your way around what you had once considered confusing programming techniques. This month I'll get into the guts of Croaker and begin writing routines for it.

Before I do that, though, let's clear up some of the confusion between 1-byte (8-bit) and 2-byte (16-bit) registers. The main difference, of course, is that the 1-byte registers can hold numbers from 0 to 255, while the 2-byte registers can hold numbers from 0 to 65535.

Our dissection of Croaker continues with a look at how the program makes the characters move.

Usually, Assembly-language programming does not use numbers out of this range (i.e., negative numbers, numbers with decimal points, and numbers greater than 65535). If you need these numbers, you can write a separate routine to define them using the normal registers. There is a Basic routine that does this, letting you use these numbers in your Basic programs.

Another difference between 1-byte and 2-byte registers is the way they are stored in memory. I said last month that

annie/gusman

memory is divided into 1-byte increments, meaning that each spot in memory can hold a number from 0 to 255. This poses no problem when storing and loading 1-byte registers.

For example, if A contained a value of 200 and you stored A at memory location 3000, memory location 3000 would be loaded with 200. The storing and loading of 2-byte registers causes some confusion, however. When storing or loading a register, you must specify a 1-byte memory location in the operand. You cannot store the 2-byte register in this 1-byte location. You logically assume that you need 2 bytes to store a 2-byte register. Therefore, not only do you use the location specified in the operand, but also the location directly after that.

For this reason, the 2-byte value is divided into the most-significant byte and the least-significant byte. The most-significant byte (MSB) is stored in the first location while the least-significant byte (LSB) is stored in the second location. The easiest way to see the MSB and the LSB is to show a 2-byte number in hexadecimal.

The MSB in the number $ABCD is $AB while the LSB is $CD. Therefore, if you specified in the operand that this number was to be stored in memory location 3000, a value of $AB would be stored in 3000, while a value of $CD would be stored in 3001. The same format is also used in loading 2-byte registers.

Refer to this month's Program Listing and notice that I have left out comments at each line and have included comments only by the subroutines. I leave it up to you to figure out the logic of the subroutines. This will give you a chance to use the Assembly language you have learned (and save me the trouble of typing in all the comments).

Notice, too, that the ORG statement tells the assembler to start assembling part 3 at the point where part 2 left off. This program is *not* to be added to part 2, but assembled separately. At the end of the series, you'll attach the parts. This Program Listing defines several labels given in part 2 and needed in part 3.

The music routine I wrote about last month is listed after the section that defines the labels. The structure of this is a little more complicated than the rest of the program—a challenge for you experts out there. You'll need to know about some addresses if you're going to attempt to figure it out.

$FF23—Enables sound
$FF20—Produces sound
16359—Contains a 2-byte address of where the music codes begin

After the music routine, you'll find two subroutines labeled SWICH1 and SWICH2. Their jobs are to switch the computer into and out of the graphics mode. SWICH1 switches the computer into the graphics mode, while SWICH2 switches the computer out of it. Croaker uses the graphics mode equivalent to PMODE 3 in Basic. Switching back and forth from the graphics mode is accomplished by storing values into the I/O area. For a more detailed description of how this is done, refer to your Color Basic manual.

Next is the PCAR subroutine. Before executing this subroutine, register Y must be loaded with a memory location where the car will be put. This memory location is an area of the hi-res screen from 1536 to 7680 decimal. The data for the car will be POKEd into this area. Also, register X must be loaded with an address where the data for the car begins. You'll notice that the subroutine stores four codes on one line (32 bytes per line) and then jumps down to the next line to add more codes. Last month's article explains why this is done. The memory location 16323 is used as a kind of scratch pad to determine when the subroutine is finished.

The PTUR subroutine is structured a little differently from PCAR. First, eight codes must be stored on each line. Also, because there is only one set of turtles, you don't have to define the address of the codes for the turtles. The routine loads this address automatically. The address where the turtles are to be put on the screen must be defined in register X. The PLOG and PWTUR subroutines that follow are structured like PTUR except that a log and a set of turtles disappearing underwater are POKEd onto the screen rather than a set of turtles.

PBLK puts a blank (blue) area of water on the screen when one of the turtles disappears underwater. The memory location into which the blank area is POKEd must be stored in register X before executing this routine. Like PTUR, eight codes are stored on each line. The code for the blue area is 170 decimal.

PBLK2 puts a blank (white) area of road on the screen at the current position of the frog. It is stored at address 16291. The car-moving routine moves an entire block of the screen at once. If the frog was on the screen when this routine was executed, it would be moved along with the cars.

Croaker is designed so the frog doesn't move when it is on the road. This routine makes the frog disappear when the move routine is executed. After execution, you can put the frog back on the screen using PFROG. Because the purpose of this routine is to make the frog disappear, 2 bytes of data are POKEd on each line. A zero is the code for a white area.

PFROG puts a frog on the screen at the current position. Notice that 2 bytes of data are put on each line as in PBLK2. The address where the frog codes begin must be defined in register Y. The routine is executed after executing PBLK2, or when the frog moves on the screen. The address 16323 is also used here to test for when the subroutine is completed.

GET and PUT are used to store and retrieve a 2-by-9 area of memory from the current position, so when the frog moves, nothing on the screen is destroyed. Before the frog makes its move, the computer calculates where it will move and gets the data that is at that area. After the frog moves, the data is restored to the area, preventing the frog from destroying the landscape in its path. As in PFROG and PCAR, the address 16323 is used as a scratch area here.

The Score subroutine adds to the score of the current player. The address 16330 tells which player is up, and the computer then finds where the score for the player begins. The value in B tells which number position the value in A will be added to. Like Music, this is a complicated routine, so don't feel bad if you don't understand it.

PSKULL puts a skull on the screen at the current position and is executed when a frog dies. Because the skull is the same size as a frog, 2 bytes of data per line are POKEd onto the screen. The

System Requirements

32K RAM
Extended Color Basic
Editor/Assembler

A. Get address for frog midway in a jump, facing the correct direction, and store it at 16265.
B. Put background back on screen.
C. Change current position address appropriately.
D. Get new background.
E. Retrieve address and put new frog jumping on screen.
F. Start sound effect.
G. Get address for frog sitting and facing the correct direction and store it at 16265.
H. Put background back on screen.
I. Change current position address appropriately.
J. Get new background.
K. Retrieve temporary address for current frog and store it permanently.
L. Put frog sitting on the screen.
M. Finish sound effect.
N. Change right/left/up/down frog address appropriately.
O. Add to score.

Table 1. Procedure for Moving Frogs

address where the data for the skull begins must be stored in register Y before PSKULL is executed.

MOVER, MOVEL, MOVEU, MOVED, DMOVEU, and DMOVED all move the frog on the screen. MOVER moves the frog right one place, MOVEL moves it left one place, MOVEU moves it up one place, MOVED moves it down one place, DMOVEU moves it up one and a half places, and DMOVED moves it down one and a half places. The roadways are wider than the rest of the screen, so the move of the frog onto or off these roadways is a longer distance. Only the up and down movements of the frog need to be elongated because the only way for a frog to get on or off the roadways is by moving up or down. Table 1 shows the procedure for moving the frogs in these subroutines.

Address 16290 contains a number indicating the right/left position of the frog while the address 16287 contains a number indicating the up/down position of the frog. These are used to test and see if the frog is within bounds, to tell if the frog is jumping onto or off a

Program Listing 1. Croaker Part 3

```
256F                    00180          ORG     $256F
        3FFE            00190 PNTR     EQU     16382   LABELS DEFINED
        3FFD            00200 DUR      EQU     16381   IN PREVIOUS
        3FFA            00210 VOICE1   EQU     16378   PROGRAM THAT
        3FF7            00220 VOICE2   EQU     16375   ARE NEEDED
        3FF4            00230 VOICE3   EQU     16372   FOR PART 3
        3FF1            00240 VOICE4   EQU     16369
        3FEF            00250 INC1     EQU     16367
        3FED            00260 INC2     EQU     16365
        3FEB            00270 INC3     EQU     16363
        3FE9            00280 INC4     EQU     16361
        2000            00290 WAVES    EQU     $2000
        2100            00300 TABLE    EQU     $2100
        23F4            00310 TURTLE   EQU     $23F4
        1F86            00320 LOG      EQU     $1F86
        23A4            00330 WIURT    EQU     $23A4
        1F78            00340 PRESSS   EQU     $1F78
        1F44            00350 PRESS    EQU     $1F44
        1F2C            00360 PLAYER   EQU     $1F2C
        1F10            00370 SONG3    EQU     $1F10
        1F1B            00380 SONG4    EQU     $1F1B
256F 86 3F              00390 MUSIC    LDA     #$3F    FOUR VOICE
2571 B7 FF23            00400          STA     $FF23   MUSIC ROUTINE
2574 8E 2000            00410          LDX     #WAVES  THAT'S USED
2577 BF 3FFA            00420          STX     VOICE1  FOR ALL
257A BF 3FF7            00430          STX     VOICE2  THE SOUNDS
257D BF 3FF4            00440          STX     VOICE3  IN THIS
2580 BF 3FF1            00450          STX     VOICE4  PROGRAM
2583 BE 3FE7            00460          LDX     16359
2586 BF 3FFE            00470          STX     PNTR
2589 8D 0B              00480 MLOOP    BSR     GET1
258B 81 00              00490          CMPA    #0
258D 26 01              00500          BNE     AGAIN
258F 39                 00510          RTS
2590 8D 0D              00520 AGAIN    BSR     GETN
2592 8D 2F              00530          BSR     PLAYN
2594 20 F3              00540          BRA     MLOOP
2596 BE 3FFE            00550 GET1     LDX     PNTR
2599 A6 80              00560          LDA     ,X+
259B B7 3FFD            00570          STA     DUR
259E 39                 00580          RTS
259F 108E 2100          00590 GETN     LDY     #TABLE
25A3 A6 80              00600          LDA     ,X+
25A5 EE A6              00610          LDU     A,Y
25A7 FF 3FEF            00620          STU     INC1
25AA A6 80              00630          LDA     ,X+
25AC EE A6              00640          LDU     A,Y
25AE FF 3FED            00650          STU     INC2
25B1 A6 80              00660          LDA     ,X+
25B3 EE A6              00670          LDU     A,Y
25B5 FF 3FEB            00680          STU     INC3
25B8 A6 80              00690          LDA     ,X+
25BA EE A6              00700          LDU     A,Y
25BC FF 3FE9            00710          STU     INC4
25BF BF 3FFE            00720          STX     PNTR
25C2 39                 00730          RTS
25C3 108E 0068          00740 PLAYN    LDY     #$68
25C7 A6 9F 3FFA         00750 PLAY     LDA     [VOICE1]
25CB AB 9F 3FF7         00760          ADDA    [VOICE2]
25CF A9 9F 3FF4         00770          ADCA    [VOICE3]
25D3 A9 9F 3FF1         00780          ADCA    [VOICE4]
25D7 B7 FF20            00790          STA     $FF20
25DA EC 3FFB            00800          LDD     VOICE1+1
25DD E3 3FEF            00810          ADDD    INC1
25E0 ED 3FFB            00820          STD     VOICE1+1
25E3 EC 3FF8            00830          LDD     VOICE2+1
25E6 E3 3FED            00840          ADDD    INC2
25E9 ED 3FF8            00850          STD     VOICE2+1
25EC EC 3FF5            00860          LDD     VOICE3+1
25EF E3 3FEB            00870          ADDD    INC3
25F2 ED 3FF5            00880          STD     VOICE3+1
25F5 EC 3FF2            00890          LDD     VOICE4+1
25F8 E3 3FE9            00900          ADDD    INC4
25FB ED 3FF2            00910          STD     VOICE4+1
25FE 31 A2              00920          LEAY    ,-Y
2600 26 07              00930          BNE     EPLAY
2602 7A 3FFD            00940          DEC     DUR
2605 27 0C              00950          BEQ     ENDIE
2607 20 BA              00960          BRA     PLAYN
2609 A6 84              00970 EPLAY    LDA     ,X
260B 20 00              00980          BRA     PAD1
260D 20 00              00990 PAD1     BRA     PAD2
260F 20 00              01000 PAD2     BRA     PAD3
2611 20 B4              01010 PAD3     BRA     PLAY
2613 39                 01020 ENDIE    RTS
2614 4F                 01030 SWICH1   CLRA            SWITCH INTO
2615 B7 FFC7            01040          STA     65479   GRAPHICS MODE
2618 B7 FFC9            01050          STA     65481
261B B7 FFCA            01060          STA     65482
261E B7 FFCC            01070          STA     65484
2621 B7 FFCE            01080          STA     65486
2624 B7 FFD0            01090          STA     65488
2627 B7 FFD2            01100          STA     65490
262A B7 FFC0            01110          STA     65472
262D B7 FFC3            01120          STA     65475
2630 B7 FFC5            01130          STA     65477
2633 86 E8              01140          LDA     #232
2635 B7 FF22            01150          STA     65314
2638 39                 01160          RTS
2639 4F                 01170 SWICH2   CLRA            SWITCH INTO
263A B7 FFC6            01180          STA     65478   SCORE SCREEN
263D B7 FFC9            01190          STA     65481   MODE
2640 B7 FFCA            01200          STA     65482
2643 B7 FFCC            01210          STA     65484
2646 B7 FFCE            01220          STA     65486
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Listing continued

roadway, and to determine the background color of the frog.

Moving the frog on the screen incorporates all these things. As you can see, the programmer pays for the speed of Assembly language in the amount of work required to write the program. And you thought Basic was picky!

The GETK subroutine checks the keyboard to see if an arrow key has been pressed and returns its findings in A. The routine in address $A1C1 scans the keyboard and returns the ASCII value of its findings in addresses 341, 342, 343, and 344.

The GETJ subroutine is the joystick equivalent of GETK. The routine in address $A9DE checks the joysticks and returns its findings in $15A, $15B, $15C, and $15D. The GETJ routine tests to see which player is playing and checks the appropriate joystick. In order for the routine to return a direction value, the button of the joystick must be pressed. This makes the game a little easier to play.

GOON tells the current player to press the joystick button or the space bar to continue the game and then waits for the instruction to be carried out. The address 16301 contains a one if the player is using the keyboard. Otherwise, it contains a two for joysticks.

The routine clears the previous message and prints the appropriate message for pressing the joystick button or space bar. It also jumps to the PRINT1 subroutine that is coming up, and prints the current player on the screen. It then branches off to wait for the instruction to be carried out. The joystick part branches even further to test the appropriate joystick for the current player. Address $FF00 tests to see if a joystick button has been pressed. This address is covered in your Color Basic manual.

PRINTS prints the score on the screen at the position specified by register Y. The address for where the score begins must be defined in register X. A value of 48 must be added to each number so when it is POKEd onto the screen, the number appears instead of another character. By POKEing a one in a screen address from Basic, you can see that a one isn't what appears on the screen. This is done in the program anywhere a number needs to be printed on the screen.

PRINT1 prints the word Player on the screen at the position specified in register X. This is used in the GOON subroutine and a couple of other places. Normally, after executing this routine, the program prints the current player number directly next to it. Next month you will write the two routines required to set up the hi-res and low-res screens. As always, questions and comments are welcome. Please include a self-addressed stamped envelope for responses. ■

Write to Mike Meehan at 1300 Fairfield Drive, Clearwater, FL 33546.

Listing continued

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2649 B7   FFD0   01230          STA    65488
264C B7   FFD2   01240          STA    65490
264F B7   FFC0   01250          STA    65472
2652 B7   FFC2   01260          STA    65474
2655 B7   FFC4   01270          STA    65476
2658 86   08     01280          LDA    #8
265A B7   FF22   01290          STA    65314
265D 39          01300          RTS
265E 1F   20     01310 PCAR     TFR    Y,D      PUT CAR
2660 C3   0028   01320          ADDD   #40      SPECIFIED BY
2663 FD   3FC3   01330          STD    16323    REGISTER Y
2666 A6   A0     01340 LOOP13   LDA    ,Y+      INTO AREA
2668 A7   80     01350          STA    ,X+      SPECIFIED BY
266A A6   A0     01360          LDA    ,Y+      REGISTER X
266C A7   80     01370          STA    ,X+
266E A6   A0     01380          LDA    ,Y+
2670 A7   80     01390          STA    ,X+
2672 A6   A0     01400          LDA    ,Y+
2674 A7   80     01410          STA    ,X+
2676 10BC 3FC3   01420          CMPY   16323
267A 26   01     01430          BNE    NEQU5
267C 39          01440          RTS
267D 1F   10     01450 NEQU5    TFR    X,D
267F C3   001C   01460          ADDD   #28
2682 1F   01     01470          TFR    D,X
2684 20   E0     01480          BRA    LOOP13
2686 108E 23F4   01490 PTUR     LDY    #TURTLE  PUT SET OF
268A 86   00     01500          LDA    #0       TURTLES AT
268C 8B   01     01510 LOOP11   ADDA   #1       AREA SPECIFIED
268E E6   A0     01520          LDB    ,Y+      BY REGISTER X
2690 E7   80     01530          STB    ,X+
2692 81   08     01540          CMPA   #8
2694 26   F6     01550          BNE    LOOP11
2696 108C 2444   01560          CMPY   #TURTLE+80
269A 26   01     01570          BNE    NEQU4
269C 39          01580          RTS
269D 1F   10     01590 NEQU4    TFR    X,D
269F C3   0018   01600          ADDD   #24
26A2 1F   01     01610          TFR    D,X
26A4 86   00     01620          LDA    #0
26A6 20   E4     01630          BRA    LOOP11
26A8 108E 1F86   01640 PLOG     LDY    #LOG     PUT LOG
26AC 86   00     01650          LDA    #0       AT AREA
26AE 8B   01     01660 LOOP12   ADDA   #1       SPECIFIED BY
26B0 E6   A0     01670          LDB    ,Y+      REGISTER X
26B2 E7   80     01680          STB    ,X+
26B4 81   08     01690          CMPA   #8
26B6 26   F6     01700          BNE    LOOP12
26B8 108C 1FD6   01710          CMPY   #LOG+80
26BC 26   01     01720          BNE    NEQU2
26BE 39          01730          RTS
26BF 1F   10     01740 NEQU2    TFR    X,D
26C1 C3   0018   01750          ADDD   #24
26C4 1F   01     01760          TFR    D,X
26C6 86   00     01770          LDA    #0
26C8 20   E4     01780          BRA    LOOP12
26CA 108E 23A4   01790 PWTUR    LDY    #WTURT   PUT SET OF
26CE 86   00     01800          LDA    #0       TURTLES GOING
26D0 8B   01     01810 LOOP59   ADDA   #1       UNDERWATER AT
26D2 E6   A0     01820          LDB    ,Y+      AREA SPECIFIED BY
26D4 E7   80     01830          STB    ,X+      REGISTER X
26D6 81   08     01840          CMPA   #8
26D8 26   F6     01850          BNE    LOOP59
26DA 108C 23F4   01860          CMPY   #WTURT+80
26DE 26   01     01870          BNE    NEQU13
26E0 39          01880          RTS
26E1 1F   10     01890 NEQU13   TFR    X,D
26E3 C3   0018   01900          ADDD   #24
26E6 1F   01     01910          TFR    D,X
26E8 86   00     01920          LDA    #0
26EA 20   E4     01930          BRA    LOOP59
26EC C6   AA     01940 PBLK     LDB    #170     PUT A BLANK
26EE 86   00     01950          LDA    #0       AREA OF WATER
26F0 108E 0000   01960          LDY    #0       AT PLACE SPECIFIED
26F4 8B   01     01970 LOOP60   ADDA   #1       BY REGISTER X
26F6 E7   80     01980          STB    ,X+
26F8 E6   A0     01990          LDB    ,Y+
26FA C6   AA     02000          LDB    #170
26FC 81   08     02010          CMPA   #8
26FE 26   F4     02020          BNE    LOOP60
2700 108C 0050   02030          CMPY   #80
2704 26   01     02040          BNE    NEQU14
2706 39          02050          RTS
2707 1F   10     02060 NEQU14   TFR    X,D
2709 C3   0018   02070          ADDD   #24
270C 1F   01     02080          TFR    D,X
270E 86   00     02090          LDA    #0
2710 C6   AA     02100          LDB    #170
2712 20   E0     02110          BRA    LOOP60
2714 BE   3FA3   02120 PBLK2    LDX    16291    PUT A BLANK
2717 CC   0000   02130          LDD    #0       AREA OF ROAD
271A B7   3FC3   02140          STA    16323    AT CURRENT
271D ED   84     02150 LOOP62   STD    ,X       POSITION
271F B6   3FC3   02160          LDA    16323
2722 8B   01     02170          ADDA   #1
2724 B7   3FC3   02180          STA    16323
2727 81   09     02190          CMPA   #9
2729 27   0C     02200          BEQ    EQU19
272B 1F   10     02210          TFR    X,D
272D C3   0020   02220          ADDD   #32
2730 1F   01     02230          TFR    D,X
2732 CC   0000   02240          LDD    #0
2735 20   E6     02250          BRA    LOOP62
2737 39          02260 EQU19    RTS
2738 BE   3FA3   02270 PFROG    LDX    16291    PUT A FROG
273B 4F          02280          CLRA            (SPECIFIED BY
273C B7   3FC3   02290          STA    16323    REGISTER Y)
273F EC   A1     02300          LDD    ,Y++     AT CURRENT
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Listing continued

Listing continued

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2741 1F   10     02310          TFR    X,D      POSITION
2743 C3   0020   02320          ADDD   #32
2746 1F   01     02330          TFR    D,X
2748 EC   A1     02340 LOOP61   LDD    ,Y++
274A ED   84     02350          STD    ,X
274C B6   3FC3   02360          LDA    16323
274F 8B   01     02370          ADDA   #1
2751 81   08     02380          CMPA   #8
2753 27   0C     02390          BEQ    EQU18
2755 B7   3FC3   02400          STA    16323
2758 1F   10     02410          TFR    X,D
275A C3   0020   02420          ADDD   #32
275D 1F   01     02430          TFR    D,X
275F 20   E7     02440          BRA    LOOP61
2761 39          02450 EQU18    RTS
2762 108E 3F8B   02460 GET      LDY    #16267   GET A 2*9
2766 BE   3FA3   02470          LDX    16291    AREA AT
2769 86   00     02480          LDA    #0       CURRENT POSITION
276B B7   3FC3   02490          STA    16323    AND STORE
276E EC   84     02500 LOOP63   LDD    ,X       IT IN MEMORY
2770 ED   A1     02510          STD    ,Y++
2772 B6   3FC3   02520          LDA    16323
2775 8B   01     02530          ADDA   #1
2777 81   09     02540          CMPA   #9
2779 27   0C     02550          BEQ    EQU20
277B B7   3FC3   02560          STA    16323
277E 1F   10     02570          TFR    X,D
2780 C3   0020   02580          ADDD   #32
2783 1F   01     02590          TFR    D,X
2785 20   E7     02600          BRA    LOOP63
2787 39          02610 EQU20    RTS
2788 108E 3F8B   02620 PUT      LDY    #16267   GET A 2*9
278C BE   3FA3   02630          LDX    16291    AREA FROM
278F 86   00     02640          LDA    #0       MEMORY AND
2791 B7   3FC3   02650          STA    16323    PUT IT AT
2794 EC   A1     02660 LOOP64   LDD    ,Y++     CURRENT POSITION
2796 ED   84     02670          STD    ,X
2798 B6   3FC3   02680          LDA    16323
279B 8B   01     02690          ADDA   #1
279D 81   09     02700          CMPA   #9
279F 27   0C     02710          BEQ    EQU21
27A1 B7   3FC3   02720          STA    16323
27A4 1F   10     02730          TFR    X,D
27A6 C3   0020   02740          ADDD   #32
27A9 1F   01     02750          TFR    D,X
27AB 20   E7     02760          BRA    LOOP64
27AD 39          02770 EQU21    RTS
27AE B7   3F6A   02780 SCORE    STA    16234    ADD TO
27B1 B6   3FCA   02790          LDA    16330    SCORE USING B
27B4 81   01     02800          CMPA   #1       TO TELL WHAT
27B6 26   05     02810          BNE    NQU110   POSITION TO ADD
27B8 8E   3FE1   02820          LDX    #16353   VALUE STORED
27BB 20   15     02830          BRA    EQU41    IN A
27BD 81   02     02840 NQU110   CMPA   #2
27BF 26   05     02850          BNE    NQU111
27C1 8E   3FD8   02860          LDX    #16344
27C4 20   0C     02870          BRA    EQU41
27C6 81   03     02880 NQU111   CMPA   #3
27C8 26   05     02890          BNE    NQU112
27CA 8E   3FD2   02900          LDX    #16338
27CD 20   03     02910          BRA    EQU41
27CF 8E   3FCC   02920 NQU112   LDX    #16332
27D2 BF   3F6B   02930 EQU41    STX    16235
27D5 5A          02940 LOP3     DBCB
27D6 C1   FF     02950          CMPB   #255
27D8 27   1A     02960          BEQ    NQU115
27DA BE   3F6B   02970          LDX    16235
27DD A6   85     02980          LDA    B,X
27DF BB   3F6A   02990          ADDA   16234
27E2 81   0A     03000          CMPA   #10
27E4 25   18     03010          BLO    EQU42
27E6 80   0A     03020          SUBA   #10
27E8 BE   3F6B   03030          LDX    16235
27EB A7   85     03040          STA    B,X
27ED 86   01     03050          LDA    #1
27EF B7   3F6A   03060          STA    16234
27F2 20   E1     03070          BRA    LOP3
27F4 CC   0000   03080 NQU115   LDD    #0
27F7 ED   81     03090          STD    ,X++
27F9 ED   81     03100          STD    ,X++
27FB A7   84     03110          STA    ,X
27FD 39          03120          RTS
27FE BE   3F6B   03130 EQU42    LDX    16235
2801 A7   85     03140          STA    B,X
2803 39          03150          RTS
2804 86   00     03160 PSKULL   LDA    #0       PUT A SKULL
2806 B7   3F71   03170          STA    16241    (SPECIFIED BY
2809 BE   3FA3   03180          LDX    16291    REGISTER Y
280C EC   A1     03190 LOP5     LDD    ,Y++     AT CURRENT
280E ED   84     03200          STD    ,X       POSITION
2810 B6   3F71   03210          LDA    16241
2813 4C          03220          INCA
2814 81   0B     03230          CMPA   #11
2816 27   0C     03240          BEQ    EQU43
2818 B7   3F71   03250          STA    16241
281B 1F   10     03260          TFR    X,D
281D C3   0020   03270          ADDD   #32
2820 1F   01     03280          TFR    D,X
2822 20   E8     03290          BRA    LOP5
2824 39          03300 EQU43    RTS
2825 1F   20     03310 MOVER    TFR    Y,D      TAKE FROG
2827 C3   0064   03320          ADDD   #100     FROM CURRENT
282A FD   3F89   03330          STD    16265    POSITION AND
282D BD   2788   03340          JSR    PUT      MOVE IT
2830 BE   3FA3   03350          LDX    16291    RIGHT ONE
2833 A6   80     03360          LDA    ,X+      PLACE
2835 BF   3FA3   03370          STX    16291
2838 BD   2762   03380          JSR    GET
283B 10BE 3F89   03390          LDY    16265
283F BD   2738   03400          JSR    PFROG
2842 8E   1F10   03410          LDX    #SONG3
2845 BF   3FE7   03420          STX    16359
2848 BD   256F   03430          JSR    MUSIC
284B FC   3F89   03440          LDD    16265
284E 83   0014   03450          SUBD   #20
2851 FD   3F89   03460          STD    16265
2854 BD   2788   03470          JSR    PUT
2857 BE   3FA3   03480          LDX    16291
285A A6   80     03490          LDA    ,X+
285C BF   3FA3   03500          STX    16291
285F BD   2762   03510          JSR    GET
2862 BE   3FA3   03520          LDX    16291
2865 10BE 3F89   03530          LDY    16265
2869 10BF 3FA0   03540          STY    16288
286D BD   2738   03550          JSR    PFROG
2870 8E   1F1B   03560          LDX    #SONG4
2873 BF   3FE7   03570          STX    16359
2876 BD   256F   03580          JSR    MUSIC
2879 7C   3FA2   03590          INC    16290
287C 7C   3FA2   03600          INC    16290
287F 86   01     03610          LDA    #1
2881 C6   05     03620          LDB    #5
2883 BD   27AE   03630          JSR    SCORE
2886 39          03640          RTS
2887 1F   20     03650 MOVEL    TFR    Y,D      TAKE FROG
2889 C3   008C   03660          ADDD   #140     FROM CURRENT
288C FD   3F89   03670          STD    16265    POSITION AND
288F BD   2788   03680          JSR    PUT      MOVE IT LEFT
2892 BE   3FA3   03690          LDX    16291    ONE PLACE
2895 A6   82     03700          LDA    ,-X
2897 BF   3FA3   03710          STX    16291
289A BD   2762   03720          JSR    GET
289D 10BE 3F89   03730          LDY    16265
28A1 BD   2738   03740          JSR    PFROG
28A4 8E   1F10   03750          LDX    #SONG3
28A7 BF   3FE7   03760          STX    16359
28AA BD   256F   03770          JSR    MUSIC
28AD FC   3F89   03780          LDD    16265
28B0 83   0014   03790          SUBD   #20
28B3 FD   3F89   03800          STD    16265
28B6 BD   2788   03810          JSR    PUT
28B9 BE   3FA3   03820          LDX    16291
28BC A6   82     03830          LDA    ,-X
28BE BF   3FA3   03840          STX    16291
28C1 BD   2762   03850          JSR    GET
28C4 BE   3FA3   03860          LDX    16291
28C7 10BE 3F89   03870          LDY    16265
28CB 10BF 3FA0   03880          STY    16288
28CF BD   2738   03890          JSR    PFROG
28D2 8E   1F1B   03900          LDX    #SONG4
28D5 BF   3FE7   03910          STX    16359
28D8 BD   256F   03920          JSR    MUSIC
28DB 7A   3FA2   03930          DEC    16290
28DE 7A   3FA2   03940          DEC    16290
28E1 86   01     03950          LDA    #1
28E3 C6   05     03960          LDB    #5
28E5 BD   27AE   03970          JSR    SCORE
28E8 39          03980          RTS
28E9 1F   20     03990 MOVEU    TFR    Y,D      TAKE FROG
28EB C3   0014   04000          ADDD   #20      FROM CURRENT
28EE FD   3F89   04010          STD    16265    POSITION AND
28F1 BD   2788   04020          JSR    PUT      MOVE IT UP
28F4 FC   3FA3   04030          LDD    16291    ONE PLACE
28F7 83   00A0   04040          SUBD   #160
28FA FD   3FA3   04050          STD    16291
28FD BD   2762   04060          JSR    GET
2900 10BE 3F89   04070          LDY    16265
2904 BD   2738   04080          JSR    PFROG
2907 8E   1F10   04090          LDX    #SONG3
290A BF   3FE7   04100          STX    16359
290D BD   256F   04110          JSR    MUSIC
2910 FC   3F89   04120          LDD    16265
2913 83   0014   04130          SUBD   #20
2916 FD   3F89   04140          STD    16265
2919 BD   2788   04150          JSR    PUT
291C FC   3FA3   04160          LDD    16291
291F 83   00A0   04170          SUBD   #160
2922 FD   3FA3   04180          STD    16291
2925 BD   2762   04190          JSR    GET
2928 10BE 3F89   04200          LDY    16265
292C 10BF 3FA0   04210          STY    16288
2930 BD   2738   04220          JSR    PFROG
2933 8E   1F1B   04230          LDX    #SONG4
2936 BF   3FE7   04240          STX    16359
2939 BD   256F   04250          JSR    MUSIC
293C 7C   3F9F   04260          INC    16287
293F 86   01     04270          LDA    #1
2941 C6   05     04280          LDB    #5
2943 BD   27AE   04290          JSR    SCORE
2946 39          04300          RTS
2947 1F   20     04310 MOVED    TFR    Y,D      TAKE FROG
2949 C3   003C   04320          ADDD   #60      FROM CURRENT
294C FD   3F89   04330          STD    16265    POSITION AND
294F BD   2788   04340          JSR    PUT      MOVE IT DOWN
2952 FC   3FA3   04350          LDD    16291    ONE PLACE
2955 C3   00A0   04360          ADDD   #160
2958 FD   3FA3   04370          STD    16291
295B BD   2762   04380          JSR    GET
295E 10BE 3F89   04390          LDY    16265
2962 BD   2738   04400          JSR    PFROG
2965 8E   1F10   04410          LDX    #SONG3
2968 BF   3FE7   04420          STX    16359
296B BD   256F   04430          JSR    MUSIC
296E FC   3F89   04440          LDD    16265
```
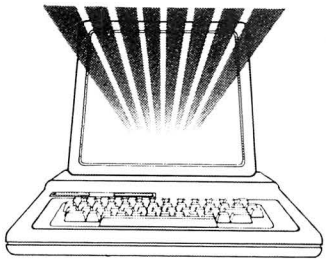

