March 1989

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Just for your Tandy Color Computer 1, 2 and 3

The RAINBOW

THE COLOR COMPUTER MONTHLY MAGAZINE

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Expanding Your Color Computer

Memory Upgrades

A Hard Drive Buyer's Guide

Discover the Inner Workings of the CoCo 3

Add a Point-and-Click Interface to Your BASIC Programs

Plus: Scratch Golfer, a Numeric Keypad, Two New OS-9 Utilities and MORE!

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Back issues of RAINBOW ON TAPE are available beginning with the April 1982 issue. A single copy of RAINBOW ON TAPE is $10 within the United States; U.S. $12 in all other countries. The annual subscription rate for RAINBOW ON TAPE is $80 within the U.S.; U.S. $90 in Canada; and U.S. $105 for all other countries.*

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In addition to all the programs offered on tape, part of one side of RAINBOW ON DISK is formatted for the OS-9 operating system. That means you can now get all the OS-9 programs from the magazine — programs that cannot be put on tape. Back issues of RAINBOW ON DISK are available beginning with October 1986. Subscriptions to RAINBOW ON DISK are $99 a year in the U.S. Canadian rate is U.S. $115. All other countries, U.S. $130. Single copy rate is $12 in the U.S.; U.S. $14 in Canada; and U.S. $16 in all other countries.*

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RAINBOW

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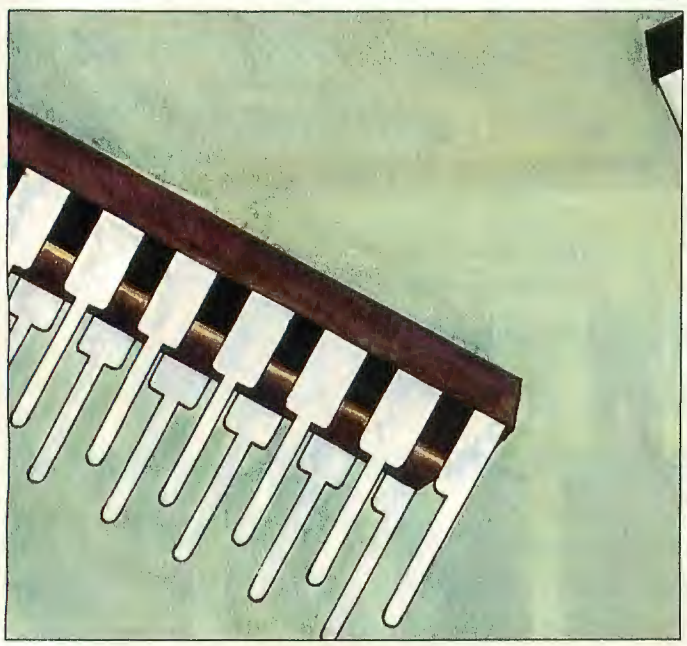

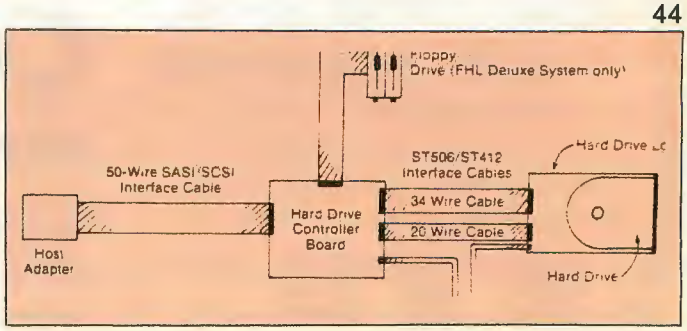

Novices Niche

The cassette tape/disk symbols beside features and columns indicate that the program listings with those articles are on this month's RAINBOW ON TAPE and RAINBOW ON DISK. Those with only the disk symbol are not available on RAINBOW ON TAPE. For details, check the RAINBOW ON TAPE and RAINBOW ON DISK ad on the inside front cover.

Departments

Columns

Rainbowtech

Barden's Buffer will return next month.

Product Reviews

THE RAINBOW is published every month of the year by FALSOFT, Inc., The Falsoft Building, 9509 U.S. Highway 42, P.O. Box 385, Prospect, KY 40059, phone (502) 228-4492. **THE RAINBOW**, **RAINBOWfest** and **THE RAINBOW** and **RAINBOWfest** logotypes are registered ® trademarks of FALSOFT, Inc. • Second class postage paid Prospect, KY and additional offices. USPS N. 705-050 (ISSN No. 0746-4797). POSTMASTER: Send address changes to **THE RAINBOW**, P.O. Box 385, Prospect, KY 40059. Authorized as second class postage paid from Hamilton, Ontario by Canada Post, Ottawa, Ontario, Canada.

• Subscriptions to **THE RAINBOW** are $31 per year in the United States. Canadian rates are U.S. $38. Surface mail to other countries is U.S. $68, air mail U.S. $103. All subscriptions begin with next available issue. • Limited back issues are available. Please see notice for issues that are in print and their costs. Payment accepted by VISA, MasterCard, American Express, cash, check or money order in U.S. currency only. Full refund after mailing of one issue. A refund of 10/12ths the subscription amount after two issues are mailed. No refund after mailing of three or more magazines.

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Letters to the RAINBOW

Ma Bell "Bytes" Off a "Bit" Too Much

Editor:

On September 30, SysOps of bulletin board systems in the Houston area began receiving calls from Southwestern Bell Telephone Company stating that their rates would be changed from residential to commercial. This decision on the part of Bell was due to a "recent clarification of an existing tariff." Although those who received the calls protested that they were not in business and that their bulletin board systems were free, Bell did not relent.

The higher rates will not only mean a lower resale value on many computer owner's expensive equipment, but, for some, will put an end to a once-affordable hobby.

Southwestern Bell spokesman Ken Brasel said Bell was simply rectifying its own error. "We shouldn't have connected these (bulletin boards) at the residential rate to begin with," he said. "When the lines are used to provide a service to others, it is business. Whether for profit or not isn't germane."

By this definition, what distinction *is* there between business and residential users? Some may argue that since churches, government, charities and other nonprofit organizations are charged at business rates, the same rule applies to home computer users. But even those organizations endeavor to make money, taxable or nontaxable. Users of SysOps and BBSs, however, generally do not. In fact, the only connection with *business* these persons have is that their hobby has worked to greatly expand and develop the telecommunications industry, making equipment more affordable.

Computer users everywhere have begun a letter writing and phone call campaign to Bell, the Public Utilities Commission of Texas and the FCC. It has been sucessful in temporarily reversing the commercial rate to free BBSs. We hope the new tariff will recommend BBS users be charged at the residential rate, but we need continued support.

Beware: If it happened in Texas, it could also happen in your state.

Nancy Ward, Secretary
Houston Area CoCo Club
Pasadena, Texas

BACK TALK

Editor:

I read with interest the letter written in "utter desparation" to RAINBOW by Mr. Ron Hengerer of Jacksonville, Florida (January '88, Page 6). It seems to me that Mr. Hengerer should be doing what the fellow on the cover is doing in the same issue. I often wonder what some of those who buy computers and other electronic devices do with the manuals that come with them. It seems to me that 95 percent or more of questions asked by novices can be answered by the manual. The clincher was the fact that he bought a modem and does not know what it is or what it is used for. If a beginner starts at the front of the manual, studies each chapter in turn until he comes to the last one, and tries the do-it-yourself programs as I did a couple of years ago, he will have fewer problems. He will know about pokes and peeks, sines and cosines, for they are all in the book. This is not to say I did not have questions, but only after searching both manuals packed in the box with my Color Computer 3 did I ask them elsewhere.

Russell Robbins
Pennsauken, New Jersey

REQUEST HOTLINE

Editor:

For those of us who came back to CoCo, please be so kind as to reprint some of those old utilities. I'm referring to such programs as *Merge* for disk drives, found in "Get it Together With Disk Merge" (February '85, Page 175). Also, you had a program that runs programs from tape without pulling the disk drive interface out of the computer.

I have a CoCo 2 and a single drive from Radio Shack as well as many 1985 programs. For awhile, after suffering a stroke, my programming days were over. But now I have the ability to continue my past pleasures, and I would like to run old tapes through the disk drive, as well as the new ones found in your magazine.

I hope to find them in future issues. It feels good to get back in the world of digitals.

Norbert B. Nowak
Taylor, Michigan

Welcome back to computing!

There's no need to miss out on past issues of THE RAINBOW. See Page ??? for a list of the back issues that are available. Although some issues are no longer in print, article copies can be obtained for $2, and back issues of RAINBOW ON TAPE and DISK are always available (see page ??? for more details).

To free up more memory to run long programs without unplugging your disk drive, check out Jeremy Spiller's Disk Off *program (July '88, Page 118). While this version runs on the CoCo 1 and 2, a version for the CoCo 3 is printed on Page 100 of the December '88 issue.*

And They're Off

Editor:

I was wondering why I have never seen an advertisement for a well-written horse-race game. I know that more people than just my family and I would like to see one.

A program like this would go over big because more than two people could play at the same time, and it could include the daily double, exacta, trifecta and quinella. Players could consider the track condition, jockey standings, speed ratings, distance of race and post position.

Anyone thinking of writing a program like the one I describe can write to me for information.

Jim Kirk
General Delivery
Logan, IL 62856

INFORMATION PLEASE

Editor:

I recently acquired two Color Computer 2s (one 16K, the other 64K). However, I was unable to buy, borrow, steal or locate a manual. Please tell me where a manual for the above can be found.

Arthur W. Woodall
605 So. Court St.
Water Valley, MS 38965

Manuals for the CoCos 1, 2 and 3 can be ordered at your local Radio Shack store through Tandy National Parts. You'll need to indicate the stock number found on the bottom of your

machine. For quicker service, be sure to prepay when ordering.

KUDOS

Editor:

I am a great fan of THE RAINBOW and anxiously wait for the new one each month. I don't program at all and use the magazine for the advertisers and to keep up with the CoCo Clubs.

I am writing specifically to ask that you evaluate the word processing program *Word Power 3.2*. I have used many word processing programs, but this one is the best one I have used so far and is simple to learn.

I was able to read the instruction book in an hour and go right into using the program. For the first time I could use bold, double-wide, underline, etc. Whenever I have a problem with one of its programs (usually caused by something dumb that I have done), Microcom has always straightened me out. The owner has even called me personally when I've had a problem. If it is a bug, I get a new corrected disk within the week. Microcom has even helped me put the printer codes on the disk over the phone.

I use *Word Power* for all my word-processing needs, both personal and business. The upgrades are great but I'm surprised Microcom can keep making such a good program better.

Kenneth Brownson
Newark, Delaware

See next month's issue for a comparative review of the word processors available on the CoCo market.

A Standing Ovation

Editor:

I would like to give hearty applause to an advertiser of yours — Zebra Systems, Inc. I purchased its old *CoCo Graphics Designer*, which I was pleased with. While at the Princeton RAINBOWfest, I decided to update to *CGD Plus*. Upon returning home with my trusty program, I discovered it would not run on my CoCo 2. There were repeated conversations, notes, etc., but this company steadfastly stood by me. My problems were isolated to my system, yet Zebra promptly worked out the bugs. Now, several "test" disks later, I have a great sign, banner and card designer so simple my seven-year-old can run it by himself. Thank you, Zebra Systems!

Kathie Donaldson
Mt. Holly, New Jersey

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or to conserve space.

Letters to the editor may also be sent to us through our Delphi CoCo SIG. From the CoCo SIG> prompt, type RAI to take you into the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, type LET to reach the LETTERS> prompt and then select Letters for Publication. Be sure to include your complete name and address.

How To Read Rainbow

When we use the term CoCo, we refer to an affectionate name that was first given to the Tandy Color Computer by its many fans, users and owners.

The BASIC program listings printed in THE RAINBOW are formatted for a 32-character screen — so they show up just as they do on your CoCo screen. One easy way to check on the accuracy of your typing is to compare what character "goes under" what. If the characters match — and your line endings come out the same — you have a pretty good way of knowing that your typing is accurate.

We also have "key boxes" to show you the *minimum* system a program needs. But, *do* read the text before you start typing.

Finally, the little disk and/or cassette symbols on the table of contents and at the beginning of articles indicate that the program is available through our RAINBOW ON DISK or RAINBOW ON TAPE service.

Using Machine Language

The easiest way to "put" a machine language program into memory is to use an editor/assembler, a program you can purchase from a number of sources. All you have to do, essentially, is copy the relevant instructions from THE RAINBOW's listing into CoCo.

Another method of putting an ML listing into CoCo is called "hand assembly" — assembly by hand, which *sometimes* causes problems with ORIGIN or EQUATE statements. You ought to know something about assembly to try this.

Use the following program if you want to hand-assemble ML listings:

```
10 CLEAR200,&H3F00:I=&H3F80
20 PRINT "ADDRESS:";HEX$(I);
30 INPUT "BYTE";B$
40 POKE I, VAL("&H"+B$)
50 I=I+1:GOTO 20
```

This program assumes you have a 16K CoCo. If you have 32K, change the &H3F00 in Line 10 to &H7F00 and change the value of I to &H7F80.

OS-9 and RAINBOW ON DISK

The OS-9 side of RAINBOW ON DISK contains two directories: CMDS and SOURCE. It also contains a file, `read.me.first`, which explains the division of the two directories. The CMDS directory contains executable programs and the SOURCE directory contains the ASCII source code for these programs. BASIC09 *programs* will only be offered in source form so they will only be found in the SOURCE directory.

OS-9 is a very powerful operating system. Because of this, it is not easy to learn at first. However, while we can *give specific instructions* for using the OS-9 programs, you will find that the OS-9 programs will be of little use unless you are familiar with the operating system. For this reason, if you haven't "learned" OS-9 or are not comfortable with it, we suggest you read *The Complete Rainbow Guide to OS-9* by Dale Puckett and Peter Dibble.

The following is not intended as a course in OS-9. It merely states how to get the OS-9 programs from RAINBOW ON DISK to your OS-9 system disk. Use the procedures appropriate for your system. Before doing so, however, boot the OS-9 operating system according to the documentation from Radio Shack.

1) Type `load dir list copy` and press ENTER.
2) If you have only one disk drive, remove the OS-9 system disk from Drive 0 and replace it with the OS-9 side of RAINBOW ON DISK. Then type `chd/d0` and press ENTER. If you have two disk drives, leave the sytem master in Drive 0 and put the RAINBOW ON DISK in Drive 1. Then type `chd/d1` and press ENTER.
3) List the `read.me.first` file to the screen by typing `list read.me.first` and pressing ENTER.
4) Entering `dir` will give you a directory of the OS-9 side of RAINBOW ON DISK. To see what programs are in the CMDS directory, enter `dir cmds`. Follow a similar method to see what source files are in the SOURCE directory.
5) When you find a program you want to use, copy it to the CMDS directory on your system disk with one of the following commands:

One-drive system: `copy /d0/cmds/`*filename* `/d0/cmds/`*filename* `-s`

The system will prompt you to alternately place the source disk (RAINBOW ON DISK) or the destination disk (system disk) in Drive 0.

Two-drive system: `copy /d1/cmds/`*filename* `/d0/cmds/`*filename*

Once you have copied the program, you execute it from your system master by placing that disk in Drive 0 and entering the name of the file.

The Rainbow Seal

RAINBOW CERTIFICATION SEAL

The Rainbow Certification Seal is our way of helping you, the consumer. The purpose of the Seal is to certify to you that any product that carries the Seal has actually been seen by us, that it does, indeed, exist and that we have a sample copy here at THE RAINBOW.

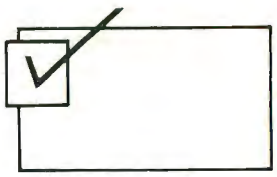
Manufacturers of products — hardware, software and firmware — are encouraged by us to submit their products to THE RAINBOW for certification.

The Seal is not a "guarantee of satisfaction." The certification process is different from the review process. You are encouraged to read our reviews to determine whether the product is right for your needs.

There is absolutely no relationship between advertising in THE RAINBOW and the certification process. Certification is open and available to any product pertaining to CoCo. A Seal will be awarded to *any* commercial product, regardless of whether the firm advertises or not.

We will appreciate knowing of instances of violation of Seal use.

Rainbow Check Plus



The small box accompanying a program listing in THE RAINBOW is a "check sum" system, which is designed to help you type in programs accurately.

Rainbow Check PLUS counts the number and values of characters you type in. You can then compare the number you get to those printed in THE RAINBOW. On longer programs, some benchmark lines are given. When you reach the end of one of those lines with your typing, simply check to see if the numbers match.

To use *Rainbow Check PLUS*, type in the program and save it for later use, then type in the command RUN and press ENTER. Once the program has run, type NEW and press ENTER to remove it from the area where the program you're typing in will go.

Now, while keying in a listing from THE RAINBOW, whenever you press the down arrow key, your CoCo gives the check sum based on the length and content of the program in memory. This is to check against the numbers printed in THE RAINBOW. If your number is different, check the listing carefully to be sure you typed in the correct BASIC program code. For more details on this helpful utility, refer to H. Allen Curtis' article on Page 21 of the February 1984 RAINBOW.

Since *Rainbow Check PLUS* counts spaces and punctuation, be sure to type in the listing exactly the way it's given in the magazine.

```
10 CLS:X=256*PEEK(35)+178
20 CLEAR 25,X-1
30 X=256*PEEK (35)+178
40 FOR Z=X TO X+77
50 READ Y:W=W+Y:PRINT Z,Y;W
60 POKE Z,Y:NEXT
70 IFW=7985THENB0ELSEPRINT
   "DATA ERROR":STOP
80 EXEC X:END
90 DATA 182, 1, 106, 167, 140, 60, 134
100 DATA 126, 183, 1, 106, 190, 1, 107
110 DATA 175, 140, 50, 48, 140, 4, 191
120 DATA 1, 107, 57, 129, 10, 38, 38
130 DATA 52, 22, 79, 158, 25, 230, 129
140 DATA 39, 12, 171, 128, 171, 128
150 DATA 230, 132, 38, 250, 48, 1, 32
160 DATA 240, 183, 2, 222, 48, 140, 14
170 DATA 159, 166, 166, 132, 28, 254
180 DATA 189, 173, 198, 53, 22, 126, 0
190 DATA 0, 135, 255, 134, 40, 55
200 DATA 51, 52, 41, 0
```

Word Power 3.2

More Versatile • More Powerful With Spooler • Calculator • Split-Screen • 2-Column Printing

"... friendly...amazing execution speed...much easier to use than VIP software & 2 other word processing systems I've tried...very user-friendly...massive text storage capacity ...highest among word processors..." - **Rainbow Oct. 88 Review for Word Power**

Unparalleled Power packed in this 100% ML Word Processor written from scratch for the CoCo 3! **No other word processor offers such a wide array of features that are easy to learn & use.**

DISPLAY & SPEED

Word Power 3.2 runs at double-clock speed and uses the **true 80-column display** with lowercase instead of the graphics screen. The result is lightning fast screen reformatting and added speed! **All prompts are displayed in plain English in neat colored windows.** The current column number, line number, page number, percentage of free memory is displayed at all times. Even the **page break** is displayed so you know where one page ends and the other begins. The Setup program allows you to change fore/background colors as well as (in)visible carriage returns. Word Power 3.2 can be used with RGB/Composite/Monochrome monitors as well as TV.

MAXIMUM MEMORY

Word Power 3.2 gives you **over 72K** on 128K and **over 450K** on 512K CoCo 3 for Text Storage - more memory than any other CoCo word-processor. Period.

EFFORTLESS EDITING

Word Power 3.2 has one of the **most powerful and user-friendly full-screen editor with word-wrap.** All you do is type. Word Power takes care of the text arrangement. The unique **Auto-Save** feature saves text to disk at regular intervals for peace of mind.

Insert/Overstrike Mode (Cursor Style Changes to indicate mode);OOPS Recall during delete;Type-ahead Buffer for fast typers;Key-Repeat (adjustable); Key-Click; 4-way cursor and scrolling; Cursor to beginning/end of text, beginning/end of line, top/bottom of screen, next/previous word; Page up/down; Delete character, previous/next word, to beginning/end of line, complete line, text before/after cursor; Locate/Replace with Wild-Card Search with auto/manual replace; Block Mark, Unmark, Copy, Move & Delete; Line Positioning (Center/Right Justified); Set/Reset 120 programmable tab stops; Word-Count; Define Top/Bottom/Left/Right margins & page length. You can also highlight text (underline-with on-screen underlining, bold, italics, superscripts, etc.). Word Power even has a **HELP** screen which an be accessed any time during edit.

SPLIT-SCREEN EDITING

Splits the screen in half so you can view one portion of your text while you edit another. You'll love it!

MAIL-MERGE

Ever try mailing out the same letter to 50 different people? Could be quite a chore. Not with Word Power 3.2! Using this feature, you can type a letter, follow it with a list of addresses and have Word Power print out personalized letters. It's that easy!

CALCULATOR

Pop-up a 4-function calculator while you edit! Great for tables!

SAVING/LOADING TEXT

Word Power 3.2 creates ASCII format files which are compatible with almost all terminal/spell-checking & other word-processing programs. Allows you to Display Free Space, Load, Save, Append & Kill files. The ARE YOU SURE? prompt prevents accidental overwriting & deletion. You can select files by simply cursoring through the disk directory. Supports double-sided drives & step-rates.

PRINTING

Word Power 3.2 drives almost any printer (DMP, EPSON, GEMINI, OKIDATA, etc). Allows options such as baud rates, line spacing, page/print pause, partial print, page numbering/placement, linefeeds, multi-line headers/footers, right justification & number of copies. The values of these parameters & margins can be changed anytime in the text by embedding Printer Option Codes. The **WHAT YOU SEE IS WHAT YOU GET** feature allows you to preview the text on the screen as it will appear in print. You can view margins, page breaks, justification & more.

PRINT SPOOLER

Why buy a hardware Print Spooler? Word Power 3.2 has a **built-in Spooler** which allows you to simultaneously edit one document & print another.

TWO-COLUMN PRINTING

This unique feature allows you to print all or portion of your text in **two columns!** Create professional documents without hours of aligning text.

SPELLING CHECKER

Word Power 3.2 comes with spelling checker/dictionary which finds & corrects mistakes in your text. You can add words to /delete words from dictionary.

PUNCTUATION CHECKER

This checker will proofread your text for punctuation errors such as capitalization, double-words, spaces after periods/commas, and more. Its the perfect addition to any word processor.

DOCUMENTATION

Word Power 3.2 comes with a well-written instruction manual & reference card which makes writing with Word Power a **piece of cake!** Word Power 3.2 comes on an UNPROTECTED disk and is compatible with RSDOS. Only **$79.95**

(Word Power 3.1 owners can get Word Power 3.2 Upgrade FREE by sending proof of purchase & $5.00 to cover S&H costs & instructions)

MICROCOM SOFTWARE

All Word Power 3.2 orders shipped by **UPS Next Day Air** at no extra charge within the Continental US. Offer good thru January 15, 1989.

To Order: Refer to Page 17 of our 6-page ad series: (Pgs. 9-17)

Credit Card Toll Free Orderline 1-800-654-5244 (9am-8pm 7days/week)

Order Status, Info, Technical Info: 716-383-8830

What's Good for General Bullmoose . . .

A whole lot of you will remember "Li'l Abner," the cartoon strip by Al Capp before he retired and ended his commentary on the world scene. One of my favorite characters in "Li'l Abner" was General Bullmoose, who — in Capp's world anyway — was a very big businessman and went by the slogan, "What's good for General Bullmoose is good for everybody!"

While Capp did not always depict General Bullmoose fondly, I always liked him. He was the sort of self-starting entrepreneur who appealed to the times in which he was created. Those times, frankly, were when big business was pretty big, and in many ways General Bullmoose was right: If the economy was good and General Bullmoose was making money, then there was full employment, wages were higher and people could easily afford "a chicken in every pot and a car in every garage." (This, at least, tells you how long ago General Bullmoose was around.)

I was thinking about General Bullmoose the other day when Tandy and Panasonic announced that Tandy will be making personal computers marketed in the United States under the Panasonic label. That, as it happened, followed on the heels of a similar announcement concerning DEC (which, of interest, had a PC called *Rainbow* several years ago). Someone asked me what all this meant, and it just sort of snapped into my head: "What's good for General Bullmoose is good for everybody!" While we should not be quite so flip about the very genuine accomplishments of John Roach and his staff at Tandy in these last few years, this is true. Sure, the folks are making money, but things are going very well for a lot of people because of it.

Since I have already mixed metaphors (or whatever) here, let me add another. We need to stir in this witch's brew a heavy dose of *DeskMate* as well. *DeskMate*, as you know, has recently been "opened up" for interfaces with outside programs. That means a lot of applications will run on it in the future — and there will be a lot of sales in places all over, too. So, I think we agree that things are good for General Bullmoose. But how are they also "good for everybody?"

Quite simply, I think, it means that

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UPS 2ND DAY AIR

— more and more — the people at Tandy will have the necessary funds to continue to innovate and produce newer and better products for us. Not only will they have those funds, but they will also be able to continue to attract and hold on to the kind of people needed not only to develop those products, but to make them work.

Finally, we are talking about what is potentially a huge user base out here. Well, it is huge already. Recent statistics from an independent firm say that the percentage of persons who use personal computers is larger for Tandy computers than for any other kind. Add Panasonic selling American-made computers in every hoot and holler in the United States, and throw in DEC's marketing muscle. It leaves us with all the financial and marketing muscle (already most considerable) on the leading edge of the technology. As a good example of this, remember Tandy has developed the THOR laser disc with its read/write technology. Don't you just wonder what else is going on in those Tandy labs?

Well, I am sure you are asking just what all this stuff means as far as we CoCo owners are concerned. The truth is that it means a great deal. It means Tandy is able to market a wide range and type of computers simply because of the base it has in the market.

"Tandy will be making personal computers marketed in the United States under the Panasonic label."

Yes, I know Tandy in Canada is no longer selling the Color Computer. There are some things to remember about that, though. First, Tandy does not sell in Canada any more at all. A company called Intertan was formed about a year ago to handle Tandy's international operations. Tandy has not stopped selling — or manufacturing — Color Computers.

The reason for the decision in Canada has as much to do with the value of the dollar and international trade as anything. Canadians could always buy CoCos for less in the United States because of the relative value of the American dollar. I am betting they will keep on doing so.

Also, frankly, I think Intertan has misjudged the impact of the CoCo on the market. Certainly, everyone has misjudged the impact of the entertainment market during the past holidays — "game machines" were almost impossible to find. And, of course, for our many Canadian friends, Intertan is committed to support the CoCos it has sold over the years. That is a basic Tandy philosophy that did not change with the changes made in corporate structure.