Listing continued

SUPER SCREEN



- **A big 51 character by 24 line screen.**
- **Full upper and lower case characters.**
- **Easily combine text with hi-res graphics.**
- **PRINT @ is completely functional on the big screen.**
- **The powerful ON ERROR GOTO is fully implemented.**
- **Auto-key repeat for greater keyboard convenience.**
- **Control codes for additional functions.**
- **Works with 16K, 32K or 64K computers.**
- **Available on disc or cassette.**
- **Works with extended and/or disc BASIC.**

51 CHARACTERS BY 24 LINE DISPLAY

Super Screen is a powerful, machine language program that significantly upgrades the performance and usefulness of 16K or greater, Extended and Disc Basic Color Computers. The standard Color Computer display screen is totally inadequate for serious, personal or business applications so Super Screen replaces it with a brand new, 51 character wide by 24 line screen including full upper and lower case characters. Instead of a confusing checkerboard appearance, you now have true lower case letters along with a screen that is capable of displaying 1224 characters. The difference is startling! Your computer takes on new dimensions and can easily handle lines of text that were simply too long and complex to display on the old screen.

COMBINE TEXT WITH HI-RES GRAPHICS

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

PRINT @ IS FULLY IMPLEMENTED

The PRINT @ statement is a valuable asset to the programmer when formatting text on the screen. The standard Color Computer will report an error if you specify a location higher than 511 but Super Screen allows locations all the way to 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!

AUTO KEY REPEAT

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

CONTROL CODES FOR ADDITIONAL FUNCTIONS

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

AND MORE GOOD NEWS...

Super Screen comes with complete, well detailed instructions and is available on cassette or disc. It adjusts automatically to any 16K or greater, Extended or Disc Basic Color Computer or TDP-100 and uses only 2K of memory in addition to the screen memory reserved during power up. Guaranteed to be the most frequently used program in your software library...once you use it, you won't be without it! Super Screen's low price will really please you; only $29.95 on cassette or $32.95 on disc!

64K Memory Expansion Kit
All parts and complete instructions
$64.95

NEW! SUPER BUG

Mark Data Products SUPER BUG is a powerful, relocatable machine code monitor program for your Coco. If you are a beginner, the program and documentation are an indispensable training aid, helping you to gain a better understanding of your Color Computer and machine code programming. If you are an accomplished computerist, SUPER BUG's capabilities, versatility and convenience will prove invaluable during programming and debugging.

SUPER BUG offers so many outstanding features that we are unable to list them all in this limited space. hex and alpha numeric memory display, modify, search and test; full printer support with baud rate and line feed select; up to 220 breakpoints; mini object code disassembler; 64K mode setup; decimal, hex and ascii code conversion routines and extensive documentation. Only $29.95 on cassette or $32.95 on disc.

ORDER ENTRY SYSTEM

The Mark Data Products sales order processing system will give a fast, efficient means to enter orders, print shipping papers and invoices, prepare sales reprots, and monitor receivables. The system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer, and one or more disc drives.

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

The MDP system:

- Is accurate, user friendly and simple to use.
- Is easy to customize for specific user requirements.
- Produces a traceable invoice.
- Handles receivables as well as closed orders.
- In capable of future expandability.

This accounting software equals or exceeds higher priced packages for other computers and includes a detailed operating manual. For just $99.95.

ACCOUNTING SYSTEM

The Mark Data Products accounting system is ideal for the small businessman needing a fast, efficient means to process income and expenses, prepare detailed reports and maintain most of the information required at tax time. The system is a family of programs which operate by means of a "menu" selection scheme. When the operator selects a task to perform, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary accounting reports including a transaction journal, a P&L or income report, an interim or trial balance and a balance sheet.

Up to 255 separate accounts may be defined and a single disc system can hold over 1,400 transactions. This system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer and one or more disc drives.

The MDP system:

- Is accurate, user friendly and simple to use.
- Is easy to customize for specific user requirements.
- Immediately updates the chart of accounts.
- Provides an audit trail.
- Includes end of period procedures.
- Is capable of future expandability.

This order entry software equals or exceeds higher priced packages for other computers and includes a detailed operating manual. For just $99.95.

IMPORTANT NEW BOOKS

"Your Color Computer" by Doug Mosher. Over 300 pages of detailed information–A CoCo encyclopedia $16.95.

"Programming the 6809" by Rodnay Zaks and William Labiak. One of the best 6809 machine language texts available—required reference material. $15.95.

WE STOCK SOFTLAW PRODUCTS

The VIP WRITER Text Processor is rated tops by Rainbow, Hot CoCo and Color Computer Magazine. After evaluation we rate it tops too. **Disc $59.95.**

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Listing continued

```
2971 83  0014      04450          SUBD   #20
2974 FD  3F89      04460          STD    16265
2977 BD  2788      04470          JSR    PUT
297A FC  3FA3      04480          LDD    16291
297D C3  00A0      04490          ADDD   #160
2980 FD  3FA3      04500          STD    16291
2983 BD  2762      04510          JSR    GET
2986 10BE 3F89     04520          LDY    16265
298A 10BF 3FA0     04530          STY    16288
298E BD  2738      04540          JSR    PFROG
2991 8E  1F1B      04550          LDX    #SONG4
2994 BF  3FE7      04560          STX    16359
2997 BD  256F      04570          JSR    MUSIC
299A 7A  3F9F      04580          DEC    16287
299D 86  01        04590          LDA    #1
299F C6  05        04600          LDB    #5
29A1 BD  27AE      04610          JSR    SCORE
29A4 39            04620          RTS
29A5 1F  20        04630 DMOVEU   TFR    Y,D     TAKE FROG
29A7 C3  0014      04640          ADDD   #20     FROM CURRENT
29AA FD  3F89      04650          STD    16265   POSITION AND
29AD BD  2788      04660          JSR    PUT     MOVE IT UP
29B0 FC  3FA3      04670          LDD    16291   ONE AND A HALF
29B3 83  00E0      04680          SUBD   #224    PLACES (USED
29B6 FD  3FA3      04690          STD    16291   FOR MOVING
29B9 BD  2762      04700          JSR    GET     FROG FROM ROADWAYS)
29BC 10BE 3F89     04710          LDY    16265
29C0 BD  2738      04720          JSR    PFROG
29C3 8E  1F10      04730          LDX    #SONG3
29C6 BF  3FE7      04740          STX    16359
29C9 BD  256F      04750          JSR    MUSIC
29CC FC  3F89      04760          LDD    16265
29CF 83  0014      04770          SUBD   #20
29D2 FD  3F89      04780          STD    16265
29D5 BD  2788      04790          JSR    PUT
29D8 FC  3FA3      04800          LDD    16291
29DB 83  0100      04810          SUBD   #256
29DE FD  3FA3      04820          STD    16291
29E1 BD  2762      04830          JSR    GET
29E4 10BE 3F89     04840          LDY    16265
29E8 10BF 3FA0     04850          STY    16288
29EC BD  2738      04860          JSR    PFROG
29EF 8E  1F1B      04870          LDX    #SONG4
29F2 BF  3FE7      04880          STX    16359
29F5 BD  256F      04890          JSR    MUSIC
29F8 7C  3F9F      04900          INC    16287
29FB 86  01        04910          LDA    #1
29FD C6  05        04920          LDB    #5
29FF BD  27AE      04930          JSR    SCORE
2A02 39            04940          RTS
2A03 1F  20        04950 DMOVED   TFR    Y,D     TAKE FROG
2A05 C3  003C      04960          ADDD   #60     FROM CURRENT
2A08 FD  3F89      04970          STD    16265   POSITION AND
2A0B BD  2788      04980          JSR    PUT     MOVE IT DOWN
2A0E FC  3FA3      04990          LDD    16291   ONE AND A HALF
2A11 C3  00E0      05000          ADDD   #224    PLACES (USED
2A14 FD  3FA3      05010          STD    16291   FOR MOVING FROGS
2A17 BD  2762      05020          JSR    GET     FROM ROADWAYS)
2A1A 10BE 3F89     05030          LDY    16265
2A1E BD  2738      05040          JSR    PFROG
2A21 8E  1F10      05050          LDX    #SONG3
2A24 BF  3FE7      05060          STX    16359
2A27 BD  256F      05070          JSR    MUSIC
2A2A FC  3F89      05080          LDD    16265
2A2D 83  0014      05090          SUBD   #20
2A30 FD  3F89      05100          STD    16265
2A33 BD  2788      05110          JSR    PUT
2A36 FC  3FA3      05120          LDD    16291
2A39 C3  0100      05130          ADDD   #256
2A3C FD  3FA3      05140          STD    16291
2A3F BD  2762      05150          JSR    GET
2A42 10BE 3F89     05160          LDY    16265
2A46 10BF 3FA0     05170          STY    16288
2A4A BD  2738      05180          JSR    PFROG
2A4D 8E  1F1B      05190          LDX    #SONG4
2A50 BF  3FE7      05200          STX    16359
2A53 BD  256F      05210          JSR    MUSIC
2A56 7A  3F9F      05220          DEC    16287
2A59 86  01        05230          LDA    #1
2A5B C6  05        05240          LDB    #5
2A5D BD  27AE      05250          JSR    SCORE
2A60 39            05260          RTS
2A61 BD  A1C1      05270 GETK     JSR    $A1C1   SCAN KEYBOARD
2A64 B6  0155      05280          LDA    341     TO SEE IF AN
2A67 81  F7        05290          CMPA   #247    ARROW KEY IS
2A69 26  03        05300          BNE    NEQU44  PRESSED AND
2A6B 86  01        05310          LDA    #1      RETURN FINDINGS
2A6D 39            05320          RTS            IN ACCUMULATOR A
2A6E B6  0156      05330 NEQU44   LDA    342
2A71 81  F7        05340          CMPA   #247
2A73 26  03        05350          BNE    NEQU45
2A75 86  02        05360          LDA    #2
2A77 39            05370          RTS
2A78 B6  0158      05380 NEQU45   LDA    344
2A7B 81  F7        05390          CMPA   #247
2A7D 26  03        05400          BNE    NEQU46
2A7F 86  03        05410          LDA    #3
2A81 39            05420          RTS
2A82 B6  0157      05430 NEQU46   LDA    343
2A85 81  F7        05440          CMPA   #247
2A87 26  03        05450          BNE    NEQU60
2A89 86  04        05460          LDA    #4
2A8B 39            05470          RTS
2A8C 86  00        05480 NEQU60   LDA    #0
2A8E 39            05490          RTS
2A8F BD  A9DE      05500 GETJ     JSR    $A9DE   SCAN JOYSTICK
2A92 B6  3FCA      05510          LDA    16330   TO SEE IF A
2A95 81  01        05520          CMPA   #1      DIRECTION HAS
2A97 27  19        05530          BEQ    EQU25   BEEN SPECIFIED
2A99 81  03        05540          CMPA   #3      AND RETURN
2A9B 27  15        05550          BEQ    EQU25   FINDINGS IN
2A9D B6  FF00      05560          LDA    $FF00   ACCUMULATOR A
2AA0 81  7D        05570          CMPA   #125
2AA2 27  06        05580          BEQ    EQU27
2AA4 81  FD        05590          CMPA   #253
2AA6 27  02        05600          BEQ    EQU27
2AA8 20  37        05610          BRA    NEQU51
2AAA B6  015C      05620 EQU27    LDA    $15C
2AAD F6  015D      05630          LDB    $15D
2AB0 20  13        05640          BRA    NEQU47
2AB2 B6  FF00      05650 EQU25    LDA    $FF00
2AB5 81  7E        05660          CMPA   #126
2AB7 27  06        05670          BEQ    EQU28
2AB9 81  FE        05680          CMPA   #254
2ABB 27  02        05690          BEQ    EQU28
2ABD 20  22        05700          BRA    NEQU51
2ABF B6  015A      05710 EQU28    LDA    $15A
2AC2 F6  015B      05720          LDB    $15B
2AC5 C1  03        05730 NEQU47   CMPB   #3
2AC7 22  03        05740          BHI    NEQU48
2AC9 86  01        05750          LDA    #1
2ACB 39            05760          RTS
2ACC C1  3C        05770 NEQU48   CMPB   #60
2ACE 25  03        05780          BLO    NEQU49
2AD0 86  02        05790          LDA    #2
2AD2 39            05800          RTS
2AD3 81  3C        05810 NEQU49   CMPA   #60
2AD5 25  03        05820          BLO    NEQU50
2AD7 86  03        05830          LDA    #3
2AD9 39            05840          RTS
2ADA 81  03        05850 NEQU50   CMPA   #3
2ADC 22  03        05860          BHI    NEQU51
2ADE 86  04        05870          LDA    #4
2AE0 39            05880          RTS
2AE1 86  00        05890 NEQU51   LDA    #0
2AE3 39            05900          RTS
2AE4 8E  05A0      05910 GOON     LDX    #1440   TELL CURRENT
2AE7 86  20        05920          LDA    #32     PLAYER TO PRESS
2AE9 A7  80        05930 LOOP65   STA    ,X+     JOYSTICK BUTTON
2AEB 8C  05C0      05940          CMPX   #1472   OR PRESS SPACEBAR
2AEE 26  F9        05950          BNE    LOOP65  TO CONTINUE
2AF0 B6  3FAD      05960          LDA    16301
2AF3 81  02        05970          CMPA   #2
2AF5 1027 0026     05980          LBEQ   NEQU43
2AF9 108E 1F78     05990          LDY    #PRESSS
2AFD 8E  05A9      06000          LDX    #1449
2B00 A6  A0        06010 LOOP66   LDA    ,Y+
2B02 A7  80        06020          STA    ,X+
2B04 8C  05B7      06030          CMPX   #1463
2B07 26  F7        06040          BNE    LOOP66
2B09 8E  058C      06050          LDX    #1420
2B0C BD  2B6E      06060          JSR    PRINT1
2B0F B6  3FCA      06070          LDA    16330
2B12 8B  30        06080          ADDA   #48
2B14 B7  0593      06090          STA    1427
2B17 BD  A1C1      06100 LOOP67   JSR    $A1C1
2B1A 81  20        06110          CMPA   #32
2B1C 26  F9        06120          BNE    LOOP67
2B1E 39            06130          RTS
2B1F 108E 1F44     06140 NEQU43   LDY    #PRESS
2B23 8E  05A5      06150          LDX    #1445
2B26 A6  A0        06160 LOOP68   LDA    ,Y+
2B28 A7  80        06170          STA    ,X+
2B2A 81  2E        06180          CMPA   #$2E
2B2C 26  F8        06190          BNE    LOOP68
2B2E 8E  058C      06200          LDX    #1420
2B31 BD  2B6E      06210          JSR    PRINT1
2B34 B6  3FCA      06220          LDA    16330
2B37 8B  30        06230          ADDA   #48
2B39 B7  0593      06240          STA    1427
2B3C B6  3FCA      06250          LDA    16330
2B3F 81  02        06260          CMPA   #2
2B41 27  10        06270          BEQ    EQU22
2B43 81  04        06280          CMPA   #4
2B45 27  0C        06290          BEQ    EQU22
2B47 B6  FF00      06300 LOOP69   LDA    $FF00
2B4A 81  FE        06310          CMPA   #254
2B4C 27  04        06320          BEQ    EQU23
2B4E 81  7E        06330          CMPA   #126
2B50 26  F5        06340          BNE    LOOP69
2B52 39            06350 EQU23    RTS
2B53 B6  FF00      06360 EQU22    LDA    $FF00
2B56 81  FD        06370          CMPA   #253
2B58 27  04        06380          BEQ    EQU24
2B5A 81  7D        06390          CMPA   #125
2B5C 26  F5        06400          BNE    EQU22
2B5E 39            06410 EQU24    RTS
2B5F C6  00        06420 PRINTS   LDB    #0      PRINT SCORE
2B61 A6  80        06430 LOOP2    LDA    ,X+     (SPECIFIED BY
2B63 8B  30        06440          ADDA   #48     REGISTER X)
2B65 A7  A0        06450          STA    ,Y+     AT POSITION
2B67 CB  01        06460          ADDB   #1      SPECIFIED BY
2B69 C1  06        06470          CMPB   #6      REGISTER Y
2B6B 26  F4        06480          BNE    LOOP2
2B6D 39            06490          RTS
2B6E 108E 1F2C     06500 PRINT1   LDY    #PLAYER PRINT 'PLAYER
2B72 A6  A0        06510 LOOP1    LDA    ,Y+     AT POSITION
2B74 A7  80        06520          STA    ,X+     SPECIFIED BY
2B76 81  12        06530          CMPA   #$12    REGISTER X
2B78 26  F8        06540          BNE    LOOP1
2B7A 39            06550          RTS
           0000    06560          END
00000 TOTAL ERRORS
```

```
AGAIN   2590
DMOVED  2A03
DMOVEU  29A5
DUR     3FFD
ENOTE   2613
EPLAY   2609
EQU18   2761
EQU19   2737
EQU20   2787
EQU21   27AD
EQU22   2B53
EQU23   2B52
EQU24   2B5E
EQU25   2AB2
EQU27   2AAA
EQU28   2ABF
EQU41   27D2
EQU42   27FE
EQU43   2824
GET     2762
GET1    2596
GETJ    2A8F
GETK    2A61
GETN    259F
GOON    2AE4
INC1    3FEF
INC2    3FED
INC3    3FEB
INC4    3FE9
LOG     1F86
LOOP1   2B72
LOOP11  268C
LOOP12  26AE
LOOP13  2666
LOOP2   2B61
LOOP59  26D0
LOOP60  26F4
LOOP61  2748
LOOP62  271D
LOOP63  276E
LOOP64  2794
LOOP65  2AE9
LOOP66  2B00
LOOP67  2B17
LOOP68  2B26
LOOP69  2B47
LOP3    27D5
LOP5    280C
MLOOP   2589
MOVED   2947
MOVEL   2887
MOVER   2825
MOVEU   28E9
MUSIC   256F
NEQU13  26E1
NEQU14  2707
NEQU2   26BF
NEQU4   269D
NEQU43  2B1F
NEQU44  2A6E
NEQU45  2A78
NEQU46  2A82
NEQU47  2AC5
NEQU48  2ACC
NEQU49  2AD3
NEQU5   267D
NEQU50  2ADA
NEQU51  2AE1
NEQU60  2A8C
NQU110  27BD
NQU111  27C6
NQU112  27CF
NQU115  27F4
PAD1    260D
PAD2    260F
PAD3    2611
PBLK    26BC
PBLK2   2714
PCAR    265E
PFROG   2738
PLAY    25C7
PLAYER  1F2C
PLAYN   25C3
PLOG    26A8
PNTR    3FFE
PRESS   1F44
PRESSS  1F78
PRINT1  2B6E
PRINTS  2B5F
PSKULL  2804
PTUR    2686
PUT     2788
PWTUR   26CA
SCORE   27AE
SONG3   1F10
SONG4   1F1B
SWICH1  2614
SWICH2  2639
TABLE   2100
TURTLE  23F4
VOICE1  3FFA
VOICE2  3FF7
VOICE3  3FF4
VOICE4  3FF1
WAVES   2000
WTURT   23A4

END
```

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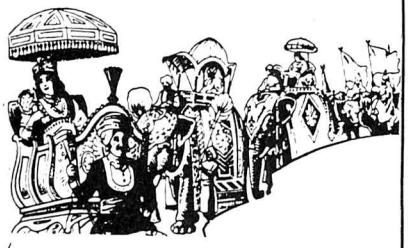

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Color Computer News, June '83

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Color Computer Magazine, June '83

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Hot CoCo, August '83

Like putting leather upholstery in your Volkswagen...Very impressed with the appearance and performance...Could easily pass as original equipment...Installation is very simple...

Rainbow, April '83

A fine piece of hardware from Mark Data Products...It is super and it is professional too...If you are searching for a replacement keyboard, it is an excellent buy...

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BY MARK D. GOODWIN

JOURNEY TO THE CENTER OF THE ROM—PART X

This last installment of the disassembly of the Color Basic ROM includes areas such as the ASCII-to-binary conversion routine, the floating-point functions, and the SGN, ABS, INT, and RND commands. Part X covers locations BB48 to FFFF.

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

BB48–BB69 Adjust (EXP1) and (SF1) for the Result

BB48	FPAC2 = 0?
BB49–BB4A	Jump if FPAC2 = 0
BB4B–BB4C	Add (EXP1) to (EXP2)
BB4D	Divide them by two
BB4E	Multiply them by two
BB4F–BB50	Jump if the result is too small
BB51–BB52	Adjust the combined exponents
BB53–BB54	Save it as (EXP1)
BB55–BB56	Jump if (EXP1) = 0
BB57–BB58	A = (SF)
BB59–BB5A	Save it as (SF1)
BB5B	Return
BB5C–BB5D	A = (SF1)
BB5E	Invert it
BB5F–BB61	Jump
BB61–BB62	Clean up the stack
BB63–BB66	Jump if FPAC1 = 0
BB67–BB69	Display OV error message

BB6A–BB7C FPAC1 = FPAC1*10

BB6A–BB6C	Move FPAC1 to FPAC2
BB6D–BB6E	Jump if FPAC2 = 0
BB6F–BB70	FPAC1 = FPAC1*2
BB71–BB72	Jump if overflow
BB73–BB74	(SF) = Positive
BB75–BB77	FPAC1 = FPAC1*5
BB78–BB79	FPAC1 = FPAC1*10
BB7A–BB7B	Jump if overflow
BB7C	Return

BB7D–BB81 Floating-Point Constant Equal to 10

BB82–BB88 FPAC1 = FPAC1/10

BB82–BB84	Move FPAC1 to FPAC2
BB85–BB87	X = floating-point constant 10 pointer
BB88	Zero B

BB89–BB90 FPAC1 = FPAC2/(X)

BB89–BB8A	(SF) = B
BB8B–BB8D	Move the floating-point value (X) into FPAC1
BB8E–BB90	Set the flags

BB91–BC0A FPAC1 = FPAC2/FPAC1

BB91–BB92	Display /0 error message if FPAC1 = 0
BB93–BB94	Invert (EXP1)
BB95–BB96	Figure the exponent and the sign of the result
BB97–BB98	Bump the exponent
BB99–BB9A	Jump if overflow
BB9B–BB9D	X = result storage pointer
BB9E–BB9F	B = number of bytes to divide
BBA0–BBA1	Save the byte counter
BBA2–BBA3	B = stop value
BBA4–BBA5	A = (MSB1)
BBA6–BBA7	(MSB1) = (MSB2)?
BBA8–BBA9	Jump if (MSB1)< >(MSB2)
BBAA–BBAB	A = (NMSB1)
BBAC–BBAD	(NMSB1) = (NMSB2)?
BBAE–BBAF	Jump if (NMSB1)< >(NMSB2)
BBB0–BBB1	A = (NNMSB1)
BBB2–BBB3	(NNMSB1) = (NNMSB2)?
BBB4–BBB5	Jump if (NNMSB1)< >(NNMSB2)
BBB6–BBB7	A = (LSB1)
BBB8–BBB9	(LSB1) = (LSB2)?