No, I won't even mention what increased sales for Tandy means to the city of Fort Worth and environs. Many of you have heard the old joke anyway: "Welcome to Ft. Worth, a division of Tandy Corporation."

— Lonnie Falk

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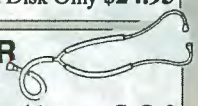

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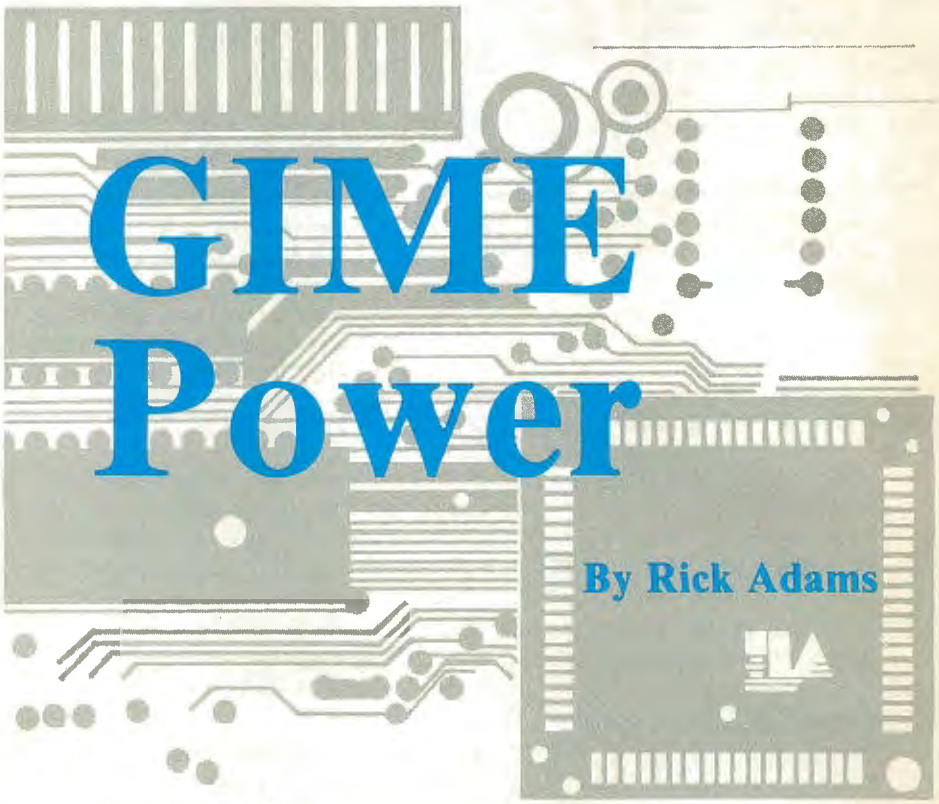
By Rick Adams



Those familiar with assembly-language programming on the Color Computer 1 (and later, the Color Computer 2) became accustomed to accessing the CoCo's inner power via two Motorola chips — the SAM (Synchronous-Address Multiplexer) and VDG (Video-Display Generator). However, with the advent of the Color Computer 3 came a new programming challenge — accessing the power of the GIME chip.

The GIME (Graphics-Interrupt Memory Enhancement) is a new proprietary chip designed to Tandy's specifications. It combines the functions of the SAM and VDG chips with an array of new and more powerful functions that had been reserved for more expensive machines. Combined with the impressive power of the Motorola 6809 CPU (Central Processing Unit), the GIME makes the Color Computer 3 a powerful machine in the computer market. Add OS-9 Level II (which takes full advantage of the 6809's multitasking capabilities and the GIME's graphics power), and the combination is amazing.

Let's look at the inner workings of the GIME chip. (See Table 1 for a summary of the GIME chip's functions.) Full programming details, available in Tandy's *CoCo 3 Technical Manual*, are beyond the scope of this article, but we get an idea of how the chip works.

Communications to and from the GIME chip take place via accesses to memory between addresses $FF90 and $FFDF. Accesses to those addresses do not go to memory but are routed directly to the GIME chip hardware. Locations $FF90 and $FF91 are two initialization registers. Bits within these two bytes are used to set up the mode in which the GIME will operate. The CoCo 2-compatible bit will disable most of the GIME chip's special features, so CoCo 1 and 2 software can operate without any conflicts with the new features available. The GIME chip provides a special SAM emulation at locations $FFC0 to $FFDF to duplicate all functions of the SAM chip used by Color Computer 1 and 2 software. Thus all accesses to the SAM result in the same operations on the Color Computer 3 that would take place on a Color Computer 1 or 2, (assuming the CoCo 2-compatible bit is on).

Other bits are used to enable or disable interrupts, set up the mode of ROM mapping, and select the set of registers used for the MMU (Memory Management Unit) feature of the GIME. Interrupts are signals that cause the CPU to drop what it's doing and execute another, more important task. When that task is done, the CPU returns to what it was doing before. Addresses $FF92 and $FF93 hold two registers that offer further control over interrupts. While on the CoCo 1s and 2s certain events within the computer generate a hardware interrupt, the GIME interrupt-enable registers at $FF92 and $FF93 let you enable interrupts from events that did not generate interrupts previously. The serial port and keyboard, the display's vertical and horizontal border, the programmable timer in the GIME, and the cartridge can all generate interrupts.

$FF94 and $FF95 hold the programmable-interrupt timer within the GIME chip. This feature allows the programmer to generate interrupt signals over a wide range of time intervals. This feature is usually used to "wake up" a background task at regular intervals. This task might keep up printer I/O, handle graphics on the screen, generate sound effects or perform some other job that's inconvenient for the main task to complete. This capability is available on the Color Computer 1 and 2, but in a limited fashion. On those machines, there are only two set speeds a programmer can use for timer interrupts. One of them is too fast for any practical use, and the other is too slow for many purposes. The flexibility provided by a timer interrupt with a programmable interval is a welcome addition to the programmer's arsenal.

Two registers controlling graphics are found at locations $FF98 and $FF99. The bit-plane graphics bit turns on the GIME's Hi-Res graphics modes. If this bit is off, one of the text modes is used. If bit-plane graphics is enabled, the area of memory reserved for the video display will be interpreted as pixel data for the screen. In a four-color mode, for example, each byte of video data will be

Rick Adams (RICKADAMS) is the author of Tandy's Temple of Rom, *the CoCo 3 version of Activision's* Shanghai, *and* DelphiTerm. *Rick, his wife Alice and their three children live in Rohnert Park, California.*

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BLANK CARTRIDGE (Disk Controller Size)**: $10.95**

ACCESORIES

5 1/4" DS/DD Disks: **$.40** each
3 1/2" DS/DD Disks: **$1.49** each
5 1/4" Disk Case (for 70 disks): **$9.95**
3 1/2" Disk Case (for 40 disks): **$7.50**

Curtis Printer Stand: **$19.95**
Surge Supresser Strip w/ 6 outlets: **$14.95**
Curtis Static Mat: **$24.95**

RIBBONS

NX1000 Color Ribbon: **$12.95**
NX1000 Black Ribbon: **$8.50**
Seikosha, EPSON, DMP, Panasonic, Okidata, Gemini Ribbons: **$8.50** each

CABLES

MAGNAVOX 8505/8515/8CM643 Analog RGB Cable: **$24.95**
SERIAL-TO-PARALLEL INTERFACE: Use your parallel printer at high speed (300-9600 baud) with CoCo. Comes will all cables. No software compatibility problems. **Only $44.95**
15" MULTIPAK/ROMPAK EXTENDER CABLE: $29.95
VIDEO DRIVER: Use a monochrome/color monitor with your CoCo. Comes with audio/video cables. Specify CoCo 1 or 2. Excellent picture quality/resolution! **$34.95**
RS232 Y CABLE: Hook 2 Devices to the serial port. Only **$18.95**
Y CABLE: Use your disk system with Speech Pak,CoCo Max, DS69, etc. **$27.95**
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SONY Monitor Cable: $29.95
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MODEM CABLE:4 pin to DB25.**Only $19.95**
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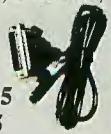

CHIPS, ETC

Disk Basic Rom 1.1 (Needed for CoCo 3): **$29.95** **ECB ROM 1.1:$29.95**
68B09E or 6809E Chip: $14.95
MultiPak PAL Chip for CoCo 3: **$19.95**
PAL Switcher: Now you can switch between the CoCo 2 and 3 modes when using the Multi-Pak. You need the OLDER & NEW PAL chip for the 26-3024 Multipak. Only **$39.95.** With NEW PAL Chip: **$49.95.**

UPGRADES

64K Upgrade for CoCo I's, CoCo II's with Cat #26-3026/27, 26-3134, 26-3136: **$29.95**
64K Upgrade for 26-3134 A/B CoCo II: **$39.95**
(Free 64K Software incl. with 64K Upgr.)

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Credit Card Toll Free Orderline 1-800-654-5244 (9am-8pm 7days/week)

Order Status, Info, Technical Info: 716-383-8830

UPS 2ND DAY AIR

COCO 3

CoCo 3 Combo Package

- 128K Color Computer 3
- 500 Pokes Peeks 'n Execs Book
- CoCo 3 Secrets Revealed Book
- Basic Programming Tricks Book
- Utility Routines Volume 1 Book
- $10 off our Drive 0 system

CoCo 3 Combo Package: $169
(Please add $8 S&H in US/$20 in Canada)

DS69B Digitizer: Use your CoCo 3 to display pictures from your VCR or video camera. Includes C-SEE 3.3 software. Only **$149.95**

Gravis Joystick: The BEST joystick for your CoCo. Tension, rotary,centering,free-floating controls with 3 buttons: **$59.95**

MPI Locking Plate (Specify Cat #):**$8**

Coming Soon: **ROMPAK Wild card**: Lets you transfer ANY Rompak to disk.

MAGNAVOX 8CM515 RGB MONITOR

Razor-sharp picture quality for your CoCo! Has 14" screen, Analog/TTL RGB, Composite Inputs for CoCo 2/3, Speaker, tilt-stand & 2 year warranty! Only **$265** (add $12 S&H/$40 in Canada)

Magnavox RGB Cable for CoCo 3 and Composite Video / Audio Cable Set with purchase of monitor: **$19.95**

DISK DRIVES for CoCo 2 & 3

There are a lot of dealers selling disk drives for the CoCo. Why buy from us? **First**, all our drives are Brand New and made by Fujitsu. They are sleek, quiet and have a reputation of superb reliability. **Second**, our Drive 0 systems come with the acclaimed DISTO Controller - with gold-plated contacts. **Third**, our Drive 0 systems come with the official 200 page Radio Shack Disk Manual with floppy disks; everything you need to get started. **Fourth**, you get $60 worth of our utility software (Disk Util 2.1A & Super Tape/Disk Transfer) & our DISKMAX software which allows you to acess BOTH sides of our drives. Our drive systems are head & shoulders above the rest.

Drive 0 (With Disto Controller, Case, Power Supply, 1 Drive Cable, Manual, Software): **$209**
Drive 1 (With Case, Power Supply & software): **$129** Bare 5 1/4" Drive: **$89**
2 Drive System (With Disto Controller, Case, Power Supply, 2 Drive Cable, Manual & Software): **$309**
1 Drive Cable: **$16.95** 2 Drive Cable: $ **22.95** 4 Drive Cable:**$ 34.95**

FD501 Upgrade Kit: Bare Drive, 2 Drive Cable & Instructions: **$109**

HARD DRIVE SYSTEMS/ INTERFACES

Complete w/ Hard Drive, Western Digital Controller, B&B Interface, Cables, Case, Power Supply, Software (HYPER IO) & Instruction manuals. Assembled/tested/formatted. Just *Plug'N'Run*. This is **the best** hard drive deal for the CoCo.

Seagate 20 Meg System: $509
Seagate 30 Meg System: $539

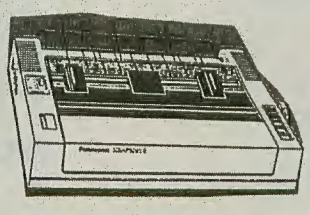
CoCo XT: Use 2 5-120 Meg Drives with your CoCo. Only **$69.95** w/ Real Time Clock: **$99.95**
CoCo XT ROM: Boots OS9 from hard/floppy. **$19.95**
HYPERIO: Allows Hard Drive Use with RSDOS. Only **$29.95 HYPERIO: Disto Version:**If you have a DISTO Controller w/ Hard Drive Interface, this program will allow you to use your Hard Drive from RSDOS!! Only **$29.95**

PRINTERS

1000 Sheets of paper included **FREE** with every printer

NX1000 Rainbow System: NX1000 Color Printer w/144 CPS draft ● Friction/Tractor Feed ● Epson/IBM Compatible ● 1 Year Warranty. Only **$289**

NX1000 System: NX1000 Printer w/ 144 cps Draft ● Friction/Tractor Feed ● Epson/IBM Compatible ● 1 Year Warranty. Only **$199**



Panasonic KX-P1080i II System: Panasonic Printer w/ 144 cps Draft ● Tractor/Friction Feed ● Epson/IBM Compatible ● 2 Year Warranty. Only **$189**

Panasonic KX-1592 System: Panasonic Printer w/216 cps Draft ● 16.5" Wide Carriage ● 2 Year Warranty: **$399**

DISTO PRODUCTS ...

Disto Super Controller: $79.95 Disto Super Controller II: $129.95

- Mini Eprom Programmer Add on: **$54.95**
- Hard Disk Add On: **$49.95**
- RT Clock & Parallel Interface: **$39.95**
- MEB Adapter Add On: **$24.95**

MULTI-BOARD ADAPTER: Printer Port, Faster RT Clock & true RS-232 Serial Port. **$59.95**

RS232 SUPER PACK: Here it is! True RS-232 Port for your CoCo. Compatible with Tandy® Deluxe RS232 Pack. Includes DB25 Cable. Requires Multipak. **Only $54.95**

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Order Status, Info, Technical Info: (716) 383-8830. **FAX**: 716-383-0026

UPS 2ND DAY AIR

$FF90 Initialization Register 0

Bit 7	CoCo 1 and 2-compatible bit
Bit 6	MMU enable bit
Bit 5	Enable IRQ bit
Bit 4	Enable FIRQ bit
Bit 3	Enable secondary vectors bit
Bit 2	Standard SCS bit
Bits 1 to 0	ROM map mode

$FF91 Initialization Register 1

Bit 7	
Bit 6	Memory type
Bit 5	
Bit 4	
Bit 3	
Bit 2	
Bit 1	Timer clock-select bit
Bit 0	MMU Task bit

$FF92 IRQ Enable Register

Bit 7	
Bit 6	
Bit 5	Enable IRQ from timer
Bit 4	Enable IRQ from horizontal border
Bit 3	Enable IRQ from vertical border
Bit 2	Enable IRQ from serial data input
Bit 1	Enable IRQ from keyboard
Bit 0	Enable IRQ from cartridge

$FF93 FIRQ Enable Register

Bit 7	
Bit 6	
Bit 5	Enable FIRQ from timer
Bit 4	Enable FIRQ from horizontal border
Bit 3	Enable FIRQ from vertical border
Bit 2	Enable FIRQ from serial data input
Bit 1	Enable FIRQ from keyboard
Bit 0	Enable FIRQ from cartridge

$FF94 Timer MSB
$FF95 Timer LSB
$FF96 <Reserved>
$FF97 <Reserved>

$FF98 Video Mode Register

Bit 7	Bit-plane graphics enable bit
Bit 6	
Bit 5	Artifact color mode bit
Bit 4	Composite-monochrome bit
Bit 3	50Hz bit
Bits 2 to 0	Lines per character row

$FF99 Video-Resolution Register

Bit 7	
Bits 6 to 5	Lines per field
Bits 4 to 2	Horizontal resolution
Bits 1 to 0	Color resolution

$FF9A Border-Palette Register
$FF9B <Reserved>
$FF9C Vertical-Fine Scroll Register
$FF9D Screen Start Address 1
$FF9E Screen Start Address 2
$FF9F Horizontal Offset Register

$FFA0-$FFA7 MMU Segments Task 0:

$FFA0 Logical Addresses $0000 to $1FFF
$FFA1 Logical Addresses $2000 to $3FFF
$FFA2 Logical Addresses $4000 to $5FFF
$FFA3 Logical Addresses $6000 to $7FFF
$FFA4 Logical Addresses $8000 to $9FFF
$FFA5 Logical Addresses $A000 to $BFFF
$FFA6 Logical Addresses $C000 to $DFFF
$FFA7 Logical Addresses $E000 to $FDFF

$FFA8-$FFAF MMU Segments Task 1

$FFA8 Logical Addresses $0000 to $1FFF
$FFA9 Logical Addresses $2000 to $3FFF
$FFAA Logical Addresses $4000 to $5FFF
$FFAB Logical Addresses $6000 to $7FFF
$FFAC Logical Addresses $8000 to $9FFF
$FFAD Logical Addresses $A000 to $BFFF
$FFAE Logical Addresses $C000 to $DFFF
$FFAF Logical Addresses $E000 to $FDFF

$FFB0-$FFBF Palette Registers

$FFB0 Color Palette 0 (Text Background Color 0)
$FFB1 Color Palette 1 (Text Background Color 1)
$FFB2 Color Palette 2 (Text Background Color 2)
$FFB3 Color Palette 3 (Text Background Color 3)
$FFB4 Color Palette 4 (Text Background Color 4)
$FFB5 Color Palette 5 (Text Background Color 5)
$FFB6 Color Palette 6 (Text Background Color 6)
$FFB7 Color Palette 7 (Text Background Color 7)
$FFB8 Color Palette 8 (Text Foreground Color 0)
$FFB9 Color Palette 9 (Text Foreground Color 1)
$FFBA Color Palette 10 (Text Foreground Color 2)
$FFBB Color Palette 11 (Text Foreground Color 3)
$FFBC Color Palette 12 (Text Foreground Color 4)
$FFBD Color Palette 13 (Text Foreground Color 5)
$FFBE Color Palette 14 (Text Foreground Color 6)
$FFBF Color Palette 15 (Text Foreground Color 7)

$FFC0-$FFDF SAM Emulation

$FFC0-$FFC5 Display mode control
$FFC6-$FFD3 Display offset
$FFD4-$FFD5 Base page
$FFD6-$FFD7 <Unused>
$FFD8-$FFD9 CPU rate
$FFDA-$FFDD <Unused>
$FFDE-$FFDF Map type

Table 1: GIME Chip Functions

COLORWARE Introduces

THE WORKS

"Your CoCo 3 will think it's a Mac."

GRAPHIC DESIGN / WORD PROCESSING / SPELLCHECKER

The Ultimate in Desktop Publishing

The Works includes everything below

All for $149.95

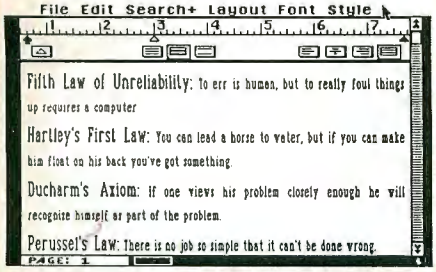
Save $80.00

Max–10+

Now with online 40,000 word spellchecker

Regularly $79.95

The latest in CoCo word processors and the only one with true WYSIWYG (What You See Is What You Get) output. Mix graphics with text. Max–10 is great for anything from greeting cards up to newsletters. Just turn the next page for a full list of Max–10's unbelievable features.



Max–10 Font Set

Regularly $29.95

36 fonts on 2 disks. Can all be used easily and quickly with Max–10.

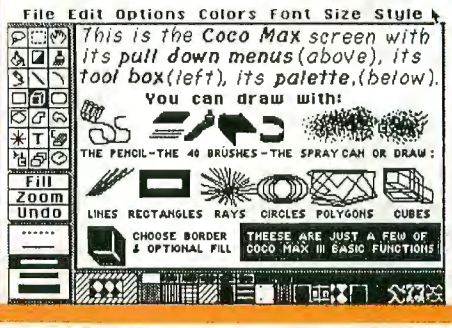
Frontier 18 point
Athens 18 point
Irvine 12 point
Irvine 24
Swan Song 12 point
Swan Song 24
Ellesmere 12 point
Ellesmere 24 point
Ellesmere Bold 24
Digital 12 point
Longhand 24
Hollow 12 point
Hollow 18 point
Rome 9 point
Rome 12 point
Stencil 18 point
Futura 24
Courier 12 point
Brookhaven 18
Thames 18 point
San Francisco 18
Century 24

All these and 14 more!

CoCo Max III

Regularly $79.95

The ultimate graphics creation program. See the list of features on the next page. Also read the superb review in **The Rainbow**, *April 1988*.



CoCo Max Fonts

Regularly $49.95

Almost 100 fonts for incredible headlines and text. Four disks full of fonts. Use CoCo Max styles (Bold, Italic, 3–D, Shadow ...), sizing and colors for absolutely wonderful effects. Thousands of combinations are possible. Here are some of the fonts:

Koloss
Digital Medium
Digital Large
Futura
GRID LARGE
HAIFA
Victory
FUTURA BLK. LG
BABY TEETH LG.
LIQUID CRYSTAL
Cartwheel
NORMANDE LG.
ORBIT
POINT OUT
SINALOA
PRINTOUT LARGE

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We understand perfectly that you have no reason to believe anything you read. Including this ad. (Or the rave reviews)

So we invite you to evaluate **The Works** yourself. Call and order it. We'll send it with detailed, clear instructions. Use it with your own CoCo 3, on your own work, for 30 days. Try it for brilliant presentation graphics, outstanding word processing. Wring it out.

After 30 days, if it isn't for you, for any reason, we'll take it back and write you a check immediately for your full purchase price.

The risk is all ours. But we urge you not to wait, this deal may end soon. We can guarantee this price only if you order now.

Call today. You have nothing to lose.

(203) 348–9436

Order line open weekdays 9 to 5 Eastern time

See next page for more ordering info.

COLORWARE

A division of Sigma Industries, Inc.

NEW REAL DESKTOP

CoCo Max™ III AND

CoCo Max III is absolutely the best drawing package available for the CoCo 3, and it does more than just let you draw. **CoCo Max III** includes animation, text, color mixing and more features than you would think possible. It combines incredible speed with dazzling graphics and it is a joy to use even its most powerful features.

Pictures, graphs, flyers, cards, signs, school projects, labels, buttons and anything else you might dream of creating is now possible with **CoCo Max III**. Is it any wonder that the majority of CoCo Gallery pictures in the last five months were created with **CoCo Max?**

Thousands of CoCo users have found that you don't have to be an artist to have fun with **CoCo Max**. You'll wonder why you waited so long to get the incredible **CoCo Max III**.

CoCo Max III is the best because it includes:
– a huge picture area (*two* full hi-res 320x192 screens) – a large editing window – Zoom mode for detail work – 28 drawing tools which you just point and click on – shrink and stretch – rotation at any angle (1.5 degree steps) – 512K memory support (*all* features work with 128K too) – an Undo feature to correct mistakes – you can even Undo an "Undo" – Animation – special effects – color sequencing (8 colors, variable speed) – thirteen fonts (more available) – each font has eight different sizes – five style options (bold, italic, 3D, etc.) for thousands of font/size/style combination possibilities. – the CoCo Show "slide show" program – color editing of patterns – automatic pattern alignment – prints in single and double size – smart lasso (move text over a background...) – advanced tools: arc, ray, cube, etc. – select 16 of the 64 colors (all 64 colors are displayed at once for selection!) – picture converter (CoCo Max II, MGE, BASIC) – extensive prompting – "glyphic" clipbook of rubber stamps – double click shortcuts – color mixing (additive/subtractive/none) – money back guarantee – sophisticated data compression saves disk space – pull down menus (no commands to remember) – forty paintbrush shapes – two color lettering – spray can – scrapbooks of pictures – error free – Y-cable or multipack not required – high speed hi-res interface included (plugs into joystick port) – disk is not copy protected – amazing "flowbrush" – RGB and composite monitor support – replace color – printing on black and white printers in five shades of gray – full color printing with optional drivers for the NX-1000 Rainbow and CGP220 – entirely rewritten for the CoCo 3

There are no limits to what you can do with this fabulous program. Speed, ease, animation, power and color, all in one package. **CoCo Max III** *is the ultimate program for the CoCo 3.* –Rainbow review 4/88

CoCo Max III: $79.95
Max-10 owners: deduct $10

System Requirements:
CoCo 3 disk system and a Joystick or Mouse

Printer drivers included:
IBM/Epson and compatibles, GEMINI, DMP105/106/130,OKI182/192, CGP220 (B&W), DMP110, DMP200

Color printer drivers (prints 125 different colors) Star NX-1000, CGP-220, or Okimate 20 each **$19.95**

For all CoCo Max Versions
Max Edit Font Editor: A font is a set of characters of a particular style. With Max Edit you can create new fonts or modify the existing ones. **$19.95**

Max Font disks (send for list) each **$19.95**

Max Font Set (95 fonts on 4 disks) **$49.95**

DS69/69B Digitizers: allows you to capture the image from a VCR or video camera and bring it into your computer. CoCo Max will let you load digitized pictures and modify them.

DS-69 (2 images per second. Requires multipak) **$99.95**

DS-69B (8 images/second) **$149.95**

CoCo 1 & 2 Owners Still Available:
(See previous ads or write for information)

CoCo Max II (works on all disk CoCos) **$69.95**

CoCo Max Tape (CoCo 1 & 2 only) **$59.95**

Y-Cable **$24.95**

CoCo Max II Picture Disk Set set of 3 disks: **$29.95**

Guaranteed Satisfaction
Use CoCo Max or Max-10 for a full month. If you are not delighted with either of them, we will refund every penny.

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A division of Sigma Industries, Inc.

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Visa or Mastercard accepted. C.O.D. orders $3 extra
Check or M.O. to: Colorware, 242-W West Ave, Darien CT 06820
Add $3 per order for shipping ($5 to Canada, 10% to overseas)
CT residents add 7.5% sales tax

PUBLISHING

COLORWARE

Max-10™

THE DAZZLING WORD PROCESSOR

You probably already have a word processor, and you probably wish it had these features:

- Fully menu driven (CoCo Max style) with point and click marking of text. You don't need the arrow keys!
- True WYSIWYG (What You See Is What You Get) including variable size fonts, styles (bold, italics, etc.) and graphics.
- Can print multiple columns on a page.
- Not limited by printer capabilities: fonts up to 24 points (1/3") high, superscripts, small print, etc.
- Fully integrated spelling checker (incredibly fast), no need to exit program to check spelling.
- Graphics can be imported from just about anything (CoCo Max; MGE; BASIC; even Macintosh pictures from a BBS) and resized to fit your document.
- Full screen preview including graphics.