Listing continued

Listing continued

BBBA-BBBB Jump if (LSB1)< >(LSB2)
BBBC Set the flags for equality
BBBD-BBBE Save the flags
BBBF Shift the result in B
BBC0-BBC1 Loop until the stop bit is found
BBC2-BBC3 Save the result
BBC4-BBC5 All bytes done?
BBC6-BBC7 Jump if all the bytes have been done
BBC8-BBC9 Jump if this is the last time
BBCA-BBCB B = stop value
BBCC-BBCD Restore the flags
BBCE-BBCF Do subtraction if necessary
BBD0-BBD1 (LSB2) = (LSB2)*2
BBD2-BBD3 (NNMSB2) = (NNMSB2)*2
BBD4-BBD5 (NMSB2) = (NMSB2)*2
BBD6-BBD7 (MSB2) = (MSB2)*2
BBD8-BBD9 Jump if bit 7 was set
BBDA-BBDB Jump if bit 7 is set
BBDC-BBDD Loop
BBDE-BBDF A = (LSB2)
BBE0-BBE1 A = (LSB2) – (LSB1)
BBE2-BBE3 Save it as (LSB2)
BBE4-BBE5 A = (NNMSB2)
BBE6-BBE7 A = (NNMSB2) – (NNMSB1) – Carry
BBE8-BBE9 Save it as (NNMSB2)
BBEA-BBEB A = (NMSB2)
BBEC-BBED A = (NMSB2) – (NMSB1) – Carry
BBEE-BBEF Save it as (NMSB1)
BBF0-BBF1 A = (MSB2)
BBF2-BBF3 A = (MSB2) – (MSB1) – Carry
BBF4-BBF5 Save it as (MSB2)
BBF6-BBF7 Loop
BBF8-BBF9 B = stop value
BBFA-BBFB Jump
BBFC Adjust (RB)
BBFD Adjust (RB)
BBFE Adjust (RB)
BBFF-BC00 Save it
BC01-BC02 Move the result to FPAC1
BC03-BC05 Normalize the result
BC06-BC07 B = /0 error code
BC08-BC0A Display /0 error message

BC0B-BC13 Move Result to FPAC1

BC0B-BC0C X = MSB and NMSB of the result
BC0D-BC0E Save them as (MSB1) and (NMSB1)
BC0F-BC10 X = NNMSB and LSB of the result
BC11-BC12 Save them as (NNMSB1) and (LSB1)
BC13 Return

BC14-BC29 Move (X) to FPAC1

BC14-BC15 Save A
BC16-BC17 D = sign
BC18-BC19 Save (SF1)
BC1A-BC1B Set bit 7 of the MSB
BC1C-BC1D Save (MSB1) and (NMSB1)
BC1E-BC1F (RB) = 0
BC20-BC21 B = EXP
BC22-BC23 X = NNMSB and LSB
BC24-BC25 Save (NNMSB1) and (LSB1)
BC26-BC27 Save (EXP1)
BC28-BC29 Get A and return

BC2A-BC2E FPAC1 to (0045) +

BC2A-BC2C X = storage pointer
BC2D-BC2E Jump

BC2F-BC34 FPAC1 to (0040) +

BC2F-BC31 X = storage pointer
BC32-BC34 Ignore

BC33-BC34 FPAC1 to (VARPTR) +

BC33-BC34 X = current VARPTR

BC35-BC49 FPAC1 to (X)

BC35-BC36 A = (EXP1)
BC37-BC38 Save it
BC39-BC3A A = (SF1)
BC3B-BC3C Mask the sign bit
BC3D-BC3E Combine (MSB1) and the sign bit
BC3F-BC40 Save it
BC41-BC42 A = (NMSB1)
BC43-BC44 Save it
BC45-BC46 U = (NNMSB1) and (LSB1)
BC47-BC48 Save them
BC49 Return

BC4A-BC5E FPAC2 to FPAC1

BC4A-BC4B A = (SF2)
BC4C-BC4D Save it as (SF1)
BC4E-BC4F X = (EXP2) and (MSB2)
BC50-BC51 Save them as (EXP1) and (MSB1)
BC52-BC53 Save (RB)
BC54-BC55 A = (NMSB2)
BC56-BC57 Save it as (NMSB1)
BC58-BC59 A = (SF1)
BC5A-BC5B X = (NNMSB2) and (LSB2)
BC5C-BC5D Save them as (NNMSB1) and (LSB1)
BC5E Return

BC5F-BC6C FPAC1 to FPAC2

BC5F-BC60 D = (EXP1) and (MSB1)
BC61-BC62 Save them as (EXP2) and (MSB2)
BC63-BC64 X = (NMSB1) and (NNMSB1)
BC65-BC66 Save them as (NMSB2) and (NNMSB2)
BC67-BC68 X = (LSB1) and (SF1)
BC69-BC6A Save them as (LSB2) and (SF2)
BC6B Set the flags for the exponent
BC6C Return

BC6D-BC79 Get the Sign

BC6D-BC6E B = (EXP1)
BC6F-BC70 Jump if FPAC1 = 0
BC71-BC72 B = (SF1)
BC73 Put the sign into Carry
BC74-BC75 B = – 1
BC76-BC77 Jump if FPAC1 is negative
BC78 B = 1
BC79 Return

BC7A-BC7B Color Basic SGN Command

BC7A-BC7B Get the sign in B

BC7C-BC92 Save B as FPAC1

BC7C-BC7D Save B as (MSB1)
BC7E-BC7F (NMSB1) = 0
BC80-BC81 B = exponent
BC82-BC83 A = (MSB1)
BC84-BC85 Adjust it
BC86-BC87 Save (EXP1)
BC88-BC89 Zero D
BC8A-BC8B Zero (NNMSB1) and (LSB1)
BC8C-BC8D Zero (RB)
BC8E-BC8F Zero (SF1)
BC90-BC92 Normalize FPAC1

BC93-BC95 Color Basic ABS Command

Listing continued

Listing continued

BC93–BC94 (SF1) = positive
BC95 Return

BC96–BCC7 Compare (X) to FPAC1

BC96–BC97 B = comparison EXP
BC98–BC99 Jump if the comparison value = 0
BC9A–BC9B B = comparison MSB
BC9C–BC9D Combine the signs
BC9E–BC9F Jump if the signs aren't equal
BCA0–BCA1 B = (EXP1)
BCA2–BCA3 EXPs equal?
BCA4–BCA5 Jump if they aren't equal
BCA6–BCA7 B = comparison MSB
BCA8–BCA9 Mask the sign bit
BCAA–BCAB Combine it with (MSB1)
BCAC–BCAD MSBs equal?
BCAE–BCAF Jump if they aren't equal
BCB0–BCB1 B = (NMSB1)
BCB2–BCB3 NMSBs equal?
BCB4–BCB5 Jump if they aren't equal
BCB6–BCB7 B = (NNMSB1)
BCB8–BCB9 NNMSBs equal?
BCBA–BCBB Jump if they aren't equal
BCBC–BCBD B = (LSB1)
BCBE–BCBF LSBs equal?
BCC0–BCC1 Jump if they aren't equal
BCC2 Return
BCC3 Put carry into B
BCC4–BCC5 Combine (SF1) with the carry value
BCC6–BCC7 Save B as the current result

BCC8–BCED Convert FPAC1 to an Integer

BCC8–BCC9 B = (EXP1)
BCCA–BCCB Jump if FPAC1 = 0
BCCC–BCCD Figure the number of places of precision
BCCE–BCCF A = (SF1)
BCD0–BCD1 Jump if FPAC1 is positive
BCD2–BCD3 Set the sign of the result to negative
BCD4–BCD6 Make FPAC1 positive
BCD7–BCD9 X = (EXP1) and (MSB1)
BCDA–BCDB Places of precision < 8?
BCDC–BCDD Jump if the places of precision < 8
BCDE–BCE0 Shift FPAC1
BCE1–BCE2 Clear the sign of the result
BCE3 Return
BCE4–BCE5 Clear the sign of the result
BCE6–BCE7 A = (SF1)
BCE8 Put the sign into carry
BCE9–BCEA Put the sign into the MSB
BCEB–BCED Shift FPAC1

BCEE–BD08 Color Basic INT Command

BCEE–BCEF B = (EXP1)
BCF0–BCF1 FPAC1 = integer?
BCF2–BCF3 Jump if FPAC1 is an integer
BCF4–BCF5 Convert FPAC1 to an integer
BCF6–BCF7 Save (RB)
BCF8–BCF9 A = (SF1)
BCFA–BCFB Save B as (SF1)
BCFC–BCFD Set carry for the sign
BCFE–BCFF A = exponent
BD00–BD01 Save it as (EXP1)
BD02–BD03 A = (LSB1)
BD04–BD05 Save it
BD06–BD08 Shift FPAC1

BD09–BD11 Save B in FPAC1

BD09–BD0A Save B as (MSB1)
BD0B–BD0C Save B as (NMSB1)
BD0D–BD0E Save B as (NNMSB1)
BD0F–BD10 Save B as (LSB1)
BD11 Return

BD12–BDB5 ASCII to Binary

BD12–BD13 Zero X
BD14–BD15 Zero (SF1)
BD16–BD17 Zero (EXP1) and (MSB1)
BD18–BD19 Zero (NMSB1) and (NNMSB1)
BD1A–BD1B Zero (LSB1)
BD1C–BD1D Zero the conversion flags
BD1E–BD1F Zero the conversion flags
BD20–BD21 Jump if the character is numeric
BD22–BD24 Call the Extended Color Basic link
BD25–BD26 Minus sign?
BD27–BD28 Jump if it isn't a minus sign
BD29–BD2A Set the minus-sign flag
BD2B–BD2C Jump
BD2D–BD2E Plus sign?
BD2F–BD30 Jump if it isn't a plus sign
BD31–BD32 Get the next character
BD33–BD34 Jump if it's numeric
BD35–BD36 Decimal point?
BD37–BD38 Jump if it's a decimal point
BD39–BD3A E?
BD3B–BD3C Jump if it's not an E
BD3D–BD3E Get the next character
BD3F–BD40 Jump if it's numeric
BD41–BD42 Minus token?
BD43–BD44 Jump if it's a minus token
BD45–BD46 Minus sign?
BD47–BD48 Jump if it's a minus sign
BD49–BD4A Plus token?
BD4B–BD4C Jump if it's a plus token
BD4D–BD4E Plus sign?
BD4F–BD50 Jump if it's a plus sign
BD51–BD52 Jump
BD53–BD54 Scientific notation flag = negative
BD55–BD56 Get the next character
BD57–BD58 Jump if it's numeric
BD59–BD5A Scientific notation flag = positive?
BD5B–BD5C Jump if it's positive
BD5D–BD5E Make the scientific notation value negative
BD5F–BD60 Jump
BD61–BD62 Flag a decimal point was found
BD63–BD64 Loop
BD65–BD66 A = scientific-notation value
BD67–BD68 Adjust it for the decimal position
BD69–BD6A Save it
BD6B–BD6C Jump if the result doesn't have to be shifted
BD6D–BD6E Jump if the result has to be made larger
BD6F–BD71 Divide the result by 10
BD72–BD73 Bump the scientific-notation value
BD74–BD75 Loop until all the divisions have been done
BD76–BD77 Jump
BD78–BD7A Multiply the result by 10
BD7B–BD7C Decrement the scientific notation value
BD7D–BD7E Loop until all the multiplications have been done
BD7F–BD80 A = sign flag
BD81–BD82 Jump if the result is positive
BD83–BD85 Make the result negative
BD86–BD87 B = number of places to the right of the decimal point
BD88–BD89 Subtract the decimal point flag
BD8A–BD8B Save the adjusted value
BD8C–BD8D Save the ASCII digit
BD8E–BD90 Multiply the current result by 10
BD91–BD92 Get the ASCII digit
BD93–BD94 Make it binary
BD95–BD96 Add it to the current result
BD97–BD98 Loop

Listing continued

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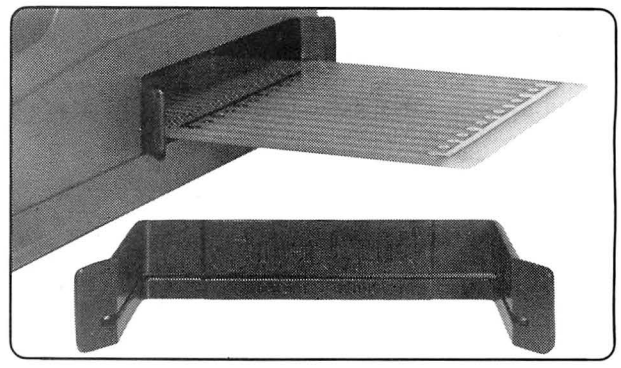

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BD99-BD9B Move the current result
BD9C-BD9E Save B as FPAC1
BD9F-BDA1 X = current result total
BDA2-BDA4 Add the digit to the total
BDA5-BDA6 B = scientific-notation value
BDA7 B = scientific-notation value*2
BDA8 B = scientific-notation value*4
BDA9-BDAA B = scientific-notation value*5
BDAB B = scientific-notation value*10
BDAC-BDAD Make the ASCII digit binary
BDAE-BDAF Save the adjusted scientific-notation value
BDB0-BDB1 Figure the new scientific-notation value
BDB2-BDB3 Save it
BDB4-BDB5 Loop

BDB6-BDBA Floating-Point Constant Equal to 99999999.9

BDBB-BDBF Floating-Point Constant Equal to 999999999

BDC0-BDC4 Floating-Point Constant Equal to 1E09

BDC5-BDCB Part of the Error Routine

BDC5-BDC7 X = IN message pointer
BDC8-BDC9 Display the message
BDCA-BDCB D = current Basic line number

BDCC-BDD8 Display the Line Number in D

BDCC-BDCD Save D as (MSB1) and (NMSB1)
BDCE-BDCF B = exponent
BDD0 A = sign of the value
BDD1-BDD3 Convert the value to floating point
BDD4-BDD5 Convert it to an ASCII string
BDD6-BDD8 Display the ASCII string

BDD9-BEBF Binary to ASCII

BDD9-BDDB U = ASCII buffer pointer
BDDC-BDDD A = space
BDDE-BDDF B = (SF1)
BDE0-BDE1 Jump if FPAC1 is positive
BDE2-BDE3 A = minus sign
BDE4-BDE5 Save the character in the buffer
BDE6-BDE7 Save the buffer pointer
BDE8-BDE9 Save the character
BDEA-BDEB A = ASCII 0
BDEC-BDED FPAC1 = 0?
BDEE-BDF1 Jump if FPAC1 = 0
BDF2 A = number of places to the right of the decimal point
BDF3-BDF4 (EXP1) > 80?
BDF5-BDF6 Jump if (EXP1) > 80
BDF7-BDF9 X = floating-point constant 1E09 pointer
BDFA-BDFC FPAC1 = FPAC1*1E09
BDFD-BDFE A = number of places to the right of the decimal point
BDFF-BE00 Save it
BE01-BE03 X = floating-point constant 999999999 pointer
BE04-BE06 FPAC1 > 999999999?
BE07-BE08 Jump if FPAC1 > 999999999
BE09-BE0B X = floating-point constant 99999999.9 pointer
BE0C-BE0E FPAC1 > 99999999.9?
BE0F-BE10 Jump if FPAC1 > 99999999.9
BE11-BE13 FPAC1 = FPAC1*10
BE14-BE15 Decrement the number of places to the right of the decimal point
BE16-BE17 Loop until FPAC1 is in range
BE18-BE1A FPAC1 = FPAC1/10
BE1B-BE1C Bump the number of places to the right of the decimal point
BE1D-BE1E Loop until FPAC1 is in range
BE1F-BE21 Round FPAC1
BE22-BE24 Figure the integer of FPAC1
BE25-BE26 B = number of decimal places
BE27-BE28 A = number of places to the right of the decimal point
BE29-BE2A Add in 10 places
BE2B-BE2C Jump if there are more than 10 places to the right
BE2D-BE2E Places to the left > 1?
BE2F-BE30 Jump if there is more than one place to the left
BE31 Decrement the number of decimal places
BE32-BE33 B = number of decimal places
BE34-BE35 A = scientific-notation value
BE36 Decrement the scientific-notation value
BE37 Decrement the scientific-notation value
BE38-BE39 Save it
BE3A-BE3B Save the number of decimal places
BE3C-BE3D Jump if there are any places to the left of the decimal point
BE3E-BE3F U = buffer pointer
BE40-BE41 A = decimal point
BE42-BE43 Save it in the buffer
BE44 Any places to the right of the decimal point?
BE45-BE46 Jump if there are any places to the right of the decimal point
BE47-BE48 A = ASCII 0
BE49-BE4A Save it in the buffer
BE4B-BE4D X = 4-byte constants pointer
BE4E-BE4F B = digit start value
BE50-BE51 A = (LSB1)
BE52-BE53 Add in the LSB of the constant
BE54-BE55 Save the new (LSB1)
BE56-BE57 A = (NNMSB1)
BE58-BE59 Add in the NNMSB of the constant and carry
BE5A-BE5B Save the new (NNMSB1)
BE5C-BE5D A = (NMSB1)
BE5E-BE5F Add in the NMSB of the constant and carry
BE60-BE61 Save the new (NMSB1)
BE62-BE63 A = (MSB1)
BE64-BE65 Add in the MSB of the constant and carry
BE66-BE67 Save the new (MSB1)
BE68 Bump the digit
BE69 Test the digit
BE6A Test the digit
BE6B-BE6C Loop until the digit has been figured
BE6D-BE6E B = binary value of the digit
BE6F-BE70 Adjust it
BE71 Make it binary
BE72-BE73 Make it ASCII
BE74-BE75 Bump the constant pointer
BE76-BE77 A = digit
BE78-BE79 Clear bit 7 of the digit
BE7A-BE7B Save it in the buffer
BE7C-BE7D Decrement the decimal point counter
BE7E-BE7F Jump if this isn't the decimal point position
BE80-BE81 A = decimal point
BE82-BE83 Save it in the buffer
BE84 Adjust the digit
BE85-BE86 Mask it
BE87-BE89 End of the constants?
BE8A-BE8B Loop until it's the end of the constants
BE8C-BE8D A = last character
BE8E-BE8F Is it a zero?
BE90-BE91 Jump if it's a zero
BE92-BE93 Is it a decimal point?
BE94-BE95 Jump if it isn't a decimal point
BE96-BE97 Decrement the buffer pointer
BE98-BE99 A = plus sign
BE9A-BE9B B = scientific-notation value
BE9C-BE9D Jump if no scientific notation
BE9E-BE9F Jump if the scientific-notation value is positive
BEA0-BEA1 A = minus sign
BEA2 Make the scientific-notation value positive
BEA3-BEA4 Save the character in the buffer

Listing continued

Listing continued

BEA5-BEA6	A = E
BEA7-BEA8	Save it in the buffer
BEA9-BEAA	A = ASCII 0 – 1
BEAB	Bump the digit
BEAC-BEAD	Subtract 10 from the scientific-notation value
BEAE-BEAF	Loop until the division is done
BEB0-BEB1	Adjust the second digit
BEB2-BEB3	Save the digits in the buffer
BEB4-BEB5	Flag the end of the ASCII string
BEB6-BEB7	Jump
BEB8-BEB9	Save the character in the buffer
BEBA-BEBB	Flag the end of the ASCII string
BEBC-BEBE	X = start of the ASCII string
BEBF	Return

BEC0-BEC4 Floating-Point Constant Equal to .5

BEC5-BEE8 Four-Byte Constants for Binary to ASCII Conversions

BEE9-BEEF Negate FPAC1

BEE9-BEEA	A = (EXP1)
BEEB-BEEC	Jump if FPAC1 = zero
BEED-BEEE	Invert (SF1)
BEEF	Return

BEF0-BF1E Computation Series

BEF0-BEF1	Save the constant pointer
BEF2-BEF4	Save FPAC1
BEF5-BEF6	Do multiplication series
BEF7-BEF8	Do multiplication series
BEF9-BEFB	X = old FPAC1 storage location
BEFC-BEFE	FPAC1 = FPAC1*(X)
BEFF-BF00	Save the constant pointer
BF01-BF03	Save FPAC1
BF04-BF05	X = constant pointer
BF06-BF07	B = constant counter
BF08-BF09	Save the constant counter
BF0A-BF0B	Save the constant pointer
BF0C-BF0D	Start over
BF0E-BF0F	X = constant pointer
BF10-BF11	Bump it to the next constant
BF12-BF13	Save the new constant pointer
BF14-BF16	FPAC1 = FPAC1 + (X)
BF17-BF19	X = storage location
BF1A-BF1B	Decrement the constant counter
BF1C-BF1D	Loop until done
BF1E	Return

BF1F-BF73 Color Basic RND Command

BF1F-BF21	FPAC1 = negative?
BF22-BF23	Jump if FPAC1 is negative
BF24-BF25	Jump if FPAC = zero
BF26-BF27	Make FPAC1 an integer
BF28-BF2A	Save the upper limit
BF2B-BF2C	Generate a random number
BF2D-BF2F	X = upper-limit pointer
BF30-BF31	Do multiplication series
BF32-BF34	X = floating-point constant 1 pointer
BF35-BF37	Add one to the current result
BF38-BF3A	Make the current result an integer
BF3B-BF3D	X = MSB and NMSB of the RND seed
BF3E-BF3F	Save them as (MSB1) and (NMSB1)
BF40-BF42	X = NNMSB and LSB of the RND seed
BF43-BF44	Save them as (NNMSB1) and (LSB1)
BF45-BF47	X = MSB and NMSB of the RND constant
BF48-BF49	Save them as (MSB2) and (NMSB2)
BF4A-BF4C	X = NNMSB and LSB of the RND constant
BF4D-BF4E	Save them as (NNMSB2) and (LSB2)
BF4F-BF51	Multiply the RND seed by the RND constant
BF52-BF53	D = multiplication rounding bytes
BF54-BF56	Adjust the value
BF57-BF59	Save them as the NNMSB and LSB of the RND seed
BF5A-BF5B	Save them as (NNMSB1) and (LSB1)
BF5C-BF5D	D = multiplication rounding bytes
BF5E-BF5F	Adjust them
BF60-BF61	Adjust them
BF62-BF64	Save them as the MSB and NMSB of the RND seed
BF65-BF66	Save them as (MSB1) and (NMSB1)
BF67-BF68	Make FPAC1 positive
BF69-BF6A	A = exponent
BF6B-BF6C	Save it as (EXP1)
BF6D-BF6E	A = RND rounding byte
BF6F-BF70	Save it as (RB)
BF71-BF73	Normalize the result

BF74-BF77 Four-Byte RND Constant

BF78-BFBC Color Basic SIN Command

BF78-BF7A	Move FPAC1 to FPAC2
BF7B-BF7D	X = floating-point constant 6.2831851 pointer
BF7E-BF7F	B = (SF2)
BF80-BF82	FPAC1 = FPAC2/6.2831851
BF83-BF85	Move FPAC1 to FPAC2
BF86-BF87	Make FPAC1 an integer
BF88-BF89	(SF) = positive
BF8A-BF8B	A = (EXP2)
BF8C-BF8D	B = (EXP1)
BF8E-BF90	FPAC1 = FPAC2 – FPAC1
BF91-BF93	X = floating-point constant .25 pointer
BF94-BF96	FPAC1 = FPAC1 – .25
BF97-BF98	A = (SF1)
BF99-BF9A	Save it
BF9B-BF9C	Jump if FPAC1 is positive
BF9D-BF9F	FPAC1 = FPAC1 + .5
BFA0-BFA1	A = (SF1)
BFA2-BFA3	Jump if FPAC1 is negative
BFA4-BFA5	Invert the flag
BFA6-BFA8	Invert FPAC1
BFA9-BFAB	X = floating-point constant .25 pointer
BFAC-BFAE	FPAC1 = FPAC1 + .25
BFAF-BFB0	Get the sign flag
BFB1	Set the flags
BFB2-BFB3	Jump if FPAC1 was positive
BFB4-BFB6	Invert FPAC1
BFB7-BFB9	X = constant series pointer
BFBA-BFBC	Do computation series

BFBD-BFC1 Floating-Point Constant Equal to 6.2831851

BFC2-BFC6 Floating-Point Constant Equal to .25

BFC7-BFE0 Series of Constants for SIN

BFC7	The number of constants
BFC8-BFCC	Floating-point constant equal to – 14.3813907
BFCD-BFD1	Floating-point constant equal to 42.0077971
BFD2-BFD6	Floating-point constant equal to – 76.7041703
BFD7-BFDB	Floating-point constant equal to 81.6052237
BFDC-BFE0	Floating-point constant equal to – 41.3417021

BFE1-BFE5 Floating-Point Constant Equal to 6.28318531

BFE6-BFEA Floating-Point Constant Equal to 7.12278788E09

BFEB-BFEF Floating-Point Constant Equal to 26913.7691

BFF0-BFFF Echo for FFF0 to FFFF ■

BY CHRIS BARAN

COOL THAT COCO

If a hot CoCo steams you, cool it with this TDP case/SAM heat-sink change to beat the F-board heat.

Owners of the F board CoCos are plagued with a problem—overheating. When the SAM chip overheats, it no longer keeps the memory chips refreshed, and random locations change value.

I have outlined three procedures that will help correct the problem.

First, examine the computer to determine if it is an F revision. An F board CoCo has a stock number of either 26-3002A, 26-3003A, or 26-3004A. If you have problems with another version, take the machine in to be repaired. My procedures will not solve your problems.

I tried the most obvious solution first, drilling 12 1-inch holes in the top of my CoCo's case. This helped extend the operation time of my machine. Unfortunately, a 13-inch TV on top of my computer blocked off the cooling holes.

Next, I attacked the offending SAM chip. I made a heat-sink from a strip of 1/16-inch thick aluminum and epoxied it to the SAM chip (see Figs. 1 and 2). You must remove the small rf shield to install the heat-sink. After removing the shield, you will see the MC68831 SAM chip. It is the 40-pin horizontal IC above the eight 16-pin vertical ICs.

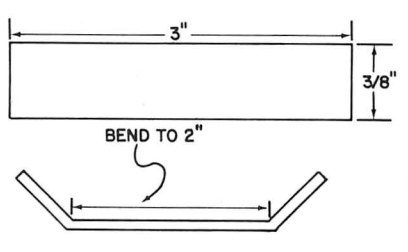

Fig. 1. Heat-sink for the SAM Chip

My ideas for cooling the computer came primarily from the owner of an F revision TDP-100. He had experienced no heating problems. Since his computer was internally identical to my Color Computer, I realized that the answer to the problem was in the design of the TDP case. The top of the case has a recessed row of vents, which allow air flow into the machine. I ordered the case from the TDP-100 at my local Radio Shack with the following information:

TDP-100	stock number 10-1010
Upper-case	part number AZ-6858, price $11.77
Lower-case	part number AZ-6859, price $8.58
TDP-100 logo	part number AHCT-093, price $1.85

Switching cases is easy. Remove the seven case screws from the bottom of the computer, being careful to mark which screw comes from which hole. Next, remove the two transformer screws and the screws holding the PC board to the lower case.

Mark the three Molex connectors that go from the ac line cord to the transformer, and remove the transformer, PC board, and keyboard in one step. Set these aside. Grasp the strain relief, holding the ac cord with a pair of vise-grips at the bottom of the strain relief, and remove it with a gradual twisting action.