Max–10 has all these unique features, plus all the features you are used to in your current word processor. Even with all this, you don't give up anything. **Max–10** is easier to use, more intuitive, faster and more powerful than anything else. It's not just a word processor, it's a desktop publisher.


THE SLIPPED DISK

Max-10 released

Colorware Inc. today announced the release of the new version of their document creator for the Color Computer 3. The original version which had taken the CoCo community by storm was already being touted as the most innovative word processor for the CoCo 3.

to bring those pictures to life. Multiple columns of text and pictures, various built-in fonts and the capability to load many more as they are made available, spelling checking, and a handy preview function which displays an entire page as it will be printed. This is truly phenomenal!

In summary this reporter can do no better than to paraphrase a well known saying: a CoCo Max picture may be worth a thousand Max-10 words, but the whole is much more than the sum of its parts.

Drawing contest

Submit a good drawing of this little fellow and you just may win our grand prize.

Weather today

Bright, partly cloudy, 20% chance of rain possibly changing to scattered flurries overnight with a low of 33°. Tomorrow's high will be in the mid- to upper- 90's.

Cars #1 cat killers

A study recently conducted by the Rainbow Institute for Deranged Stuffed Animals reveals that the vast majority of feline deaths is due to collisions with heavy mid-size family sedans. No information was made

Now with this new version, Colorware has brought to the CoCo market something many have been clamoring for: a real desktop publishing system. Coupled with the already sensational CoCo Max III color graphic creator and editor, the new Max-10 can add words

PAGE 1

Max–10: $79.95

CoCo Max III owners: deduct $10

Max–10 requires a CoCo 3, at least 1 disk, & joystick or mouse

Printer drivers included: IBM/Epson and compatibles; DMP 105, DMP106, DMP130; CGP220 (B&W); Gemini/Star

Some of the many features of **Max–10:**

– Blinding speed – printing in multiple columns – online dictionary – spell checking – graphics can be mixed with text – full justification of proportionally sized characters – bold, italic, underline superscript and subscript type styles – superb file support, just point and click – "Undo" lets you correct mistakes – easy to use, no commands to remember – any graphics program can be used – pictures can be shrunk or stretched to fit – right and left alignment – centering – variable line spacing – page numbering – current page number displayed on the screen – variable tab stops – left and right margins – tabs and margins can vary in the same document – cut and paste text and graphics anywhere in the file – page break shows on the screen – pull down menus are quick and simple to use – lightning fast access to any point in the document with the scroll box – twenty fonts (styles and sizes), more available – any number of character sizes and styles can be mixed on the same line – up to more than 120 characters per line, depending on font size, style and letters – headers and footers, even with graphics – file compatibility with other word processors – right, left, bottom and top margins – word wrap – set starting page – type ahead – key repeat – key click – scroll up and down – ASCII file output for compatibility – disk directory – kill files– block cut, copy and move – global search and replace – paragraph indent – clipboard – merge – show file (on disk) – free memory display – page count – paragraph count – word count – graphics can be resized and moved – multiple fonts – error recovery – true lowercase – 512K memory support (all features work with 128K too) – complete point and click cursor control – moving, clearing and changing blocks of text is ridiculously easy, just point and click at each end of the text block – onscreen ruler – preview file before loading – search and replace – disk is not copy protected – more than 35 pages of text

CoCo Max III and Max–10 Perfect Together

You do not *need* **CoCo Max III** to insert and print graphics in **Max–10**. Max–10 works with any graphics creation program, and you can also use graphics downloaded from bulletin boards.

Similarly, you do not *need* **Max–10** to create graphics with text in **CoCo Max III**. There are tremendous lettering capabilities in **CoCo Max III**, with its many fonts, styles, and sizes.

Together **Max–10** and **CoCo Max III** are an unbeatable combination. This desktop publishing system is better than anything you've ever seen on a CoCo. We are so confident that you will use, and enjoy using the two software packages, that we offer an unconditional money back guarantee. Stop wasting your time and effort using inferior or obsolete products. Move up to the new generation of CoCo software now.

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interpreted as four 2-bit values, specifying four dots (or pixels) of video on the display. The values of each of these 2-bit values are used to reference the color palettes, which contain the color codes to be used. For a 16-color mode, each byte of video data will be interpreted as two 4-bit values. (Of course, more RAM is needed for such a screen.) For text modes, the data in the video display memory will be interpreted differently.

Each character on a text screen is specified by two adjacent bytes in memory. The first byte is the character itself, in ASCII code. The second, called the *attribute* byte, specifies the manner in which the character is displayed. It is interpreted like this:

Attribute	Byte
Bit 7	Blink
Bit 6	Underline
Bits 5 to 3	Foreground palette for character
Bits 2 to 0	Background palette for character

The background palette has eight added to it before it is used. Thus, a zero in bits 2 through 0 results in the use of Palette 8, a one, Palette 9, and so on.

Bit 5 of the video mode register at Location $FF98 controls the color set available to Color Computer 1 and 2 programs using artifact colors. This trick, discovered after the release of the Color Computer 1, enables color sets not supported by the original VDG chip. The only drawback is that the color set selected is dependent on the clock's state at the time the computer is turned on or reset — requiring the user to press reset repeatedly until the proper colors appear. (Any software that has a setup screen with a message like "Press Reset until this square is blue" uses this mode.)

The artifact-color mode bit removes this guesswork. Depending on the original programming, a value of either zero or one in this bit will make the software come up in the proper mode every time. This bit is set to one value or the other depending on whether the F1 key is pressed when the reset key is pressed. This lets non-programmers set or clear this bit, so existing programs with this problem may be initialized correctly.

Bit 4 of $FF98 is the monochrome bit and reflects some foresight on Tandy's part. It enables support for composite monochrome monitors, a monitor Tandy does not currently market. Bits 2 to 0 of $FF98 and bits 6 to 0 of $FF99 set up the resolution and number of colors used by the various Hi-Res GIME graphics modes.

$FF9A contains the color value for the display border. Normally this register is set to zero, so the display will have a black border like the Color Computers 1 and 2, but now the border can be set to any one of the 64 colors available via the GIME. More palette registers are found at locations $FF00 through $FFBF. They control the color set visible on the display.

Color Computers 1 and 2 can display up to eight colors. The GIME allows display of up to 16 colors at one time, chosen from a palette of 64. Color Computers 1 and 2 display one of a number of fixed color sets, but the GIME palette registers allow the programmer to pick and choose the colors used, for more realistic graphics.

$FF9C and $FF9F are the vertical and horizontal fine-scroll registers. They let the display scroll in either direction under hardware control — a feature that has yet to be used in any commercial software. An unfortunate bug in early production runs of the GIME chip rendered the horizontal-scroll register useless. These features may see some interesting applications once machines with later versions of the GIME chip become more widely available.

Locations $FF9D and $FF9E control the section of memory used by the GIME chip for its video. One nice thing about this 2-byte register: The section of memory used for the GIME's video need not reside in the current memory map.

This brings us to one of the GIME chip's most powerful features: the MMU. The 6809 CPU chip can only address 64K of memory at one time. This is an inherent limitation designed into the 6809 when memory cost more than it does today. To get around this limitation and make the 128K and 512K Color Computer possible, Tandy added the GIME's MMU feature.

On a 128K Color Computer 3, memory is available as sixteen 8K segments of memory. On a 512K machine, there are 64 of these 8K segments available. When the MMU is enabled, a set of eight registers in the GIME control which segment is addressed by the CPU. The MMU register at $FFA0, for example, controls which segment is seen in memory from addresses $0000 to $1FFF. The next register controls addresses $2000 to $3FFF. This scheme continues through the MMU register at $FFA7, which determines the segment to be mapped in at addresses $E000 through $FDFF. (Addresses $FE00 through $FFFF are a special case since the GIME chip is addressed in that range.)

There are two sets of MMU registers. The set at $FFA0 to $FFA7 is used if Bit 1 of $FF91 is zero; if it is one, the set at $FFA8 to $FFAF is used. This feature can be used to switch rapidly between two pre-defined sets of MMU values. In this manner, sections of memory can be switched into, and then out of, the 64K address space at will. Memory segments switched out of the space do not lose their contents and can even be switched back in at a different place.

The Color Computer 3's Super Extended BASIC uses the MMU to access high-resolution graphics areas outside the normal 64K address space. Much of the commercial software for the Color Computer 3 also uses the MMU to run a program larger than the 64K limit of the Color Computer 1 and 2. OS-9 Level II provides access to the full 128K or 512K of memory available with no special programming needed.

So there you have it — a quick look inside the GIME, the powerhouse chip inside our favorite new machine. There are many sources available for more information. Perhaps the best source of data on the GIME is Tandy's *Technical Reference Manual for the Color Computer 3*. Other sources of information are *Inside OS-9 Level II*, and the *BASIC Unraveled* series. Finally, there are many knowledgeable Color Computer users on the CoCo and OS-9 SIGs of online services like Delphi and CompuServe. Professional software developers have long known of the value such online services can provide. Delphi has many tutorial articles on 6809 programming and details on the GIME chip available in its CoCo SIG's online database.

Armed with this information, many of you may decide to tackle the world of assembly-language programming on the Color Computer — a task that is both challenging and rewarding to those willing to persevere. Perhaps this quick tour of the many powerful functions available via the Color Computer 3 GIME chip will inspire some of you to begin that journey.

(Questions or comments concerning this article may be directed to the author at 712 Brett, Rohnert Park, CA 94928. Please include an SASE when requesting a reply.)

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VIP Writer III has 106K total text storage in a 128K CoCo 3 (495K in 512K). VIP Writer III creates ASCII text files which are compatible with all other VIP Programs as well as other programs which use ASCII files. You can use VIP Writer III to even type BASIC programs! There is a 48K text buffer (438K in a 512K CoCo 3) and disk file linking allowing virtually unlimited text space. VIP Writer III works with up to four disk drives and lets you display directories and free space as well as rename or kill disk files. In addition VIP Writer III is 100% compatible with the RGB Computer Systems Hard Disk.

POWERFUL EDITING FEATURES

VIP Writer III has a full featured screen editor which can be used to edit text with lines up to 240 characters long with or without automatic word wrap around. You can select type-over mode or insert mode. There is even an OOPS command to recall a cleared text buffer. Other editing features include: Type-ahead • typamatic key repeat and key beep for flawless text entry • end of line bell • full four way cursor control with scrolling • top of textfile • bottom of textfile • page up • page down • top of screen • bottom of screen • beginning of line • end of line • left one word • right one word • DELETE character, to beginning or end of line, word to the left or right, or entire line • INSERT character or line • LOCATE and/or CHANGE or DELETE single or multiple occurrence using wildcards • BLOCK copy, move or delete with up to TEN simultaneous block manipulations • TAB key and programmable tab stops • word count • line restore • three PROGRAMMABLE FUNCTIONS to perform tasks such as auto column creation and multiple copy printing.

Writer III or Library /W owners: Upgrade to the VIP Writer III 2.0 for $10 + $3 S/H. Send ORIGINAL disk and $13 total.

AUTOMATIC TEXT FORMATTING

VIP Writer III automatically formats your text for you or allows you to format your text in any way you wish. You can change the top, bottom, left or right margin and page length. You can set your text flush left, center or flush right. You can turn right hand justification on or off. You can have headers, footers, page numbers and TWO auxiliary lines which can appear on odd, even or all pages. You can also select the line on which they appear! You can even change the line spacing! Parameters can be altered ANYWHERE !

PREVIEW PRINT FORMAT WINDOW

VIP Writer III features an exclusive format window which allows you to preview your document BEFORE PRINTING IT! You are able to move up, down, left and right to see centered and justified text, margins, page breaks, broken paragraphs, orphan lines etc.

PRINTING VERSATILITY

VIP Writer III prints TWICE as fast as any other CoCo word processor! It supports most serial or parallel printers using J&M JFD-CP or Rainbow interface and gives you the ability to select baud rates from 110 to 19,200. You can imbed printer control codes anywhere in your text file EVEN WITHIN JUSTIFIED TEXT! VIP Writer III also has TWENTY programmable printer macros which allow you to easily control all of your printers capabilities such as bold, underline, italics and superscript using simple key strokes. Other features include: multiple copy printing • single sheet pause • line feeds.

BUILT IN PRINT SPOOLING

VIP Writer III has a print spooler with a 57,000 character buffer which allows you to print one document WHILE you are editing another. You don't have to wait until your printer is done before starting another job! Some word processors DO NOT include this feature!

50,000 WORD SPELLING CHECKER

VIP Writer III includes VIP Speller (not FREEWARE) to check your text for misspelled words It has a 50,000 (not 20,000) word dictionary that can be added to or edited.

QUALITY DOCUMENTATION

VIP Writer III comes with a well written 125 page manual which is Laser printed, not dot-matrix like the competition. It includes a tutorial, glossary of terms and examples for the beginner as well as a complete index! VIP Writer III is truly the BEST you can buy.

VIP Writer III includes VIP Speller 1.1. **DISK $79.95**

Available through Radio Shack Express Order Cat. #900-0908

VIP Writer owners: Upgrade to the Writer III 2.0 for $49.95 + $3 S/H. Send original disk and $52.95 total.

VIP Database III

VIP Database III features selectable screen displays of 40, 64 or 80 characters by 24 lines with choice of 64 foreground, background, hilite and cursor colors for EASY DATA ENTRY. It uses the CoCo 3's hardware screen and double clock speed to be the FASTEST database available! VIP Database III will handle as many records as will fit on your disks and is structured in a simple and easy to understand menu system with full prompting for easy operation. Your data is stored in records of your own design. All files are fully indexed for speed and efficiency. IN-MEMORY SORT of records is LIGHTNING FAST and provides for easy listing of names, figures, addresses, etc., in ascending or descending alphabetical or numeric order. Records can be searched for specific entries using multiple search criteria. The built-in mail-merge lets you sort and print mailing lists, print form letters, address envelopes - the list is endless. The built-in MATH PACKAGE even performs arithmetic operations and updates other fields. VIP Database III also has a print spooler and report generator which uses print forms you create. **DISK $69.95**

Available through Radio Shack Express Order Cat. #900-0915

VIP Database owners: Upgrade to the VIP Database III for $39.95 + $3 S/H. Send ORIGINAL disk and $42.95 total.

VIP Calc III

FAST 4-color POPUP menus • PRINT SPOOLER 32, 40, 64 and 80 Column HARDWARE display! Runs VERY VERY FAST at double clock speed!

Now every CoCo 3 owner has access to a calculating and planning tool better than VisiCalc™, containing all its features and commands and then some. VIP Calc III allows a large worksheet with up to 512 columns by 1024 rows! In addition, VIP Calc III has up to 16 windows which allow you to compare and contrast results of changes. Other features include 8 AND 16 digit precision • trig. functions • averaging • algebraic functions • column and row ascending and descending SORTS • locate formulas or titles in cells • block move and replicate • global or local column width • limitless programmable functions • create BAR charts. Embed printer control codes for customized printing. Combine spreadsheet data with VIP Writer documents to create ledgers, projections, statistical & financial budgets and reports. **DISK $69.95**

VIP Calc owners: Upgrade to the VIP Calc III for $29.95 + $3 S/H. Send original disk and $32.95 total.

VIP Library /WDCE

The VIP Library /WDCE combines all six popular VIP application programs - VIP Database III, VIP Writer III, VIP Speller, VIP Calc III, VIP Terminal and VIP Disk-ZAP - into one integrated program on one disk called VIP Desktop. **DISK $179.95**

For VIP Library shipping please add $4 USA. $5 Canada. $10 Foreign.

VIP Library owners: Upgrade to the VIP Library /WDCE for $99.95 + $3 S/H. Send ORIGINAL disk and $102.95 total.

VIP Library /WDE owners: Upgrade to the VIP Library /WDCE for $10 + $3 S/H. Send ORIGINAL disk and $13 total.

Buy RGB-DOS for $29.95,

Get Hard Disk support, new commands and a Disk Drive FREE!*

Sounds too good to be true? If you own a Radio Shack FD 502 or other double sided Disk Drive, using RGB-DOS, you can access the other side of your Disk Drive giving a second disk drive absolutely free!* RGB-DOS also supports up to 2 Hard Drives that can be used by DISK BASIC as well as OS-9. RGB-DOS works with CoCo 1, 2 and 3 and supports double sided drives and faster stepping rates. Other features include: Full screen directory display shows drive #, free space and even a disk name! • RUNM command and FLEXIKEY Last Command Recall and Edit system • EPROM version executes any program when CoCo is turned on for hands free start-up. 64K Req'd.

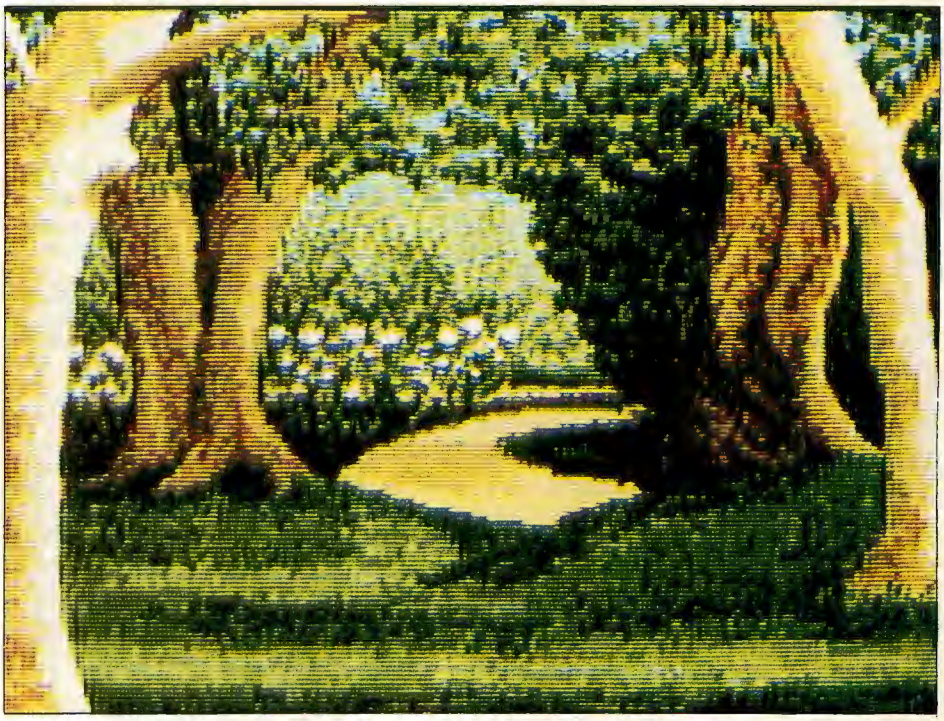
All products run under RSDOS and are not copy protected.

SD Enterprises

✆(503) 663-2865 ✉POB 1233 Gresham, OR 97030

We accept VISA / MASTERCARD and C.O.D. orders by phone.
Non VIP Library orders add $3 for shipping and handling in USA. Canada $4. Foreign $6. COD orders add an additional $2.75. Checks allow 3 weeks for delivery.

CoCo GALLERY



1st Prize

Parkview
Barbara Ann Storrier

Drawn originally with pen & ink, Barbara recreated this landscape of Lacy Park in San Marino, California, on the CoCo 3. The striking realism showcases the features of *CoCo Max III* and the artist's talents. Barbara lives in Arcadia, California.

2nd Prize

War
Ken Robison

Breaking through the enemy's perimeter, this soldier moves closer to his objective. Ken, a citizen of Port Colborne, Ontario, designed this scenario via *The Rat* package.

3rd Prize

River
Joel R. O'Rear

Red sky at night, sailors delight. Joel has enjoyed photography since his days in the Navy and now transfers his pictures to the computer with *CoCo Max III*. He lives in Tucumcari, New Mexico.

Honorable Mention

Faucon
Pierre Morris

This revered bird waits patiently for its prey. Pierre used a program he designed that enables him to obtain 256 different colors onscreen. He resides in Beauport, Quebec.

Honorable Mention

Butterfly
Brad Bansner

Although it isn't spring yet, I daydream of the plant life turning green again. Brad's *Colormax Deluxe* "Butterfly" is a welcome sight. A sophomore in high school, he sent this picture from Wyomissing, Pennsylvania.

SHOWCASE YOUR BEST! You are invited to nominate original work for inclusion in upcoming showings of "CoCo Gallery." Share your creations with the CoCo Community! Be sure to send a cover letter with your name, address and phone number, detailing how you created your picture (what programs you used, etc.) and how to display it. Also please include a few facts about yourself.

Don't send us anything owned by someone else; this means no game screens, digitized images from TV programs or material that's already been submitted elsewhere. A digitized copy of a picture that appears in a book or magazine is *not* an original work.

We will forward one first prize of $25; one second prize of $15 and one third prize of $10. Honorable Mentions may also be given.

Please send your entry on either tape or disk to the CoCo Gallery, THE RAINBOW, P.O. Box 385, Prospect, KY 40059. Remember, this is a contest and your entry will not be returned.

— Tony Olive, Curator

Those loving creatures that share our lives

Animal Stories

By Steve Blyn
Rainbow Contributing Editor

This month's program is a fun language arts program for elementary-school children. First and second graders will probably need assistance with some of the vocabulary words and spelling, but third graders and higher should have no trouble working on their own.

This program is concerned with pets. You know — those fuzzy, furry, obedient, curious creatures that share both our children's and our own lives. Pets are often considered full-fledged members of a family. Our own family has given its hearts to several pets over the years.

Even the computer world has fallen prey to this phenomenon. Look at the popularity of the imaginary CoCo Cat. No RAINBOWfest is complete without appearances from the furry feline. Little kids line up at these semiannual events to greet and hug CoCo Cat; adults stop to take pictures. Buttons with CoCo Cat's image are sold — all this for an imaginary mascot.

Things have gotten so out of hand that a new store called The Yuppie Puppy recently opened near Computer Island. In this store, you could easily spend a small fortune on pet clothing and gifts. Pets have certainly become a big business.

We have decided to write a program that kids can use to show their love for their pets — real or imagined. This program will help children create a short poem or story about a pet. If a printer is available, this poem or story will be printed on paper. Underneath the text is room to draw a picture of the real or imaginary pet.

The program first requests information about the child and the pet. These questions and answers are contained in lines 70 to 190. One by one, questions are asked, and the computer waits for the student to type an answer. A few of the answers had to be error-trapped. It is necessary, for example, for the child to type in either *boy* or *girl* for an answer on Line 120. The error-trapping is on lines 130 to 150. The program will not proceed until one of these responses is keyed in. A correct response is needed here to enable the computer to choose the proper gender of other pronouns later on. Most other answers allow more creativity or flexibility on the part of the student.

The child should enter short answers to the questions. One- or two-word answers are all that are required. If longer answers are entered, the CoCo's 32-character line limit will be exceeded. This would ruin the screen output of the finished product. (Naturally, the printer's output can handle longer lines of text.)

Lines 220 to 300 contain the directions for a printout of a story about the pet. The story's content is dependent on the child's answers to the questions. If there is no printer at hand, key in the program until Line 340. The remainder of the program contains the directions to print the story on any printer.

There are two options after the story appears on the screen. This routine is included on lines 310 to 320. The child may either end the program by pressing E or have the story printed on a printer by pressing P. As a precaution, be sure there is a printer connected and online before pressing E. If a mistake is made and the key is inadvertently pressed, control of the computer can be regained by pressing the Reset button on the rear-left side of the computer.

Experiment with any alterations you want or feel appropriate to your child's or pet's needs. You could change any of the questions or alter parts of the fixed content of the story. As always, we at Computer Island hope that you and your children enjoy and learn from our programs. □

Steve Blyn teaches both exceptional and gifted children, holds two master's degrees and has won awards for the design of programs to aid the handicapped. He owns Computer Island and lives in Staten Island, New York.

The Listing: PETSTORY

```
10 REM"THE YUPPIE PUPPY"
20 REM"STEVE BLYN,COMPUTER ISLAN
D,STATEN ISLAND,NY,1989"
30 CLEAR 1000
40 CLS:AA$=STRING$(32,191)
50 PRINT@8,"PET    QUESTIONS";
60 PRINT@32,AA$;
70 PRINT@64,"WHAT IS YOUR FIRST
NAME ?":LINEINPUT A$
80 GOSUB 210:PRINT"ARE YOU A BOY
 OR A GIRL?";:LINEINPUT Q$
90 IF Q$="BOY" THEN R$="HIS" ELS
E IF Q$="GIRL" THEN R$="HER" ELS
E 80
100 GOSUB 210:PRINT"WHAT KIND OF
 PET DO YOU HAVE?":PRINT"MY ";:L
INEINPUT B$
110 GOSUB 210:PRINT"WHAT IS YOUR
 PET'S NAME?":LINEINPUT C$
120 GOSUB 210:PRINT"IS "C$" A BO
Y OR A GIRL?":PRINT"A ";:LINEINP
UT D$
130 IF D$="BOY" THEN X$="HE":Y$=
"HIS"
140 IF D$="GIRL" THEN X$="SHE":Y
$="HER"
150 IF D$<>"BOY" AND D$<>"GIRL"
THEN 120
160 GOSUB 210:PRINT"HOW OLD IS "
C$"? ";:LINEINPUT E$
170 GOSUB 210:PRINT"NAME ONE FOO
D THAT "X$" LIKES":PRINT"TO EAT
BEST. ";:LINEINPUT G$
180 GOSUB 210:PRINT"NAME ONE THI
NG THAT "X$" LOVES":PRINT"TO DO
OFTEN. ";:LINEINPUT H$
190 GOSUB 210:PRINT"WRITE SOMETH
ING THAT TELLS WHAT":PRINTC$" LO
OKS LIKE. ";:LINEINPUT I$
200 GOTO 220
210 PRINT@64,"":PRINT@96,"":PRIN
T@64,"";:PLAY"O3L80CEDFGGG":RETU
RN
220 CLS:PLAY"O3L8CDEDC":PRINT@4,
A$;"'S YUPPIE ";B$
230 PRINT@32,AA$
240 PRINT@64,"MY PET'S NAME IS "
C$"."
250 PRINT C$" IS A "D$" "B$"."
260 PRINT@160,C$" IS "E$" YEARS
OLD AND"
270 PRINT Y$" FAVORITE FOOD IS "
G$"."
280 PRINT@256,X$" LOVES TO "H$".
"
290 PRINT X$" LOOKS LIKE "I$"."
300 PRINT@352,A$" WILL ALWAYS LO
VE "R$:PRINT "PET "B$" NAMED "C$
"."
310 EN$=INKEY$
320 IF EN$="E" THEN 330 ELSE IF
EN$="P" THEN 340 ELSE 310
330 CLS:END
340 REM"****PRINTING ROUTINE***"
350 PRINT#-2,TAB(30)A$;"'S YUPPI
E ";B$:GOSUB 470
360 PRINT#-2,TAB(25)"MY PET'S NA
ME IS "C$"."
370 PRINT#-2,TAB(28)C$;" IS A ";
D$;" ";B$:GOSUB 470
380 PRINT#-2,TAB(25)C$" IS "E$"
 YEARS OLD AND"
390 PRINT#-2,TAB(28)Y$;" FAVORIT
E FOOD IS ";G$:GOSUB 470
400 PRINT#-2,TAB(25)X$;" LOVES T
O ";H$;"."
410 PRINT#-2,TAB(28)X$" LOOKS LI
KE "I$".":GOSUB 470
420 PRINT#-2,TAB(25)A$;" WILL AL
WAYS LOVE "R$
430 PRINT#-2,TAB(28)"PET ";B$;"
NAMED ";C$;".":GOSUB 470
440 PRINT#-2,TAB(10)STRING$(60,"
-")
450 PRINT#-2,TAB(25)"HERE IS A P
ICTURE OF MY PET"
460 GOTO 310
470 FOR T=1 TO 3:PRINT#-2," ":NE
XT T:RETURN
```

Telewriter-128™

the Color Computer 3 Word Processor

TELEWRITER: UNDISPUTED #1

If you've read the other word processor ads, you've probably had your fill of cold lists of features, and claims of ultimate speed, power, and ease of use. So let's try to get past the overblown claims and empty buzz words—with 2 simple facts:

Fact 1: Telewriter is undisputedly the #1 most popular word processor on the Tandy Color Computers.

Fact 2: Telewriter's exemplary ease of use and power have been acclaimed in numerous magazine reviews and in thousands of letters and calls from end users.

THE OTHERS DON'T UNDERSTAND

So why has Telewriter gained such a large and loyal following, while other Color Computer word processors have come and gone? Ironically, our competitors' ads tell you *exactly* why.

For them, word processing is nothing more than features and numbers. The longer the list of features, and the bigger the numbers, the better the word processor. Or so they think.

They just don't understand that power and ease of use are not gained by tacking on random features or throwing in freebie utilities or forcing you to use a cumbersome mouse.

Real Power, *true* Ease of Use, and *genuine* Speed can only be attained through thoughtful, logical, intelligent design, attention to detail, and a commitment to the act and the art of writing. That's the Telewriter tradition, and that's the reason for Telewriter's phenomenal success.

TELEWRITER—128: INTELLIGENT DESIGN PERFECTED

And now, Telewriter-128, the latest Telewriter, uses the added hardware power of the Color Computer 3 to bring this intelligent design to its logical perfection.

Telewriter-128 adds unsurpassed speed and important new features to the already impressive arsenal of Telewriter-64. Not just speed for speed's sake, or features for the sake of advertising—but speed where it counts and features that make you a more efficient, more effective writer.

Rainbow magazine put it this way: "Telewriter-128 will set the word processing standard for the Color Computer 3 because it is so simple and user friendly. . . . The 81-page tutorial/user's manual is nicely done. It is written in easy to understand language but the program itself is so easy. . . . Most people will be able to use the software right out of the package."

TELEWRITER-128 OR DESKTOP PUBLISHING

Desktop publishing is nice for adding pictures and fancy fonts to newsletters or business presentations—but its graphics orientation sacrifices some important capabilities when it comes to working with words.

If your main concern is expressing ideas through words (notes, letters, reports, papers, novels, etc.), the dedicated word processing power of Telewriter-128 still provides the most efficient tool for the job. Each tool has its place—desktop publishing for striking visuals, Telewriter-128, for effective writing.

TELEWRITER-128 OR TELEWRITER-64

You can no longer afford to be without the ease, power, and efficiency, that Telewriter brings to everything you write.

Telewriter-128 for the Color Computer 3 costs $79.95 on disk, $69.95 on cassette.

For the Color Computer 1&2, **Telewriter-64** costs $59.95 on disk, $49.95 on cassette.

To order by MasterCard or Visa, call **(619) 755-1258** anytime, or send check to:

COGNITEC
704 Nob Avenue
Del Mar, CA 92014

(Add $2 S&H. Californians add 6% tax. To upgrade from TW-64 to TW-128 send original TW-64 disk and $41.95.)

Telewriter is also available through your nearby Radio Shack Computer Center and participating Radio Shack stores and dealers—or order direct from Express Order by dialing **1-800-321-3133.**

Ask for: **Telewriter-128** (disk) . . . cat #90-0909
Telewriter-64 (disk) . . . . cat #90-0254
Telewriter-64 (cass) . . . . cat #90-0253

FEATURES THAT MATTER: Telewriter's outstanding design and its complete set of features, put it in a class by itself, for smooth, efficient writing and letter perfect printed documents. Telewriter-128 includes:

Unbeatable SCREEN PERFORMANCE: lightning fast paging and scrolling, on-screen text that never lags behind your typing, and a response that is always instantaneous, no matter how much text is in the buffer, or where you are in the document.

26 User definable MACRO KEYS type your often used phrases and titles with a single keypress—saving you time and freeing your concentration for writing. User settable DUAL SPEED CURSOR moves you anywhere on the line, on the page, or in the document, fast or slow—you decide, with the touch of a finger. Fast PRINT PREVIEW MODE shows you text as it will print: headers, footers, margins, page breaks, page numbers, justification—saves time and paper and guarantees perfect looking documents everytime.

Instant, ON-LINE HELP summarizes all Telewriter-128 commands and special symbols. The On-line OPTIONS MENU lets you instantly customize the writing environment at any time to suit your precise needs (Screen/character color, Monochrome on/off, Key repeat/delay rate, 2 Cursor repeat/delay rates, Case-sensitivity of search, Auto file backup on/off, and more). A SINGLE FUNCTION KEY takes you instantly to any menu, so you never have to stop and think.

The 24, 25 or 28 LINE SCREEN DISPLAY option lets you see 16% more on-screen text (28), or wider line spacing (25). The auto-loading OPTIONS FILE stores all your Macros, Print Format settings, and Options Menu settings, so they are always there everytime you run Telewriter-128. 3 pop-up STATUS WINDOWS tell you cursor position, word count, free space, etc.

The QUICK SAVE feature lets you instantly save your current document with just 2 keystrokes and without leaving the editor. CURSOR THROUGH DIRECTORY to Load, Append, Rename and Kill files—so you'll never type a filename after the first time. HANGING INDENTS help you organize ideas on the page more effectively. Also: Footers, Multiple Print, Print to Disk, Key Click, Key Repeat, 40/80 Column Option, Overstrike, Word Delete, Nested Macros, Definable Foreign and Math Symbols and more. . . .

And, of course, Telewriter-128 incorporates all the Features of TELEWRITER-64, like: Works with *absolutely any printer* that works with your Color Computer (1, 2, or 3). Uses simple Embedded Control Codes so *all* intelligent features of your printer are easily accessed, including: Underlining, Boldface, variable Fonts, Sub-script, Super-script, Italics etc.

Format commands allow dynamically changing Margins, Headers, Spacing, Centering, etc., anywhere in the document. Format menu sets Margins, Spacing, Page numbering, Baud rate, Lines per page, Justification. Chain Printing means the size of your printed document is unlimited. Also Single page and Partial Print.

Fast full-screen editor with wordwrap, text alignment, block copy/move/delete, global search and replace, wild card search, fast 4-way auto-repeat cursor, fast scrolling, forward and backward paging, settable tabs, word and line counter, full error protection. Insert or delete anywhere on screen. Simple, easy to remember, "mnemonic" Editor Commands. Load, Save, Append, Partial Save files to disk or cassette. Kill, rename and list disk files. ASCII file compatibility.

The ninth in a series of tutorials for the beginner to intermediate machine language programmer

Machine Language Made BASIC

Part IX: Let There Be Music

By William P. Nee

The Color Computer is adept at producing musical sounds. Complicated and expensive hardware can replicate almost any musical instrument and play over many octaves with several voices. This month we'll explore the SOUND and PLAY commands and execute them from machine language programs. In a later article, we'll learn how to play music with up to six voices (notes) at one time. However, for right now, let's stick to one note at a time.

Let's start with the SOUND command. To use this command in BASIC, you need to enter a note (1 to 255), followed by the duration of play. Table 1 gives each note and its corresponding number. Middle C is C4, with a value of 89. These values can only approximate the note's actual frequency, but they will produce a good sound.

Load Register A with the desired sound and Register B with the duration; store A in Location $8C and execute the SOUND command at Address $A951. Please note: You'll lose anything stored in registers A and X. Routine 1 plays every note from 1 to 255. A sine-wave table of 36 notes (used in cassette programs) starts at Address $A85C. If you want to play these notes, try Routine 2.

Notes	Octave				
	3	4	5	6	7
C	---	89*	176	218	239
C#/D-	---	99	180	221	241
D	---	108	185	223	242
D#/E-	---	117	189	225	243
E	---	125	193	227	244
F	5	133	197	229	---
F#/G-	19	140	200	231	---
G	32	147	204	232	---
G#/A-	45	153	207	234	---
A	58	159	210	236	---
A#/B-	69	165	213	237	---
B	78	170	216	238	---

*Middle C

Table 1: SOUND Notes

To play a tune with notes of different durations, make up your own note table of two bytes for each note and its duration. Load Register A with the note and Register B with its duration, then play the note. Decrease the note counter and continue until out of notes. Playing notes can also be integrated with your visual display, but that will slow down the tempo.

The PLAY command is more complicated and requires more set-up. It uses the following locations:

Location	Description
$D8	Number of notes, pauses, etc.
$DE	Octave (0 to 4)
$DF/E0	Volume
$E1	Note length
$E2	Tempo
$E5	Number of dots after length

Each note is numbered from one to 12 since there are 12 half-steps in an

---

Bill Nee bucked the "snowbird" trend by retiring to Wisconsin from a banking career in Florida. He spends the long, cold winters writing programs for his CoCo.

```
         ORG   $3000
SOUND    LDD   #$0101      NOTE = 1, DURATION = 1
AGAIN    STA   $8C
         PSHS  A           SAVE NOTE
         JSR   $A951       SOUND NOTE
         PULS  A           GET NOTE
         INCA  NEXT NOTE
         CMPA  #$FF        TOP NOTE?
         BLO   AGAIN       IF LOWER, AGAIN
         SWI
```

Routine 1: Playing the Notes

```
         ORG   $3000
START    LDY   #$A85C      ADDRESS OF NOTE TABLE
         LDB   #1          NOTE DURATION
         LDA   #36         NUMBER OF NOTES TO PLAY
         STA   NOTES       SAVE IT
LOOP     LDA   ,Y+         GET A NOTE
         STA   $8C
         JSR   $A951       PLAY THE NOTE
         DEC   NOTES       ONE LESS TO PLAY
         BNE   LOOP        IF NOT OUT OF NOTES, BACK TO LOOP
DONE     SWI
NOTES    RMB   1
         END   START
```

Routine 2: Notes From a Sine-Wave Table

Note	Location				
	O0	O1	O2	O3	O4
	$9C62	$9C7A	$9C92	$9C9E	$9CAA
C	#$1A8	#$0D3	#$A6	#$51	#$26
C#	#$190	#$0C7	#$9C	#$4C	#$23
D	#$17A	#$0BB	#$93	#$47	#$21
D#	#$164	#$0B1	#$8B	#$43	#$1F
E	#$150	#$0A6	#$83	#$3F	#$1D
F	#$13D	#$09D	#$7B	#$3B	#$1B
F#	#$12B	#$094	#$74	#$37	#$19
G	#$11A	#$08B	#$6D	#$34	#$18
G#	#$10A	#$083	#$67	#$31	#$16
A	#$0FB	#$07C	#$61	#$2E	#$14
A#	#$0ED	#$075	#$5B	#$2B	#$13
B	#$0DF	#$06E	#$56	#$28	#$12

Table 2: PLAY Delay Cycles

Volume:	$DF/E0:	Volume:	$DF/E0:
V31	#$FA02	V30	#$F606
V29	#$F20A	V28	#$EE0E
V27	#$EA12	V26	#$E616
V25	#$E21A	V24	#$DE1E
V23	#$DA22	V22	#$D626
V21	#$D22A	V20	#$CE2E
V19	#$CA32	V18	#$C636
V17	#$C23A	V16	#$BE3E
V15	#$BA42	V14	#$B646
V13	#$B24A	V12	#$AE4E
V11	#$AA52	V10	#$A656
V9	#$A25A	V8	#$9E5E
V7	#$9A62	V6	#$9666
V5	#$926A	V4	#$8E6E
V3	#$8A72	V2	#$8676
V1	#$827A	V0	#$7E7E

Table 3: PLAY Volume

octave (C natural, C sharp/D flat, D natural, D sharp/E flat, E natural, F natural, F sharp/G flat, G natural, G sharp/A flat, A natural, A sharp/B flat and B natural).

There are five available octaves, but the computer subtracts one from the octave number, giving us octaves 0 to 4. The frequency table for the five octaves begins at $9C62. (See Table 2). The volume is a two-byte number corresponding to `V31`, `V0` (Volume 0) in BASIC. Table 3 gives the BASIC volume and the corresponding number that goes in locations $DF and $E0. The first number is 126 plus four times the volume; the second number is 126 minus four times the volume.

The length can be any value between 1 and 255. Adding a dot after the value increases the value by one half. The common notes and their lengths are as follows:

Note	Length
Whole	L1
Half	L2
Quarter	L4
Quarter Triplet	L6
Eighth	L8
Eighth Triplet	L12
Sixteenth	L16
Sixteenth Triplet	L24
Thirty-second	L32
Thirty-second Triplet	L48

The tempo can be any number between one and 255. The computer defaults to a tempo of two at power-up. Use the same length values as above for

a pause or rest. A pause actually plays a note, but at V0. The number of notes and pauses to be played goes into Location $D8, and the location of your note table goes into $D9/DA. Since $D8 is a one-byte location, you cannot have a note table of more than 255 notes. Any more will require a second note table.

The PLAY command goes from Address $9A22 to $9CB5, taking up 660 bytes — quite a routine. Fortunately there is a way to get around entering individual volumes, tempos, notes and lengths. This method involves loading your note table location into Location $A6/A7 (the current pointer location) and creating a note table using the *EDTASM* FCC (Form Constant Character) op code. The note table must start and end with quotes, just as the PLAY command would. Use all the PLAY command notations, such as notes A to G, octaves 1 to 5, lengths 1 to 255, tempo, pause, etc. After using the PLAY routine at $9A22, reload Location $A6/A7 with its original value. This routine *cannot* be executed from *ZBUG*; you must be in BASIC. Remember: Once you go to BASIC, your machine language program buffer is lost. It's still in *ZBUG*, but the source code has vanished. Try Routine 3; notice that NTAB1 starts at $301D and NTAB2 starts at $3056. Jot down those locations if you want to correct or change any notes. While in *ZBUG*, use the A mode to find that the last byte used ('') is at $30CE. If you want to add any more notes, they would have to start after that location.

When there are no errors in the source code, enter Q to return to BASIC, then enter EXEC &H3000 to play the music. If you decide to slow down the tempo, enter EXEC &HC000 to return to *EDTASM*, then Z to get to *ZBUG*. Since NTAB1 contains the tempo, type A for the ASCII mode and 301D/ to get to NTAB1. Continue pressing the down-arrow key until you get past the T. The next byte contains the original tempo of 4. Enter 3E to change the tempo and return to the edit mode, then press Q to return to BASIC. Type EXEC &H3000 again, and the same music plays — but at a slower speed.

When you first power up, the subroutine at Address $829C sets the octave (O3), the volume (V15), the length of the note (L4) and the note's tone (T2). Unless you're going to change one of these, you don't need to enter them. Regardless of what any manual states, the scale goes from C to B in each octave.

```
         ORG  $3000
START    LDX  $A6          SAVE CURRENT POINTER LOCATION
         PSHS X
         LDX  #NTAB1       REPLACE IT WITH NOTE TABLE 1 LOCATION
         STX  $A6
         JSR  $9A22        PLAY NOTE TABLE 1
         LDX  #NTAB2       REPLACE IT WITH NOTE TABLE 2 LOCATION
         STX  $A6
         JSR  $9A22        PLAY NOTE TABLE 2
         PULS X            GET OLD POINTER AND PUT IT BACK
         STX  $A6
         RTS               RETURN TO BASIC
NTAB1    FCC  /"T4V30O3L4CP100C/
         FCC  /GP100GAP100AGP100G/
         FCC  /FP100FEP100E/
         FCC  /DP100L8.DL16EL2C"/
NTAB2    FCC  /"L4GP100GFP100FEP100E/
         FCC  /DP100DGP100GFP100F/
         FCC  /EL100FEDL8.EL10F/
         FCC  /L4EDCP100CGP100GAP100A/
         FCC  /GP100GFP100FEP100E/
         FCC  /DL100EDCL8.DL16EL2C"/
         END  START
```

Routine 3: Replacing Locations

The Listing: MLNOTES

```
3000                 00100        ORG   $3000
3000 9E     A6       00110 START  LDX   $A6
3002 34     10       00120        PSHS  X
3004 8E     3019     00130        LDX   #NTAB1
3007 9F     A6       00140        STX   $A6
3009 BD     9A22     00150        JSR   $9A22
300C 8E     3058     00160        LDX   #NTAB2
300F 9F     A6       00170        STX   $A6
3011 BD     9A22     00180        JSR   $9A22
3014 35     10       00190        PULS  X
3016 9F     A6       00200        STX   $A6
3018 39              00210        RTS
3019        22       00220 NTAB1  FCC   /"T4V30O3L4CP100C/
3029        47       00230        FCC   /GP100GAP100AGP100G/
303B        46       00240        FCC   /FP100FEP100E/
3047        44       00250        FCC   /DP100L8.DL16EL2C"/
3058        22       00260 NTAB2  FCC   /"L4GP100GFP100FEP100E/
306D        44       00270        FCC   /DP100DGP100GFP100F/
307F        45       00280        FCC   /EL100FEDL8.EL10F/
308F        4C       00290        FCC   /L4EDCP100CGP100GAP100A/
30A5        47       00300        FCC   /GP100GFP100FEP100E/
30B7        44       00310        FCC   /DL100EDCL8.DL16EL2C"/
            3000     00320        END   START

00000 TOTAL ERRORS
```

My program offers a simple tune, but don't stop with my tune. The musical possibilities are endless. You only need a CoCo, some imagination and some patience.

Questions or comments about this tutorial may be directed to the author at Route 2, Box 216C, Mason, WI 54856-9302. Please enclose an SASE when requesting a reply.)

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Upgrading CoCo's Memory

By Martin H. Goodman, M.D.

Probably one of the simplest things CoCo owners can do to improve the utility and performance of their machines is adding more memory. All it takes is the right chips and tools and a few modifications to your computer. Usually memory upgrades can be done by CoCo owners with a little help from Tandy or a third-party vendor. This article discusses things to consider before upgrading memory, offers the general procedures for upgrading memory, and gives brief technical reviews of the various products on the market.

The Warranty

Some of the procedures I discuss involve opening your CoCo. Please note: Opening the computer can void the warranty, so if your machine is under warranty you may want to wait until that warranty has expired. More adventurous users may want to run their machines continuously for 72 hours. If no trouble arises, these hardy souls may assume with *some* degree of confidence that their warranties will not be needed and open their machines.

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

Defining Directions

I often describe procedures for the CoCo circuit board. While some diagrams are provided, many procedures are just described. At all times I will be talking about the CoCo circuit board as if it were sitting in front of you in the CoCo case with the keyboard (or the space where the keyboard was) facing you — as if you were about to type on an intact CoCo. When I say *front*, I mean "toward the keyboard," and when I say *rear* or *back*, I mean "toward the back of the computer, where the power and reset switches, and joystick, cassette and serial port connectors are located." Similarly, *right* means "toward the system bus (ROM pack) connector," and *left* means "toward the power supply side of the circuit board."

Opening the Machine

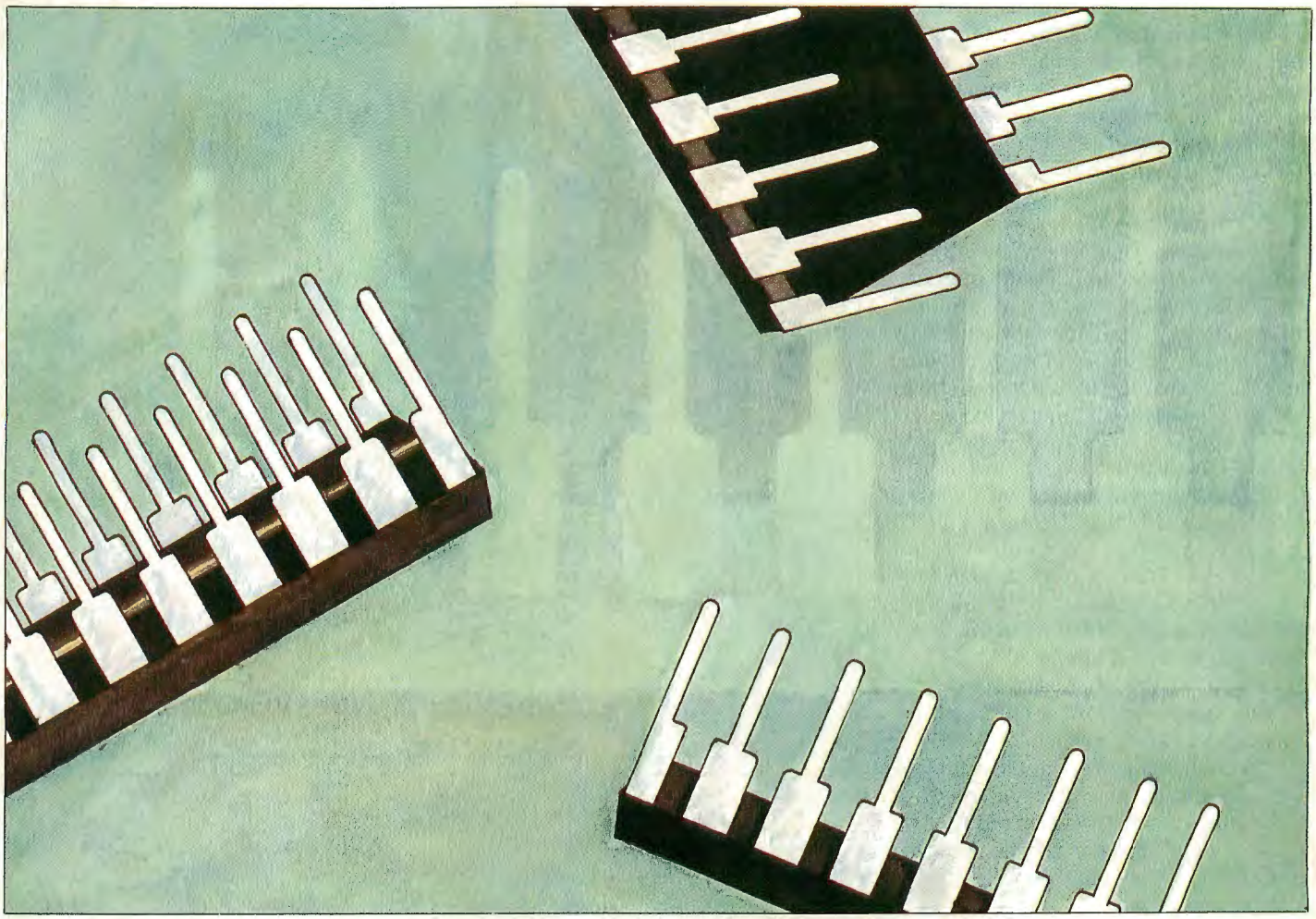
Upgrading memory on all CoCos requires opening up the machine. This is accomplished by removing the screws holding it together (accessed from the bottom of the case). In most cases it is necessary (or at least desirable) to remove the keyboard to gain better access to the circuit board. On all CoCos, beginning with the CoCo 1's "F board," the keyboard is attached to the computer with a mylar ribbon cable that plugs into a connector on the CoCo motherboard. You can pull the mylar cable out of this connector and reinsert it later. Do not scratch or tear the mylar cable; it's rather delicate.

Turn the Power Off!

Let me remind you to *unplug* the machine before working on it. Trying to modify a CoCo with the power on could result in frying some or all of the chips in the computer and possibly getting you electrocuted in the process. Electrocution by 110 volts AC is a grisly way to go.

Put the Chips in the Right Way

Plugging in a chip upside down can destroy the chip, so plug in the chips



correctly. Chips are typically oriented using either a notch or a dot (or both) at one end of the chip. This mark should correspond to the notch on the socket for that chip, to the notch on the silk-screen or to the part of the socket that has one corner filed down. On *most* CoCo models, all chips point the same way. Use this information to guide your placement of new chips. However, this information cannot be used when putting a new ROM chip into models A and B of the CoCo 2. In that situation, pay attention to the marks on the chip and the socket in which it goes.

You will need a Phillips screwdriver to open up the CoCo's case. In addition, you need a soldering iron and solder for almost all CoCo 1 and 2 upgrades. A temperature-controlled or low-wattage (15 to 25 watts) pencil iron with a small tip is essential. Some upgrades require cutting pliers, and most of the upgrades need needle-nosed pliers and a short piece of wire.

ROM and RAM chips are sensitive to static electricity. They are usually shipped in anti-static tubes or on anti-static foam pads. Make sure you and the foam surrounding the RAM chip have touched the ground plane on the CoCo before you handle or insert the chips. This will bring you, the CoCo and the chip to the same potential. Be careful in dry, cool environments, especially if you are on a thick rug. In such situations, it may be necessary for you to ground yourself to a water pipe via a conductive wrist band before working on the machine. Be sure the machine's ground and the foam-padded chips are brought to the water-pipe ground, too.

The best tool for removing memory chips from their sockets is a small screwdriver, which can be slipped between the chip's body and the socket and then rotated to gently pull up first one and then the other side of the chip. Occasionally a chip will be in a position not easily reached with a screwdriver. In this case, you may want an IC extractor tool. Radio Shack sells its extractor in combination with a IC inserter tool (Cat. No. 276-181, $6.95); however, many electronic supply houses sell an extractor for $2 or less. The extractor is a U-shaped piece of resilient metal with little teeth at the end of the U. Slip the teeth under the IC at both ends and use a rocking motion to remove the chip. Caution: It is easy to misuse the tool — especially when attacking a "stuck" chip. Be careful.

When inserting chips in the sockets, first put the chip on its side and gently bend the pins a little inward. Brand-new chips are often supplied with the pins angled out a bit, which makes it difficult to insert them. When inserting the chip, make sure all pins go into the holes of the socket. It is easy to leave one pin sticking out or (worse) bend a pin under the chip.