Using a fine, flat screwdriver, pry the rubber feet from the bottom of your lower case. Apply these to the lower case for the TDP. Insert the ac cord into the hole provided in the new case, and push in the strain relief. Attach the Molex connectors to the transformer and reinstall the transformer, PC board, and keyboard. Install your new TDP-100 top case, and reinstall the seven screws.

With these modifications, I can run my TDP/CoCo for hours with no problems. I also expect to get longer component life from my machine.

To date, the TDP case/SAM heat-sink modifications have been successful on six F-board Color Computers. ■

System Requirements

F-Board CoCo

Address correspondence to Chris Baran, P.O. Box 2012, Uniontown, PA 15401.

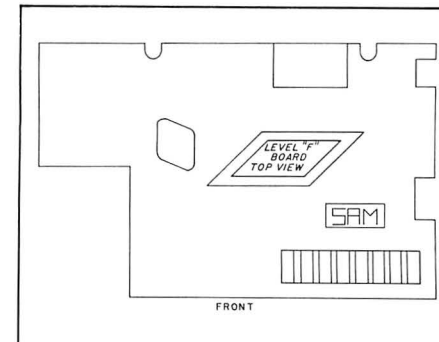

Fig. 2. SAM Chip Location

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BY ROGER A. SMITH JR.

HURRICANE TRACKER

Keep up with television meteorologists using your own hurricane-tracking program for the CoCo.

This is an emergency storm warning! Hurricane Celeste has just rounded the cape and is heading up the coast at record speed, leaving destruction in her wake. Don't depend on your local weather station for news and information. Track her yourself with this high-resolution hurricane tracking program.

After you load and run the program, it displays a title screen, and draws a hi-res (PMODE 4) map. The program has no menu screen; instead you enter all commands by pressing a single key while it displays the map.

Press C to paint all the land masses black. (This command won't work after a storm is plotted.)

Press G to display a grid marked at every 5 degrees of longitude and latitude.

Press the space bar to erase and redraw the chart.

Press A to add data entries. If you have entered data previously, or loaded data from tape, then the A command adds another entry. If you haven't entered any data or you have used the clear-data command (Q), then the A command creates a new set of data.

After pressing A, the program prompts you to enter the name of the storm (if you're creating a new set of data). If the storm is unnamed, enter Unnamed. Next, enter the latitude and longitude of the storm. For the wind speed, you can enter the actual speed in miles per hour or D if the storm is a tropical depression, S if the storm is a tropical storm, or H (or just enter) if the storm is a hurricane.

Press enter in response to the latitude prompt to exit the add-entries command.

Press S to save the data to tape. The program asks you if you're sure you want to load data. If you don't, press N; otherwise press Y.

A	Add data entries (or create data)
C	Color the land masses (won't work after plotting)
G	Display grid marks
L	Load data from tape
Q	Clear data from memory
P	Plot storm's course
S	Save data to tape
<SPACE>	Erase and redraw screen

Table 1. Summary of commands

System Requirements

16K RAM
Extended Color Basic

Rewind the cassette; press play and record; then press enter and the data is saved on tape. The program adds a delay to skip over the tape's leader.

Press L to load data from tape. Answer the "Are you sure..." question with Y, then rewind the tape; press play and hit enter. The data loads from tape. Loading data from tape erases any data from memory.

Press P to plot the storm's course. The program reads data from memory, so you must use the A or L commands before plotting. The program plots the course of the storm using symbols for tropical depressions (a circle with a cross in it) if the wind speed is less than 40 miles per hour, tropical storms (a hollow cyclone symbol) if the wind speed is 40–73 miles per hour, and hurricanes (a solid cyclone) if the wind speed is 74 miles per hour or greater.

The latest location of the storm is circled and the storm's name appears beside the last symbol. The plot of the storm remains until you erase the map by pressing the space bar even if its data is erased or new data loaded. This means you can display more than one storm.

The final command (Q) lets you erase the data in memory so that you can use the A command to start storing data on new storms.

This program uses several features of Extended Color Basic that are not described or are glossed over in the manual.

The DRAW commands make use of

the "=" subcommand to get the value of a variable. This avoids use of STR$ and string concatenation as in the statement:

```
DRAW "S"+STR$(S)+"BM"+STR$(X)+
","+STR$(Y)+";U5R5D5L5"
```

Using the "=" subcommand you can rewrite this as:

```
DRAW "S=S;BM=X;,=Y;U5R5D5L5"
```

You can draw diagonal lines of angles at other than 45 degree increments by using the relative M subcommand without the B option.

```
DRAW "U5M+4,+5;U5"
```

is used to draw the letter N in the program.

The use of AND, OR, and NOT to manipulate bits is only briefly mentioned at the back of the Color Basic manual (pp. 257–258).

This program uses AND as a modulus function. In line 2000 T is set equal to (T+1) AND 15. Since 15 in binary is 00001111, the last 4 bits of T+1 are stored in T (see p. 257 of the Color Basic manual) and T is kept in the range 0–15.

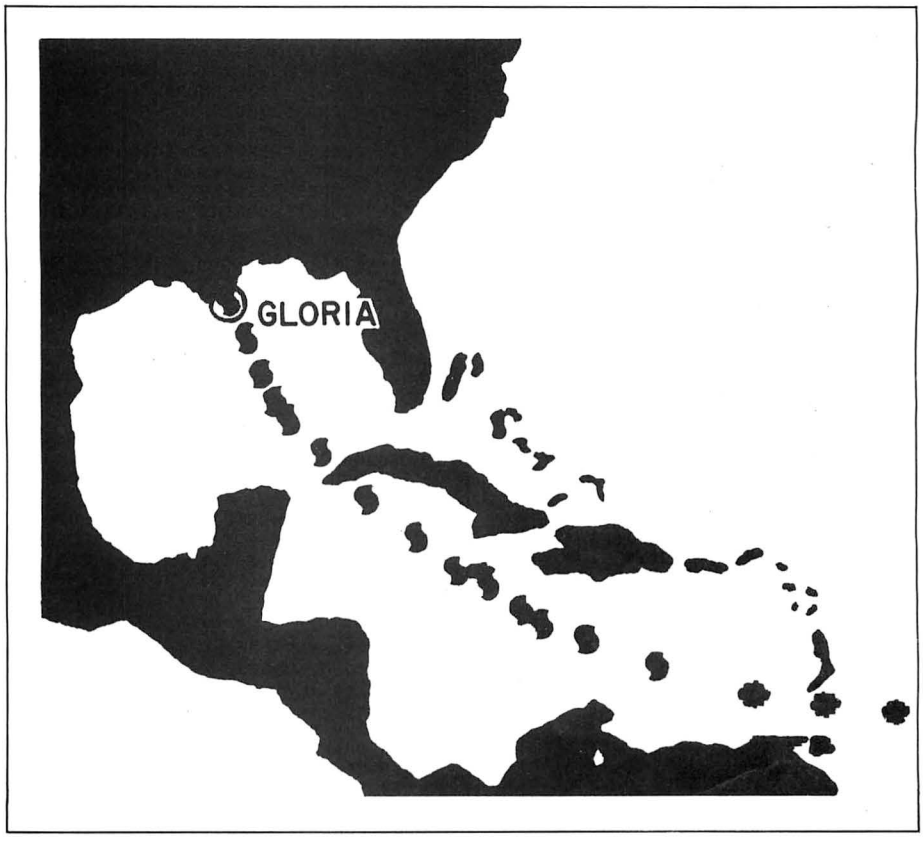
You can use OR to set specific bits in a variable. For example, A=A OR 128 would set bit 7 in the integer representation of A (the variables are actually stored in a floating point representation).

The NOT operator complements a value. It changes all 1 bits to 0 bits and 0 bits to 1's. You can use NOT as a logical operator in conjunction with AND, OR, and the relational operators (=, <, >, <=, >=, and <>). NOT inverts the result of the logical value following the NOT.

Line 2000 of the program uses the following string function:

```
CHR$(128-(T=8)*127)
```

This function returns CHR$(255) if T=8. Otherwise it returns CHR$(128).



When T=8 the expression (T=8) is true and it returns a value of −1 so the CHR$ expression becomes CHR$(128−(−1)*127) or CHR$(255). When (T=8) is false (T≠8) it returns a value of zero and the character expression becomes CHR$(128−(0)*127) or CHR$(128).

An IF statement actually tests for a zero value (false) or a not-zero value (true). Line 110 of the program contains the statement:

```
IF F THEN LINE (X,Y)-(X2,Y2),PSET...
```

If F has a value that is not zero (true) then the program executes the LINE statement.

Table 1 is a summary of the program's commands. Table 2 is sample data for a fictional storm that you can use to test the program. Enter the data using the A command then use P to plot the storm's course. You can use S to save the data to tape if you wish. ■

Address correspondence to Roger A. Smith, 505 Ridge Lake Road, Crestview, FL 32536.

Storm name: Gloria

Latitude	Longitude	Windspeed
17.5	65	D
18.2	70	D
19.8	75	S
22	80	S
24.2	85	S
26.7	90	H
29	95	H

Table 2. Sample data for a fictional storm. Enter the data using the A command.

```
1 REM ***** HURRICANE TRACKING S
YSTEM *****
2 REM *****        BY ROGER SMITH
      *****
3 REM
1Ø CLEAR24Ø
2Ø PMODE4,1:COLORØ,1:PCLS
3Ø CLS:MX=5Ø:DIM LA(MX),LN(MX),W
S(MX),S(4,4),D(4,4),H(4,4),A$(26
)
4Ø SCREEN1,1:GOSUB7ØØØ:GOSUB 5ØØ
Ø
5Ø PF=Ø:RESTORE:PMODE4,1:COLORØ,
1
6Ø PCLS:SCREEN1,1
7Ø F=1
8Ø READX$:IFX$="X"THEN22Ø
9Ø READY$:IFX$="."THENF=1:X$=Y$:
READY$
1ØØ IFF=1THENREADX2,Y2
11Ø X=VAL(X$):Y=VAL(Y$):IFF THEN
LINE(X,Y)-(X2,Y2),PSETELSELINE-(
X,Y),PSET
12Ø F=Ø:GOTO8Ø
13Ø DATA138,Ø,136,4,133,3,134,Ø,
.,13Ø,Ø,132,3,132,6,134,1Ø,133,1
2,13Ø,14,135,14,133,18,129,18,12
8,22,122,28,118,28,1Ø8,38,1Ø5,38
,1Ø6,4Ø,1Ø3,42,1ØØ,5Ø,1Ø2,56,1Ø4
,62,1Ø6,64,1Ø5,63,11Ø,76,11Ø,83,
1Ø8,86,1Ø8,88,1Ø5,87,1Ø2,88,1Ø4,
86,1Ø1,84,98
14Ø DATA78,94,73,94,7Ø,93,71,93,
62,87,54,8Ø,58,78,57,76,54,71,51
,68,52,64,54,63,48,61,52,54,54,5
6,55,54,57,56,58,57,61,54,61,52,
6Ø,5Ø,61,44,6Ø,4Ø,57,34,58,3Ø,56
,27,57,16,64,1Ø,64,5,74,8,84,4,8
8,6,1Ø8,12,122,25,131,38,128,42,
129,43,126
15Ø DATA48,126,5Ø,112,62,11Ø,69,
112,66,12Ø,6Ø,14Ø,58,146,86,145,
9Ø,15Ø,88,176,1Ø2,188,114,183,12
6,191,135,182,136,176,158,167,16
2,17Ø,157,172,159,176,156,182,16
Ø,188,162,186,161,176,172,182,18
2,178,188,179,198,18Ø,2Ø2,178,2Ø
1,177
16Ø DATA 214,177,2Ø8,179,222,191
,.
17Ø DATA198,4Ø,197,42,199,41,.,8
Ø,1Ø8,84,1Ø7,85,1Ø4,98,1ØØ,11Ø,1
Ø2,112,1Ø6,115,1Ø5,12Ø,1Ø7,116,1
Ø4,12Ø,1Ø4,134,114,134,116,143,1
17,144,12Ø,124,122,126,117,118,1
12,117,11Ø,1Ø2,1Ø7,96,1Ø5,1ØØ,1Ø
4,94,1Ø4,84,1Ø8,8Ø,1Ø8,.,Ø,144,1
Ø,146,2Ø,143,42
18Ø DATA158,48,158,62,162,64,16Ø
,66,16Ø,64,164,76,175,75,18Ø,86,
187,88,191,.,142,13Ø,144,132,156
,132,16Ø,134,164,132,168,132,172
,13Ø,176,132,178,13Ø,174,126,171
,126,164,121,156,122,15Ø,121,148
,122,151,124,15Ø,125,154,128,142
,128,142,13Ø
19Ø DATA.,184,13Ø,193,132,184,13
2,184,13Ø,.,197,13Ø,2Ø2,128,.,2Ø
8,131,2Ø9,132,.,21Ø,137,211,137,
.,216,138,217,139,.,212,142,212,
143,.,217,143,216,144,.,218,149,
219,153,.,219,154,221,159,219,16
1,.,218,162,216,164,.,217,181,22
1,18Ø,22Ø,177
2ØØ DATA217,177,217,181,.,116,88
,12Ø,77,121,78,.,124,77,126,8Ø,1
24,82,.,13Ø,96,132,98,131,91,.,1
35,91,137,93,.,137,98,139,1Ø1,.,
143,1Ø2,145,1Ø3,142,1Ø6,.,146,11
5,15Ø,112,.,155,1Ø8,16Ø,1Ø9,16Ø,
114,.,116,132,116,133,126,133,12
8,131,116,132
21Ø DATA.,1Ø7,89,1Ø2,9Ø,X
22Ø SCREEN1,1
23Ø C$=INKEY$:IFC$=""THEN22ØELSE
IFC$=CHR$(32)THEN5Ø
24Ø IFC$="C"ANDPF=ØTHENPAINT(Ø,Ø
),Ø,Ø:PAINT(136,Ø),Ø,Ø:PAINT(17Ø
,191),Ø,Ø:PAINT(13Ø,116),Ø,Ø:PAI
NT(16Ø,13Ø),Ø,Ø:PAINT(124,132),Ø
,Ø:PAINT(185,131),Ø,Ø:PAINT(22Ø,
179),Ø,Ø
25Ø IFC$="G"THENGOSUB1ØØØELSEIFC
$="L"THENGOSUB11ØØØELSEIFC$="S"T
HENGOSUB12ØØØELSEIFC$="A"THENGOS
UB13ØØØELSEIFC$="P"THENGOSUB14ØØ
ØELSEIFC$="Q"THENGOSUB9ØØØ
26Ø GOTO22Ø
1ØØØ FORLA=15TO45STEP5:FORLN=6ØT
O95STEP5
1Ø1Ø IFLA/1Ø=INT(LA/1Ø)ORLN/1Ø=I
NT(LN/1Ø)THENS=4ELSES=2
1Ø2Ø GOSUB1ØØØØ:IFX>=ØANDX<=255A
NDY>=ØANDY<=191THENDRAW"S=S;BM=X
;,=Y;NU2NR2NL2ND2"
1Ø3Ø NEXT:NEXT:RETURN
1Ø4Ø PRINT:PRINT"ARE YOU SURE YO
U WANT TO DO THIS(Y/N)?  ";
1Ø5Ø GOSUB2ØØØ:IFA$<>"Y"ANDA$<>"
N"THEN1Ø5ØELSEPRINTCHR$(8);:RETU
RN
2ØØØ T=(T+1)AND15:IFT=ØORT=8THEN
PRINTCHR$(8);CHR$(128-(T=8)*127)
;
2Ø1Ø A$=INKEY$:IFA$=""THEN2ØØØEL
SERETURN
3ØØØ PRINT:PRINT"READY CASSETTE
AND PRESS enter  ";
3Ø1Ø GOSUB2ØØØ:IFA$<>CHR$(13)THE
N3Ø1Ø
3Ø2Ø PRINTCHR$(8);:IFIO$="O"THEN
GOSUB8ØØØ
3Ø3Ø OPENIO$,-1,"STORMDAT":RETUR
N
4ØØØ PF=1:WS=WS(P):IFWS<4ØTHENPU
T(X-3,Y-3)-(X+3,Y+3),D,PSETELSEI
FWS<74THENPUT(X-3,Y-3)-(X+3,Y+3)
,S,PSETELSEPUT(X-3,Y-3)-(X+3,Y+3
),H,PSET
4Ø1Ø RETURN
5ØØØ PCLS:N$="Hurricane":X=1Ø:Y=
2Ø:S=16:GOSUB6ØØØ:X=25:Y=45:N$="
Tracking":GOSUB6ØØØ:X=4Ø:Y=7Ø:N$
="System":GOSUB6ØØØ:S=8:X=1Ø:Y=8
6:N$="By Roger Smith":GOSUB6ØØØ
5Ø1Ø DRAW"S4"
5Ø2Ø CIRCLE(3Ø,96),3:LINE(28,96)
-(32,96),PSET:LINE(3Ø,94)-(3Ø,98
),PSET:GET(27,93)-(33,99),D,G
5Ø3Ø FORX=4ØTO225STEP1Ø:PUT(X-3,
93)-(X+3,99),D,PSET:NEXT
5Ø4Ø CIRCLE(3Ø,1Ø6),2:DRAW"BM28,
1Ø6;U2RUR2":DRAW"BM32,1Ø6;D2LDL2
":GET(27,1Ø3)-(33,1Ø9),S,G
5Ø5Ø FORX=4ØTO225STEP1Ø:PUT(X-3,
1Ø3)-(X+3,1Ø9),S,PSET:NEXT
5Ø6Ø PUT(27,113)-(33,119),S,PSET
:PAINT(3Ø,116),Ø,Ø:GET(27,113)-(
33,119),H,G
5Ø7Ø FORX=4ØTO225STEP1Ø:PUT(X-3,
113)-(X+3,119),H,PSET:NEXT
5Ø8Ø PLAY "T5;O4;ABCDDCBA":RETUR
N
6ØØØ SB=S:SS=S/2:FORH=1TOLEN(N$)
:B=ASC(MID$(N$,H,1)):IFB>96THENB
=B-97:S1=SS ELSES1=SB:B=B-65
6Ø1Ø IFB<ØORB>25THENB=26
6Ø2Ø IFX>5ANDX<25ØANDY>5ANDY<186
THENDRAW"S=S1;BM=X;,=Y;"+A$(B)
6Ø3Ø X=X+(S1/4)*6+1:NEXT:RETURN
7ØØØ A$(Ø)="U5R4D5U3L4":A$(1)="U
5R3D2L3R4D3L4":A$(2)="NR3U5R3":A
$(3)="U5R3FD3GL3":A$(4)="NR4U3NR
2U2R4":A$(5)="U3NR2U2R4":A$(6)="
BM+3,-4;HL2GD3FR2EUL":A$(7)="U5D
2R3U2D5":A$(8)="BR2NL2NR2U5NR2L2
"
7Ø1Ø A$(9)="BUFREU4RL2":A$(1Ø)="
U5D3E3G2F2D":A$(11)="NU5R4":A$(1
2)="U5F2E2D5":A$(13)="U5M+4,+5;U
5":A$(14)="BU4ER2FD3GL2HU3"
7Ø2Ø A$(15)="U5R4D2L4":A$(16)="B
UU3ER2FD2GNFNHGLH":A$(17)="U5R4D
2L4RF3":A$(18)="R4U3L4U2R4":A$(1
9)="BR2U5NL3R3"
7Ø3Ø A$(2Ø)="NU5R4U5":A$(21)="BU
5M+2,+5;M+2,-5;":A$(22)="NU5E2F2
U5":A$(23)="M+4,-5;BM-4,+Ø;M+4,+
5"
7Ø4Ø A$(24)="BU5F2NE2D3":A$(25)=
"NR4M+4,-5;L4":A$(26)="C1U7RD7RU
7RD7RU7RD7RU7L6D7R6CØ":RETURN
8ØØØ MOTORON:FORX=ØTO3ØØØ:NEXT:R
ETURN
9ØØØ CLS:PRINT"CLEAR DATA":PRINT
:GOSUB1Ø4Ø:IFA$="N"THENRETURNELS
ENM$="":ST=Ø:EN=Ø:RETURN
1ØØØØ X=INT((97.5-LN)*6.4+.5)-1:
Y=INT((38.67-LA)*6.6899+.5):RETU
RN
11ØØØ CLS:PRINT"LOAD DATA FROM T
APE":GOSUB1Ø4Ø:IFA$="N"THENRETUR
N
11Ø1Ø IO$="I":GOSUB3ØØØ:INPUT#-1
,NM$:PRINT:PRINT"LOADING DATA FO
R ";NM$:PRINT
11Ø2Ø ST=Ø:EN=Ø
11Ø3Ø IFEOF(-1)THENCLOSE:RETURN
11Ø4Ø INPUT#-1,LA(EN),LN(EN),WS(
EN)
11Ø5Ø EN=EN+1:IFEN>MX THENEN=Ø:S
T=1
11Ø6Ø IFEN=ST THENST=ST+1
11Ø7Ø GOTO11Ø3Ø
12ØØØ IFNM$=""THENRETURNELSECLS:
PRINT"SAVE DATA TO TAPE":GOSUB1Ø
4Ø:IFA$="N"THENRETURN
12Ø1Ø IO$="O":GOSUB3ØØØ:PRINT:PR
INT"SAVING DATA FOR ";NM$:PRINT
12Ø2Ø PRINT#-1,NM$:P=ST
12Ø3Ø IFP=EN THENCLOSE:RETURN
12Ø4Ø PRINT#-1,LA(P),LN(P),WS(P)
12Ø5Ø P=P+1:IFP>MX THENP=Ø
12Ø6Ø GOTO12Ø3Ø
13ØØØ CLS:PRINT"ADD ENTRIES":PRI
NT
13Ø1Ø IFNM$=""THENINPUT"STORM NA
ME";NM$:GOTO13Ø1Ø
13Ø2Ø PRINT:PRINT"JUST PRESS ent
er AT LATITUDE":PRINT"PROMPT TO
EXIT":FL=Ø:PRINT
13Ø3Ø PRINT
13Ø4Ø INPUT"LATITUDE";LA$:IFLA$=
""THENRETURN
13Ø5Ø LA(EN)=VAL(LA$):IFLA(EN)<Ø
THEN13Ø4Ø
13Ø6Ø INPUT"LONGITUDE";LN(EN):IF
LN(EN)<ØTHEN13Ø6Ø
13Ø7Ø IFFL=ØTHENPRINT:PRINT"ENTE
R WIND SPEED OR":PRINT"   'D' IF
 TROPICAL DEPRESSION":PRINT"   '
S' IF TROPICAL STORM":PRINT"   '
H' IF HURRICANE":FL=1
13Ø8Ø INPUT"WIND SPEED";WS$:IFWS
$="D"THENWS$="3Ø"ELSEIFWS$="S"TH
ENWS$="5Ø"ELSEIFWS$=""ORWS$="H"T
HENWS$="1ØØ"
13Ø9Ø WS(EN)=VAL(WS$):IFWS(EN)<Ø
THEN13Ø8Ø
131ØØ EN=EN+1:IFEN>MX THENEN=Ø:S
T=1
1311Ø IFEN=ST THENST=ST+1
1312Ø GOTO13Ø3Ø
14ØØØ P=ST
1401Ø IFP=EN THEN145Ø
1402Ø LA=LA(P):LN=LN(P):GOSUB1ØØ
ØØ:IFX>=9ANDX<=246ANDY>=9ANDY<=1
82THENGOSUB4ØØØ:FL=1ELSEFL=Ø
1403Ø P=P+1:IFP>MX THENP=Ø
1404Ø GOTO1401Ø
1405Ø IFEN=ST ORFL=ØTHENRETURNEL
SECIRCLE(X,Y),6
1406Ø X=X+9:T=X+1:Y=Y+6:S=4:N$=S
TRING$(LEN(NM$)," "):GOSUB6ØØØ:X
=T:Y=Y-1:N$=NM$:GOSUB6ØØØ:RETURN
```

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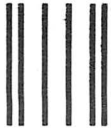

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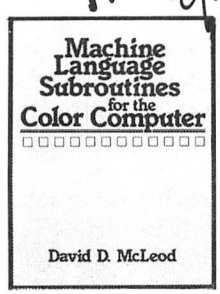

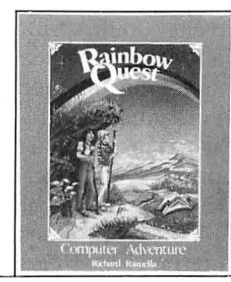

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The DOSsier

Disk Utilities And More On 80-Column Patches

by Scott Norman

When in doubt, reorganize. Now that this column has gone monthly it has a new title, ostensibly chosen to reflect my long-range goal of treating operating systems other than Flex. This means that I'm going to get to OS-9 software soon, but don't be surprised if the occasional Star-DOS piece sneaks in as well.

There's another reason for the name change, though. I'm just a sentimental old sod at heart, and I wanted the magazine to carry on a great literary tradition. Just think of some of those other greats: Fyodor DOStoyevski, John DOS Passos....

A less serious-minded friend suggested OScar Wilde and F. Scott FLEXgerald. That sort of flippancy should not be encouraged.

Rumors, Rumors

I find myself newly returned from a CoCo trade show, at which I got to engage in some really serious rumor swapping.

As usual, the most intriguing stories had to do with possible evolution of the CoCo. At present (mid-April), most of the speculation deals with a *pair* of machines: a minor upgrade slated for the spring or summer and a major revision due later in the year. The former will supposedly incorporate such features as a built-in monitor driver and an ACIA (asynchronous communications interface adapter) for the serial port—worthwhile improvements, but boring nonetheless.

The even more nebulous (and exciting) follow-on product is said to be more of a business machine, possibly incorporating an improved display and multiple 64K banks of RAM. Could this be the Color Computer that demands OS-9? Some of us maintain that the Microware operating system is of less than obvious benefit for the existing machine.

We'll just have to wait and see. As always, there's plenty of room for misinterpretation of Radio Shack's intentions along with the fun. The last time the Super CoCo stories were this prevalent, Tandy brought forth the Model 2000—a nice product, but scarcely what we had in mind.

Unfinished Business

Last month, I described how I reworked my copy of DynaCalc for use with the Word-Pak 80-column, 25-line display board. The method required nothing more than Flex and information concerning the locations that you had to change to reformat the display.

In essence, I used Flex's GET command to load the applications program into RAM, the Frank Hogg Laboratories monitor program to change the appropriate constants, and the Save utility to return the modified file to disk. But DynaCalc's structure made the job a little more complex than I've indicated.

There are other ways to do this sort of thing, and I'd like to touch on a few of them this month. For variety, I'll describe how I recently modified Stylograph, the word processor from Great Plains Computer Co. (see the May 1984 Re:FLEX for a review).

Stylo is available in both Flex and CoCo OS-9 editions, so this will give me the opportunity to say a few words about some useful utility packages for both operating systems.

Stylo is a little simpler to set up for 80-column output than DynaCalc, since you only have to change one location in the word processor. The Word-Pak documentation states that you must switch the contents of $14A5 in version 2.0 from $D6 to $D0, while in version 2.1 it is the data in $14E1 that you must change. My own copy of Stylo is v2.1, so from now on I'll just concentrate on the latter address.

The FIX command provides an alternative to using a full-fledged monitor. FIX is part of the standard TSC Flex utility command set.

This nifty utility loads a binary file into a special buffer region of memory, so you can work on applications programs that use system locations when you actually run them. The great thing is that you can refer to individual bytes in the file by the addresses into which they actually load and not concern yourself with their location on disk.

Unfortunately, FIX isn't included with FHL's CoCo Flex (not with any version up to 5.0:3, anyway), but those of you with access to the original TSC operating system can use it. The omission was just the result of some tradeoff or other, I suppose; I have copied FIX from my TSC library disk onto the FHL system disk I use every day, and it seems to work perfectly.