Many of these upgrades call for you to solder wire across two adjacent solder pads on the motherboard of the CoCo. Often the wire should be an eighth of an inch long — or less. Handling such short pieces of wire can be quite difficult. I recommend you jumper such pads in the following manner: Strip a bit of the insulation off a piece of 24-, 26- or 30-gauge wire. Then bend it at its end, so the length you want to

use is bent in an L shape. Now *tin* that end of the wire, and put a little blob of solder on the two pads you need to join. Using the rest of the wire as a handle, lay the L part of the wire across the pads and melt the solder to the wire and the pads. When the solder has thoroughly melted, flowed over the wire and bonded to the pads, let the joints cool. Then cut off the remainder of the wire.

CoCos 1 and 2

If you own a CoCo 1 or CoCo 2 with 16K of memory, you should upgrade. Upgrades for late-model CoCo 1s and all models of CoCo 2 are easy, relatively inexpensive and (for most programs) necessary because 64K is now the standard for CoCo 1 and 2 memory.

The upgrade procedure will vary with the model CoCo 1 or 2 you have, as will the exact type and number of memory chips required. All CoCo 1s and CoCo 2s whose Tandy catalog numbers do not have an A or B suffix require eight 4164 chips. These chips can be as slow as 200 ns in access time. However, any faster chips of that kind (150 ns, 120 ns, etc.) will work fine. At the time I am writing this article, these chips sell for between $1 and $2 each.

If you have a late-model CoCo 2 whose serial number includes an A or B, your upgrade to 64K will require two 4464 chips. These are 18-pin, 4-bit-by-64K chips. They may have a 200-ns access time or faster.

CoCo 1 C-, D- or E-Board Computers

These large Color Computers came with a *chicklet* keyboard and a gray case. When opened, they have a keyboard connected to the motherboard at a 16-pin connector. At the front-right side of the computer, you will see a multidigit number followed by the letter C, D or E. C-board computers will also have a satellite board connected to the main board via a cable. For all but the most fanatic hackers, the C-board upgrade can be considered impossible. C-board computers are rare and should not be upgraded but considered museum pieces.

D- and E-board CoCos can be upgraded to 64K, but the procedure is tedious, especially for the D board. These upgrades were covered in past issues of THE RAINBOW (see "ROM-RAM Roundup," May 1984, Page 49) and space does not permit my rehashing those instructions. Problems arise because the D-board CoCo 1 was not designed to support any more than 16K of memory. The E-board CoCo 1 was designed to support 64K memory chips but was not designed to use more than 32K of those chips. Thus extensive modifications to the chip power supply and address lines and the addition of an extra logic gate in the memory circuitry is required to accomplish the upgrade of those machines. The E-board CoCo 1 was designed to accept half-bad (optimists call them half-good) 64K memory chips (sometimes mistakenly called 32K-RAM chips), which Tandy bought at a discount. The board even had a jumper, so Tandy could populate it with chips that had either their top or bottom halves intact.

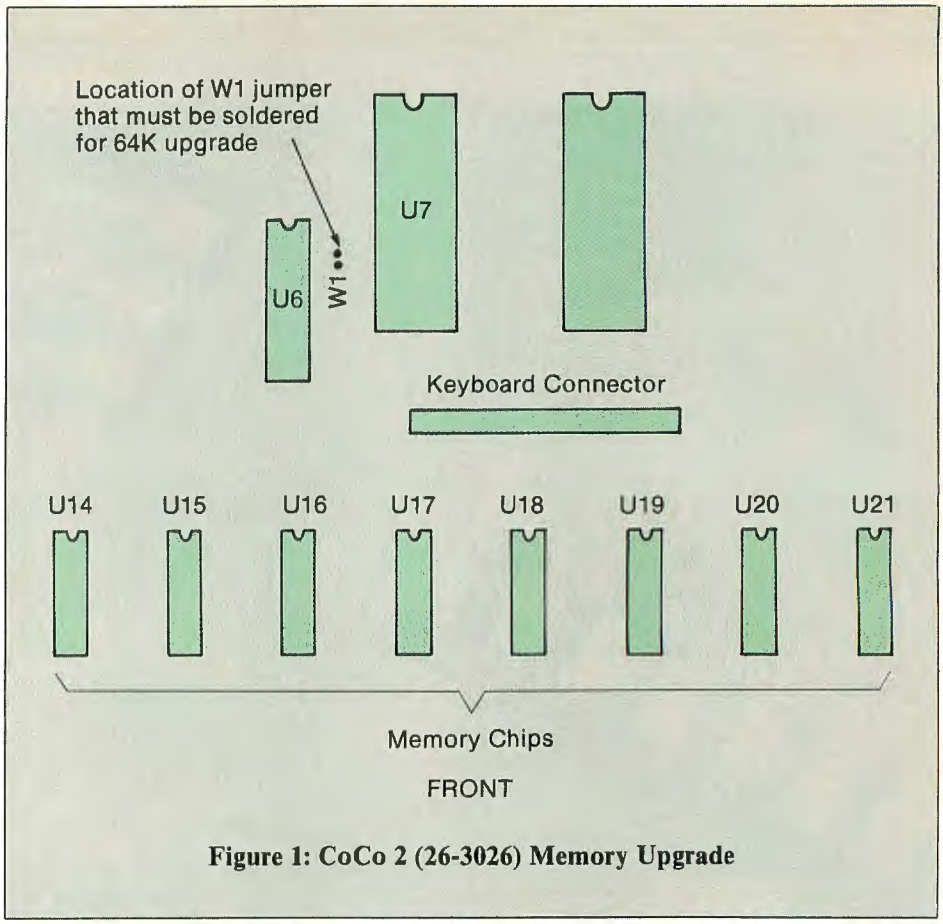


Figure 1: CoCo 2 (26-3026) Memory Upgrade

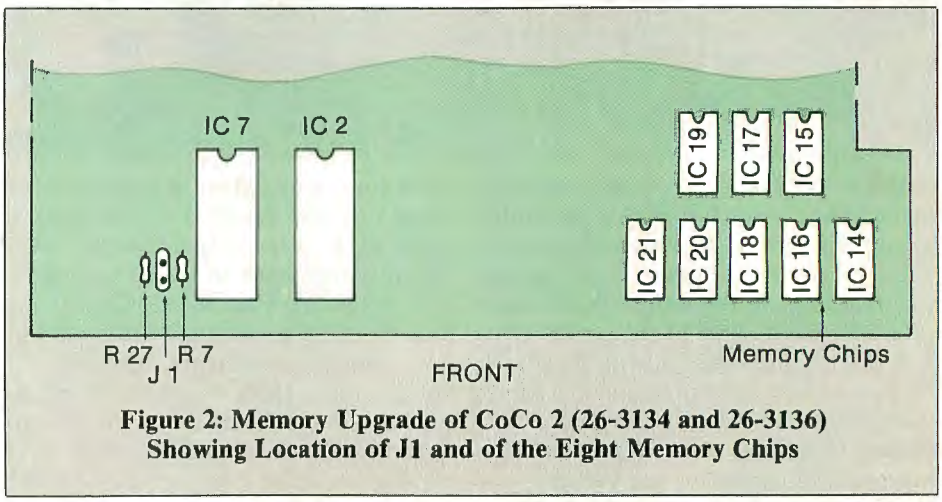


Figure 2: Memory Upgrade of CoCo 2 (26-3134 and 26-3136) Showing Location of J1 and of the Eight Memory Chips

The CoCo 1 F-board (Cat. Nos. 26-3002A, 26-3003A and 26-3004A) was the first Color Computer made by Tandy designed from the start to be upgraded to 64K of memory. The 3002A and 3003A models require memory upgrading. They are large computers, like the CoCo 1 C-, D- and E-board machines. The CoCo 1 F board did not actually have the letter *F* on its circuit board. Rather, it had either no letters at all, or the phrase *REV NC* was silk-screened on it. However, because it followed the CoCo C, D and E boards, CoCo owners refer to it as the F-board CoCo 1. The machine came in a beige

case with a keyboard somewhere between the old CoCo chicklet keyboards and the later keyboards. This was a low-profile keyboard, with keys that looked as if they had been melted down. Early F board units were also gray and had the chicklet keyboard. Tandy marketed the same machine in a square white case as the TDP 100 computer.

This computer's upgrade consists of removing the metal shield that hides the 74LS783 chip and the eight DRAM chips. This shield is attached with little tabs, some of which can be removed by moving your finger around under the circuit board. With most of the tabs unbent, the shield can be removed from above. You then remove the old 16K DRAMs (U21 through U28) and cut out capacitors C58, 60, 62, 64, 66, 68, 70 and 72. Insert the eight 4164 DRAMs in the sockets you just cleared. Two sets of three staking pins are located to the left of the DRAM chips. Each has a jumper that connects the middle pin to one of the two side pins. These jumpers should be moved from the 16K position to the 64K position. Another set of three pins is to the right of the DRAM chips. This set also needs to have its jumper moved from the 16K to the 64K position. (Note: If you fail to move all three of these jumpers, you will probably burn out your new DRAM chips.) A fourth jumper needs to be added (not moved). This jumper must connect two pins labeled *64*, found to the left of U17 (the 6821 chip). Serious hackers will remove the jumpers entirely and solder the appropriate pins together.

CoCo 2s

If you own an American-made, original CoCo 2 (Cat. No. 26-3026 or 3027) with 16K of memory, open the computer and remove all eight socketted 16K DRAM chips. These are located in the front of the computer in a single row of eight chips and are numbered U14 though U21. Replace them with 4164 chips. Now find U7, a 40-pin 6822 chip in the center of the board, toward the rear. Just to the left-front of U7 (bottom of the chip), you will find two adjacent solder pads labeled *W1* on the circuit board.

These two pads are close together and oriented front to back. Jumper these two pads together, using a tiny bit of wire and a soldering iron. When you have jumpered them, the jumper wire will run parallel to U6 and U7. That's all there is to it — your upgrade is complete. (See Figure 1 for details.)

If you own one of the first Korean-made CoCo 2s (Cat. No. 26-3134 or 26-3136), you need eight 4164 chips. Upgrade the memory on your computer in the following manner: Open your machine. You will find eight socketted 16-pin 16K DRAM chips, which are in two rows (one of five and one of three chips). Remove those chips. Immediately to the left of IC-7, between R27 and R7, you will see two solder pads labeled *J1*. Solder a jumper between those two pads. This jumper will run front to back and join the two J1 pads. That's all there is to this upgrade. (See Figure 2 for details.)

If you want to upgrade a 26-3134A, 26-3134B, 26-3136A, or 26-3136B model CoCo 2, the procedure is slightly different. You will need two 4464 DRAM chips. These chips are 4-bit-by-64K DRAMs and have 18 pins. These are the *same* chips used in 128K CoCo 3s. If you upgraded your CoCo 3 and saved the four 18-pin chips you removed from it during that upgrade, you own two sets of "upgrade kits" for these CoCo models. When you open these CoCo 2s, you will find two socketed 18-pin memory chips — 4416 chips. Remove these two chips and replace them with two 4464 chips. Now look on the left front of the circuit board. There you will find two solder pads labeled *RAM Size* and *64K*. The two pads are enclosed by a white silk-screen rectangle. Solder a jumper between those two pads. That's all there is to it. (See Figure 3 for details.)

On all these A and B models of CoCo 2 there are two white connectors that look like the white connectors for the memory upgrade board on the CoCo 3. You cannot use those connectors. They are there to support a plug-in board with eight 4164 chips, which Tandy used at one time to upgrade these machines. When Tandy designed those boards, the cost and availability of DRAMs was in a state of flux, and Tandy could not be sure which would be the most economic upgrade — two 4464 chips or eight 4164 chips. For this reason, the company designed the boards to allow use of two 4464 chips on the board, *or* eight 4164 chips via a plug-in memory upgrade board.

The CoCo 2 B models have both the white connectors and places on the main circuit board where Tandy could solder eight 4164 chips. Therefore, the B model boards can be upgraded to 64K in one of three ways: Two 4464 chips to replace the 4416 chips, a plug-in board with eight 4164 chips, or 4164 chips soldered directly to places provided on the motherboard. For both the A and B models of the CoCo 2, I recommend using the two 4464-chip approach. This approach is cleaner, simpler, and puts less power drain on the computer.

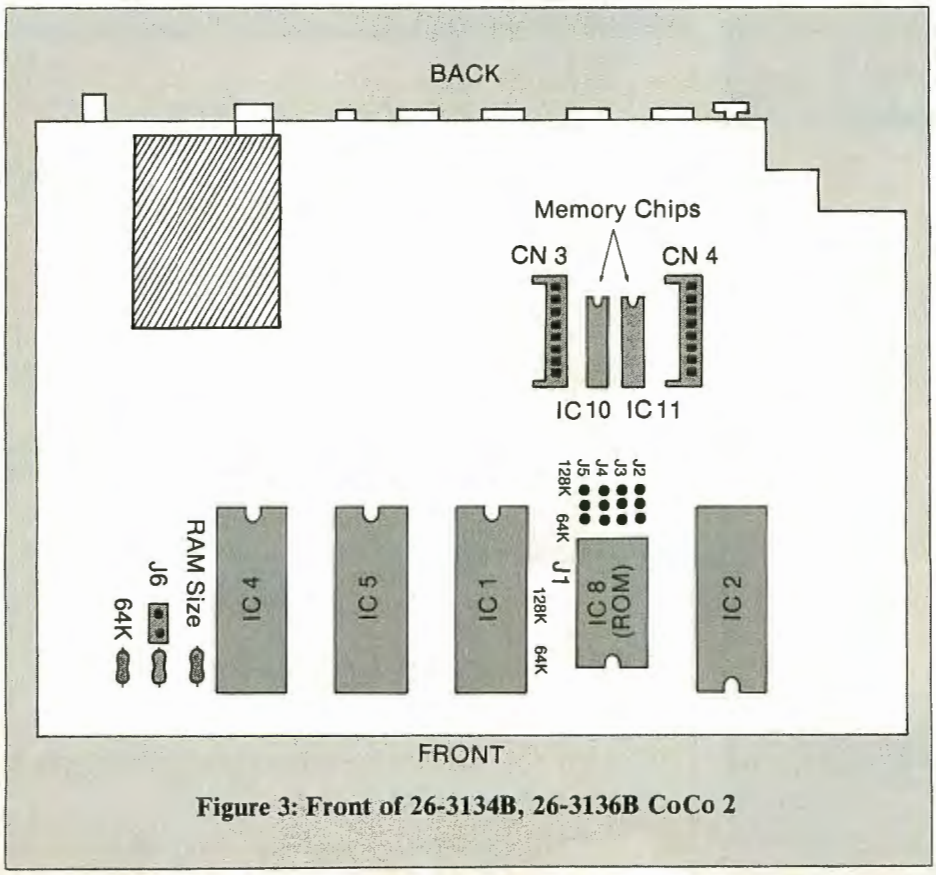


Figure 3: Front of 26-3134B, 26-3136B CoCo 2

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Testing Memory

After upgrading your memory to 64K, you should get the Color BASIC or Extended Color BASIC copyright message when you turn on your CoCo. Entering PRINT MEM (or ?MEM) will give you the number 24871 if you have Extended Color BASIC or 31015 if you have Color BASIC. Even with a full 64K of memory, the CoCo is capable of using only the lower 32K of RAM under Color BASIC. This is true even for a 512K CoCo 3. The problem here is that the ROM software was never revised to work with more than 32K of RAM memory. To better test memory, try using one of a number of RAM-test programs published in past issues of RAINBOW or posted on Delphi.

ROM Upgrade

On some of the computers discussed, you may be hampered by a lack of both memory and Extended Color BASIC (ECB). With the CoCo 1 and 2, Tandy offered the machines in any of three options: 16K Color BASIC, 16K Extended BASIC and 64K Extended BASIC. Those with machines with only Color BASIC (not ECB) are missing a great deal. Such machines lack most of the graphics commands under BASIC and cannot be used with a disk controller — ECB is needed for the Disk Controller to work. If your machine does not have ECB, you can add it yourself.

There are two types of Extended BASIC upgrades for Color Computers 1 and 2. If you have only Color BASIC and own any CoCo 1 or CoCo 2 (Cat No. 26-3126 or 26-3134), you will need a 24-

There are two types of Extended BASIC upgrades for Color Computers 1 and 2. If you have only Color BASIC and own any CoCo 1 or CoCo 2 (Cat No. 26-3126 or 26-3134), you will need a 24-pin, 8K-by-8-bit Extended BASIC ROM. If you own a Cat No. 26-3134A or 26-3134B model CoCo 2, you will need a 28-pin 16K Extended Color BASIC ROM that has both Color BASIC 1.3 and Extended Color BASIC 1.1. Both these chips can be ordered from Microcom, Computer Plus, MicroWorld or Tandy National Parts. The cost should be under $25.

Installing the 28-pin Extended BASIC ROM in an A- or B-model CoCo 2 is a bit trickier. Refer to Figure 3 for a diagram of the Model B CoCo 2. Remove the 24-pin Color BASIC ROM from the 28-pin socket, and locate the five ROM size jumpers near that socket. Four are behind it, and one is to the left of the socket. These jumpers are labeled *64* on one side and *128K* on the other. They are soldered in place. The 64K and 128K refer to the number of bits in the ROM chip and are not indicative of a 128K RAM memory upgrade for that machine. Clip all five jumpers where they touch the 64K solder pad. Then bend them over so they touch the 128K solder pad. Now solder them in that position. A fine pair of diagonal cutters and a fine-tipped soldering iron are helpful. You can remove the old jumpers and install new ones; however, I prefer the first method because it's faster. After moving the jumpers, insert the 28-pin ROM chip into the socket. The notch on the chip must point toward the *front* of the computer (i.e., it should be pointing in the direction opposite to IC chips 4, 5 and 1, which lie to its left, and point in the same direction as IC 2, to its right). You have now rewired the ROM socket to accept the pin of a 28-pin 16K-by-8 ROM.

Hacker's note: The 24-pin 8K DECB ROM is pin-compatible with a Motorola 68766 EPROM. This ROM is predominantly pin-compatible with a 27128 EPROM; however, you must short Pin 1 to Pin 28 of the EPROM after programming it to make sure it will work in a CoCo. Pin 1 of the ROM is not connected internally, whereas Pin 1 of a 27128 EPROM needs to be tied high to +5 volts. On some CoCo models, Pin 1 is left unconnected. In addition, while you can read the 28-pin ROM in most EPROM programmers, you cannot read the 24-pin ROM because it is a dynamic ROM, which requires its enable line to be pulsed each time a byte is read from it. The best way to extract data from that ROM is to read its contents using a working CoCo that has the ROM installed.

Why upgrade to 512K?

All OS-9 Level II users require 512K to make any reasonable use of OS-9 Level II's capabilities. At this time, few Disk BASIC programs make use of memory above 128K. *Word Power 3.1* from Microcom, *Vterm* from Gimmesoft, and *CoCo Max 3* and *Max 10* from Colorware are among the exceptions, using a significant amount of the memory available with a 512K CoCo 3. Microcom sells a disk duplicator implementing a complete RAM image of the disk to be copied if you have a 512K CoCo 3. SpectroSystems soon presents an ADOS enhancement providing a very Disk BASIC-compatible RAM disk feature.

The Tandy 512K Upgrade

The upgrade provided by Tandy's designers is in the form of a plug-in memory board populated with 16 one-bit-by-256K (41256) chips. For this upgrade, first remove the four 4464 chips from their sockets. Next make a minor alteration in the timing of the RAS and CAS lines by removing C65 (a timing "fudge-factor" capacitor on the RAS line). Finally, insert a populated memory-upgrade board into the three white connectors provided on the CoCo 3 motherboard. Most third-party upgrades are electrically identical to the Tandy upgrade, but these vendors often suggest different timing modifications.

The 256K DRAM Crisis

About a year ago, 256K DRAMs were cheap and plentiful. They were available to dealers at about $2 a chip or less. Then U.S. chip makers — unable to compete with Japanese production — demanded limitations on memory-chip import. The government responded by pressuring Japan to cut back on this import. After this, all but one U.S. manufacturer (Micron Technologies) ceased production of 256K DRAMs, which they deemed unprofitable, and Japanese manufacturers began converting factories that had been making 256K DRAMs into plants to make 1-megabit chips. At this same time, there was an unforeseen increase in the demand for 256K DRAMs because desktop computers with standard memories of 640K or more were coming into their own. These computers required 256K chips.

The combination of these factors caused DRAM chip prices to skyrocket. Over a period of months, the price soared to a high of $15. By July '88, the price leveled off, but it hasn't come down much. Dealers still pay between $9 and $13 per chip for memory chips on a 16-chip CoCo 3 upgrade board. Therefore, the cost of a fully populated CoCo 3 memory-upgrade board can be in excess of $170. (Compare this to the $100 or so that such upgrade boards were selling for before the DRAM crisis.) There is no end to this crisis in sight. Prices for 256K DRAMs are expected to remain high for an indefinite time. No matter who is to blame for the prices, we must deal with these high memory-chip prices.

Tandy was able to lock its supply of 256K DRAMs at a fixed price for a long time, so recently the Tandy upgrade, at $130 to $150, has been the most economical way to add 512K to your CoCo

3. However, I doubt Tandy can sell memory chips at that price for long.

Memory Chips

The CoCo's manner of addressing memory is a bit odd. The timing on the GIME chip for its memory access is not quite right, especially on older (1986) GIME chips. Users have been faced with an array of inconveniences: "Sparklies" occasionally appear on the screen; memory chips in the 512K upgrade run hot; and some particular brands of memory chip work better than others for subtle reasons. I have been told that the minimum access time for proper operation of a DRAM chip on a CoCo 3 running at 2 Mhz is around 142 nanoseconds. In theory, one really should use 120-ns access-time parts. In practice, however, most 150-ns parts will work fine. Although NEC memory chips are reported to work very well, I have used several brands of memory chips (including NEC, Motorola, TI, Hitachi, Fujitsu, Micron Technologies, and Samsung) with no problems.

Available Memory Upgrade Boards

With one exception, the various CoCo 3 memory upgrade boards come with sockets for the DRAM chips and can be populated with any speed or brand of DRAM chip. With DRAMs so expensive these days, many sales of 512K upgrades are in the form of bare boards users will populate when they get good deals on memory chips.

Considerations in 512K upgrade-board design include the following:

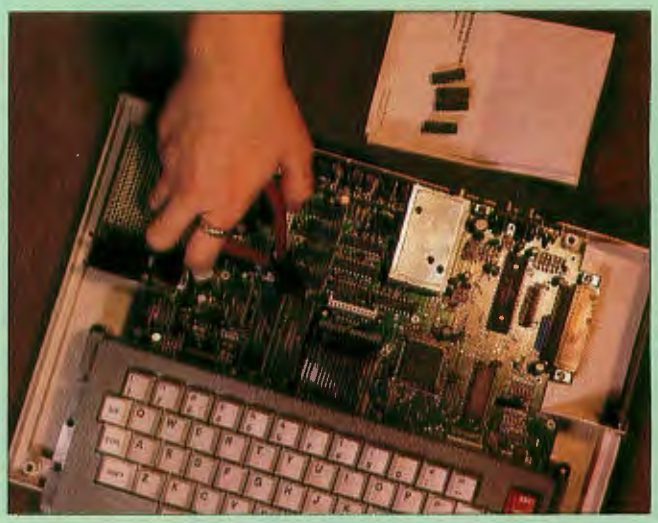
- The quality of the chip sockets used
- The layout of the traces on the board
- The number and value of deglitching capacitors used
- The positioning of the deglitching cap traces

Sockets with gold plating are best but are too expensive for use in this market. Next to gold-plated sockets, double-wipe sockets would be best (i.e., sockets that contact each pin of the memory chips on two sides). Single-wipe sockets are least desirable, but they work adequately. A large fraction of CoCo 1s and 2s use single-wipe sockets for their memory chips, and the CoCo 3 uses single-wipe sockets for its 4464 chips. All these work reliably. Proper provision for wide ground plane traces will reduce noise on the power-supply lines and radio frequency interference.

In theory, every DRAM chip should have a .33-mfd deglitching capacitor wired to its positive and ground pins. In practice, many board makers cannot include a cap for every memory chip, so some chips share the same deglitching cap. In addition, many manufacturers supply boards with .1-mfd deglitching caps, despite manufacturers' specifications, which often say the .33 mfd value is preferred. The shorter the length of wire or printed circuit board trace between the power supply pins of the DRAM chip and its associated deglitching cap, the better.

The Tandy 512K upgrade board is (or was) sold with DRAM chips by Tandy for between $130 and $150. Its price may increase as Tandy's supply of lower-priced DRAMs is exhausted. The Tandy board is unique because it is mounted upside down (i.e., the DRAM chips are facing the CoCo motherboard, and the solder side of the board is up). Tandy designed the board this way because it was easier to mass-produce. All components (including the

Tandy's 512K Upgrade



These photographs illustrate the steps involved in upgrading to 512K with the Tandy upgrade. *Above left*: The CoCo 3 with case top removed. The upgrade is shown behind the computer. *Above right*: The four 4464 RAM chips have been removed and capacitor C65 is being clipped with "dikes." While the keyboard has been left in the computer, it has been moved slightly forward. More working room can be gained by carefully removing the keyboard entirely. *Right*: The completed upgrade. Note how the ground plane is visible and the chips, which are underneath, cannot be seen.

pins that connect it to the motherboard) are soldered on the same side of the board, so the entire thing can be wave-soldered. By putting the solder side up, Tandy can add a foil-ground plane to reduce radio interference and comply with FCC regulations. Tandy has the only memory-upgrade board with such an added ground plane. Tandy's board uses roughly 12 deglitching caps for the 16 DRAM chips, and each are .1-mfd in value. All reports indicate that the Tandy board works adequately; however, when the DRAM chips get hot, their position beneath the board conserves that heat. Tandy uses single-wipe sockets in all of the Tandy 512K upgrade boards I have seen.

Although PBJ no longer makes products for the CoCo market, before it disappeared it ran off a large number of 512K memory-upgrade boards. This board is still sold by Computer Plus. The board comes with about a dozen .1-mfd deglitcher caps for its 16 memory chips. It is supplied with a variety of sockets — sometimes double-wipe, sometimes single-wipe. I used a PBJ upgrade board for nearly a year in one of my CoCo 3s, and it worked fine. One word of warning: PBJ's quality control seems a bit sloppy. I have seen three separate boards delivered to customers "dead on arrival." Naturally, a dealer will take back and replace a bad board, but you may need a second board present to be sure the problem is the board and not your chips.

Tony DiStefano (author of the "Turn of the Screw" column in RAINBOW) designed a 512K upgrade board sold by CRC. This is the smallest 512K upgrade board I have seen. Tony also uses .1-mfd caps. He says some production runs of the board use single-wipe sockets and others use double-wipe sockets. I used one of his boards for several months with no problems, nor have I heard of any problems with them. Prior to shipment of any bare board, it is tested using continuity checks to weed out boards with internal shorts. Tony's quality control should be quite good.