With FIX on the system disk in drive 0 and Stylo on the work disk in drive 1, the patching process starts with

```
+++FIX,1.STYLO.CMD
```

If you don't specify a separate output file name, the modified file will replace the original when you exit the command. You must specify the extension in this case because FIX normally expects to work with .BIN files.

FIX responds with its own prompt, a colon. It offers 10 commands for examining and changing memory locations. The one of immediate interest is M, for memory examine and change; M 14E1 brings the response D6 (the present contents of $14E1), and then the system pauses for input. Typing the desired contents (D0) in hex and adding an extra enter keystroke to terminate the process returns you to the colon prompt. At this point, FIX's E command writes the modified file to the disk. You are then returned to Flex.

That's about as simple as a patch

can get. Notice that I never had to concern myself with the start, finish, and transfer addresses of the applications program when saving the new version. The method I presented last month required that information.

Although they're not really the subject of this column, I should mention some of the other FIX options. Some of the available subcommands let you view sections of memory, expand an existing file by adding new blocks of addresses to it, display the start, finish, and transfer addresses of each contiguous block of object code, and change or even remove the transfer address. FIX is very useful, and I think it would have been worthwhile to have retained it in FHL Flex.

There are alternatives to acquiring the whole TSC system just to get FIX, however. For less than half the price you can buy collections of Flex utilities containing routines that let you read, modify, and rewrite any sector on a disk. You can then reduce the problem of modifying an applications program to finding where the desired information resides.

This requires a little detective work, but it is possible. I'm going to describe how I did the deed with Examine, one of the 10 disk diagnostic/repair utilities in the TSC Flex Diagnostics package. I believe that Hogg Lab's Flex Color Utilities disk includes similar options.

Since every user organizes his working disks differently, there is no way of telling where a given file resides. Therefore, what follows has to be a general description of the technique rather than a sure cure for everyone's Stylograph.

If you are contemplating a similar job, it might be best to follow along with your own Flex manual so that you can read the descriptions of how files are organized; the information is all back there in the *Advanced Programmer's Guide*.

Heavy Going

Examine has nine commands, but for this project I'll consider only three:

- D,(sector address)—read and display a sector;
- M,(byte number)—modify data in buffer; and
- W,(sector address)—write the buffer to disk.

Sector addresses consist of four hex digits: ttss, where tt is the track number and ss is the sector number within the track. The byte number consists of two hex digits, and runs from 00 to FF for each sector on the disk.

"...calculations like the ones I've just gone through can only serve as rough guides."

The command EXAMINE 1 informs the system that drive 1 contains the work disk you care about; it responds with the unmistakable prompt, "Command:". First you must look at the directory to learn where Stylo is stored on the disk.

The directory starts at sector 5 of track 0, which calls for a D,0005 command. This brings up a single-sector display consisting of a 16-by-16 array of hex digits, plus another array that gives the ASCII translation wherever possible: a great help in locating file names.

Each directory sector contains 10 file entries at most, so it is quite likely that you'll have to step through several displays to locate the entry for Stylograph. The shorthand command D,+ takes you to the next physical sector on the disk.

My copy of Stylo finally showed up in sector 0008, byte 10. It looked like this, where I've added the translations of interesting bytes:

```
53 54 59 4C 45 00 00 00 43 4D 44 00 00 17 0E ...
S  T  Y  L  O           C  M  D        17 0E
```

The four digits, 170E, represent the track and sector numbers of the first sector of the Stylo file. That's where you should look next.

The command D,170E brings up a display that begins as follows:

```
17 0F 00 01 02 00 00 FF ...
```

170F is the pointer to the next sector in the file, 0001 means this is the first record, 02 is the Flex start-of-record indicator, the two 00s are the most-significant and least-significant bytes of the actual loading address, and FF indicates that there are 255 data bytes in this record.

So all this effort just verifies that Stylo loads into memory starting at location 0000! Remember, you want to change the data that will load at location $14E1, or 5345 (decimal) bytes above 0000; the problem is to determine where this data might be *on the disk*. In other words, how far is it from sector address 170E?

Each Flex sector can contain a maximum of 252 data bytes, so if Stylo is stuffed onto the disk with no gaps, it should require 21.21 sectors (5345 ÷ 252). Since a double-density disk formatted with the NEWDISK command has 17 sectors per track (on my system, anyway), the desired address should be about one track, 4.21 sectors past the beginning of the program at sector 170E—that is, about 20 percent of the way into sector 1900.

That's actually a little crude. There is no D6 in the vicinity of this estimated location. The first candidate is more than a full sector downstream, at byte 71 (hex) of sector 1901. If you examine Stylo, you'll see that some of

---

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the sectors contain less than their potential 252 data bytes, which explains the discrepancy.

Thus, calculations like the one I've just gone through can only serve as rough guides. Fortunately, D6 is a fairly uncommon entry, and is easy to pick out if you don't have to look at much of the code. For the record, the code in the immediate vicinity of the location in question is as follows:

B2 D6 01 04 05 ...

Having found a suspect location, you can change it with Examine's M command: M,71 D0 does the job. You can then rewrite the modified sector to the disk with a command of W,1901. Now when I use Stylo, I can burn my eyeballs out on lines up to 80 characters long.

This is admittedly a roundabout way to change a single byte in a program, but I still think it's a nice example of the way a good set of tools lets you interact with your disk files. This is just the tip of the iceberg, too; the TSC and Hogg Laboratory utility collections contain all sorts of other goodies for Flex operators. Even dyed-in-the-wool applications-software users like me have to learn something about file organization eventually.

"Even dyed-in-the-wool applications-software users like me have to learn something about file organization eventually."

Some OS-9 Equivalents

A couple of vendors have gotten off to an early start with utility packages for OS-9. FHL has a number of such products, along with a versatile disk driver named SDisk. This lets you customize your system, so you can take advantage of disk drives more competent than the ones Radio Shack supplies—just the sort of capability the SETUP command offers to Flex users.

Computerware has bundled its own command for modifying device descriptors together with several other utilities in an economical ($29.95) package called Disk Fix and Utilities (look for a review of it in this issue).

Disk Fix contains a utility called Patch that inspects and modifies the disk files, the same as do Examine and Fix. It can find every occurrence of a specified string or byte pattern in a file, and it includes a comprehensive facility for examining and changing data in memory. I don't know if anyone has an OS-9 patch for the Word-Pak running yet, but if so, a package like this will make it a pleasure to do the necessary surgery on Stylograph and any other applications software that comes along. ■

Address correspondence to Scott Norman, 8 Doris Road, Framingham, MA 01701.

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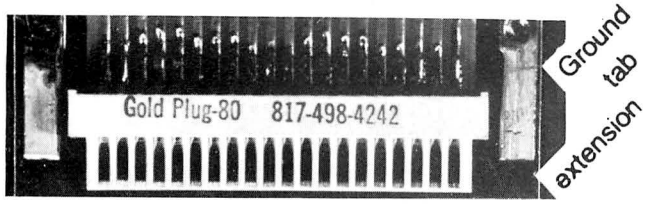

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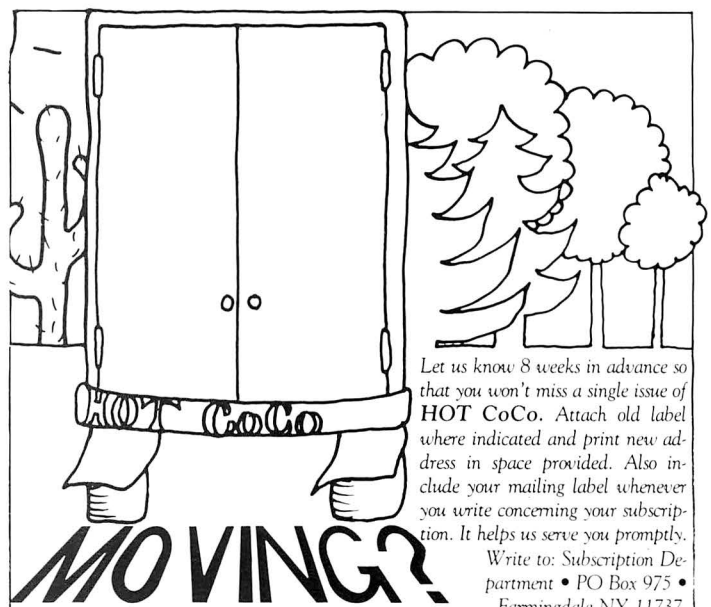

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The Educated Guest

How-To's Of Flash-And-Flair Graphics

by Charles H. Santee

Over the past few months I have explored improving educational programs through sound educational design. Now it's time for a little flash and flair. Animate, this month's program, shows you how to create and animate graphics. While anyone can use it to develop graphics programs, I hope teachers will put it to work adding movement to their educational programs.

Graphics play an important role in presenting or illustrating educational concepts, especially for young children and handicapped individuals with a limited reading vocabulary. You can use graphics to illustrate a complicated science or math concept. For example, complex mathematical formulae can often be clarified by graphing.

One *HOT CoCo* reader, Richard E. Rand (Aroostook Computer Educators, Presque Isle, ME), suggested another example. He sent a screen dump of a program that uses the graphics screen to illustrate multiplication of fractions.

Often, educational programs use graphics to reinforce achievement. Some use a thermometer or bar graph to show the number of problems answered correctly. When used in simulations, graphics make actions and reactions more realistic.

There are, however, several drawbacks in using graphics. Creating them is time consuming. An effective computer graphics presentation requires artistic flair and an ability to make a reasonable representation with a limited number of colors and resolution. Those fascinating graphics you see are often fantasy characters and cartoon-like drawings. Realism is difficult to achieve on the computer screen.

Often, poorly designed graphics call to mind ideas not intended by the programmer. Contrary to the adage that a picture is worth 1,000 words, a few well-chosen words can often conjure up an image that is 1,000 times more effective than a pixelated visual screen..

Yet another drawback to the flash and flair of graphics is that they often distract from, rather than enhance, the educational process. However, don't let these negative considerations dissuade you. I am a strong advocate for more flash and flair.

Programs that use effective graphics are usually better than those that don't. Educational programs should be eye-riveting and entertaining. Multisensory bombardment is usually more effective than controlled unisensory presentation. But please, actively involve the learner!

You can use this month's program, Animate (Listing 1), to create a small graphics figure, which you can move across the screen. Once you have created the graphics you want, save them as DATA statements to incorporate into a Basic program.

Using Animate

At the beginning of the program you see a grid of 12 squares (four across and three down). You create your figure in the upper left corner. Use the right joystick to move a flashing cursor to the desired starting place, then press B to begin. A small red mark notes this position. Move the cursor to a new position and press a number between one and four. Each number corresponds with a different color as indicated below:

1 = Blank Line—move to a position without drawing
2 = Yellow—draws a yellow line
3 = Blue—draws a blue line
4 = Red—draws a red line

If you make a mistake, press the left arrow to erase the last line drawn. To start over, press B. When you finish, press S to save the picture, which is then transferred to one of the blank squares in the grid. As you create pictures, notice the positions in which they are saved. Mentally number each position (picture created) as shown in Table 1.

When you have created all the pictures you want, press A to animate. The program asks you which picture you want to animate, and you must press a number between 1 and 11. There is a short pause and you see a blank screen with a blinking cursor.

Use the joystick to move to a position on the screen and press the fire button to see the picture you selected. Move to a new location and press the fire button again. To animate the figure proceed in small steps, pressing the fire button at each step. When you are finished, press Q to quit.

Your picture moves across the screen for each step you created. You can then press R to repeat the animation, Q to quit, or S to save.

If you press S to save, the program saves your animation in an array. If you press Q, you can save all animations to disk or tape. Table 2 summarizes the commands for each step of the animation process.

How the Program Operates

In Step 1, the program saves each line drawn as a string that is an absolute movement, or as a color string for a DRAW statement. When you press S to save, it converts each line into a relative move for the DRAW state-

System Requirements

16K RAM
Extended Color Basic
Disk (optional)

ment. When you press A to animate, the program creates a duplicate of the relative-move string without the colors. This is used to draw over the picture, erasing the last location moved to.

Finally, the path is defined by a string of characters with six characters defining each location in the path. These strings are saved to disk or as DATA statements. Here are examples of the strings created by this program:

1. The string that draws the picture—DR$ = "C2M+10,+10C3M-10,-20"
2. The string that erases the picture—B$ = "M+10,+10m-10,-20"
3. A string that determines the path of animation—A = "020030030040050060070080090100"

The program saves these strings as DATA statements starting with a line number of 1010.

Draw Picture Here	1	2	3
4	5	6	7
8	9	10	11

Table 1. Graphics Grid for Animate (Program Listing 1)

"With this program you can define an animation path with about 40 different steps."

Basic Animation with DATA Strings

To create a Basic program that uses the strings created by Animate, you can load or merge the DATA statements and then add a driver to animate the figures. Program Listing 2 animates a single figure. Program Listing 3 demonstrates simultaneous animation of two figures. To animate two figures you need an animation path that is the same length for both figures.

Improvements

With this program you can define an animation path that has about 40 different steps. See if you can figure out a way to create an animation path with up to 120 steps. (Hint: Create an animation path consisting of one character for each horizontal and vertical location in the path.)

With this program, the background color must always be the same. See if you can create a program that will work across different backgrounds. (Hint: Use the GET and PUT statements instead of the DRAW statements for animation. Add a routine to load in a background picture before performing the animation.)

The driver programs for the animation use FOR...NEXT statements. These are very slow in a long program. See if you can create a program that drives the animation more efficiently.

Create an animation program that lets you test animation with more than one figure. Perhaps the program could create all the statements you need to animate the figures so that you do not have to type in the driver for the animation.

Suggestions for the Nonprogrammer

I would like your suggestions for effective uses of graphics and animation as educational tools. Maybe you can suggest some ways that graphics and animation can be effectively used to teach concepts. Here are some ideas to get you started:

- Teach map skills through a graphics trip across a map. (See my program in *HOT CoCo*, May 1984.)
- Simulate the operation of mechanical devices through animation and graphics (i.e., how does a car work?).
- Demonstrate, test, or improve perceptual abilities using a developmental framework such as that developed by Jean Piaget.
- Give meaning to sentence content or structure through graphics representation.
- Use graphics as a means of communication for nonreaders.

You can contact me with your ideas and suggestions c/o *HOT CoCo*, 80 Pine St., Peterborough, NH 03458. ■

Step 1—Create a picture

Joystick	= Move to a new position
B	= Begin a new picture
1	= Draw a blank line
2	= Draw a yellow line
3	= Draw a blue line
4	= Draw a red line
S	= Save the picture for animation
Left Arrow	= Erase the last line
A	= Go to the animation path

Step 2—Create an animation path

Joystick	= Move to a new location
D or Fire Button	= Select a point in an animation path
Left Arrow	= Erase the last path
Q	= Quit animation path selection—Go to the next step

Step 3—Review the animation

R	= Repeat the animation
S	= Save the animation (in memory)—Go back to step 2
Q	= Quit the review process—Go to step 4

Step 4—Save the animations created on disk or tape

D	= Save to disk
T	= Save to tape
Q	= Quit without saving
P	= Go back to create a new animation path

Table 2. Animation Commands

Program Listing 1. Animate

```
1Ø CLEAR 3ØØØ
2Ø DIM CR(2Ø),D$(2Ø)
3Ø PMODE 3,1:PCLS:SCREEN 1,Ø
4Ø SH=Ø:SV=Ø:C=1:B$="1"
5Ø FOR A=64 TO 192 STEP 64:COLOR
 ABS(C-1),1:LINE (A,Ø)-(A,191),P
SET:NEXT A
6Ø FOR A=64 TO 128 STEP 64:COLOR
 ABS(C-1):LINE(Ø,A)-(255,A),PSET
:NEXT
7Ø GOSUB 21Ø
8Ø H=JOYSTK(Ø)+SH:IF H>SH+6Ø THE
N H=SH+6Ø
9Ø V=JOYSTK(1)+SV:IF V>SV+6Ø THE
N V=SV+6Ø
```

Listing 1 continued

Listing 1 continued

```
1ØØ GET(H,V)-(H+2,V+2),CR,G
11Ø PUT(H,V)-(H+2,V+2),CR,PRESET
:PLAY"P128":PUT(H,V)-(H+2,V+2),C
R,PSET
12Ø X$=INKEY$:IF X$="" THEN 8Ø
13Ø IF X$="S" AND D>1  THEN 27Ø
14Ø IF X$="A" AND DR$(1)<>""  TH
EN 43Ø
15Ø IF X$="B" THEN GOSUB 21Ø:GOT
O 8Ø
16Ø IF X$=CHR$(8) AND D>1 THEN D
$(D)="":D=D-1:COLOR C,1:LINE(Ø,Ø
)-(62,62),PSET,BF:FOR A=1 TO D:D
RAW D$(A):NEXT:GOTO 8Ø
17Ø IF D=>2Ø THEN PLAY"L8T8GC":G
OTO 8Ø
18Ø IF X$=B$ THEN D=D+1:D$(D)="B
M"+STR$(H)+","+STR$(V):DRAW D$(D
):PSET(H,V,ABS(C-1)):GOTO 8Ø
19Ø IF X$>"Ø" AND X$<"5" THEN D=
D+1:GOSUB 25Ø:D$(D)=D$(D)+"M"+ST
R$(H)+","+STR$(V):DRAW D$(D):GOT
O 8Ø
2ØØ GOTO 8Ø
21Ø FOR A=Ø TO D:D$(A)="":NEXT
22Ø COLOR C,1:LINE(SH,SV)-(SH+62
,SV+62),PSET,BF:D=1:D$(D)="BM"+S
TR$(H)+","+STR$(V):DRAW D$(D):PS
ET(H,V,ABS(C-1))
23Ø LH=H:LV=V
24Ø RETURN
25Ø IF X$<>C$ OR D=2 THEN C$=X$:
D$(D)="C"+X$
26Ø RETURN
27Ø H1=VAL(MID$(D$(1),3,4)):CM=I
NSTR(D$(1),","):V1=VAL(RIGHT$(D$
(1),LEN(D$(1))-CM-1))
28Ø NH=NH+64:IF NH>192 THEN NH=Ø
:NV=NV+64
29Ø F$="BM"+STR$(NH+LH)+","+STR$
(NV+LV)
3ØØ FOR A=2 TO D
31Ø IF LEFT$(D$(A),1)="C" THEN D
R$=DR$+LEFT$(D$(A),2):D$(A)=RIGH
T$(D$(A),LEN(D$(A))-2)
32Ø H2=VAL(MID$(D$(A),3,4)):CM=I
NSTR(D$(A),","):V2=VAL(RIGHT$(D$
(A),LEN(D$(A))-CM-1))
33Ø HS=H2-H1:VS=V2-V1:H1=H2:V1=V
2
34Ø IF HS<Ø THEN SH$="-" ELSE SH
$="+"
35Ø IF VS<Ø THEN SV$="-" ELSE SV
$="+"
36Ø IF LEFT$(D$(A),1)="B" THEN M
$="BM" ELSE M$="M"
37Ø DR$=DR$+M$+SH$+STR$(ABS(HS))
+","+SV$+STR$(ABS(VS))
38Ø NEXT A
39Ø DRAW "BM64,64":DRAW F$:DRAW
DR$
4ØØ DR=DR+1:DR$(DR)=DR$
41Ø DR$=""
42Ø FOR A=1 TO D:D$(A)="":NEXT:G
OSUB 21Ø:GOTO 8Ø
43Ø CLS:A$=""
44Ø PRINT"PRESS q TO QUIT":PRINT
"     or"
45Ø PRINT"ENTER THE NUMBER OF TH
E FIGURE  YOU WANT TO ANIMATE"
46Ø X$=INKEY$:IF X$="Q" OR X$="q
" THEN 83Ø ELSE IF X$<"1" OR X$>
"8" THEN 46Ø
47Ø Z=VAL(X$)
48Ø IF Z>DR THEN CLS:PRINT@33Ø,"
not a valid number":PLAY"L4T4CGC
GCG":GOTO 43Ø
49Ø DR$=DR$(Z)
5ØØ I=INSTR(DR$," "):IF I<>Ø THE
N IF I>1  THEN DR$=LEFT$(DR$,I-1
)+RIGHT$(DR$,LEN(DR$)-I):GOTO 5Ø
Ø ELSE DR$=RIGHT$(DR$,LEN(DR$)-1
):GOTO 5ØØ
51Ø B$=DR$
52Ø I=INSTR(B$,"C"):IF I<>Ø THEN
 IF I>1  THEN B$=LEFT$(B$,I-1)+R
IGHT$(B$,LEN(B$)-I-1):GOTO 52Ø E
LSE B$=RIGHT$(B$,LEN(B$)-2):GOTO
 52Ø
53Ø B$(Z)=B$
54Ø PMODE 3,1:PCLS:SCREEN 1,Ø
55Ø H=JOYSTK(Ø)*4:V=JOYSTK(1)*3
56Ø GET(H,V)-(H+2,V+2),CR,G:PUT(
H,V)-(H+2,V+2),CR,PRESET:PLAY"P1
28":PUT(H,V)-(H+2,V+2),CR,PSET
57Ø IF (PEEK(6528Ø) AND 1)=Ø THE
N GOSUB 63Ø:GOTO 55Ø
58Ø X$=INKEY$:IF X$="" THEN 55Ø
59Ø IF X$="D"  THEN GOSUB 63Ø:GO
TO 55Ø
6ØØ IF X$=CHR$(8) THEN GOSUB 66Ø
:GOTO 55Ø
61Ø IF X$="Q" THEN GOTO 7ØØ
62Ø GOTO 55Ø
63Ø L$="BM"+STR$(H)+","+STR$(V)+
DR$:DRAW L$
64Ø IF LEN(A$)>22Ø THEN PLAY"O2G
CGCGCO3":RETURN
65Ø H$=" "+STR$(H):H$=RIGHT$(H$,
3):V$=" "+STR$(V):V$=RIGHT$(V$,3
):A$=A$+H$+V$:RETURN
66Ø IF LEN(A$)<6 THEN RETURN
67Ø L$="BM"+MID$(A$,LEN(A$)-5,3)
+","+MID$(A$,LEN(A$)-2,3)+"C1"+B
$:DRAW L$
68Ø A$=LEFT$(A$,LEN(A$)-6)
69Ø RETURN
7ØØ PMODE 3,1:PCLS:SCREEN 1,Ø
71Ø IF LEN(A$)<6 THEN CLS:PRINT@
32Ø,"YOU MUST ENTER A PATH":PLAY
"T4L4GCGCGC":GOTO 43Ø
72Ø FOR A=1 TO LEN(A$)STEP 6
73Ø L$="BM"+MID$(A$,A,3)+","+MID
$(A$,A+3,3)
74Ø DRAW L$:DRAW DR$:PLAY"P128":
DRAW "C1":DRAW L$:DRAW B$
75Ø NEXT A
76Ø DRAW  L$:DRAW DR$
77Ø X$=INKEY$:IF X$="" THEN 77Ø
78Ø ON INSTR("RrSsQq",X$) GOTO 7
ØØ,7ØØ,82Ø,82Ø,83Ø,83Ø
79Ø CLS:PRINT"PRESS: r TO REPEAT

8ØØ PRINT"       q TO QUIT"
81Ø PRINT"        s  TO SAVE":GOT
O 77Ø
82Ø A$(Z)=A$:DR$="":B$="":A$="":
PLAY"CDEFG":GOTO 43Ø
83Ø CLS:PRINT"PRESS d TO SAVE TO
 DISK":PRINT"       t TO SAVE TO
TAPE":PRINT"       q TO QUIT WITH
OUT A SAVE"
84Ø PRINT"       p TO DO ANOTHER
PATH"
85Ø X$=INKEY$:IF X$="" THEN 85Ø
86Ø ON INSTR("DdTtQqPp",X$) GOTO
 87Ø,87Ø,875,875,1Ø1Ø,1Ø1Ø,43Ø,4
3Ø
87Ø CLS:INPUT"NAME OF DISK FILE"
;NF$:GOTO88Ø
875 CLS:INPUT"NAME OF TAPE FILE"
;NF$
88Ø IF X$="D" OR X$="d" THEN OPE
N"O",#1,NF$
89Ø IF X$="T" OR X$="t" THEN OPE
N"O",#-1,NF$
9ØØ FOR A=1 TO D
91Ø N=D*1Ø+1ØØØ:N$=RIGHT$(STR$(N
),LEN(STR$(N))-1)
92Ø D$(1)=N$+"DATA "+CHR$(34)+DR
$(D)+CHR$(34)
93Ø N=N+2:N$=RIGHT$(STR$(N),LEN(
STR$(N))-1)
94Ø D$(2)=N$+"DATA "+CHR$(34)+B$
(A)+CHR$(34)
95Ø N=N+2:N$=RIGHT$(STR$(N),LEN(
STR$(N))-1)
96Ø D$(3)=N$+" DATA "+CHR$(34)+A
$(A)+CHR$(34)
97Ø ON INSTR("DdTt",X$) GOTO 98Ø
,98Ø,99Ø,99Ø
98Ø FOR B=1 TO 3:PRINT#1,D$(B):N
EXT:GOTO 1ØØØ:CLOSE#1
99Ø FOR B=1 TO 3:PRINT#-1,D$(B):
NEXT:CLOSE#-1
1ØØØ GOTO 1Ø1Ø
1Ø1Ø END                    END
```

```
5 FOR B=1 TO 2
1Ø READ  DR$(B),B$(B),A$(B)
12 NEXT B
15 PMODE 3,1:PCLS:SCREEN 1,Ø
2Ø FOR A=1 TO LEN(A$(1)) STEP 6
25 '##### COMPUTE LOCATION ####
27 FOR B=1 TO 2
3Ø L$(B)="BM"+MID$(A$(B),A,3)+",
"+MID$(A$(B),A+3,3)
35 '##### MOVE TO LOCATION ####
4Ø DRAW L$(B)
45 '##### DRAW FIGURE #########
5Ø DRAW DR$(B)
52 NEXT B
55 '##### PAUSE TO SEE FIGURE ##

6Ø PLAY"P12Ø"
61 FOR B=1 TO 2
62 DRAW L$(B)
65 '##### DRAW BACKGROUND COLOR
7Ø DRAW "C1"
75 '##### ERASE FIGURE #########
8Ø DRAW B$(B)
82 NEXT B
9Ø NEXT A
1ØØ GOTO 2Ø
1Ø1Ø DATA "C3M+1Ø,+ØM+Ø,+1ØC4M-1
Ø,+ØM+Ø,-1Ø"
1Ø12 DATA "M+1Ø,+ØM+Ø,+1ØM-1Ø,+Ø
M+Ø,-1Ø"
1Ø14 DATA "Ø1ØØ1ØØ2ØØ2ØØ3ØØ3ØØ4Ø
Ø4ØØ5ØØ5ØØ6ØØ6ØØ7ØØ7Ø"
1Ø16 DATA "C2M+1Ø,+1ØBM+Ø,-1ØM-1
Ø,+1Ø"
1Ø18 DATA "M+1Ø,+1ØBM+Ø,-1ØM-1Ø,
+1Ø"
1Ø2Ø DATA "Ø7ØØ1ØØ6ØØ2ØØ5ØØ3ØØ4Ø
Ø4ØØ3ØØ5ØØ2ØØ6ØØ1ØØ7Ø"
```

Program Listing 3. To Animate Two Objects

```
1Ø READ  DR$,B$,A$
15 PMODE 3,1:PCLS:SCREEN 1,Ø
2Ø FOR A=1 TO LEN(A$) STEP 6
25 '##### COMPUTE LOCATION ####
3Ø L$="BM"+MID$(A$,A,3)+","+MID$
(A$,A+3,3)
35 '##### MOVE TO LOCATION ####
4Ø DRAW L$
45 '##### DRAW FIGURE #########
5Ø DRAW DR$
55 '##### PAUSE TO SEE FIGURE ##

6Ø PLAY"P64"
65 '##### DRAW BACKGROUND COLOR

7Ø DRAW "C1"
75 '##### ERASE FIGURE #########

8Ø DRAW B$
9Ø NEXT A
1ØØ GOTO 2Ø
1Ø1Ø DATA "C2M+1Ø,+ØM+Ø,+1ØM-1Ø,
+ØM+Ø,-1Ø"
1Ø12 DATA "M+1Ø,+ØM+Ø,+1ØM-1Ø,+Ø
M+Ø,-1Ø"
1Ø14 DATA "Ø1ØØ1ØØ2ØØ2ØØ3ØØ3ØØ4Ø
Ø4ØØ5ØØ5ØØ6ØØ6ØØ7ØØ7Ø"
```

Program Listing 2. To Animate One Object

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Doctor ASCII

by Richard E. Esposito and Ralph E. Ramhoff

Send your questions to Doctor ASCII, c/o HOT CoCo, *Pine St., Peterborough, NH 03458. Be sure to include a self-addressed, stamped envelope for a reply.*

Q. How do I tell which printed circuit board my Color Computer has? All I know is that I have a 32K Extended Color Basic.

Charlotte Stukes
Coppecas Cove, TX

A. With the exception of some early CoCos, there are three revision levels of PC boards: the D, the E, and what is commonly called the F board. All CoCo 2's have a different board from any of the original CoCo boards. The D board was designed at the time when only 4K or 16K RAM chips were used in the CoCo, and is identified by the fact that the serial number in the lower right corner of the PC board has a D as its rightmost character.

The E board was introduced when Radio Shack started using half-certified 64K RAM chips. Since they wanted the CoCo to accommodate chips with either half good, they added a jumper position marked high/low. The component numbers or designations on this board are the same as on the D board. The jumpers have positions for 32K in addition to the 4K and 16K positions. It can be identified by the fact that the serial number in the lower right corner of the PC board ends with the letter E.

The F board was introduced when 16K chips became as cheap as 4K chips and half-certified 64K chips were difficult to find. This board was a complete redesign in that some of the components were changed or upgraded. All the components were given new designations. This board can be identified by the fact that the serial number is not followed by a letter.

The CoCo 2 is a complete redesign of the CoCo in that it only has a 5-volt power supply. The 16K chips in this machine are not the same as those used in the original CoCo. If you do the piggyback upgrade to 32K on this machine, *do not* use 4116 chips. They will damage your computer!

Q. I have ECB 1.0, Basic 1.1, 32K RAM, and serial number 00000 58. Is this an F board? Is this a 64K machine? Also, what does the P suffix on my chips mean?

William F. Tague
Montour Falls, NY

A. You have an F board, and yes it does have 64K. The P suffix means that the chips are enclosed in plastic as opposed to ceramic cases.

Q. I have just received my first issue of *HOT CoCo* and I love it. I would like information on operating systems. How do I figure out which one to buy (Flex, OS-9, or CP/M)? Where do I buy each of these? Is it possible to use Cobol on my CoCo? What do I need to enter machine-language programs?

Shirley Ulling
Burbank, CA

A. You have a split decision on this one. I (Richard) favor Flex while Ralph favors OS-9. Each of these operating systems has advantages and disadvantages.

● **Richard**: Flex has been around longer and because of this, there is more software for it. It was also designed for a 64K machine, so you do not have Flex software that scratches for space.

● **Ralph**: OS-9 as implemented by Radio Shack for the CoCo also uses 64K of memory. It has not been around for quite as long, but it has gained popularity more rapidly than Flex in the business market. This has caused the rapid development of software packages and high-level languages for OS-9 (i.e., Cobol).

● **Richard**: What do you mean 64K for OS-9? Take the Shack's OS-9, add O-Pak (unless you like that 32-by-16 display with those dumb reverse-video characters) and run Basic-09 and you have only 4K left for your program. With XBasic and Flex, you have 26K!

● **Ralph**: Basic-09 is far advanced above XBasic. This additional flexibility requires some overhead. You can run larger programs by compiling them to intermediate code without O-Pak in the system and using the RUNB program provided with Radio Shack's Basic-09 to run the program with O-Pak.

● **Richard**: Who wants to go through all that trouble? Besides, Flex software is cheaper and look at the variety of languages available. These languages will run on the plain vanilla 64K CoCo with Flex: Fortran77, Forth, C, Mumps, Pascal, PL9, and 6809 Assembly. To get the same capability with OS-9, you need to lay out a wad of cash to get a monitor and an 80-column card to free up the 8K that is consumed by O-Pak.

● **Ralph**: As I indicated above, O-Pak is *not* an integral part of OS-9. If you cannot find any more problems with OS-9, why don't you just admit that OS-9 is the best? OS-9

also supports C, Pascal, and 6809 Assembly. In addition OS-9 supports Cobol and the highly acclaimed Basic-09. The OS-9 Pascal supports native mode code as does the Flex Pascal. However, it also supports a P-code interpreter with full interactive debugging capabilities. There is also a utility program that allows Flex to run as if it were OS-9!

● **Richard:** I will admit that OS-9 has many more capabilities, but when you shoehorn it into 64K RAM, it loses most of its thunder. I prefer the user friendliness of Flex and the confidence that I have the same power in my 64K CoCo as someone with a $10,000 Gimix when running Flex. Until the CoCo breaks the 64K barrier with the necessary software to support OS-9 level II, I maintain that Flex is best!

● **Ralph:** OS-9 is patterned after the Unix operating systems, which are considered to be the state of the art in user-friendly operating systems. The 64K CoCo does not have the hardware to even be considered in the same league as the Gimix, $10,000 or not. I still consider OS-9 to be the most "bang for the buck" operating system for the CoCo.

● **Ralph and Richard:** Whichever of these you feel is best for you, remember that they both have strengths and weaknesses. We are in agreement, however, that using CP/M with its Z-80 on a CoCo with its 6809E is like replacing the 428 cubic-inch V-8 engine in a Trans Am with a 1.2-liter, four-cylinder VW engine. The only reason we can see for using CP/M is to run programs from a different machine that uses CP/M, or if you want to use a software package that is available only under CP/M.

Flex for the CoCo is marketed by Atomtronics, Data Comp Systems, Frank Hogg Labs, Spectral Associates, and Star-Kits. OS-9, catalog #26-3030, is marketed by Radio Shack. O-Pak is marketed by Frank Hogg Labs. CP/M for the CoCo is marketed by Color Power Unlimited Inc. and Wayne Technology.

As far as machine language, you have several options. If you only need to enter a machine-language program that someone else has assembled you can use a Basic POKE routine or a simple monitor (Doctor ASCII, December 1983, p. 129). If you want to work with the assembler and machine language, you need a good interactive debugger such as Z-Bug in Radio Shack's EDTASM+ package. This is just one of a great many good debuggers. The other tool you will need for larger programs is an editor/assembler. Many disk, tape, and ROM-pack editor/assemblers are available, including EDTASM+.

Q. I just purchased my first disk drive for my CoCo. I immediately looked through my back issues of *HOT CoCo* for your "Disk Utilities" article (September 1983, p. 134). My feelings, like yours, were to eliminate the cassettes and ROM packs. Your Tapefix program is very effective, and I was able to put all tape programs, except Donkey King, on disk. In your discussion of the Romfix program, you said to put a piece of tape over the cartridge select land. Would you please tell me what this means? Regarding the directory-print program, my printer (RS DMP-100) operates normally at 600 baud. How can I modify the program to work with my printer?

Gary Wood
Indianapolis, IN

A. The Tapefix program loads programs into memory with an offset. The Donkey King program, by Tom Mix Software, fills virtually all of the lower 32K RAM in your machine. This means that the Tapefix program cannot successfully offset load it. Donkey King is available on disk; you should write Tom Mix Software and ask if they would accept your cassette as a trade-in on the disk version.

Hold the ROM-pack cartridge with the slot toward you and the label facing up. The cartridge-select land will be the leftmost land. You should put a piece of cellophane tape or equivalent on the top and bottom of this land, being careful not to cover any of the adjacent lands.

The directory-print program sets the printer baud rate in line 30 with a POKE 150,41. Change the printer baud rate to 87 for 600 baud, which you have, or to one for those of you with 9,600 baud printers.

Q. I have a Model III disk drive and a Model III disk-drive cable. I would like to use it with my CoCo 2 using the J&M disk controller card. The disk was a number 3 drive and I believe that it uses the cable to determine the drive number rather than a jumper in the drive itself.

Can you tell me why you can buy expansion boards so cheaply for the Commodore 64 as compared to the price for expansion boards for the CoCo? I have seen ads for expander boards for the Vic 20 that allow 128K through bank selection. Does anyone make anything similar for the CoCo?

Ahsan A. Akmal
Chicora, PA

A. Look at the disk-drive cable connector that connects to the drive. If there are teeth missing, you are correct that the drive cable determines the drive selection. The Radio Shack Color Computer disk cable would then work with your Model III drive. Another problem you will have is that the disk controller requires 12 volts dc. This voltage was supplied through the computer ROM-pack slot in the original CoCo. The CoCo 2 is strictly a 5-volt dc machine. Therefore, you must run a jumper wire from the disk-drive power supply, or from an external power supply, to provide the 12-volt dc to the disk controller. Consult with J&M Systems Ltd., 137 Utah NE, Albuquerque, NM 87108, before attempting this.

Dynamic Electronics Inc., P.O. Box 896, Hartselle, AL 35640, markets a product called ME-128-64, which expands the Color Computer from 64K to 128K RAM via bank switching. The only problem is that no software has yet been developed that uses the extra 64K. The same can be said for the Vic 20.

Q. I have a TDP-100 with 16K. If I upgraded my TDP-100 to 32K, would I have a 64K computer? If so, would the performance differ if I had the 64K upgrade installed?

Whenever I press the reset button, my tape recorder runs until I release the button. Is there a software fix for this? Is there any way to copy ROM cartridges into RAM and then alter the code? I have the Scripsit ROM pack and would like to make a few modifications to it. I know you can do

this using Radio Shack's Multi-Pak Interface, but it's out of my budget range at this time.

John Bednarski
Greenfield, MA

A. Yes, when the 4164 chips are installed to give you 32K, they will actually be giving you 64K of RAM. It makes no difference who does the installation, but beware of those who are using piggybacked 16K chips.

Stopping the recorder from running during a reset would require a hardware modification.

You can save the ROM pack's code onto tape using a CSAVEM command. You can then load it into RAM after bringing the machine up in 64K mode. ROM packs have a starting address of &HC000, an EXEC address of &HC000, but the end address varies. If you have a disk system, the process is more complicated because the DOS normally resides in the same address space as the ROM-pack code. To run ROM packs from disk, see "Disk Utilities," *HOT CoCo*, September 1983.

Q. I enjoy your column immensely, so I hope Barry Hornstein (March 1984, p. 136) doesn't sue you for malpractice for your diagnosis of his keyboard rollover problems. The original CoCo operated as you explained it. However, as the proud owner of a new 64K CoCo with the 1.2 version of Color Basic, mine works differently. I loaded a program that expected the rollover table to become $FF when the key was released and found that the 1.2 ROM does not change the value back to $FF until a new key is pressed. Fortunately a small but annoying adjustment will repair the damage. To cause the 1.2 ROM to function like the original CoCo, you simply POKE the value 255 into the rollover table after PEEKing. Do you know why these changes to the rollover table were made? Incidentally, your keyboard rollover table was missing the line for value 247.

Charles H. Styer
Tifton, GA

A. I guess we're both right on this one. I was referring to the differences between the 1.0 and 1.1 ROMs. I ran a test program with the 1.1 and 1.2 ROMs and sure enough, both of our stories checked out. The missing line from the keyboard rollover table is:

X Y Z ↑ ↓ ← → space 247

Perhaps they changed the rollover table to squeeze out a few more bytes. It sure can give programmers a headache when they need to worry about being compatible with three different ROMs.

Q. I installed 64K in an E board CoCo with a kit from Green Mountain Micro. I get a PRINT MEM of 24871. I ran the memory test program from your March 1984 column and my computer hung up at EXEC 32382. Does this mean I made a mistake in my installation?

Jack Mesick, Jr.
Key West, FL

A. Somebody goofed. The lines 10, 70, 80, and 170 need correction. The corrected lines are:

```
10 FOR I=32382 TO 32407
70 DATA 255, 223, 167, 128, 183, 255, 222, 140
80 DATA 255, 0, 38, 241, 183, 255, 223, 28
170 IF PEEK(49152)=68 THEN S=&HE000 ELSE S=&HC000
```

Sorry for the inconvenience.

Q. I have a D board 16K CoCo and I would like to expand it to 64K. Why can't I use the Basic 1.0 ROM instead of replacing it with the 1.1 or 1.2? My local Radio Shack store will not sell me the ROM without the "required" installation. I cannot stand the thought of being without my CoCo for two weeks or longer, so what can I do?

Which type of monitor should I buy? I plan to use VIP Writer in its 85-character-per-line mode and possibly purchase an 80-column board.

L. R. Jansen
Trumansburg, NY

A. In the center of page 16 of the Motorola documentation for the 6883 SAM chip, under the heading "Important," it states "Be sure to program the SAM for the correct memory size *before* using RAM." The problem with the 1.0 ROM is that its code programs the SAM for only 4K or 16K dynamic RAMs. The 1.1 or 1.2 ROMs will program the SAM for 64K RAMs if they are present. There are advertisers in this magazine that will sell you the ROM without installation, or you can order it from Radio Shack, part no. AXX7072.

Do not count on using the 85-column mode too much. It uses a 3-by-8 dot matrix with no spaces between the characters. You cannot solve this with software; it is a hardware limitation imposed by the 6847 VDG. To get an improved text display (greater than 64 characters per line), you need a card that bypasses the 6847 and uses its own CRT controller such as the 6845. You can get a monochrome high-resolution monitor that mates with these 80-column cards for about $100.

Q. Recently I had my 16K CoCo upgraded to Extended Basic, but I didn't know it would take away 6K of my memory. Will I still be able to use 16K software that I might purchase?

Ryan Moody
Shawnee, OK

A. You lost the 6K because Extended Basic sets aside 6K on power up for graphics screens. It is as if you had typed PCLEAR4 immediately upon power up. If you are going to run a Basic program that does not need four pages of graphics screen, you can PCLEAR a smaller number. This frees up 1.5K for each page freed. For some reason, Radio Shack chose not to allow the command PCLEAR0, but you can still do it by typing POKE25,6:NEW and you will then have as much memory available as you did before installing Extended Basic. When a machine-language program is advertised as 16K, they are referring to a machine with 16K RAM and that is what you still have.

Q. I am entering college in the fall and I would like to pursue a career as a programmer/systems analyst. There are so many computer languages available (Cobol, Fortran, C, Pascal, Ada, BAL, etc.). Which ones are the most important in terms of my career goal?

Gary Hansen
Salt Lake City, UT

A. Let me borrow a quote from George G. Dodd of General Motors Research Labs:

> We use Cobol as a primary programming language, Fortran as a secondary language, and PL/I least of all across the whole industry. These are our languages and probably will be our languages forever. Lots of programs are written in Cobol and Fortran and won't be changed. So our first problem is that our students sometimes can't talk the language of the streets.

There have been many languages introduced over the years and the new ones always have features that are not available in Fortran and Cobol, but the best of these features eventually get incorporated into Cobol and Fortran.

I suggest that even if your program does not require you to do so, take courses in Cobol, Fortran, and Assembly language. The first two are needed because of the aforementioned reasons, and Assembly is needed because it is the course in which you learn how a computer works.

Q. I am new to computers and enjoy and get a lot out of *HOT CoCo*. Can you tell me how to get a machine-language program that has an autostart in it to keep from executing so that I can get the begin, end, and start addresses?

In addition, I am getting ready to buy a disk drive, but am confused about the advertisements I see. If I buy a drive with a Radio Shack controller and cable, can I still use Flex or OS-9 or do I need a special cable or controller? Just what do I need to get up and running?

Randy Stewart
APO NY, NY

A. There are two ways to cause a machine-language program to autostart. The most common is to append an autostart bootstrap program to the front of the program. This bootstrap is a small program that is loaded over several of Basic's pointers. The program then automatically starts execution when it finishes with the CLOADM. This method is easy to defeat, but requires a lot of machine-language savvy.

To avoid this autostart, you must offset load the bootstrap so that it does not change Basic's pointers. Disassemble it and change it so that the JMP instruction is changed to an RTS. You will also need to determine the start, end, and EXEC addresses from the code in the bootstrap program. To back up the machine-language program, CLOADM the bootstrap with an offset that keeps it out of the memory being loaded with the machine-language program. Use a machine-language monitor, such as Cbug by The Microworks, to change the JMP to an RTS. EXEC the bootstrap program to load the machine-language program. When the cassette stops, use CSAVEM to make a backup of the machine-language program. The backup program will not be an autostart program, so you can put it on disk. Remember, machine-language programs that start below $0E00 require special handling for disk systems. The procedure for saving them to disk was outlined in "Disk Utilities" (*HOT CoCo*, September 1983).

The second autostart method is to save the program on a machine with more memory than the machine it is to execute on. The program is saved so that when it is loaded on the smaller machine it writes its execution address over the system stack. When the CLOADM routine finishes loading it executes an RTS instruction that returns to the address on the stack. The easiest way to defeat this is to get more memory so that the Basic system stack is not overwritten. On a 16K machine you can go to 32K. On a 32/64K machine you need to play games with the Basic ROM. The correct procedure was outlined in "40K Color Basic" (*80 Micro*, May 1983, p. 212).

Your disk question is not as simple as it sounds. The Radio Shack drives are 5¼ inch, soft sectored, 35 tracks with 48 tracks per inch (tpi), double density. Any soft-sectored drive that works with the Model I/III/4 will work with the CoCo. There are some non-Radio Shack disk controllers around, but the popularity of the Radio Shack controller justifies using it. On Radio Shack's disk drives, the drive selection is done by removing teeth from the cable/drive connector. For many drives, this is not acceptable. The Western Digital 1793 floppy disk controller does not support side selection for double-sided drives. To use double-sided drives on the CoCo, the drive 3 select line is used. If the teeth are missing to send the drive 3 select to the drive, you cannot use the second side of your double-sided drive. You can buy cables with all the teeth intact from other sources. You can also buy 80-track drives for the CoCo. These drives record at 96 tpi! If you use one of these drives, we strongly recommend that at least one of your drives be of the 48 tpi variety.

The Flex and OS-9 operating systems will run on a single-drive system. However, due to the amount of software provided with them, we recommend a dual drive CoCo for these operating systems.

Q. I have seen ads for color monitors that say fully compatible with the Color Computer. How will CoCo graphics on such a monitor compare with its graphics on a regular TV? Also, Commodore makes a nice monitor that's very inexpensive ($222). Is it possible to hook it to the CoCo, and will the improvement in picture quality be worth it?

Tony Whitaker
Blacksburg, VA

A. The composite video monitors you are referring to are essentially TV sets with the tuners removed. There are a number of TV sets on the market that have direct video connections so that they can be used as both a television and a monitor. The picture quality will improve with a monitor. However, if you are already using a high-quality TV (such as Sony or Sharp), the improvement will be negligible. We recommend buying a high-quality TV with the direct video connections instead of a dedicated monitor. That way, when you outgrow your CoCo, you can still use it to watch the Redskins on Sunday. Remember, to get direct video out of your CoCo, you must bypass the RF modulator in the computer. ■

REVIEWS

CONTENTS

Disk Fix and Utilities	**96**
Grafplot v1.1	**98**
Magigraph	**102**
Video Reverser	**104**
TCE Math Package	**104**
Chess-007	**106**
Gameware	**107**

Willy's Warehouse, Waterloo, Mr. Dig, Time Bandit

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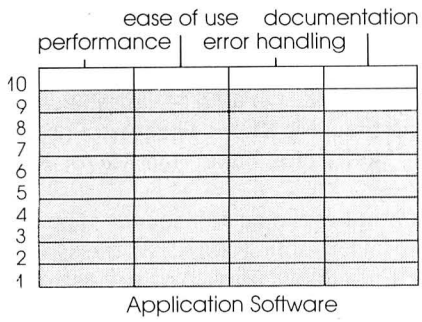

Disk Fix and Utilities
Computerware
P.O. Box 668
Encinitas, CA 92024
619-436-3512
64K, OS-9
$29.95 disk

by Douglas L. Swank

Disk Fix and Utilities is a group of useful OS-9 utility commands and a set of new disk-driver modules that let you use double-sided and high-speed drives from non-Tandy suppliers. One command lets you instantly alter the step speed or number of tracks of the drives currently connected, and you also get procedures for customizing new master disks to your system needs.

OS-9 has been available for other systems for five or six years, and the professional polish on these utilities makes me suspect the package was rewritten for the CoCo from bigger systems. If so, you can enjoy the benefit of all the debugging and fine-tuning at a very modest price. Programs such as these make me regret all the time I wasted learning CP/M.

Error Handling

Error handling for all commands is done in OS-9's usual friendly manner, and a look at that feature might make users of other systems jealous. Type a command name and you get a thumbnail sketch of the expected format.

This built-in help feature sometimes appears if you call a command with invalid parameters. Calls with minor errors revert to the OS-9 system error messages. In either case, the command is not executed, so no harm is done.

Documentation

The documentation is as good as the error handling. The instructions clearly explain options and defaults and give examples. Most commands have parameters following the name, and the manual uses the same symbols and syntax as the Tandy manuals. Even the manual's page size and typeface are similar, which induced me to copy the book and tape its pages into the back of the Tandy manual.

Ease of Use and Performance

All utilities perform well and are easy to use. Simply copy a utility to your system CMDS file, and you have a new and powerful command. However, you must include the modules to redefine disk drives in a new boot package, so users of exotic drives have more work to do. All commands performed perfectly during my single- and multitasking checks.

The DMODE and NEWFMT commands let you set up drives and format disks to any number of tracks from 1–40, single or double sided. These require the new boot pack mentioned above, but they will be very useful if you have fast drives from third-party suppliers. (Flex users also have this capability, and I've seen dramatic demonstrations of how access time improves on drives with faster step times.)

You can use the DIRCOPY utility with all systems, and it alone probably justifies the cost of the entire package. It's a sort of super-backup routine, and includes all the options I've ever wished for in the original system.

It gives a yes/no prompt for each file copied, sorts new disk directories into alphanumeric order, copies subdirectories, rewrites only outdated files, and more. It has an impressive range of options, and, best of all, when you use it with no options, it behaves exactly like the original OS-9 COPY module.

Unlike the Microware BACKUP routine that blindly creates a clone of the old disk, DIRCOPY creates new directories and repacks the files as it copies them. A bit of judicious selection produces a new disk with more free space and faster access to most-used files. (The first files or directories you copy seem to have the shortest access time when called later.)

The penalty here is slower operation during backup and the need for some user input as the disk is copied—a small price to pay for creating a new, customized system disk.

Basic-09 users can call system commands within Basic programs, and they could use DIRCOPY as a one-line file-backup routine in a database. Its prompting and selective copying make it a natural for such an application.

The commands PATCH, FILELOOK, and COMPARE are most useful to machine-language tinkerers. COMPARE compares a disk file with a module in memory, and would be invaluable if you wanted to see if bytes had been changed in the version in memory. PATCH lets you change individual bytes of a disk file, and FILELOOK produces a listing of the size and type of modules in a disk file.

The step-by-step notes on creating a boot file with the new disk modules seemed a bit roundabout, but did work. As the authors mention, there are many other ways of doing this, and they include all essential modules.

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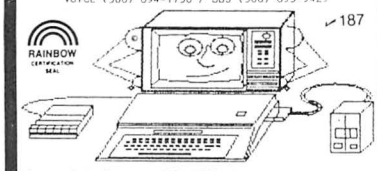

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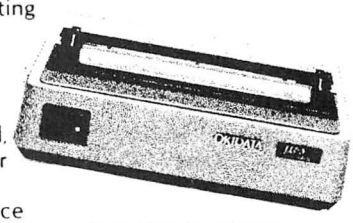

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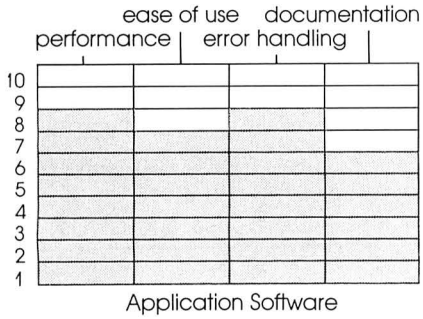
The suggested method is a good choice for new users with nonstandard drives and modest experience in altering the boot file. You also get notes on doing this procedure with a single drive. The modification programs are supplied as OS-9 procedures, which are in plain text so you can easily edit them.

The complicated boot procedure does add some difficulty to the documentation. Otherwise, all of these utilities performed perfectly, and I found that the DIRCOPY and NEWFMT utilities were excellent in performance and error handling.

The package is a good value for any serious OS-9 user, especially if you own fast disk drives. ■



Grafplot v1.1
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by Scott L. Norman

Hawkes Research Services' Grafplot v1.1 uses the CoCo's high-resolution capabilities to create line graphs and scattergrams on a 220-by-174-pixel plotting area. It can handle data entered from the keyboard or from a prerecorded file, and can also calculate its own data points from any equation you insert into the program's Basic code.

There are several options for controlling the appearance of a plot, and the hooks for interfacing to screen-print routines are all in place. As a bonus, you get a version of Radio Shack's Screenprint driver for the Shack's own printers.

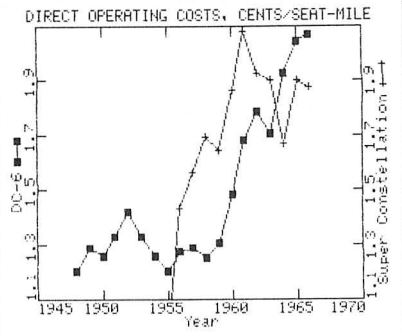

Fig. 1. A typical Grafplot graph, with separate vertical axes for the two data sets.

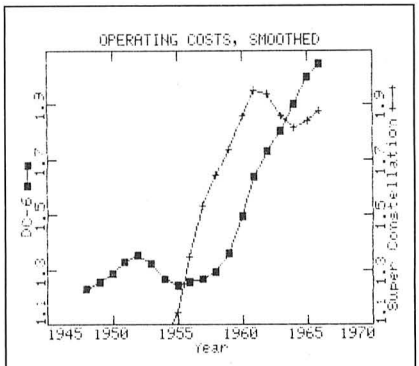

Fig. 2. The same data, smoothed by a five-point binomial-smoothing algorithm.

A recent upgrade from version 1.0 to 1.1 has significantly increased Grafplot's capabilities, but it has made the documentation less manageable. My review copy of the manual came with seven pages of changes, many of them significant; it was often necessary, and inconvenient, to refer to both sets of instructions during operation. However, Hawkes Research has promised a new, unified edition.

Performance and Ease of Use

Grafplot is capable of straightforward handling of most conventional graphing chores. An auto-prompting feature speeds things along by leading you through the most often-used options, so if your requirements are not too exotic, you can create graphs quickly.

This isn't to imply that you have to settle for bare-bones presentations; standard features include:

- Two independent vertical axes, with the option of using different scales to plot multiple data sets on a single graph.
- Three graphing symbols—point, cross, and filled square—and single- or double-thickness connecting lines. You can leave data points unconnected for scattergrams.
- Automatic scaling of any or all axes so as to make the best use of the plotting area. Scale factors *are always* chosen to place the automatically-generated tick marks at sensible intervals—not 1.3472 units, or anything of the kind.
- The ability to use both upper- and lowercase characters and punctuation marks in the graph title and in labels assigned to the axes.

Other options further enhance the usefulness of the program; I'll discuss some of them later.