Performance Peripherals makes a high-quality 512K upgrade board using sixteen .33-mfd deglitching caps (one for each DRAM chip) and double-wipe IC sockets. Bare upgrade boards are tested in a CoCo 3 before shipping, and the boards are sent only when tested and burned in as good. This is a painstaking amount of quality control. I currently use one of its boards in my development system and have had no problems with it. Performance Peripherals is a small company but worthy of serious consideration by CoCo 3 owners.

J&R makes another design of memory upgrade board. This board features an excellent ground plane on the PC board. The company uses double-wipe sockets and 16 caps (one per DRAM chip); however, it tends to use only .1-mfd instead of .33-mfd caps. I've never used this board, but I have examined one. It looks well-made and -designed, and I have heard of no problems from anyone using one. J&R is the only company to offer a board in kit form (without sockets on the board).

The Hemphill upgrade is the most unique memory upgrade of all. Instead of using dual-inline pin chips, Hemphill uses single-inline pin chips. This lets the company make a very small circuit board and include one capacitor per chip. The company uses .33-mfd caps. The memory chips are soldered to the board, making them less usable anywhere else but making the board reliable and trouble-free. Hemphill's upgrade has a reputation as one of the most reliable and trouble-free 512K upgrades. You must buy this board with the chips provided.

All 512K upgrade boards advertised in RAINBOW work fairly well. Although there are a number of theoretical reasons to prefer one to another, you will get reliable performance regardless of which one you purchase. (See Table 1.)

Timing Modifications

When you install a 512K upgrade board, make a timing modification to the computer, or it will not work. There are various modifications to the CoCo 3 recommended by different manufacturers. Tandy's service manual for the CoCo 3 specifies the removal of only C65 (the RAS timing fudge-factor capacitor). Many third-party upgrades specify removing both C65 and C66 (a CAS line timing fudge-factor cap). Hemphill Electronics suggests yet a third timing modification for installation of its upgrade. The company suggests leaving both C65 and C66 in place and soldering a 47-ohm resistor in parallel with R22 (a 120-ohm timing fudge-factor resistor on the RAS line). Some people who have tried the Hemphill modification say their memory chips run cooler with that modification than with the cap-removal mods. Some

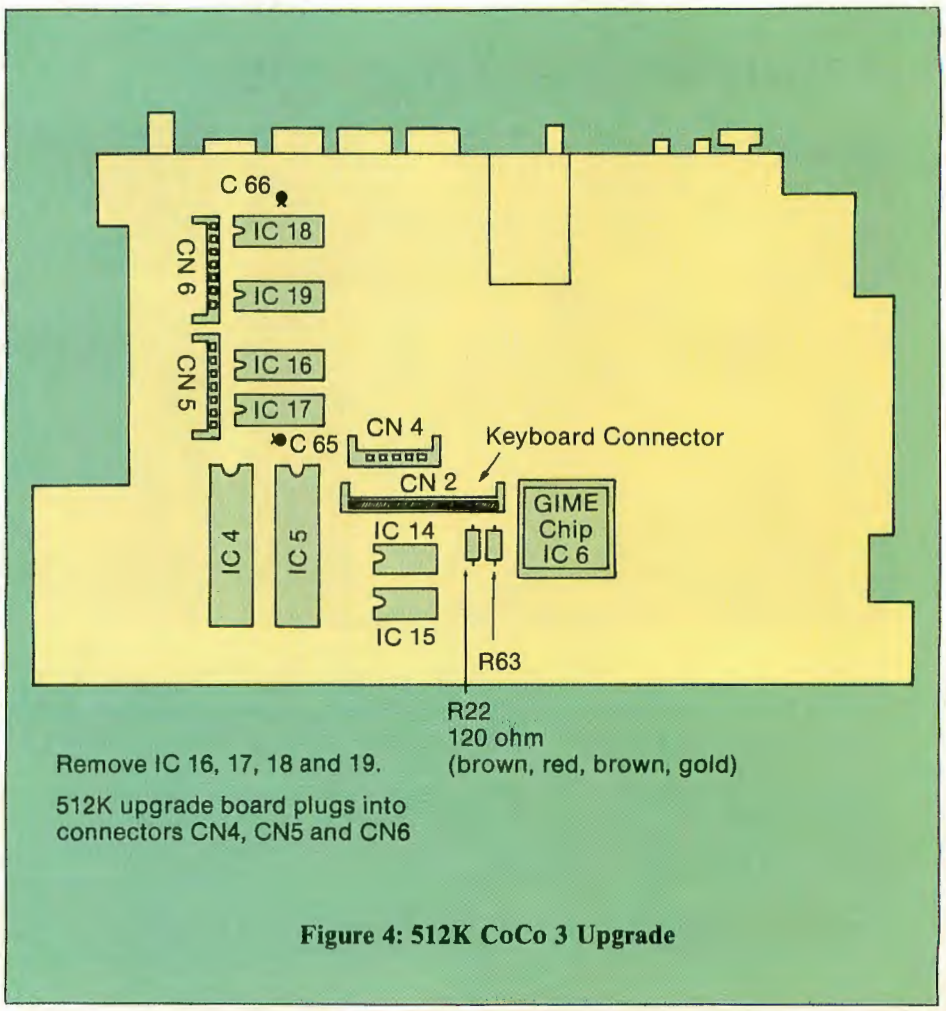


Figure 4: 512K CoCo 3 Upgrade

also claim the Hemphill method results in fewer or no sparklies on machines that previously had them.

Figure 4 shows the location of the various components referred to above. C65 and 66 are little green blobs, and R22 is a gray cylinder with brown, red, brown and gold stripes. If you destroy the capacitors in the act of removing them, you can find near replacements at Radio Shack. Radio Shack Part No. 272-121 is a 47-pf capacitor. Two of those in parallel will be 94-pf — close to the 82-pf value for C65. Two of those capacitors in series will yield a value of 23.5 pf — close enough to the 27-pf value for C66. If you try the Hemphill upgrade, Radio Shack sells a 47-ohm resistor (Cat. No. 271-009).

Company	Product	Warranty	Bundled Software	Comments
Tandy/Radio Shack*	Tandy 512K	90-Day	None	Optional installation extra.
Computer Plus*	Tandy 512K Tandy OK PBJ 512K PBJ OK	90-Day One Year	None	Optional installation extra.
The Computer Center*	Disto 512K	90-Day	RAM Disk RAM Test	Optional installation extra.
Owl-Ware*	LR Tech 512K Performance Peripherals 512K	One Year One Year	 RAM Disk RAM Test Printer spooler	Optional installation extra.
Performance Peripherals	Performance Peripherals 512K	One Year	RAM Disk RAM Test Printer spooler	
MicroWorld*	Tandy 512K	90-Day	None	Optional installation extra.
Microcom Software*	Performance Peripherals 512K	90-Day	RAM Disk RAM Test Printer spooler Backup utility OS-9 LII RAM Disk	Optional installation extra.
CRC/Disto	Disto 512K	90-Day	RAM Disk RAM Test Printer Spooler	Optional installation extra.
Arizona Small Computer Co.	Disto 512K	180-Day	RAM Disk RAM Test Printer Spooler	In-shop installation included.
J & R Electronics	J & R 512K J & R OK J & R Kit		RAM Disk RAM Test Printer Spooler	Available in kit form.

*These advertisers also offer 64K upgrades for the CoCo 1 and 2.
Because of rapidly fluctuating chip costs, our advertisers request that you contact them for current pricing information.

Table 1: Sources for CoCo Memory Upgrades

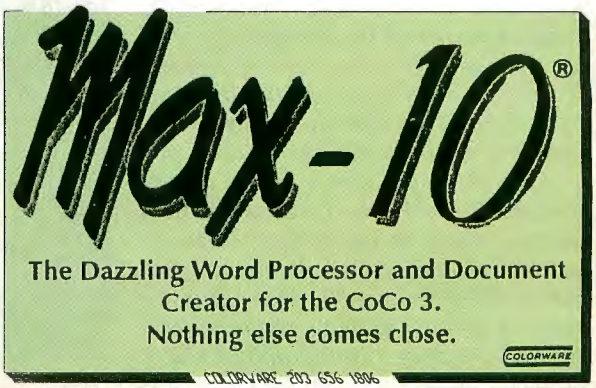
About Those 4464 Chips...

Memory on the CoCo 3 is addressed via the GIME chip, which is both a memory-manager chip and a video-display generator chip. The CoCo 3 comes supplied with 128K of memory in the form of four socketted 4-bit-by-64K 18-pin 4464 chips. This memory is wired so it presents 64K of 16-bit words to the GIME chip. Therefore, while the 6809 can address external memory along an 8-bit data path, the GIME chip can read the DRAMs 16 bits at a time. This allows the GIME chip to read memory faster to properly update the Hi-Res color graphics screens. Each of the four 64K-by-4 chips contributes one quarter of each 16-bit word read by the GIME chip.

The logical way to accomplish an upgrade to 512K on the CoCo 3 would be to substitute 4-bit-by-256K chips for the 4-bit-by-64K chips with which it came. After all, 44256 chips do exist; they sell for about $45 each. But Tandy chose not to provide for this upgrade route. The 44256 chips are 20-pin chips, with a different pin out from the 4464 chip. Worse, the 44256 chips require a different refresh cycle because they are internally more like the 1-bit-by-1-megabit chips than the 4-bit-by-64K chips. They require a 512-cycle refresh while the GIME chip provides a 256-cycle refresh. There is no way around this problem. The chips cannot be interfaced to the GIME chip.

Finally, hold onto those 4464 DRAMs you remove. If a problem develops in your upgrade, you will have an alternative of downgrading to 128K, or you may want to switch these chips with those in another board. There are not many machines around that use the 4464 DRAMs for memory upgrade, except the Tandy 3000 and some 10-Mhz 8088 PC compatibles. If you are certain you have no use for your 4464 DRAMs, you can send them to me in care of RAINBOW magazine. I sometimes have projects that use them.

That's all there is to it. Follow the instructions found in this article carefully, and you will soon have the memory you and your computer need. Modifying your Color Computer takes time and patience. Look around; find the best merchandise for you. Then watch for the best prices on that equipment. Once you have your parts and your tools, be sure to take the time to do the work right.



What's the best choice?
You decide

A Hard Drive for Your CoCo

By Martin H. Goodman, M.D.

Over the last two years, more and more Color Computer owners have been adding hard drives to their systems and enjoying the benefits of greater storage capacity and speed of operation. During this time, vendors have begun to market a variety of hard-drive systems, and the entry-level price for these has dropped under $200 — even for the non-hacker. When you compare the cost of adding a hard drive to that of adding two floppy drives to your system, you'll see that the hard drive is the sensible choice. For around $250, you can add a 5- or 10-Meg system and increase storage and access speed.

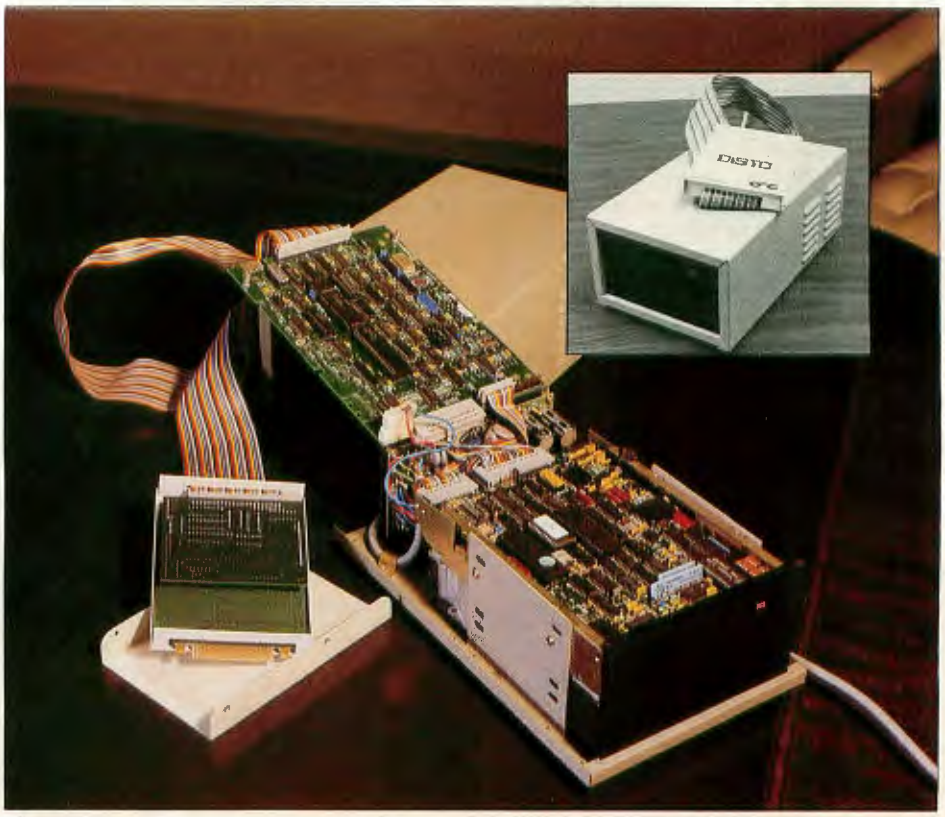
When you consider adding a hard drive, you are bombarded by a bewildering array of alternatives. This is an introduction to the basic elements of any CoCo hard-drive system and the options available for it. I don't have experience using all the systems described, so do not consider this a comparative review of the products.

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

The Elements of a CoCo Hard Drive

Color Computer hard-disk systems consist of both the physical hardware (circuit boards, hard drive, case and power supply) that must be added to the system and the driver software that lets the system use this added hardware. The differences in OS-9 driver software are of limited significance; however, the differences in Disk Extended Color BASIC driver software are significant.

A final common element in all hard-drive systems is the actual hard drive. Hard-disk drives are characterized in terms of their physical size, the number of platters inside them, the number of



The Arizona Small Computer's 20-Meg system. *Inset*, the Disto Interface.

cylinders per platter and the number of heads. A *platter* is the hard disk inside the drive. Typically, each platter is serviced by two heads, one on each side of the platter. These heads write concentric circular tracks of data called *cylinders*. A CoCo floppy disk will have a maximum of two heads, each of which accesses up to 40 tracks, for a total data-storage capacity of 360K bytes. A small data capacity hard-disk drive will have four heads and 306 cylinders (tracks) for each head — a total capacity of 10 Meg. Higher-capacity drives can have over a thousand cylinders per platter and eight or more heads — and up to 500-Meg capacity.

The disk in a CoCo floppy drive rotates at 300 rpm. The disks in a hard drive rotate at 3600 rpm. The heads of the hard drive float a fraction of an inch above the oxide-coated aluminum platters, which are physical disks inside the hard disk drive. Do not jostle the hard-disk drive or the case in which it resides while it is in operation. A minor bump while the drive is spinning can cause the head to bash into the platter, destroying all the data on that cylinder and (perhaps) adjacent cylinders as well. In addition, this can destroy the heads, rendering the drive useless and destroying all the data on it.

Hard drives used in CoCo systems are manufactured by many companies and come in an assortment of sizes, shapes, capacities and power requirements. They can be as big as 5¼-inch, full-height floppy drives or as small as 3½-inch half-height drives. Hard drives vary in capacity from 5 to several hundred Meg. Those commonly used in the Color Computer market are in the 5- to 40-Meg range. When we discuss small-capacity (5- to 40-Meg) hard-disk drives, the bigger drives are older drives.

Most hard-drive systems for the CoCo use a hard drive with a logic board, which talks to the hard-drive controller via a ST506 or ST412 interface. This interface consists of a 34- and a 20-contact edge connector. It is named after two ancient 5-Meg Shugart drives: the ST506 drive and the ST412 drive, which originally used this hardware interface. This same generic physical hard drive is still used in most IBM PC XT and AT-compatible computer systems. The phrases *ST506* and *ST412* refer to the same physical hardware.

However, the old ST506 drive from Shugart did not include buffered seeks. This deficiency resulted in slower operation. For years, all hard drives with ST506/ST412 interfaces have been made with *smart* logic boards, and to varying degrees, they support buffered seeks. Although the term *ST506* implies a drive that does not support buffered seeks and the correct term is *ST412*, in practice the two terms are used interchangeably.

In most cases, the hard drive and a power supply will be mounted in a case, often with an additional *controller* circuit board. While hard drives resemble floppy drives externally, they usually require more power. Thus, only the latest (most expensive and compact) 3½-inch hard drives can use a power supply designed for floppy drives. In order to reach the appropriate speed, the oldest full-height hard drives require as much as 5 amps on their 12-volt supply lines during the first seconds of operation. Once at operating speed, such drives draw 1 to 2 amps at 12 volts and about an amp at 5 volts. By comparison, a typical floppy drive requires 0.6 amps at 12 volts and 0.3 amps at 5 volts.

One major difference between the various hard drives is the distinction between those that can and those that cannot be used with an RLL (Run Length Limited) controller. Most hard drives are designed to work with hard-drive controllers that write data to the platters with MFM (Modified Fre-

What Does a Hard Drive Offer?

A 20-Meg hard-disk drive holds more information than 120 single-sided, 35-track floppy disks or about as much information as 55 double-sided, 40-track floppy disks. Information on the hard drive can be accessed more than ten times as fast as information on a floppy drive. With a hard drive, you don't need to shuffle through stacks of disks looking for the program or file you need; it's at your fingertips.

Hard drives do not completely replace floppy drives. Many systems still require at least one working floppy drive, which is accessed when the system is booted. Hard-drive users will need to use floppy disks to add new software and data to their systems and to back up the information on their hard drives. The latter is critical, for in the unlikely event that your hard drive crashes, greater amounts of data can be lost than with floppy drives.

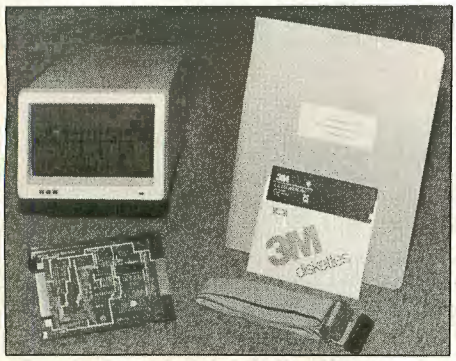
All OS-9 Level II users will benefit from a hard-drive system. OS-9 can be cumbersome on a floppy-based system if all your most-used commands aren't loaded into memory at startup. A seasoned OS-9 user will still benefit from having all software and data files on hand. In a hard-drive system, OS-9 Level II comes into its own. Because of OS-9's design, software compatibility with any OS9-based hard-drive system is near 100 percent. There are some exceptions (including hard-coded drivers found in some sloppily coded Tandy OS-9 games). However, these are the exceptions, and patches can be made for most of them.

Many Disk Extended Color BASIC (DECB) users will benefit from a hard-drive system; however, here the issue is not as clear-cut as it is for OS-9 users. Most DECB applications run fine on a floppy-disk system. However, the system code in the BASIC ROM was designed for use with 35-track, single-sided floppy drives and was not written to substitute larger-capacity floppy drives or hard-disk drives easily. Because the system code in the ROM is so inflexible, authors of different DECB software chose a variety of ways to let their programs handle disk files. Some of the methods make it hard for the application program to work with the modified DECB code needed for hard-drive systems. Because neither Tandy nor Microsoft set standards for extending DECB to larger floppy- and hard-drive capability, authors for different hard-drive systems chose various approaches to such extensions. However, in some cases, the DECB software patches sold by one company are available in versions that run with hardware sold by different companies.

DECB users who brave the problems associated with running Extended Color BASIC on a hard drive will benefit from the immense storage provided by this system. While compatibility problems are real, the popular implementations of DECB hard-drive systems have solved most of them, and patches make the more popular application software hard-drive compatible. Those who use DECB software to generate and modify graphics images will benefit from use of a hard drive. Such users work with many moderate-sized picture files and will appreciate not changing disks constantly to find or save the necessary graphics file. DECB-based BBSs are improved by the addition of a hard-disk drive because the operators can maintain a larger message and database area than with a floppy-drive system. □

quency Modulation) coding. Some of the newer hard drives also accept data sent in RLL format. These RLL-capable drives hold about 50 percent more data when used with an RLL controller rather than an MFM controller. The speed of data transmission between the drive and the controller is also 50 percent faster when used with an RLL controller.

While one might assume that RLL is the way to go, only a fraction of the newer (more expensive) hard drives can be used with an RLL controller, and some disk drives rated for use with RLL don't give reliable operation when used in that manner. The Seagate ST238 drive is an example of a drive rated for use with RLL but only able to give reliable performance when used with an MFM controller. The "extra speed" RLL offers is of little significance on CoCo systems because the speed bottleneck is not between the drive and the controller board but between the CoCo's host adapter and the controller board. Finally, few CoCo users need to squeeze the extra megabytes out of the hard drive. Unless you know what you're doing and really need every byte you can get, stick to the reliable (less expensive) MFM hard drives and controllers.



A complete system from RGB.

The Controller Board

In order to hook a CoCo to a floppy drive, you need to plug a floppy-drive controller card into the CoCo or Multi-Pak Interface. This card is designed for the Color Computer and connects to the CoCo system bus at one end and to the logic board's 34-pin edge connector on the floppy drive. All hard-drive systems for the CoCo also require a controller board. Like the floppy drive's controller board, this board connects (via two cables) to the logic board on an ST506 interface hard drive. Unlike in the floppy system, however, this card does not plug into the Color Computer or Multi-Pak.

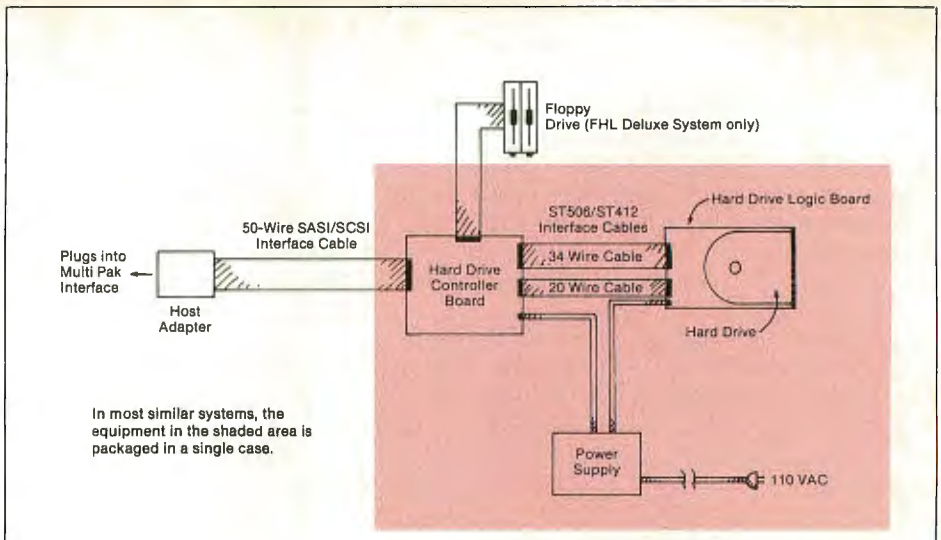


Figure 1: Typical hardware setup.

None of the controller boards used with CoCo hard drives were designed for the Color Computer. They are generic hard-drive controller boards used on a large number of small computer systems. In almost all cases, these boards talk to the main computer system via a SASI or SCSI bus, which usually takes the form of a 50-pin cable. The main computer system must have another card plugged into it to generate the bus. This other card is usually referred to as the *host adapter*.

SASI (pronounced *sassy*) stands for Shugart Associates System Interface. It represented the earliest incarnation of the bus now used to hook small computers to hard-drive controllers. The SASI protocol is a hardware and software standard because it defines the cable, the nature of the signals carried and details of the software protocol used. In this manner, the computer can talk to devices on the SASI bus. Electronically this standard is a parallel port, allowing 8-bit data transfer between a small computer and other devices (such as a hard-drive controller card). Originally this bus took the form of a 50-wire cable. However, many of the wires on that cable were reserved for future assignment, and uses were never defined for them, so some CoCo hard-drive systems use less than 50 wires in the SASI cable.

Soon after the SASI standard was introduced by Shugart, others decided to make some improvements. SASI was enhanced and incarnated as the SCSI (Small Computer System Interface) standard. SCSI (pronounced *scuzzy*) is backward-compatible to SASI (i.e., a computer generating a SCSI bus can talk to a device that has a SASI bus). A computer that generates a SASI bus *may* be able to talk to a device with a SCSI bus, but it cannot use all the SCSI standard features.

SASI and SCSI differ significantly because the SCSI bus supports multiple-master devices on the same bus (i.e., there can be more than one controlling host computer on the same SCSI bus). This is implemented through use of open-collector control lines and other hardware and software protocols. Additionally, full SCSI ports allow the hosts to be disconnected and reconnected in the middle of a command sequence.

Both SASI and SCSI ports can support multiple slave devices, and frequently both standards are used together. Indeed, you often encounter the phrase *SASI/SCSI compatible*. With either SASI or SCSI ports, a hard-drive controller card can be supported, and tape backup and CD ROM units can (in theory) be added. True, this ability is almost useless to most Color Computer users because no standard packages include hardware and software for using such devices. However, such packages may be available in the future, so the manufacturers of CoCo host adapters have been revising their products to make them SCSI-compatible and to increase the number of devices on which they can work.

Hard-drive controller cards differ from CoCo floppy-drive controller cards in another respect: They are smart devices with onboard microprocessors. At a software level, the host computer

talks to these boards using a sophisticated language. A single command can tell these boards to fetch a sector from the hard drive or to write one. These boards usually *buffer* (store on the board) at least a sector's worth of data. Thus, the CoCo can send data to the hard-drive controller board and then do other things while the hard-drive controller board writes that data. Similarly, the CoCo can tell a hard-drive controller board to fetch a sector and then do something else while the board finds that sector on the hard drive, takes the data from the hard drive and places it in its buffer. When the board has gathered the requested data, it will send the CoCo an interrupt to let the computer know it has the data. In contrast, standard CoCo floppy-drive controllers are simple (dumb) devices. You must write tedious, critical code to walk these controllers through their operations.

The Host Adapter

The host adapter is a card specific to the CoCo system bus into which it plugs. On the host-adapter card, some circuitry creates a SASI or SCSI bus. This bus then links the host adapter (and thus the CoCo itself) to the generic hard-drive controller board. Most host adapters for the CoCo exchange one byte of data between the CoCo and the SASI or SCSI bus at one time.