In addition to the plotting routine itself, both tape and disk versions of Grafplot contain files required for printing graphs. One is SCRPRT, Radio Shack's own driver. 32K versions of Grafplot use a new version of this file, relocated to live at the top of memory. This is the routine to use if you have one of the Shack's Line Printers or DMP-series machines.

You also get a SETUP file that relocates any suitable screen print utility to make it available to Grafplot. By suitable, I mean that the screen printer should be less than 655 bytes long, and should have the same addresses for loading and execution.

As a matter of great practical importance, the programs in Custom Software Engineering's Graphics Screen Print Routine (GSPR) series satisfy these criteria. Grafplot's opening menu explicitly asks whether you want to use one of them, or the Radio Shack routine.

After you load the screen-print program, Grafplot asks for your method of data entry: tape, disk, keyboard, or user-defined function. The manual describes the file structure in detail, for those wishing to write Grafplot-compatible output routines for their own applications programs. You use conventional Extended Color Basic syntax to place the user-defined functions in a particular line of the program.

Figure 1 is an example of a typical Grafplot application: comparing the operating costs of two commercial aircraft of the 'fifties and 'sixties. With two axes (you can have one or two), Grafplot will plot scales along both the left and right sides of the graph.

In the auto-prompt mode, the pro-

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3	8	13	18	23	153	158	163	168	173	303	308	313	318	323	453	458	463	468	473
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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
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415	Chesstech, Ltd.	105
560	CHF, Company	110
461	Chroma-Systems Group	114
219	Cigna Company	33
561	CoCo Pro	111
121	Cognitec	9
455	Compukit Corp.	109
18	Computer Plus	7
506	Computer Systems Center	15
507	Computer Systems Center	60
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557	Creative Technical Systems	112
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331	Rainbow Quest	101
*	Shelf Boxes	86
331	Wayne Green Books	83
536	Cybertron	114
213	Data-Comp	97
565	Derringer Software	110
209	Dorsett Educational Systems	17
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27	Dragon User	109
447	DSS Peripheral Corp.	55
72	Dynamic Electronics	75
216	EAP Company	87
261	Frank Hogg Laboratory	86
98	Green Mountain Micro	51
9	H&E Computronics	CIII
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559	Hawkes Research Services	111
359	Homebase Computer Systems	91
*	HOT CoCo	
	Advertising	101
	Back Issues	100
	Dealer Sell	54, 87
	Foreign Dealer	74, 114
	HOT CoCo Subscriptions	18
	Instant Coco	35
	Mailing List	49, 75
	Moving	87
	Subscription Problems	100
91	Incentive Software	33
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187	Int'l Color Computer Club	97
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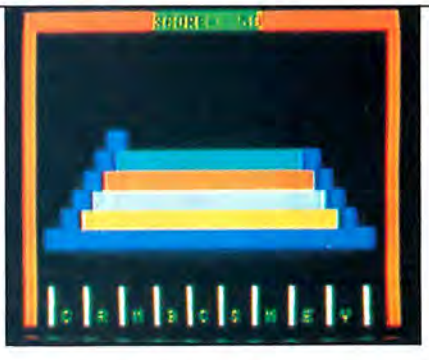


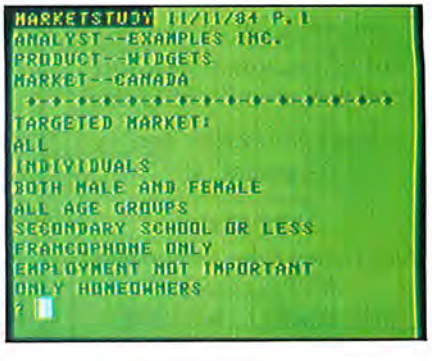
Then there's Carl The Robot, David Meredith's feature article on the Logo-like language and its uses with a robot (named Carl, of course). Meredith will challenge and entertain you.

Or, you can learn how to build the Co-Co Mouse, a small robot device, in the third installment of J.J. Barbarello's "ROM Hacker" series.

If you have some potential young programmers who still don't know their way around the keyboard, "Typing Teacher" will solve your problems.

For the adult student of serious marketing, September's "Market Study" program is a necessity in determining the best possible market for your product.

Read all this and more in next month's *HOT CoCo*.



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gram will only accept data for two Y-axes when the X-axis values are identical for both data sets. In other words, I could use the auto-prompt mode to generate Fig. 1, because I had two sets of figures for the same series of years. If you want to plot multiple sets of data with different X values, you must use Grafplot's detailed main menu to manually set all the plotting parameters.

You can enter data as follows:

- X, Y, & Z—best used when the X values are not separated by a constant step size;
- Paired Y & Z—for use when it is convenient to enter the two values corresponding to each X, one after the other; and
- Separate Y & Z—for times when it is easiest to go through the entire list of Y values, then return to do the Zs.

You can only use the second and third options when the values of X are separated by a constant increment.

After I entered all the Y and Z values in my example, Grafplot sorted the data into ascending order according to the values of X. This is really only necessary for the X, Y, & Z mode, in which there is nothing to force you to enter data points in X order.

Note that the program always keeps track of the variable to which every entry belongs, though, so it won't confuse a Y with a Z or X—as long as you don't!

With all the data in place, the program turns to prompting for the various labels and plotting symbols. First it requests the label for the X axis; you can use up to 40 characters, and there is an on-screen guide to how much space remains.

Next, you can label the Y axis with up to 28 characters, and you must specify the type of plotting symbol and line to be used for the Y data. This is then repeated for the Z axis. Finally, you enter the title for the entire graph.

Grafplot gives you the option of defeating automatic scaling for any or all of the axes. If you specify complete auto-scaling, it will draw the graph at this point; otherwise, you have to make your selection for each axis in turn before you can see the results of your labors.

Why would anyone want to do without automatic scaling, if it gives such nice results? One reason might be that the automatic-scaling routine can be too loyal a servant; it always sets the axes so as to display *all* of the data.

If you select the minimum and maximum for one or more axes yourself, you can use Grafplot as a window into part of your data set. In effect, you can zoom in to examine small variations that might be lost if you were to use too large a scale.

I chose total automation for my example, however, and I think you'll agree that Grafplot did a fine job. Take a close look at Fig. 1 and notice that it arrived at reasonable intervals for all axes. The years, which were entered as integers, stayed that way; I have used other graphing routines that would try to give me dates like 1955.00.

Also, note that the vertical axes identify the data to which they refer. The little keys explain that the black squares represent the Douglas DC-6, and the crosses represent the Lockheed Super Constellation. It just so happens that both vertical scales were the same here, but that has nothing to do with how the program functions.

"Grafplot is a high-quality product for general use..."

Grafplot has a few more special features that deserve mention. One which is especially valuable for emphasizing major trends is the binomial-smoothing option. This replaces every data point with a weighted average of its own value and the value of other points on either side. The net effect is to smooth out any sharp local peaks and valleys in favor of long-term trends.

Figure 2 is an example of 5-point smoothing applied to the data of Fig. 1 (this means that it averaged each data point with the two points on either side). Things have become noticeably smoother, at the cost of a little accuracy. The smoothing operation destroys the original data for your graph, so the program cautions you to make a copy before proceeding.

You must run multiple data sets like

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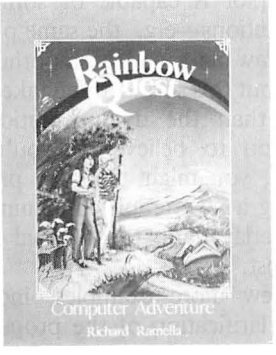

Rainbow Quest has 25 programs in all. Book and software are sold together in a protective storage binder with complete instructions. Each **Rainbow Quest** package for the **Color Computer** is $24.95.

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those in my example through the smoothing routine one at a time.

There is also a numerical integration option, by means of which Grafplot can calculate the area under a curve. As the documentation points out, you can also use it to evaluate the definite integral of an algebraic expression.

The trick, of course, is to use the expression as a user-defined function and graph it. Use the trapezoidal approximation, and you can achieve four-figure accuracy for an integral, if you employ Grafplot's full capacity of 200 data points.

These two options are reached through the program's 16-entry main menu, which never even appears during a completely automated plotting cycle like the one in my example. It does appear if you decline the auto-prompting option at the outset, however, and you can reach it from the seven-item graphing menu (the normal exit route from a graph drawn on the video display).

Other items on the graphing menu let you save, load, or print out complete graphs and draw overlays (additional data points added to an existing plot). The main menu, on the other hand, provides a complete set of options for data manipulation, setting labels and plotting symbols, and so forth.

This certainly represents a great deal of versatility, but be warned that Grafplot's advanced features are not so easy to use. The overlay feature, in particular, takes a little work. This is a subtle point in most graphing programs, though, and some of my difficulties are tied up with the present state of the documentation. I'll discuss that shortly.

Error Trapping

Grafplot is robust. Most common slipups (entering an alphabetic character where a number is needed, for instance) merely result in a request to reenter the information. The program reminds you to place the data disk in the drive (only one drive is supported) whenever you save a graph to disk, and then you receive an "Are you sure?" message.

Hitting the break key at certain sensitive points can crash the program, but it is often possible to restart without losing data; the manual specifies several entry points. Although there

"Grafplot is capable of some slick presentations... but this sort of thing takes more doing than the documentation can lead you to believe."

are several common routines to disable the break key, it might be a worthwhile feature for the vendor to add.

An incorrectly entered data point or two need not spell disaster. You can always edit or delete data by means of main menu commands, and you can even ignore "outlier" points when graphs are drawn.

Documentation

I've already mentioned that I received a transition edition of the Grafplot manual, consisting of the version 1.0 book and a set of supplementary sheets for version 1.1. I don't want to dwell on the difficulties of using two sources, since it's clearly a temporary arrangement, but there are a few areas that could stand improvement—even if the existing material were edited into one manual.

Grafplot is capable of some slick presentations—e.g., the same plot can show raw data and a smoothed version—but this sort of thing takes more doing than the documentation can lead you to believe. If you're not careful, you might find the program drawing a new graph containing only the overlay data, the original having been lost.

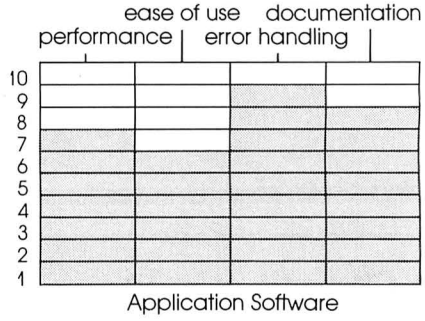
A few more examples, including some clarification of the proper time for changing the overlay's plotting symbol, would be most welcome. (In contrast to the original graph, overlays seem to require specification of the plotting symbol before data entry begins.)

It would also be useful to have a definition of the offsets requested by the graph-printing routine. By experimenting, I found that an offset of 16 roughly centers a graph on the page, but it would be nice to know for sure.

There are a couple of screen prompts that don't offer all of the permissible responses, although they do appear in the printed documentation.

With the exception of the overlay problem, however, I think these are minor criticisms. I have given Grafplot's documentation a so-so rating primarily because of the interim nature of the material I was able to examine.

This is still a high-quality product for general use; the binomial-smoothing routine is an especially welcome touch. The biggest remaining deficiency I have found in the entire program is the lack of a way to suppress numerical values on the X axis in favor of alphabetical data. I often want to use labels like Jan, Feb, Mar, etc. for graph coordinates, and right now I can't. Maybe next time. ■



Magigraph
The Micro Works
P.O. Box 1110-D
Del Mar, CA 92014
619-942-2400
Extended Color Basic
$34.95 16K cassette
$39.95 32K disk
$44.95 Amdisk cartridge

by Gary L. Matthews

Magigraph is an ingenious and useful, although highly specialized, means of creating high-resolution graphics.

Since the ads state that the program will "turn your Color Computer into a graphic-design center with the ease of a keystroke," I expected Magigraph to be a general-purpose graphics editor. Alas, it is not. If you don't already have the tools and talent to create excellent graphics, you probably won't have much use for this software. But if you have the skill, it can add some nifty refinements and special effects.

Magigraph provides a magnified view of a portion of the graphics screen on which you can draw detailed images. However, you must do so one dot at a time. To draw lines, circles or arcs, or to fill in designated areas with color, you must use Basic routines.

Offsetting this apparent drawback are a variety of powerful functions for manipulating an image once you've created it. You can rotate, invert, copy, or merge segments of the screen with other segments; and you can apply Boolean logic operations—AND, OR, NOT, and EXCLUSIVE OR—to screen contents in various ways for special effects. Other features let you use images in Basic or machine-language programs once you've created them.

The display presents either the graphics screen on which you are working, or a "design window" that shows a close-up portion of your picture. The enter key switches between the two. The design window actually is the standard text screen, except that Magigraph reserves the left half as a window on which you draw an image.

This window consists of a 16-by-16 matrix of graphics blocks, corresponding to a 16-by-16-pixel portion of the graphics screen. Since text-screen blocks are not always the same shape as graphics-screen pixels, this means you will see a highly elongated close-up in the higher-resolution modes. Some people might find this hard to get used to, but it didn't bother me.

The right half of the text screen shows information regarding the status of the image on which you're working. Adjacent to each row of the design window is a readout, in hexadecimal notation, of the memory contents of the four bytes controlling that segment of the screen. Since each byte is represented by two hex characters, this consumes an 8-by-16 section of the screen. The remainder of the screen—the entire right-hand quarter—is devoted to auxiliary information that includes:

- The current background color—selected from any of the eight available (green, yellow, blue, or red in Color Set 0, or white, cyan, magenta, or orange in Color Set 1). Selecting a background color forces the program to use the color set to which that color belongs.

"You can dump any image stored in Magigraph's design window to a printer."

- The current graphics mode—Magigraph supports PMODE 4, PMODE 3, PMODE 1, and the G2C mode, which is not available from Extended Color Basic. The latter has the advantage of having pixels that are the same shape as the graphic blocks used in the design window, so that the shapes being viewed correspond perfectly. This is the mode to which Magigraph is set on power up. Pressing one of several numeric keys (or the * key for PMODE 4) selects the mode.
- Cursor direction indicator—the arrow keys move the cursor around the design window, either one pixel at a time or in jumps. Touching the first letter of a color will set the pixel under the cursor to that color, and move the cursor in the direction indicated by the last arrow movement.

In doodling with Magigraph, I found that this created an annoying tendency for the cursor to move in an undesired direction, and I would prefer that The Micro Works omit this autoincrementing.

- The cursor's absolute coordinates on the graphics screen, in hexadecimal—the documentation tells you how to use this to help read an image into Magigraph from, say, a photograph traced onto graph paper.
- Whether the design window is locked or unlocked—controls what happens when cursor movements cross the boundary of the design window. In the locked condition, they wrap around within the design window, which stays put relative to the graphics screen. When unlocked, they cause the design window itself to move one byte across the graphics screen in the direction of the arrow command.

Along with the color-setting and cursor-control commands, there are one- or two-key commands for clearing the design window, pushing or pulling whole rows or columns of pixels in any direction, and rotating and inverting the screen. A shifted I, for example, changes the window to its mirror image, while a shifted T rotates it 90 degrees counterclockwise. These commands let you show a character, once drawn, in any position within the design window.

When you toggle to the graphics screen, the design window appears as a relatively small square, or cursor window, that you can move quickly around the screen. Pressing the G key from the graphics screen places the current contents of the cursor window in a buffer from which it can be copied to other locations on the screen.

In copying, you can also modify these contents as described above, or you can merge them with other screen images using the AND, OR, NOT, and EXCLUSIVE OR options. This can cause color changes and inversions, picture mixing, and a variety of other effects.

Magigraph also has nine animation buffers designed for storing minor variations of one figure and reviewing them rapidly, so you can check the smoothness of an intended animation effect. Pressing the 1–9 keys sends the corresponding buffer to the screen. If you don't want to use them for animation, you can use these buffers in much the same way as the regular GET/PUT buffer.

You can dump any image stored in Magigraph's design window to a printer, along with its pixel codes. This makes it easy to create the tables needed to use such an image in a Basic or Assembly-language program.

In general, then, Magigraph can be useful for any graphics project that involves highly detailed, close-up work and repetitive small patterns. It is not especially helpful in drawing landscapes or other images involving broad splashes of color, random shapes, and nonrepeating patterns.

If your work requires detailed lettering or the character-set design for the CoCo's hi-res screen, if you design small animated figures and arcade games, or if you simply like to doodle out complex, abstract images, you are likely to use Magigraph often. And, of course, it is ideal for doing touch-up work and adding detail to graphics screens created by other programs or utilities.

I also found I could use Magigraph to mix colors, although the manual doesn't mention the technique. In the higher-resolution modes such as PMODE 3, a checkerboard pattern of dots produces the effect of a secondary color not normally available. Red and yellow produce orange; red and

blue produce purple, and so on.

Magigraph made it easy to fill the design window with such a checkerboard pattern, then use the GET/PUT options to replicate it over wider areas of the screen. I could then carve out areas covered in this way into more detailed shapes, using Basic commands or Magigraph itself. (Of course, the Micropainter ROM pack from Radio Shack does the same thing and paints complex shapes automatically; but it is not available on disk, which drastically limits its usefulness.)

Magigraph supports cassette or disk operations; a short, resident Basic program handles disk I/O, much as it is done in the Telewriter word processor. The manual lists the source code for this program, so you can upgrade the cassette version to disk simply by typing it in.

Magigraph features abundant error-trapping; it asks you to confirm I/O commands that might destroy screen contents, and some commands automatically abort if conditions are not right. Thus, the program will not try to print if the printer is off, it will refuse to load cassette files that are not in the right format, and so on.

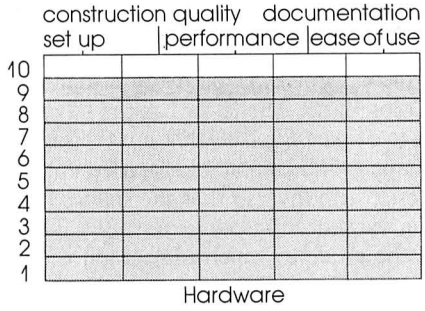
Magigraph lets you exit to Basic and return without harming screen or buffer contents. I tried running Magigraph simultaneously with a Basic picture-editor program from an old issue of *80 Micro* and found that I could switch between them at will, using the Basic program to draw and paint the shapes that Magigraph could not, then using Magigraph to enhance and refine the pictures so created.

I was not able to determine whether Magigraph is compatible with the X-Pad graphics tablet, but it works fine with the Radio Shack digitizer, which I use in lieu of a tablet.

Magigraph's documentation is neat and professionally done. It comes with a wealth of charts, illustrations, tables, and appendices and includes quite a few sample files along with explanations of how they were produced. The manual lists Basic and Assembly-language programs that use Magigraph to create animation.

My most serious complaint about Magigraph is the way the design window moves around the screen one byte at a time. Since each byte typically controls four pixels, this means the window always stops on a four-pixel boundary. In using the GET/PUT functions, I often wished I could move the window smoothly and stop on any given pixel.

So, don't expect Magigraph to perform miracles, but if you are a serious graphics programmer, you may well find it a handy addition to your software toolbox. ■



Video Reverser
Dynamic Electronics
P.O. Box 896
Hartselle, AL 35640
$19.95

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

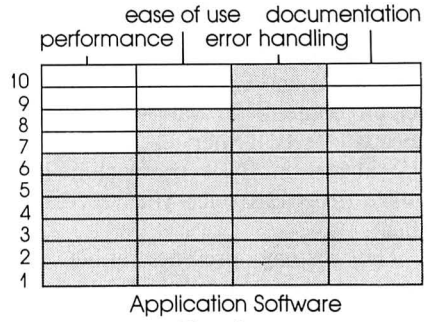
The Video Reverser is a piece of hardware that will let you switch to a green-characters-on-black-background display. It is unique in that it requires absolutely no soldering, because it uses eyelets in place of solder joints. And it is quick and easy to install.

The kit consists of a short cable, an IC that mounts on top of the Video Display Generator (VDG) chip, and a three-position toggle switch that lets you select one of three display formats. You can switch to green upper- and lowercase characters against a dark background, all green capitals against a dark background, or the normal black-on-green display.

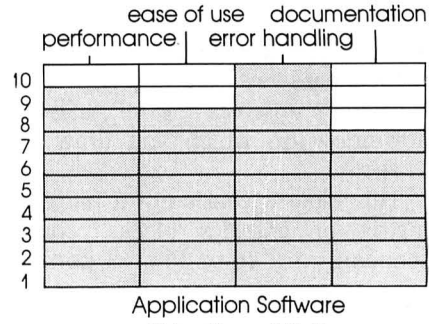
To install the device, remove the VDG chip from its socket, slip the Video Reverser IC's eyelets onto the designated pins of the VDG chip, and then put the chip back into its socket. Double-sided tape holds the two ICs together. Next, drill a ¼-inch hole in the upper part of your CoCo's case, through which you mount the toggle switch.

Even though the reverser doesn't require soldering, you probably should regard it as a permanent addition. The instructions tell you to bend pin 32 on the VDG chip so it won't create a bridge after you reinsert it into its socket. To try to bend the pin again would probably break it off.

I prefer this piece of hardware to a software modification that eats up valuable RAM. The instructions and diagrams are clear and simple enough for most people to follow, and the Reverser performs well. It's a simple piece of equipment for $20, but the easy installation is a definite plus. ■



Fractions



Criss Cross Math

Fractions
$16.95 16K cassette
Criss Cross Math
$14.95 16K cassette
TCE Programs Inc.
Box 2477
Gaithersburg, MD 20879
301-963-3848

by John Steiner

Criss Cross Math and Fractions are two Color Basic programs in TCE Programs' series for elementary-level students.

Fractions

Fractions contains two cassettes. The first is a repetitive tutorial on proper, improper, and mixed fractions, and the second is a flash-card type drill and practice of the concepts covered in the tutorial.

Both programs use string graphics to represent wholes and fractional parts of wholes, and graphics numbers for the fractional values.

In the drill, the student can choose the fractional type with which he wants to work. The screen then displays a graphics representation of a fraction, and the student must enter the correct fractional equivalent. If he chose to work with improper fractions, he must also convert them into the correct mixed fraction.

A few notes of music reward the student's success, and the correct answer appears if he hasn't responded correctly after three tries. At any time, the student can press the space bar to return to the main menu for a new choice.

The graphics representation of fractions is an example of the computer's ability to display a concept that is otherwise difficult to demonstrate. In most cases, students can easily see the parts of the whole after working with the lesson only a few minutes.

Fractions would be especially useful as remedial instruction. With the volume turned low, the student who is having trouble with the concepts could get some extra help right in the classroom. The practice tape will keep him busy as long as his attention span holds out.

Fractions

Criss Cross Math

Criss Cross Math

Criss Cross Math is an adaptation of tic-tac-toe. A student can play against the computer, or against another student.

To begin, the screen displays a tic-tac-toe board with the squares numbered 1–9. The student picks a square, which then presents a math problem. If he answers correctly, he gets an X for that square.

As usual, the object is to get three Xs in a row. In the single-player game, you get two tries at each problem. If you fail after two tries, to answer correctly, the computer gets an O for the space. When you or the computer get three Xs or Os in a row, or when you fill all squares, the game ends.

If you fail to answer a problem correctly in the two-player mode, the opponent does not automatically get the square, but must earn it by answering the math problem.

You can play as long as you want in either one- or two-player mode. The main menu lets you choose addition, subtraction, or a mixture of both, and one of five levels of difficulty.

You must answer the problems from right to left, as you would on a sheet of paper, rather than the calculator style left-to-right entry form. For example, in the problem 21 + 35, the student first enters a 6 (5 + 1), then the 5 (2 + 3). This seemed backwards to me, but the student just learning to add and subtract will find it perfectly natural.

Of the TCE programs I have seen, I found this one to be the most interesting and useful for elementary age students. The game can occupy two students at a time, and you get the additional motivation of playing against an opponent.

In conclusion, the single-sheet documentation has been, in all cases, more than adequate to get the programs going. The cassettes come in a hinged cardboard box and provide better-than-average protection and storage.

Both math programs are useful for home and classroom study. Both performed with no detectable bugs, and I couldn't crash them with inappropriate input. Criss Cross Math is more interesting, while Fractions, perhaps of necessity, is repetitive. Both are good examples of reasonable quality, inexpensive educational software. ■

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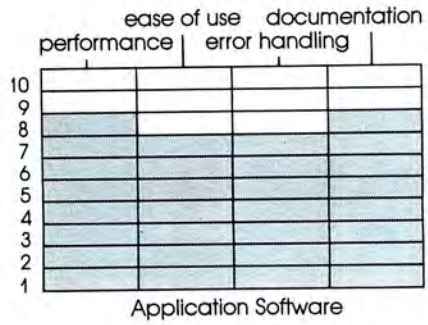


Chess-007
Chesstech Ltd.
3080 Trenwest Drive, Suite 2
Winston-Salem, NC 27103
919-768-2370
32K, Extended Color Basic, 2 joysticks
$59.95 cassette

by Terry Kepner

For the chess fanatic, here's a product to improve your playing skills. Chess-007 is primarily a training and practice program, but it also offers a chess board with built-in time clock, should you wish to play an opponent.

There are really only two ways to improve your chess game: playing against skilled opponents, and studying the games of very skilled players. You might be lucky enough to have a few worthy opponents with whom you play, and there are books available that let you study the masters' games, move by move. But studying these games doesn't let you explore the options that were available to each master at several points in his game. Also, studying from a book requires setting up a chess board and manually executing the moves listed in the book, which leads to possible errors should you misplace a piece, or make a wrong move.

Chess-007 addresses this problem by letting you type in games from these books and examine them in detail. To help prevent typing errors, the program checks each move for legality as you enter it, and leaves space for any comments you might want to include at that point.

Once a game is in place, or as you're entering it, you can add sidelines that explore the possible consequences of playing variations of the moves listed in the book.

An important point to this is that the computer doesn't play against you, it is just the storage medium.

You enter all the moves for both sides, and you use two joysticks for menu and move selection. I would prefer an arrow-key option.

Chess-007 offers a review option that lets you review an in-memory game. You can move either forward or backward through the game, with choices appearing whenever you encounter a sideline. You can also enter comments on the moves.

A play mode lets you enter a game, one move at a time, with options to retract the last move or add comments. You also have options to record, erase, or skip ahead to a spot just after the next prerecorded chess game on the tape.

The tournament-play mode lets you enter the primary and secondary play times and number-of-moves limits. Normally, a tournament game has a 90-minute time limit for the first 30 moves and a 60-minute limit for the next 40 moves (primary, secondary, and number of moves for each).

"Chess-007 is written in machine language and has room for about 1,000 board positions (less with comments), so it's fast and capable."

A faster and more frustrating method is to specify 10-second accumulative blitz. To play this way, put 10 in both primary and secondary time blocks, with the number-of-moves limits set equal to one. As you play, you have only 10 seconds to decide your move, but time saved in the previous move is added to the next. Thus, if you make your first move in three seconds, you'll have 17 seconds for your second move. This type of play places a premium on chess playing and joystick control. You can, of course, use time limits other than 10 seconds.

You can also play skittles, in which you place a time limit on the total game, without regards to single moves. If your clock runs out while you're playing, you lose. If you want to continue the game, reset the clock. If you want handicapping, you can select different limits for the players.

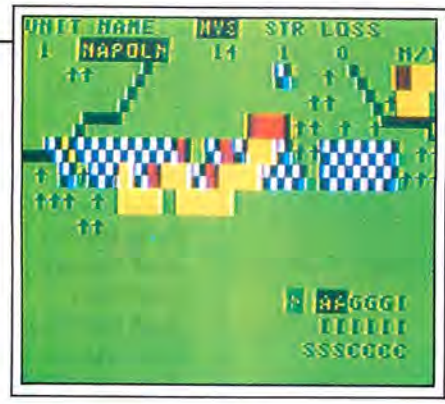
Of course, there is an option for manual setup that lets you lay out the chess board in a configuration other than normal, useful for studying endgame sequences. Legal move checking is suspended while you're setting up this type of game.