A typical CoCo hard disk system is shown in Figure 1. This figure is a representation of the arrangement of hardware used in Owl-Ware/LR Technologies, RGB Computer Systems/Ken-Tron Electronics, and Isted/Frank Hogg Laboratories. In these setups, a separate physical host adapter plugs into the Multi-Pak. This adapter produces a SASI or SCSI bus connected via ribbon cable to a separate box housing a hard-drive controller, the actual hard-disk drive with its logic board, and a power supply to operate the hard-drive and the hard-drive controller board. Please note: Although the Isted/FHL Deluxe system's host adapter uses the same interfaces as the other systems mentioned in Figure 1, this adapter uses a bus unique to that system.

Although many hard drives talk to the rest of the computer system (specifically to a hard-drive controller) via a ST506 or ST412 interface, more recently manufacturers have been making hard-disk drives that are attached to a combined logic and controller board. Such hard drives connect to the rest of the system via a SCSI bus because it eliminates one extra board (the SCSI controller board). By eliminating the ST506 interface, faster data transfer rates can be achieved. Apple Macintosh and Macintosh II computers use such SCSI drives, as do some high-performance IBM PC systems. Drives equipped with the SCSI board tend to be higher-capacity drives. I know of no dealer who currently supplies such drives with any of the commercial packages, but hackers who chance upon such drives should know that when hooked to a CoCo SASI/SCSI host adapter they can operate with the CoCo. Check with the maker of the software and host adapter to see if a particular SCSI drive is supported. The Shugart N series works with most current CoCo host adapters (i.e., those from CRC/Disto, Owl-Ware, Frank Hogg Laboratories and Ken-Ton Electronics/RGB Computer Systems.)

The Hard-Drive Market

Radio Shack is not in the CoCo hard-drive market. The Tandy Color Computer's hard-drive host adapter

(the only one supported by the hard-drive software in Tandy's OS-9 package) has three small-scale logic chips and a 50-pin connector. Tandy sells this device for $129.95, without a hard-disk drive or a controller. Old Radio Shack 35- and 15-Meg hard-drive packages have an internal customized WD-1000 controller. It works properly only with a few specific Tandy hard-drive packages, which are no longer sold. This takes Tandy and Radio Shack out of the CoCo hard-drive market.

Burke & Burke

Figure 2 illustrates a significant variant of the basic component arrangement. Chris Burke, of Burke & Burke, wanted to design a low-cost, quality hard-drive system for the CoCo. He noted that one of the major expenses in most CoCo systems was the controller card. These generic SASI or SCSI cards cost $150 or more brand new. Although suppliers could sometimes get deals on used controller boards, such supplies were uncertain and could falter at any time. Chris says he got an idea from one of my "CoCo Consultation" columns about the desirability of adapting devices specific to the IBM PC world to the CoCo and so benefiting from the economy of mass production enjoyed by such products. Chris noted that IBM PC-specific hard-drive controller cards were often available for $50 or less new. These PC-specific products were a combination of an IBM host adapter and the controller card — all on the same card. Chris decided to adapt a particular IBM bus-specific hard drive controller card to the CoCo.

Much to his (and everyone else's) surprise, the hardware needed to make this conversion of the Western Digital IBM disk controllers was simple. To make the conversion, he used a single inexpensive chip. Indeed, most of the magic (and expense) of his adapter is in the box that supports the PC Western Digital hard-drive controller card and converts it — electronically and physically — into a device that plugs into a Multi-Pak. Chris even had room on his adapter to provide an optional real-time clock.

Having adapted the hardware, Chris was faced with the problem of writing drive software. IBM PC disk controllers all write 512-byte sectors, but CoCo Disk BASIC and OS-9 operating systems are geared for 256-byte sectors. Using clever software tricks, Chris solved those problems and now offers a full line of hardware and software for his system. Indeed, his *Hyper I/O* (for running DECB on the hard drive) became so popular he developed versions of the software that are compatible with other brands of CoCo hard-drive hardware, including those from CRC/Disto and Owl-Ware.

The system developed by Chris Burke of Burke & Burke is different from all the other systems available for the Color Computer. All other systems use a generic SASI, SCSI or similar controller and come with a host adapter to let the CoCo generate the signals needed for the controller board to talk to the computer. The Burke & Burke system uses a different sort of hard-drive controller.

Hard-drive controller cards designed to work with the IBM PC-compatible computers are different from the generic SASI and SCSI controllers. They are designed to plug into the system bus on an IBM PC. A host adapter dedicated to PC-compatible computer buses and a hard-drive controller are on the card. Due to the economics of mass production, these cards are available (new) for between half and a quarter of the price of comparable SASI and SCSI cards.

Chris Burke decided to use the Western Digital line of PC-compatible controller cards. Later he was able to support a few other common IBM PC controller cards. (A full listing of these is given in the hardware section of this article.) Chris Burke devised an adapter and cage, so the PC-bus Western Digital controller card can be adapted to the CoCo system bus and mounted in a little metal box. This device connects to the logic board on the physical hard drive via the standard ST506/ST412 cables (one 20-pin cable and one 34-pin cable).

This arrangement has a number of advantages. First, if you own this system and later want to convert to a PC-compatible computer, you already have a hard drive and controller card for it in the Burke & Burke system. Next, the Western Digital hard-drive controllers are widely available, and hackers who want to build their own system are able to purchase just the adapter and necessary driver software from Burke & Burke.

However, there is a far greater advantage to Chris Burke's choice of controller. Using these PC controllers, he is able to transfer data between them without time-consuming hardware/software handshaking. Thus, his system has data-transfer speeds similar to that exhibited by the FHL deluxe system. Indeed, in some independent tests reported by Kevin Darling, the Burke & Burke and FHL systems both took about 45 seconds to transfer a megabyte of data from a hard drive while the various SASI/SCSI-based CoCo hard drive systems took 85 seconds.

Chris Burke also makes available the adapter board only. Chris not only provides needed device descriptors and drivers for his hard-drive systems, he also sells a useful utility called *EZGen*, which makes altering your boot file a simpler process than it used to be. Burke & Burke employs the ROM socket on the Western Digital controller card to provide data for booting the system from the hard drive. However, Burke &

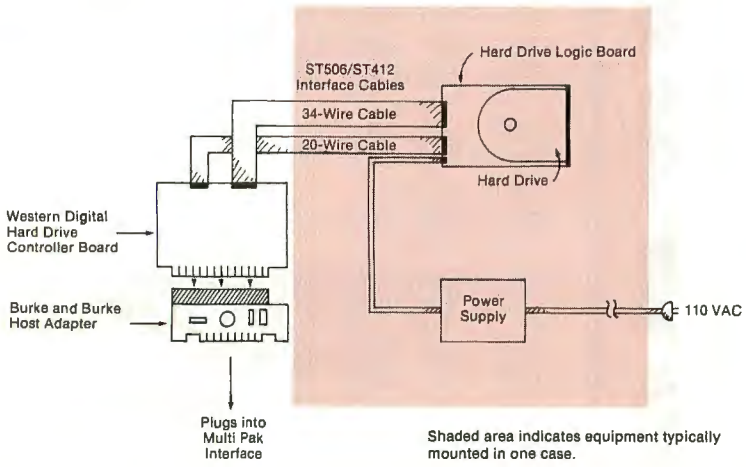


Figure 2: The Burke & Burke arrangement allows the use of standard IBM PC-bus compatible controllers packaged in a metal housing along with the host adapter.

Burke will not provide source code for their drivers. The company supports Radio Shack's Disk Extended Color BASIC on its hard-drive system through a product called *Hyper I/O* — a powerful (somewhat complex) software package that allows you to create virtual disks of any size to run under Disk BASIC. You can use *Hyper I/O* to create both 35-track virtual drives and giant virtual drives on the hard drive. It can also be used with a normal floppy disk controller to utilize 40- and 80-track double-sided disks. The level of compatibility with *Hyper I/O* is quite good. Even most programs that use undocumented ROM calls will work with it. Versions of *Hyper I/O* that work with Owl-Ware, Disto and RGB systems are available. Unfortunately, RGB Computer Systems' Disk BASIC for hard-drive systems is not available in a version that works with Burke & Burke's hardware.

Burke & Burke encourages hidebound Disk BASIC programmers to try OS-9 with yet another product it sells. *RSB* is an OS-9 program that lets you run DECB under OS-9. It provides a familiar programming environment for Color BASIC users within the OS-9 operating system, while providing access to some of OS-9's unique aspects. (See Page 110 for a more detailed review of *RSB*.)

Burke & Burke's 20-Meg system (ST-225), packaged and sold by Howard Medical.

At present, Burke & Burke does not sell its hardware as packaged systems. The company's hard-drive hardware and software is used, however, in fully configured hard-drive systems available from a number of respected CoCo vendors. Howard Medical in Chicago and Microcom and Frank Hogg Laboratories in New York sell systems using the Burke & Burke line of products. These companies sell new, tested 20-Meg Seagate ST225 half-height 5¼-inch hard drives with the systems they sell. All three companies have long track records as honest dealers in the CoCo Community. These three companies have enjoyed many compliments from their customers for their prompt service and equitable resolutions of any problems arising in the course of sales. I know and recommend the people at all three companies.

Steve Bjork currently uses a Burke & Burke hard-drive system and reports

COCO GALLERY LIVE
SHOWCASE YOUR BEST AT RAINBOWFEST

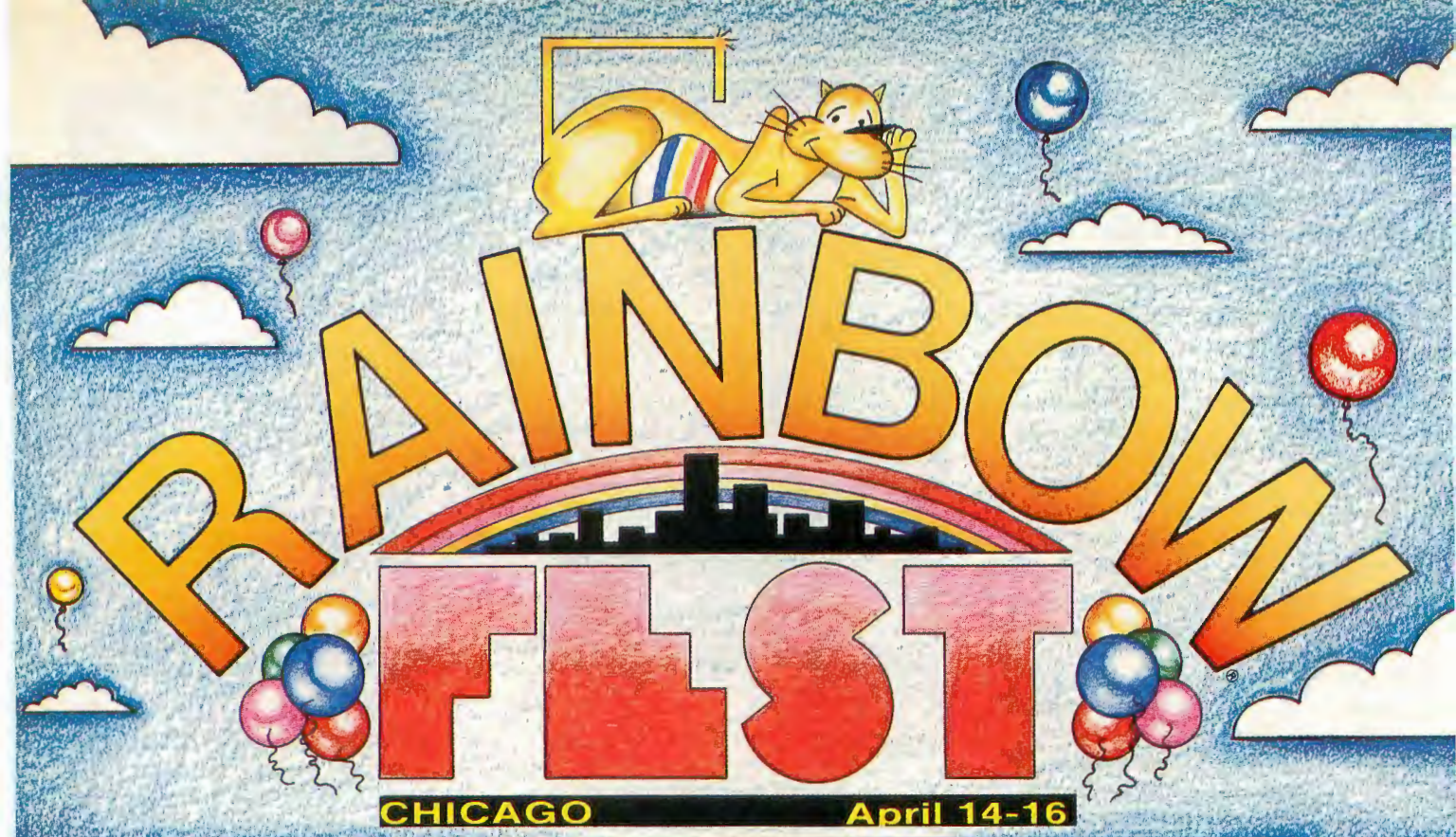
We are taking the popular "CoCo Gallery" on the road to RAINBOWfest Chicago — and we'd like you to submit your own graphics creations to be exhibited at the show!

RULES

- You can enter color or black-and-white photographs or printouts of your original artwork produced on the CoCo 1, 2 or 3. Entries must be framed, mounted or matted, and may not be smaller than 5-by-7 inches or larger than 11-by-14 inches.
- Don't send us anything owned by someone else; this means no game screens, digitized images from TV programs or material that's already been submitted elsewhere. A digitized copy of a picture that appears in a book or magazine is ***not*** an original work.
- Along with your entry, send a cover letter with your name, address and phone number, detailing how you created your picture (what programs you used, etc.). Please include a few facts about yourself, too!
- Your name, address and phone number, along with the title of your work, must be clearly marked on the back of each entry, and a disk copy of each piece must also be included.
- Entries must be mailed to THE RAINBOW before March 31, 1989, or brought to the RAINBOWfest registration booth by 10 a.m., Saturday, April 15th.
- All entries to CoCo Gallery Live become the property of Falsoft, Inc., all rights are reserved.

There will be two categories: one for graphics produced on the CoCo 1 and 2, and one for CoCo 3 graphics. Several awards will be made in each category. Winners will be determined by votes from RAINBOWfest attendees. In case of any ties, winners will be determined by our chief judge, CoCo Cat.

Prizes and ribbons will be presented Sunday, April 16, 1989, and winning entries will be published in the August '89 issue of THE RAINBOW. Send your entry to "CoCo Gallery Live," THE RAINBOW, 9509 U.S. Highway 42, Prospect, KY 40059.



RAINBOWfest is the only computer show dedicated exclusively to your Tandy Color Computer. Nowhere else will you see as many CoCo-related products or be able to attend free seminars conducted by the top Color Computer experts. It's like receiving the latest issue of THE RAINBOW in your mailbox!

RAINBOWfest is a **great opportunity** for commercial programmers **to show off new and innovative products for the first time. Chicago is the show** to get information on capabilities for the CoCo, along with a terrific selection of the latest CoCo software. In exhibit after exhibit, there will be demonstrations, opportunities to experiment with software and hardware, and special RAINBOWfest prices.

Set your own pace between visiting exhibits and attending the valuable, free seminars on all aspects of your CoCo — from improving BASIC skills to working with the sophisticated OS-9 operating system.

Many people who write for THE RAINBOW — as well as those who are written about — are there to meet you and answer questions. You'll also meet lots of other people who share your interest in the Color Computer. It's a person-to-person event and a tremendous learning experience in a fun and relaxed atmosphere.

A special feature of RAINBOWfest is the **CoCo Gallery Live Showcase**, where CoCo artists enter their own graphics creations for display at the show. Cash prizes are presented and winning entries are decided by votes from RAINBOWfest attendees. *(See the previous page for more details.)* As an additional treat for CoCo Kids of all ages, we've invited frisky feline CoCo Cat to join us for the show. RAINBOWfest has something for everyone in the family!

If you missed the fun at our last RAINBOWfest in Princeton, why don't you make plans now to join us in Chicago? For members of the family who don't share your affinity for CoCo, there are many other attractions in the Chicago area.

The Hyatt Regency Woodfield — Schaumburg, Illinois offers special rates for RAINBOWfest. **The show opens Friday evening** with a session from 7 p.m. to 10 p.m. It's a daytime show Saturday — the CoCo Community Breakfast (separate tickets required) is at 8 a.m., then the exhibit hall opens promptly at 10 a.m. and runs until 6 p.m. On Sunday, the exhibit hall opens at 11 a.m. and closes at 3 p.m.

Tickets for RAINBOWfest may be obtained directly from THE RAINBOW. We'll also send you a reservation form so you can get a special room rate.

The POSH way to go. You can have your travel arrangements and hotel reservations handled through RAINBOW affiliate, POSH Travel Assistance, Inc., of Louisville. For the same POSH treatment many of our exhibitors enjoy, call POSH at (502) 893-3311. All POSH services are available at no charge to RAINBOWfest attendees.

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COCO COMMUNITY BREAKFAST

Rick Adams — Software Developer

Our keynote speaker for the traditional CoCo Community Breakfast is Rick Adams, who is the founder of Color Central Software and the author of programs like *DELPHIterm*, Tandy's *Temple of ROM* and Activision's CoCo 3 version of *Shanghai*.

Mr. Adams will describe his life as a programmer on the "front lines" of the ongoing efforts to program software for the CoCo 3, including humorous "war stories" from some of his software developments.

Don't forget . . .

If yours is one of the first 500 ticket orders, a coupon for a complimentary issue of The Second RAINBOW book of Simulations will be enclosed with your tickets — if yours is one of the first five orders received from your state, a coupon for a complimentary RAINBOWfest T-shirt will be enclosed with your tickets. So hurry up and place your order to take advantage of this offer.

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Please send me:

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Make checks payable to: The RAINBOW. Mail to: RAINBOWfest, The Falsoft Building, 9509 U.S. Highway 42, P.O. Box 385, Prospect, KY 40059. To make reservations by phone, in Kentucky call (502) 228-4492, or outside Kentucky call (800) 847-0309.

that it has fully met his need for a reliable system for software development. In addition, Tim Koonce (author of *Vterm*) has praised the Burke & Burke system, which he uses daily. Both of these CoCo celebrities have only the highest praise for the extensive support Chris Burke has offered when support was needed.

CRC/Disto

Figure 3 shows another variant of the typical arrangement. Tony DiStefano has been designing an extensive line of products for the CoCo to eliminate the need for a Multi-Pak. His hard-drive host adapter does not plug into the Multi-Pak. Instead, it is on a card with an MEB (Mini-Expansion Bus, specific to CRC/Disto products) that mounts inside one of the two available CRC/Disto floppy-disk controller cards. Thus, you can hook a floppy-disk controller (regular or no-halt variety) and a hard-disk drive to your CoCo without using a Multi-Pak. However, you must use the CRC/Disto controller in order to do this, and you cannot add another company's hardware cards to your system without getting a Multi-Pak. CRC/Disto is selling a 4-in-1 MEB card that has a hardware serial port, parallel port, real-time clock and a Disto host adapter on a card that fits inside a CRC/Disto floppy controller. If you choose the 4-in-1 card, you will need to supply an external power source (using a wall transformer) because the CoCo 3 does not have enough power to operate both the floppy controller and all four other functions.

Tony DiStefano (author of RAINBOW's monthly "Turn of the Screw" column) is the engineer behind the line of Disto products produced and sold by CRC of Canada. Even before it had a hard-drive host adapter, Disto had standardized its line of products around a unique Mini-Expansion Bus (MEB).

The MEB was created to eliminate the need for a Multi-Pak. This is nice because the Multi-Pak is no longer being produced. Currently, CRC/Disto has four products that create the MEB. Among them are the Super Controller I and the No-Halt Super Controller II. These controllers can work as ordinary floppy-disk controllers, but they are internally expandable because they possess this mini-expansion bus. (The Super Controller II is available from Radio Shack stores through Express Order.)

CRC/Disto makes two cards that act as SASI/SCSI hard-drive host adapters. Both are tiny cards that plug into the MEB inside either of the Super Controllers. One card is only a host adapter. The other is a 4-in-1 card that offers a serial port, a parallel port, a real-time clock, and a host adapter. The 4-in-1 card requires a separate power supply, because the CoCo 3 alone cannot supply enough current to operate all of its functions. Either of these host-adapter cards then connects to SASI or SCSI hard drive controller boards, which in turn connect to a ST506/ST412 interface hard drives. (See Figure 3.)

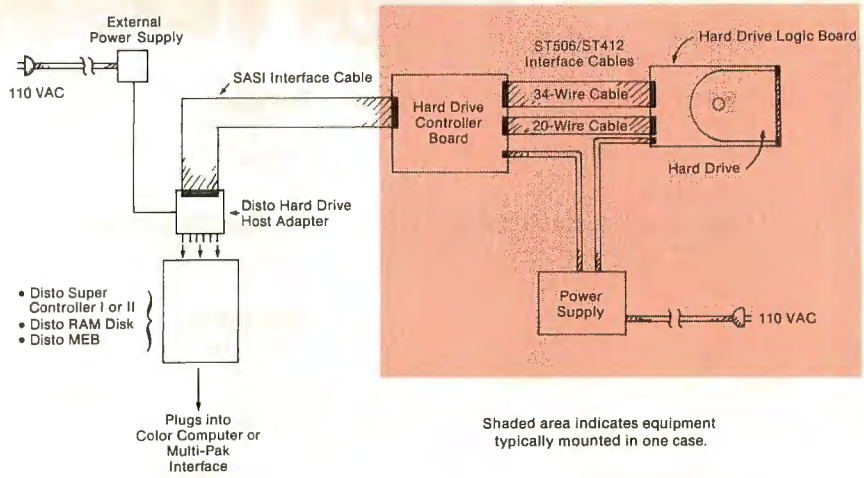


Figure 3: The Disto interface is plugged into an expansion point offered on many other Disto products.

If you already have a Multi-Pak or other disk controller, Disto offers one of two alternatives. You can purchase an MEB Card, which adapts Disto's two host-adapter cards so they can be plugged into a Multi-Pak. You can also purchase the RAM disk card, which supports up to a megabyte of extra RAM (that can be used only as a RAM-disk, not as main system memory). This provides space to plug in MEB-based host adapters. If you use either of these adapter cards, you can use Disto host adapters with other brands of regular and no-halt disk controllers.

Disk BASIC users will be happy to know Burke & Burke's *Hyper I/O* and RGB's BASIC for the hard drive exist in versions that work with Disto host adapters. The Disto, Owl-Ware, RGB and Ken-Ton Electronics systems are similar because they use the same variety of SASI and SCSI hard-drive controllers. Owl-Ware, RGB and Ken-Ton Electronics systems' host adapters are addressed to the same I/O port locations: $FF74 through $FF77. Disto's MEB products' I/O port addresses are a bit different. The MEB uses the SCS line to create its I/O port addresses, keeping the MEB ports in the range of $FF50 to $FF5F. Naturally, the Disto Super Controllers decode the SCS line for their floppy controller ports, so the controller registers are valid only in the $FF40 to $FF4F range and an image is not formed in the $FF50 to $FF5F area as it is with Radio Shack floppy controllers. Disto's 4-in-1 card's RS-232 port is not easily used with conventional Disk BASIC-based terminal programs because its I/O port address is different from the traditional addresses used by the Deluxe RS-232 Pak and subsequent clones.

However, the different port address poses no real problems under OS-9 because once a proper driver for the RS-232 port is installed, all OS-9 software calling the port can find it without any modification. The Disto hardware RS-232 port found on the 4-in-1 card uses the same 6551 UART chip as used by the Tandy Deluxe RS-232 Pak.

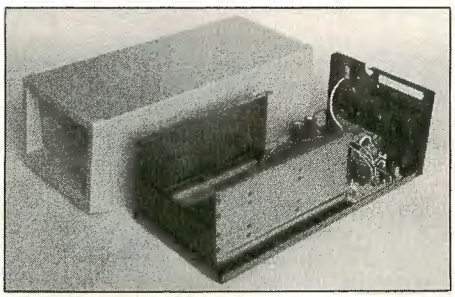
Arizona Small Computer Peripherals is a new company, dedicated to providing exceptional bargains on CoCo hard-drive systems. Using the Disto host adapter and software, along with a Xebec 1410A controller, it put together cost-effective hard-drive systems with CMI full-height 5-, 8-, 10- and 20-Meg hard drives. Some of the drives the company sells are brand new; others are used but tested thoroughly and sometimes reconditioned. Many of the Xebec controllers sold by Arizona Small Computer Peripherals are used. In some of its lowest priced systems, the company does not include a case for the hard drive, controller and power supply.

However, the company is able to offer full systems for under $150. (If you do not own a Disto Super Controller, you may have to spend more — as much as $100 more if you don't own a Multi-Pak.)

The people at Arizona Small Computer Systems have a full professional facility for repairing hard drives, including test equipment, and a complete working "clean room" in which drive "bubbles" can be repaired and drive platters replaced. If you send them your OS-9 system disk, they will configure their hard drive system for you. This way you'll need only turn on the drive and it will boot from the floppy drive. They are working on their own version of Disk Extended BASIC drivers for their systems. Dale Puckett has used the Disto hard drive system for quite a while, and it has performed reliably.

Frank Hogg Laboratories

Frank Hogg Laboratories has been selling OS-9 hard-drive systems longer than any other RAINBOW advertiser. In the past, however, these were for its QT line of 680XX systems, not the CoCo. It currently sells two different hard-drive systems for the CoCo. The economy model is the system designed by Burke & Burke. Frank Hogg Laboratories also sells, exclusively, a full-featured system engineered by Bruce Isted of Calgary, Alberta. This system is unique in several respects. First, it is the most expensive hard-drive system for the CoCo. For the price, however, several unique features are delivered.



Heavy duty power supply and case offered by FHL.

This system uses a Western Digital WD-1002-05 controller board. This unit is a high-performance item, fashioned for the mini computer and the high end of the microcomputer market. It features greater data transfer rate than the average SASI or SCSI controller board/host adapter arrangement. The controller board used also supports three hard drives. In addition to talking to up to three hard-disk drives, this board can support up to four double-sided floppy disk drives. The support provided is unusual because the system can talk to ordinary 360K or 720K 5¼- or 3½-inch floppy drives; the high-density, double data rate 1.2-Meg, 5¼-inch floppy drives; and the 1.44-Meg 3½-inch floppy drives. Although these drives are not supported in the system as delivered, tinkerers can alter certain jumper settings on the controller board and add a simple adapter-patch board to assign some of the floppy drives as high density and others as low density. At present, both the hard and floppy drives are supported under OS-9, and users must have a separate Radio Shack controller and floppy drives hooked to a Multi-Pak if they want to use DECB. However, software to make the system work under Disk BASIC is in the works. The floppy-drive controller in the FHL deluxe system is a no-halt controller, so when a floppy disk is accessed, no keyboard input or data coming in through the serial port is lost.