Chess-007 is written in machine language and has room for about 1,000 board positions (less with comments), so it's fast and capable. If you're looking for an aid in improving your chess gamesmanship, check out Chess-007; I think it's worth the money. ■

Chess-007

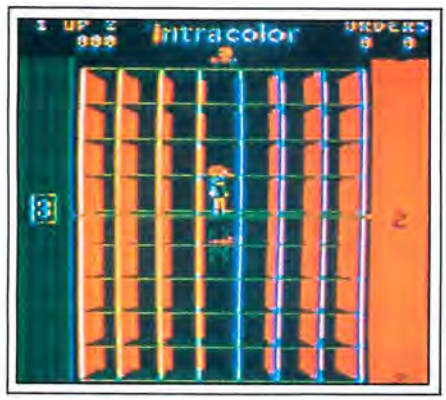
Gameware

Color Computer arcade games seem to be getting better and better. This month I'll look at three new releases that truly live up to that statement. First, however, let's look at something that's a little different.

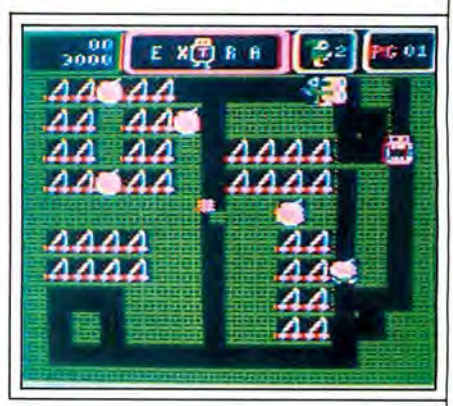


Waterloo

"...arcade games seem to be getting better and better. This month I'll look at three new releases..."



Willy's Warehouse



Mr. Dig

Ark Royal

Waterloo is a game for thinkers. It is a strategy game that re-creates the Battle of Waterloo. You play the part of Napoleon, with cavalry, infantry, artillery, skirmishers, and the dreaded Imperial Guard at your command.

You must deploy your forces and take three towns, hold each for three turns, and then reach Waterloo before time runs out. The trick is to soften up the British and Prussian units with your artillery to minimize your losses in a direct attack. Each unit has a different strength rating, and during an attack strength points are taken away according to the enemy unit's strength, the direction from which you attack, and whether you've benefited from Napoleon's presence.

After each turn you can call up information screens that show relative losses, objectives to be taken, distance to Waterloo, and your troop strength unit by unit.

The playing screen is a fairly good representation of a map, with letters representing Napoleon's forces, blue blocks for British forces, and magenta blocks for the Prussians.

Waterloo is an engrossing and challenging game, but it has a couple of minor flaws. It is dreadfully slow, as most of it is in Basic. Much of the delay occurs between turns when the program sets up the next playing screen. Waterloo has a save-game option, but if you try to load a saved game from cassette and get an I/O error, you must reload the main program before trying again. Despite these faults, I recommend Waterloo to strategy-game fans.

Waterloo requires 32K and costs $24.95 on cassette from Ark Royal, P.O. Box 14806, Jacksonville, FL 32238, 904-777-1543.

Intracolor

It seems as if this company never misses. **Willy's Warehouse** is no exception. It combines constant action and a need for planning ahead to make an original and addicting game.

Willy is always running back and forth on an elevator platform lugging numbered boxes from one side to fill the orders on the other. The trouble is all the little critters running around making life difficult. If Willy is smart, he stores as many boxes as he can on the shelves found at each level. If he places a box over a question mark, he gets a mystery bonus.

You have the option of using the keyboard or joystick to move Willy, but the joystick is much more effective than the keyboard. The graphics and sound are superb, and the game has a high playability rating; the progression of difficulty seems to be at an ideal pace. You don't suddenly find yourself in an impossible situation, yet things never get slow enough to bore you.

Willy's Warehouse requires 32K and costs $34.95 on disk or cassette from Intracolor, P.O. Box 1035, East Lansing, MI 48823, 517-351-8537.

MichTron

If you like fast, wild, arcade action, **Time Bandit** should satisfy you. You guide a time traveler through time gates into the Old West, fantasy, and space worlds, each with many different screens. You do battle with ghosts, monsters, orbs, gunfighters, and (my favorite) killer Smurfs.

You also have time working against you. You loose energy points once it runs out on a particular screen. You also lose energy when a baddie touches you. Points accumulate according to the treasures you find, things you shoot, and time left when you finish a screen.

The graphics are unequaled. I don't know of any other Color Computer game that has so many objects moving on the screen at once. Time Bandit is one game that you won't "wear out" after an hour of playing.

Time Bandit requires 32K and costs $27.95 on cassette and $29.95 on disk from MichTron, 1691 Eason, Pontiac, MI 48054, 800-392-8881.

Computerware

Mr. Dig is Computerware's latest game, and it upholds that firm's reputation for turning out quality products. Mr. Dig is not exactly fast action, but you must be aware of what is happening on the entire screen at all times.

You control a dwarf-like guy who

High Scores

Name	Game	Score
Tony Galavan Cassidy, BC	Defense	128,385
Michael McDonough Marietta, GA	Megabug	11,171
	Clowns and Balloons	47,000
	Poltergeist	4,785
Woody Woodrum Garrettsville, OH	Klendathu	652,760
Oliver Banta Lincoln, NE	Tut's Tomb	84,420
	Ms Gobbler (level 15)	22,630
Ray Gallantry Brampton, Ontario	Keys of the Wizard (level 1)	632
Dan Shargel Arroyo Grande, CA	Whirlybird Run	78,450
Greg Burke Kenora, Ontario	Colorpede	1,376,460
	Doodle Bug	1,470,200
	Zaksund	556,780
	Ninja Warrior	74,500
	Frog Trek	14,700
M.A. Brickles Allen Park, MI	Scarfman	121,600
Peter Stumpf McHenry, IL	Robottack	1,080,000
	Doodle Bug	880,000
	Trapfall	75,000
	Cosmic Invaders	100,000
	Berserk	9,150
Eric W. Lund Millington, NJ	Grabber	42,850
	Firecopter	65,280
	Pinball	48,700
	Bird Attack	54,900
	Moon Hopper	61,870
	Planet Invasion	79,200
	Invader's Revenge	16,300
Mark E. Reynolds Bennington, NH	Mudpies	113,800
Peter Paplaskas Pembroke, NH	Bag It Man	46,800
Bradwers Omaha, NE	Buzzard Bait	673,280
	Donkey King	196,250
	Foodwar	73,065
	Sands of Egypt	112 turns
Scott Ihle Jacksonville, FL	Shark	174,000
	Katepil Attack	9,451
Philip Bretsky East Setauket, NY	The King	208,800
Greg Gallo East Hartford, CT	Lunar Rover Patrol	181,400
Glenn Heinze Kitchener, Ontario	Lancer	147,100
Ronald Purdue Byron, MN	Color Trek	(level 5) 3,656
Kent Jakway Garrett, IN	Microbes	98,450
Kenneth Dey Kansas City, MO	Pyramid	220 pts., 136 turns
Pete Crandall Towanda, PA	Frogger	56,500
Quentin Dunne Sayre, PA	Ghost Gobbler	92,450
Larry Blenenfeld Ft. Lauderdale, FL	Mr. Dig	1,700,000
Stephane Asselin Hauterive, Quebec	Bloc Head	337,800
	Cubix	11,640
	Solo Pool	81
	Junior's Revenge	36,200
	Wacky Food	105,100
Matt Bender Centerport, NY	Death Trap	70,214
Randy Goebel Troy, MI	UFO	206,250
	Space Assault	216,750
	Qubix	22,930
	Star Traveler	313,860
	Venturer	1,253,300
Mark Goebel Troy, MI	Android Attack	26,390
Victor Capton Troy, MI	Zaxxon	401,350
	Polaris	33,132
Michael Capton Troy, MI	Time Bandit	45,460

Gameware

continued

tunnels his way to caches of cherries. Monsters clumsily pursue him through the tunnels, and while there's no danger of them outrunning your character, they can outnumber and corner him.

The only weapon he has is a magic bouncing orb that ricochets off the tunnel walls. You must wait before using the orb again, as it must be recharged. If you are tricky enough, you can dig underneath one of the apples on the screen and crush your enemies with it.

Occasionally a "letterman" will appear on the playing screen, jumping down from the title. If you eliminate all of them, you get an extra Mr. Dig.

The graphics are good, and I liked the sound effects, though others around me complained that they were annoying. To each his own. I liked Mr. Dig, but I thought it could be more challenging, especially in the higher difficulty levels. I had no trouble scoring well over 100,000 points with little practice. Maybe if the critters were sneakier...

Mr. Dig requires 32K and costs $27.95 on cassette and $30.95 on disk from Computerware, P.O. Box 668, Encinitas, CA 92024, 619-436-3512.—*M.N.*

Tips

Shenanigans Suds

In Mark Data's Shenanigans, how do you find the subway, and how do you read the sign seen from the fire escape?

Jack Darling
Washington, DC

I've solved the adventure, although I've never been able to read the sign. The help command returned the clue, "A sign of the times." I suspect it may be a Mark Data advertisement, but I could be wrong. Finding the subway depends on the kind of beer you buy in the Irish pub. A loyal Sinn Feiner would have nothing else.—M.E.R.

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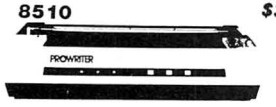

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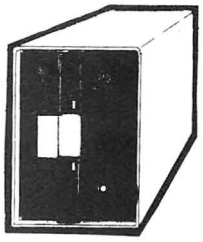

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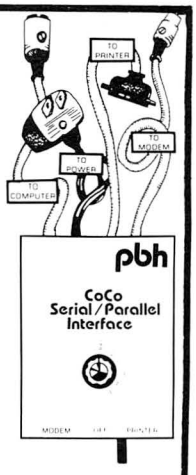

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PRODUCT NEWS

edited by Cynthia Smith

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.

Hard Disk And Operating System

The Micro R.G.S. Inc. Hard Disk Drive and Operating System for the Color Computer is now available. It features tape to hard disk, disk to hard disk, hard disk to tape, hard disk to disk, duplicate, cold start, M-Run, all Extended Basic commands, and can be fully integrated into Color Disk Basic (5 meg $1,295, 10 meg $1,595). You do not need a floppy disk drive to use the Micro R.G.S. Hard Disk System.

Without the hard drive the Interface Card and H-DOS operating system sell for $425. The Peripheral H-DOS Utility Pack (Boot Straps, OS-9, Flex, MDIR) sells for $129.

Contact Micro R.G.S. Inc., 30 Canusa St., Beebe Plain, VT 05823, 800-361-4970. In Canada call 800-361-5155.

Reader Service ✓ 566

Master Design: More than Pictures

Master Design by Derringer Software Inc. does more than draw pictures. As a text designer it generates lettering in the graphics modes from sizes 2 to 32 in a wide range of styles. Nine different settings for thickness, and nine for creating open lettering produce type in skinny, bold, textured, tall, drop shadow, and raised shadow designs.

As a graphics editor, Master Design lets you take full advantage of all graphics commands and uses a two-cursor concept for quick formatting of boxes, lines, and special patterns and backgrounds. You can create designs and use the text designer to label areas or place titles and create mirror images of the display.

Master Design comes with a 7- and 8-bit version of a hi-res screen-print routine that works in any PMODE and prints normal or reversed images.

Save and load your creations to and from disk or cassette, and even load hi-res displays created by other programs.

The Letter Head Utility lets you convert any hi-res display to access Telewriter 64. The Basic program modules have step-by-step instructions and can be used in your own Basic programs for printing displays without using graphics pages. You can link up to 88 pages of graphics for printing.

Master Design requires 32K with at least one disk drive and sells for $34.95 plus $2 shipping. Contact Derringer Software Inc., P.O. Box 5300, Florence, SC 29502-2300.

Reader Service ✓ 565

Power Payment

The Computer Check Carrier lets you process conventional checks for personal and small-business uses. Produced by CHF Co., this carrier is designed for adjustable, tractor-type printers. The slotted, translucent, vinyl sheeting check holder lets you use regular, inexpensive personal or company checks as supplied by your bank, and gives you professional-looking checks in half the time.

Checks with carbons are easily accommodated and the product includes a Basic program to format checks for your own system. You can use the program as a subroutine in your present check writing program.

The personal check holder (S-100) is 8 inches wide and holds eight personal-size checks. The commercial version (S-200) is 9½-inches wide and holds six commercial-size checks. You can also use the Computer Check Carrier in friction-type printers and regular typewriters.

Order directly from CHF Co., P.O. Box 185, Oberlin, OH 44074, for $11.95 check or money order.

Reader Service ✓ 560

CHF Co.'s Computer Check Carrier

Transfer Switches

Sab-Link Incorporated has announced a new line of transfer switches for the Color Computer. Co-Switch uses the four-pin DIN connector like the one that comes on the CoCo and lets you safely share multiple I/O devices with one computer without cable swapping.

Co-Switch also lets you have several CoCos sharing one device, such as a printer. It comes with multiple sockets (female) on its back panel, and different models allow up to 11 devices to be shared with one CPU, or vice-versa. Long cables with male plugs are available as an option.

Price for the two-way model starts at $29.95. For more information contact Sab-Link, Dept. CoCo-R, 7301 N.W. 41st St., Miami, FL 33166. 305-592-6092.

Reader Service ✓ 564

What's News?

Newsoft Inc. is running a new service exclusively for the Color Computer. Newsoft News Service (NNS) is designed especially to bring daily news and information to local Bulletin Board Systems. Concise electronic articles are available for downloading to BBS system operators anywhere in the United States.

NNS is a source of news on computers, science, technology, trivia, and history. It also offers columns including: NEWBYTES—daily computer news column; TEKBYTES—hardcore hackers' technical information; TRVBYTES—daily trivia column; DAYBYTES—"this day in history" feature each day with computer-history fun facts; SCIBYTES—news from the front lines of science and technology; and FEMBYTES—a look at

women in the computer industry.

Newsoft News Service is a wire-service-like information source and is available on a subscription basis. Rates vary from $8.50 a month for a BBS with network status, to $24.95 for a one-time, one-month subscription. NNS has a free, no-obligation sample download available on the 300dps dataline: 503-235-5114.

Contact Newsoft Inc. Computer Services, 2704 N.E. Everett St., Portland, OR 97232.

Reader Service ✓ 563

How's Disk For Organization?

Inland Corporation's Diskette Carousel protects and stores up to 72 5¼-inch floppies in a high-impact, smoked plastic rotating file. Unlike storage tubs and trays, in the Diskette Carousel floppies never rub, lean, or slide against each other. They are stored in protective, color-coded envelopes. The Inland unit is designed to stack, stores more than tubs and trays, and is priced about the same.

It is priced to retail at $29.95. Contact Inland Corporation, 32051 Howard, Madison Heights, MI 48071. 1-800-521-8428.

Reader Service ✓ 562

New From CoCoPro

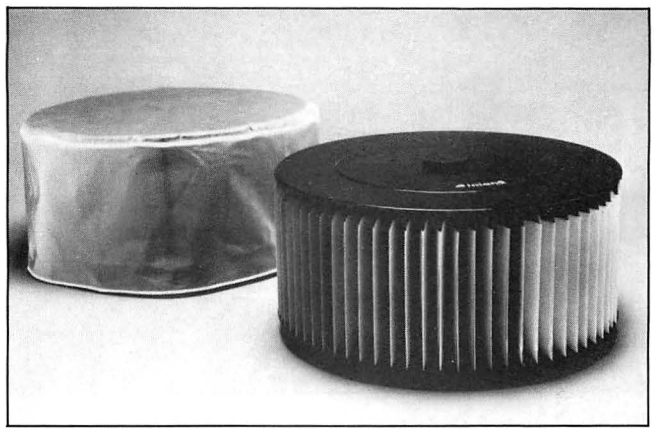
CoCoPro has announced Master Directory Version 2. This package maintains a common directory to all your disks, and with a press of one key you can add all file names of a disk to the master directory. The main menu provides the following functions: add all files on a disk; delete disk from master directory; set special controls; manual changing of master directory; prepare listings; and restore allocation of directory.

You can display disk or filename directories on the screen or list them on a printer, and the disk directory report identifies each disk by number and a short description.

You can also request either four columns using condensed print or two columns using standard print. Selections of fewer than 600 file names are sorted in memory with a fast, machine-language sort, and selections of over 600 file names use disk work space to let you sort over 3,000 file names.

Master Directory Version 2 is in Basic for easy customizing and includes all instructions. It sells on disk for $29, postpaid. Owners of Version 1 can receive an upgrade for $10 by sending the original cassette or disk and a check or money order to CoCoPro, P.O. Box 37022, St. Louis, MO 63141.

Reader Service ✓ 561



Diskette Carousel from Inland Corporation

Office Oak

The Oak 170 Series of computer furniture offers flexibility for an array of computer equipment, and accommodates nearly all personal computer systems.

Bush Industries' new series includes a desk ($279.95), hutch ($199.95), printer stand ($199.95), corner connector ($69.95), monitor/printer platform ($44.95), and an optional lockable door module. The oak furniture has an 8-step, hand-rubbed finish, and the acrylic-coated, laminated work surfaces have a warm dark brown, non-glare finish.

Contact Bush Industries, 312 Fair Oak St., Little Valley, NY 14755.

Reader Service ✓ 558

Graphics Package

Hawkes Research Services has released a new version of Grafplot, a high-resolution, graph-drawing program for the Color Computer. Grafplot includes everything you need to produce professional-quality line graphs and scatter plots of any type of numeric data. Grafplot includes a Universal Screenprint program for any printer. In addition, the new package includes a free screen-print program for printing graphs on Radio Shack printers (DMP-100/200 or LP-VII/VIII).

Grafplot draws up to three complete axes with tick marks and numeric labels, and four on-screen labels for the axes and graph title, all with full 96 character ASCII upper- and lowercase with real descenders. A special feature allows the generation of graphs with two vertical scales, one on the left and one on the right, to allow the display of different quantities or scales on the same graph. It will graph up to two data sets of 200 points each in a single pass, and allows unlimited overlays and chaining of data files.

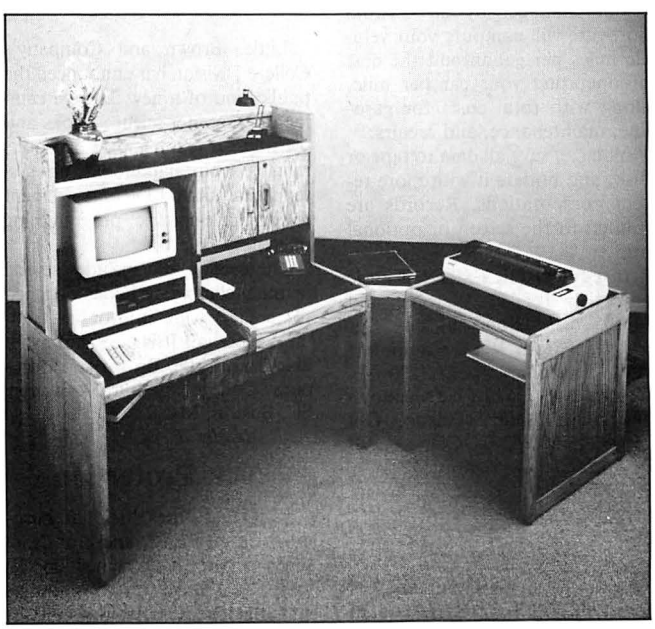
Grafplot is completely menu driven but has a unique auto-prompt feature that bypasses the menus and takes you automatically through all of the steps necessary to enter, draw, and print a graph. The program automatically calculates all of the parameters needed to draw a graph with the data centered inside of axes marked with round numbers and even tick marks. A window feature lets you magnify or reduce any portion of the data to any scale without distortion.

The data editor supports add, change, insert, delete, and sort functions. The user-defined function draws a graph of any mathematical equation, and the integration feature can be used to calculate the area under a curve or to evaluate the integrals of complex mathematical functions that cannot be solved analytically. The moving-averages routine removes noise from data for trend analysis of stocks and investments. Data, graph parameters, and completed graphs can be saved or loaded to or from tape or disk.

The 40 pages of documentation include a user's manual, a tutorial with sample data and completed graphs, and a troubleshooting section with a comprehensive variable list. Grafplot is written in unprotected Basic with machine-language subroutines for speed.

Grafplot is available on cassette for 16K Extended Color Basic ($35) and 32K ($40), or for 32K Color Disk Basic ($45), plus $3 shipping, from Hawkes Research Services, 1442 Sixth St., Berkeley, CA 94710. 415-526-1248.

Reader Service ✓ 559



Bush Industries' Solid Oak Modular Computer Furniture

Those Who Can, Teach

With Color Math Quiz, Fraction Math Quiz, and Decimal Math Quiz from Creative Technical Consultants, students in grades 2 through 12 can improve

their math skills. All three programs feature multiple-choice answer format, five skill levels, personalized screen prompts, and entertaining music and graphics.

As the skill level increases from 1 to 5, the problems increase in difficulty and the incorrect answers presented become closer to the correct answer. The liberal use of music, graphics, and rewards throughout the program keeps the students interested and motivated. They are available on cassette only.

- Color Math Quiz offers a menu with six math operations to choose from: two-number addition, three-number addition, subtraction, multiplication, division, and decimal addition.
- Fraction Math Quiz has seven fraction math menu choices for practice in reducing to lowest terms, adding, subtracting, multiplying, dividing, converting mixed numbers to fractions, and converting fractions to decimals.
- Decimal Math Quiz provides drill in the basic four math operations: adding, subtracting, multiplying, and dividing, with one to four place decimal numbers.

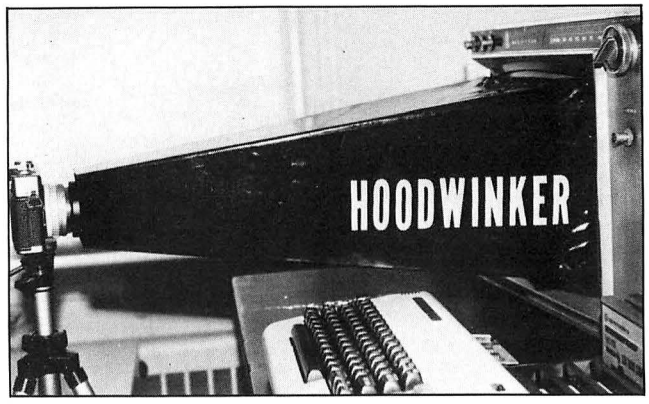
All three programs are written for the Color Computer, Color Computer 2, or TDP-100 with at least 16K and Extended Color Basic. They are available for $15.95 each or $42.95 for all three.

- Musical Strings is an educational program designed to stimulate musical creativity and teach computer string-variable concepts to students from third grade to adult. The menu-driven program begins with a brief, animated presentation about string variables, then goes through examples of music strings for the Extended Basic Play command. Finally, it turns the computer keyboard into a piano so the students can compose musical strings to listen to or add to their original programs. Full instructions and personalized prompts appear on the screen as they are needed. It sells on cassette for $17.95.
- Custom Flashcards is for both teachers and students in grades 2 through college. It lets you create your own flashcard sets, store them on tape, and recall them to study as often as you wish. After you have created a set of cards you can instruct the computer to flip through either the A or B side first, setting the clock for the time you want for answering. You can answer either verbally, to yourself, or a classmate, or you can type in the answer and have the computer check for the correct match. The cassette version sells for $17.95.
- *The Guide to String Variables* was written to help teachers and parents understand and explain the concept of string variables. It begins with a discussion of computer variables in general, then zeros in on the how and why of string variables. It is written in clear language and includes plenty of examples and review exercises. With this booklet you can learn to unlock the full power of your CoCo. It sells for $3.95.

These two programs and the booklet are written for the Color Computer, Color Computer 2, or TDP-100 computer with at least 16K and Extended Color Basic.

Contact Creative Technical Consultants, P.O. Box 652, Cedar Crest, NM 87008. Write for a free catalog of their software and hardware, or a free copy of the instruction booklets for these programs.

Reader Service ✓ 557



The Hoodwinker from Sector Systems Company

Auto Compute

Car Manager by 80 Custom Software will compute your vehicle miles per gallon and the cost of operating your car per mile, along with total costs for gasoline, maintenance, and repairs.

You can save all data to tape or disk, and update it with more recent computations. Records are printed to the screen or optional printer.

It requires 16K Extended Basic and sells for $12.95 tape and $15.95 disk. You can buy Car Manager from Reitz Computers and Electronics Inc., 3170 W. Central Ave., Westgate Meadows Shopping Center, Toledo, OH 43606. 1-800-242-COCO.

Reader Service ✓ 552

Hoodwinked!

Sector Systems Company has announced a new CRT camera hood, Hoodwinker, that lets you produce 35mm slides directly from the CRTs of your personal computers. You can now project tables, spreadsheets, and computer graphics output onto large screens using a standard 35mm slide projector. You no longer need expensive plotters or printers.

The Hoodwinker weighs only 5 ounces and attaches directly to your camera. With the output created on the CRT, the Hoodwinker is positioned over the screen to shoot the slide in seconds. This allows CRT photos in full room light. It eliminates reflections and maintains accurate focus distance. The Hoodwinker is available for both 49mm and 52mm lens thread sizes from Sector Systems Company, P.O. Box 751, Marblehead, MA 01945. 617-631-2878. Cost is $49.95 plus $3 shipping.

Reader Service ✓ 554

Free For Readers

Little, Brown and Company's College Division has announced the publication of a new 32-page catalog of computer science books and software. It features over 50 books ranging from handbooks on systems analysis and DP management to language-specific programming references.

The catalog also includes several personal computing books designed for readers with little or no technical expertise. It is free, and available from Little, Brown and Company, College Division, 34 Beacon St., Boston, MA 02106.

Reader Service ✓ 555

New Protection

PMC Industries Inc. has introduced a new AC line transient/surge suppressor designed specifically to protect microcomputers and microprocessor-based instrumentation. The Model 003 is designed to provide protection by instantly sensing and suppressing high voltage transients that can cause damage and data scrambling.

The Model 003 features suppression capabilities of 15,000 amperes maximum surge current with an energy absorption of 200 joules. It is designed for use on any standard 120 VAC line and responds to transients and surges in less than 25 nanoseconds. The unit offers two three-wire grounded outlets, a 15 amp fuse, on/off switch and indicator light, and 6 feet of three-wire grounded line cord. Recommended price is $135. Contact PMC Industries Inc., 9353 Activity Road, San Diego, CA 92126. 714-695-3520.

Reader Service ✓ 550

Rabbit CoCoCom

CoCoCom is a smart-terminal program for the Color Computer. This program is required in order to access CompuServe, Dow Jones, and other bulletin boards around the country.

Features include off-line message preparation and editing, upload and download file capabilities, and automatic storage of all communications. Captured data can be sent to a printer or renamed and archived on disk. CoCoCom supports 330-, 600-, and 1,200-baud printers.

It requires 16K Extended Disk Basic and one disk drive. A printer is not required. CoCoCom sells for $12 tape and $15 disk. Tennessee residents add 6 percent tax. Contact Rabbitt Ware Inc., Route 1, Bascomb Road, Jackson, TN 38305. 901-668-8816.

Reader Service ✓ 556

Paintpot

Here is a graphics program called Paintpot designed for fast creation of sketches and graphics designs in four colors. It is easy enough for children to enjoy, yet powerful enough for the advanced user.

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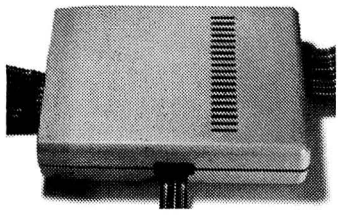

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