The Western Digital controller used in the FHL deluxe system can transfer data faster than the SASI/SCSI controllers used by all competing systems except those by Burke & Burke. The system can do this because it does not go through a handshake with the host adapter during data transfer. Data can be read or written to the Isted host adapter without checking the status of handshake lines for each byte. Additionally, Bruce Isted's system allows transfer of data between the CoCo and the host adapter two bytes at a time. While the FHL deluxe system is similar in configuration to the SASI and SCSI systems sold by others, this system uses a cable and a communication protocol between its host adapter and controller that is neither SASI nor SCSI, but rather a protocol unique to the Western Digital WD-1002-05 board.

FHL has also come out with a variation on this system, the Eliminator. This is a single card that plugs into the CoCo system port and provides two hardware serial ports, a parallel port, a real-time clock and the host adapter needed to work with the high performance Western Digital controller. The Eliminator uses CMOS logic chips so it will not need an external power source.

Frank Hogg Laboratories caters to tinkerers and sells only the critical hardware and software pieces of the system. This allows hackers to put together the system for less money if they have access to bargains in hard drives, WD-1002-05 controller cards, cases, power supplies, etc. Western Digital makes a variant of the WD-1002-05 controller card called the WD-1002-HDO card that is basically the same card without the components devoted to talking to floppy drives. Greg Law, SysOp on Delphi's OS-9 SIG, has been using one of these systems for some years, configured with high density floppy drives. He reports reliable service from it.

Owl-Ware

Owl-Ware's advertisements in RAINBOW promise "Proven Technology," and its hard-drive system confirms the claim. Its CoCo system has been available longer than any other CoCo hard-drive system.

The system was originally engineered by LR Technologies and consists of a host Adapter, which generates a SASI bus and is connected to one of several SASI or SCSI controller boards (which, in turn, is connected to and packaged with a hard-disk drive and power supply). LR Tech designed the host adapter. Owl-Ware has since obtained the rights to the LR Tech design and — after making some revisions to it — is producing the interface itself. The people at Owl-Ware tell me that the product is more fully SCSI than their older SASI device. They are even hinting about producing software and hardware packages to support tape backup units and CD ROMs on this SCSI bus.

The systems Owl-Ware sells include new hard-disk drives, which are *burned in* (tested in operation for some hours) before shipment. In addition, its interface is more complex electronically than those of its competitors. These factors make this product more expensive when ordered as a working system. However, like Frank Hogg Laboratories and most hard drive system vendors, Owl-Ware will cater to the tinkerer. It sells pieces of the system to those who want to make their own. The hacker package includes the host adapter, drivers for various different controller boards and a full source code listing of the drivers. (You need an OS-9 Level I assembler to use that listing.) It sells for under $120. If you want to forgo the testing done prior to shipping, you can have around $60 deducted from the price of the system.

Unlike the FHL deluxe system, Owl-Ware's system can be supported by three different software packages that allow operation under DECB. The company sells *Owl BASIC 3* for its hard-drive system. Implementations of DECB on Owl-Ware's hardware are also available from Burke & Burke, which has a

version of its *Hyper I/O* that runs with this hardware. RGB Computer Systems' primary concern is support of Radio Shack's Disk BASIC, but it also has a version of its software that runs with the Owl-Ware hardware. The exact degree of compatibility and flexibility offered depends on which BASIC system software you get. All are fairly compatible, but none are totally compatible.

At this time, Owl-Ware's host-adapter card does not have a real-time clock, which will come as a disappointment to OS-9 users. However, the company has acquired rights to manufacture J&M's floppy controllers and plans on engineering and selling a single card that will be a floppy disk controller and a hard-drive host adapter. Its commitment to supporting OS-9 users will be extended by the introduction of a major word processor, said to be similar to Microsoft's *Word*.

The people at Owl-Ware maintain voice lines for support of their hardware and tell me that they will soon set up a 24-hour BBS to support their products. Rick Adams, author of several pieces of commercial Color Computer software and author of *RickyTerm* and *DelphiTerm*, owns an Owl-Ware hard-drive system. Since its arrival, the system has worked ruggedly and reliably.

RGB/Ken-Ton Electronics

Roger Krupski of RGB Computer Systems has a particular interest in supporting Radio Shack's DECB with the greatest amount of compatibility possible. His hardware is a SCSI host adapter for the CoCo (which he developed together with the folks at Ken-Ton), a standard SASI or SCSI hard-drive controller card, hard drive and power supply. The unique aspect of Krupski's system is the software. RGB's implementation of DECB is considered the most compatible. RGB also provides patches for some of the popular Disk BASIC application programs, which present problems for any hard drive implementation of DECB. Of course, RGB also provides OS-9 drivers. The RGB Computer System software supporting DECB on a hard drive is available in forms that work with hardware from Owl-Ware, Ken-Ton and CRC/Disto. However, versions are not currently available for the Burke & Burke system.

Ken-Ton Electronics has long sold CoCo products for industrial systems. Part of their business involves building complete Color Computer systems customized for particular business and user applications. This work has resulted in Ken-Ton's SCSI host adapter for the CoCo, which is included in RGB's systems. This host adapter features heavy gold contacts and is available with a real-time clock that uses a rechargeable lithium battery (say goodbye to battery replacement.) Optionally, users can purchase the Ken-Ton SCSI Interface in an open collector version. This allows more than one CoCo to access the controller and hard drive on the same system. Also, to support larger systems, Ken-Ton offers H-DOS. While very similar to RGB-DOS, this custom DOS features optimized commands, a larger sector space and storage of hard drive parameters in EPROM (instead of on the physical disk) to increase data security. Ken-Ton also sells a dual-com RS-232 port board that provides up to two RS-232 ports. Joe Scinta, the man behind Ken-Ton, is a savvy engineer who knows CoCo hardware inside and out.

Where to Go From Here . . .

Main Hard Drives Currently Being Sold

Seagate ST-225 20 Meg
Seagate ST-238 30 Meg (RLL)
Seagate ST-251 40 Meg
Miniscribe M-8425 20 Meg
Miniscribe M-8438 30 Meg
Miniscribe M-3650 40 Meg
Miniscribe M-6085 70 Meg
CMI 5206 5 Meg
CMI 5412 10 Meg
CMI 6426 20 Meg
CMI 6639 30 Meg (non-RLL)

Commonly Supported Hard Drive Controllers

MFM	RLL
Adaptec 4000	Adaptec 4070
DTC-5150	Adaptec 2072
WD1002-SHD	DTC-5160
WD1002-GEN	WD1002-27X
WD1002-WX1	
Xebec 1410	

Arizona Small Computer Systems sells complete systems as well as the individual components that make up a hard drive system. All units include the Disto interface ($50), the WD1002-SHD controller ($75) and OS-9 drivers. In addition, all system drives are formatted under OS-9 and are shipped with approximately 1 Meg of public domain software on the drive. A 20-Meg system, including a CMI 6426 drive and a power supply and case ($50), sells for $350. A similar system with a 30-Meg drive (CMI 6639, non-RLL) is available for $425. Lower-end systems, sold with power supply but no case, are the 5-Meg system (CMI 5206, $60) for $120 and the 10-Meg system (CMI 5412, $75) for $160. All products carry a 180-day warranty.

Burke & Burke's main item of interest is an IBM PC bus-compatible interface, the CoCo XT, retailing for $69.95 without the real-time clock (RTC) option and $99.95 with the RTC. The CoCo XT includes drivers for both OS-9 and Disk BASIC. Other related products include *Hyper-I/O* ($29.95), *RSB* ($39.95) and the hardware XT-ROM ($19.95). All CoCo XT boards, built and tested by Burke & Burke, include a 90-day warranty.

CRC/Disto is offering the Disto Hard Disk Interface for $49.95. This interface offers the advantage of eliminating the Multi-Pak Interface while preserving access to most of the hardware accessory functions OS-9 users require. The MEB Adapter, used to carry this SCSI interface, is sold for $24.95. Alternatives to the MEB are the Super Controller I ($99) and the Super Controller II ($130). Both units feature an internal MEB to hold the hard drive interface. The Disto interface includes a 90-day warranty.

The Computer Center sells drive/controller kits that can be used if you want to build your own hard drive system. A 20-Meg ST-225 drive with the WD1002-GEN controller goes for $339, and a 40-Meg ST-251 drive with the same controller can be had for $499.

Frank Hogg Laboratories offers the Burke & Burke interface and optional extras at Burke & Burke prices. Additionally, FHL carries a full line of hard drive systems and components. Complete systems built around the Burke & Burke interface include: 20 Meg (using an ST-225 or Miniscribe M-8425) for $498, 30 Meg (Miniscribe M-8438) for $548 and 40 Meg (M-6085, full height) for $618. In the high-speed category, FHL offers deluxe systems built around its Eliminator interface ($199). These deluxe systems feature built-in capability to handle three hard drives and four floppy drives, including high-density (1.2 Meg and 1.44 Meg) floppy drives, in a no-halt fashion under OS-9. At present, the deluxe systems are strictly for use with OS-9. Systems, including the WD1002-05 high-speed controller ($199), are as follows: 20 Meg (ST-225 or M-8425) for $799, 40 Meg (M-3650) for $899 and 70 Meg (M-6085, full height) for $1335. All systems include a dual half-height power supply (60W with cooling fan) and case ($99.95), cable set and OS-9 Level I and II software. All units are fully tested and FHL warranties its products for one year.

Disk BASIC Software

At present, there are three sets of driver software to let you use hard-drive systems under DECB. RGB appears to have concentrated on Disk BASIC's use on a hard drive. The company divides the drive into however many standard 35-track disks can fit on it. The software allows you to cordon off some of the hard drive for use with OS-9. This approach has certain advantages and disadvantages. By making the virtual drives all 35-track, RGB gets around many compatibility problems caused by software whose file I/O does not use calls in Disk BASIC ROM. In most cases, the software gives you the 100 or more accessible virtual 35-track drives. For example, type `BACKUP 53 TO 105`, and the contents of virtual Drive 53 are backed up to virtual Drive 105. Also (via a software switch) bring in or out your four physical single-sided floppy drives (i.e., set things up so that drives 0 through 3 can be physical floppy or virtual drives actually part of the hard disk drive).

RGB's software offers exceptional compatibility. All implementations of Disk BASIC on a hard drive must be done by by burning an EPROM with a modified version of the DECB ROM code. RGB's version of this modified ROM is still only 8K in size, which means that it will not suffer compatibility problems from software that expects the upper 8K of the CoCo ROM address space to be unused. In addition, RGB's software stays almost completely out of the *base page* of RAM memory. Thus, its parameters are unlikely to conflict with variables that application software tends to store in the base page. (I believe RGB uses only a single byte in the base page of RAM for system variables.) Finally, RGB's software comes with a few patches not available elsewhere, to allow certain application programs (ones that don't go through `DSKCON` when they input or output disk sectors) to work with RGB software. When these patches are included, RGB states that its system will run *TW-80*, *TW-128*, *CoCo Max 3*, *Max 10* and other popular Disk BASIC software. BBS users, please note: RGB's implementation of Disk BASIC can be set up to automatically boot a particular program on power up. This means that after a power failure, your BBS can automatically restart itself from your hard drive.

The software offered by Owl-Ware and hinted at by Arizona Computer Systems is likely to be similar to the software offered by RGB systems. But RGB has had a long time to work bugs out of its system. This is not the case with the other offerings.

Burke & Burke offers an alternative to RGB systems. The approach is quite different and has its pros and cons. Under *Hyper I/O*, Burke & Burke formats the entire hard disk drive as an OS-9 hard disk. It then creates Disk BASIC devices in the form of OS-9 binary files on the hard drive. Under *Hyper I/O*, these virtual disks can be any size the user cares to make them. Steve Bjork reports that it is desirable to make at least one or two of them standard 35-track single-sided virtual drives. However, you can define drives a megabyte or more in size. If you are using 40-track double-sided floppy drives under Disk BASIC, you can define similar-sized devices on the hard disk.

The Burke & Burke approach offers a few nice features. First, you can change the proportions of the hard

Howard Medical carries a 20-Meg system retailing for $499. This system is built around the Burke & Burke approach and includes an ST-225 20 Meg drive, Burke & Burke interface, DTC-5150 controller, and a case and power supply. The drive is tested and formatted before shipping and the system is warranted for one year. If you want the RTC option for the Burke & Burke interface, include $20. In addition, Howard Medical is offering *Hyper-I/O* ($29.95), *RSB* ($39.95) and the XT-ROM ($19.95).

Ken-Ton Electronics offers a SCSI interface and will develop custom hard drive systems on request. Because of the many options available, you are invited to call for specific information. The Ken-Ton SCSI Interface currently retails for $89 without the real-time clock option and $119 with the clock installed. This true-SCSI interface will work with most any SASI or SCSI controller and allows control of multiple devices (hard drives, floppies, CD ROMs, etc.). It features real gold contacts. The clock option uses a rechargeable Lithium battery so replacement is unnecessary. The unit is also compatible with RGB-DOS, H-DOS (an extension of RGB-DOS), Owl-DOS and LR Tech software. Ken-Ton will supply custom drivers for the interface at the user's request. The interface is available in an open-collector version ($10 extra), which allows multiple CoCos to drive SCSI devices. Ken-Ton's software will not run with the Burke & Burke interface.

Owl-Ware has made some refinements to the LR Tech interface and the result has been dubbed the LR Tech/Owl Interface ($99). This host adapter will drive the Adaptec SCSI controllers. Among many other controllers, it will also easily drive the Omti 5000 series of controllers, allowing use of hard drives, floppies and other devices. A 10-year clock option is being offered for $25. Among several systems, Owl-Ware is offering a 20-Meg ST-225 ($239) complete with controller, LR Tech/Owl Interface, cables, case and power supply ($95) for $599. A similar 40-Meg, M-3650 system sells for $725. These systems are available in kit form for $549 and $659, respectively. Alternatively, they can be had in kit form with the Burke & Burke interface for $489 and $609. All assembled systems are formatted and tested before shipping. An optional product is Owl BASIC, a hard drive BASIC, selling for $35 with a hard drive purchase or $79 separately. Owl-Ware currently warrants drives for one year and all other products for six months.

Microcom Software sells both the Burke & Burke line and the Disto line of hard disk products. In addition, a complete 20-Meg system (ST-225) with the Burke & Burke interface goes for $509. For $539, a complete 30-Meg system (ST-238) is available. Microcom sells a separate case and power supply ($119) and the WD1002-GEN and WD1002-27X controllers for $79 each. The Seagate drives (with controller and cables) are sold as follows: 20-Meg ST-225 for $299, 30-Meg ST-238 for $329 and the 40-Meg ST-251 for $439. Microcom also offers a Disto version of Burke & Burke's *Hyper-I/O* for $29.95. All products listed are warranted for 90 days.

MicroWorld sells the ST-225 20-Meg drive for $259 or $299 with a WD1002-WX1 controller. The 30-Meg ST-238 RLL drive retails for $309 or $349 with WD1002-27X controller. Also, the 40-Meg ST-251 drive goes for $399 (without controller only).

Perry Computers sells the bare, 20-Meg ST-225 for $239 and the 20-Meg Miniscribe M-8425 for $240. The bare 40-Meg ST-251 drive is available for $409.

RGB Computer Systems can supply complete hard drive systems and software. Because of the different equipment available, you are invited to call RGB for specific information. RGB Computer Systems is also offering RGB-DOS, a hard drive-compatible DOS, at a price of $29.95. RGB-DOS has many of the features found in other alternate DOSs for the CoCo in addition to added commands for hard drive access. Because of its design, RGB-DOS works equally well with the CoCo 1, 2 and 3, and it will work with floppy-only systems. In addition to the inclusion of an non-OS-9 autoexec file, it allows users to boot OS-9 straight from the hard drive. Like Ken-Ton, RGB Computer Systems' software will not run with a Burke and Burke interface.

True Data Products offers parts and pieces of hard drive systems. There you can find the WD1002-WX1 controller for $99. The ST-225 20-Meg bare drive retails for $249 ($299 with controller) and the bare 40-Meg ST-251 can be had for $399 ($459 with controller). Alternatively, True Data sells a power supply, case and controller combo for $199. □

drive in OS-9 and Disk BASIC use (i.e., by killing or creating another of these virtual devices, you can add or subtract space allocated to Disk BASIC). This is not the case with the RGB software; it locks you into a particular partition at the start. Second, software and text files written under Disk BASIC are relatively accessible to OS-9 programs.

However, the ROM is 16K, which means it can be used only with third-party controllers. To use it with a Radio Shack controller requires a special adapter. Because *Hyper I/O* uses more RAM-base page locations for its system variable, there is more potential for compatibility problems with other software, and at present Burke & Burke does not have as many specific patches for popular software offerings as does RGB Computer Systems. Please note: Some of the fixes that RGB sells with its Disk BASIC system software will fix the target programs, so they work with Burke & Burke's *Hyper I/O*, too. (These patches are not sold separately by RGB; you have to buy the entire package.)

Although I imply that Burke & Burke's system may have some compatibility problems, Steve Bjork reports that *Hyper I/O* does provide a satisfactory degree of compatibility with application software designed to work with Disk Extended Color BASIC.

Technical Hints for Tinkerers

If you are making your own hard drive system with pieces of one of the systems I have mentioned, the following technical information may be of help to you. The following SASI and SCSI controllers work with CRC/Disto host adapters:

SASI:	WD1002SHD XEBEC 1410A DTC (all of the 520 series)
SCSI:	Rodime 650 series of drive plus controller Seagate N series of drive plus controller Adaptec 4000A (MFM type) and 4070(RLL type)

- Most of these should also work with Owl-Ware and Ken-Ton/RGB host adapters, but contact the manufacturer in question to make sure.
- Tony DiStefano seems to prefer the Adaptec controller boards.

Name	Username	Company
Burke, Chris	COCOXT	Burke & Burke
Krupski, Roger	HARDWAREHACK	RGB Computer Systems
DiStefano, Tony	DISTO	CRC/Disto
Isted, Bruce	BRUCEISTED	Designer of the FHL Deluxe System
Vishinski, Tom	OWL1	Owl-Ware
Law, Greg	GREGL	SysOp of the OS-9 SIG
Koonce, Tim	TIMKOONCE	Author of *VTerm*, A knowledgeable OS-9 programmer and hardware expert
Darling, Kevin	KDARLING	SysOp on CompuServe's OS-9 SIG
Adams, Rick	RICKADAMS	OS-9 technical consultant

Table 1: Whom to Contact on Delphi

The Burke & Burke host adapter can be used with the following IBM PC controller boards:

Western Digital:	
WD1002-WX1	(MFM type)
WD1002S-WX2	(MFM type)
WD1002-27X	(RLL type)
WD1002-GEN	(MFM type)
DTC:	
DTC5150CRH	(MFM type)
DTC5160CRH	(RLL type)
Adaptec:	
ACB2072	(RLL type)

The OMTI 5520 controller will also work with the Burke & Burke adapter, but it will not support the Burke & Burke boot ROM. If you use this controller, you must boot your hard-drive system from a floppy disk drive. Actually, this is not as much of a problem as some might think, and many seasoned OS-9 users prefer booting off a floppy anyway, for the added flexibility it offers.

If you are packaging your hard drive and controller board in a case, Frank Hogg warns you to beware of potential problems. Mount your hard drive controller in a plane that is at least ½-inch away from the the hard drive and its logic board. If you do not do this, you may get unreliable operation due to interference between the controller board and the logic board. If you package a floppy drive in the same case with the hard drive, put the logic board of the floppy drive next to the metal side of the hard drive — not next to its logic board. Placing the logic board of the floppy drive close to the logic board of the hard drive can cause interference and unreliable operation.

As in all systems, it is best to keep inter-connecting cables as short as possible. While SASI and ST506 cables have been known to work at lengths of 6 feet or more, I suggest lengths be kept under 3 feet for each cable.

All the companies and people involved in the CoCo hard drive business seem reputable and conscientious. At the beginning of system development, almost all the developers encountered problems with their equipment. For example, when the CoCo 3 was introduced, none of the developers realized the timing of the SCS line on the CoCo 3 was different from the timing of the SCS line on the older CoCo models. Specifically, devices using the SCS line on a CoCo 3 must gate that line with the high portion of the E-clock signal. In some of their early products for the CoCo 3, both Disto and Burke & Burke failed to do this, and maddeningly intermittent unreliable operation resulted. Eventually both Chris Burke and Tony DiStefano solved this subtle problem. Although all their current products implement the required gating of the SCS line, in the beginning, these problems caused ill will between them and some customers and dealers. I urge patience should problems arise and remind you that even subtle problems can be solved.

For more details on hard drives, refer to Kevin Darling's article on hard drive systems, published in the OS-9 Special Interest Groups on Delphi and Compuserve. It was a valuable reference in writing this article. When you consider getting a system, contact the maker first. Delphi users can contact many of the principals online. Refer to Table 1 for a list of such people, their usernames and their companies or qualifications. Of course, you can contact me, MARTY-GOODMAN. I'm always available on Delphi to answer questions.

Color Computer I, II, III

Free Software for Drive 0 Systems

CoCo Checker...Test roms, rams, disk drives and & controller printer, keyboard cassette & more.
Tape/Disk Utility...Transfers disk to tape and tape to disk.

159.95 Drive 0
- Full Ht Drive
- Single Case
- Heavy Duty Power Supply
- 2 Drive Cable
- Gold plated contacts
- Controller & manuals

179.95 Drive 0
- Double Sided Slim Line Drive
- Case holds 2 slim line drives
- Heavy Duty Power Supply
- 2 Drive Cable
- Gold plated contacts
- Controller & Manuals

269.95 Drive 0 & 1
- 2 Double Sided Slim Line Drive
- Case holds 2 slim line drives
- Heavy Duty Power Supply
- 2 Drive Cable
- Gold plated contacts
- Controller & Manuals

Other Drive Specials

119.95
2nd Drive
for new Radio Shack
includes:
- Slim Line DS/DD Drive
- Cabling & Instructions
- Mounting Hardware

Full Ht Drive	89.95
Full Ht Drive Ps/Case	129.95
Slim Line Drive	99.95
Slim Line Drive Ps/Case	139.95
2 Slim Drives Ps/Case	239.95
Disk Controller	59.95
Single Ps & Case	44.95
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Disk Controller	59.95
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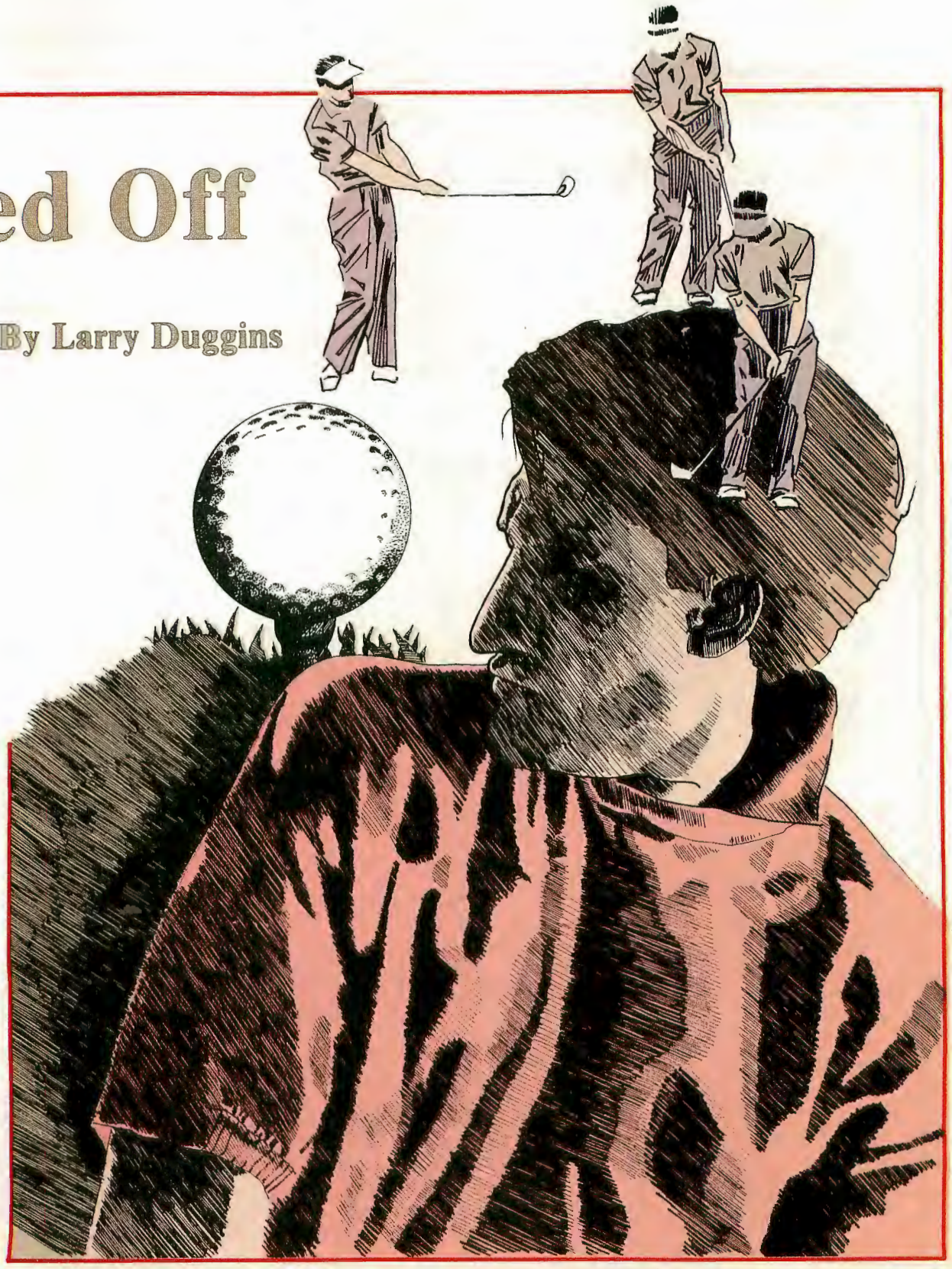
Enjoy the game on and off the green

Teed Off

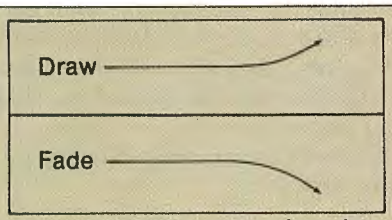
By Larry Duggins



Have you ever dreamed of consistently hitting a golfball 250 to 300 yards and having it land in the fairway? Have you imagined your shot sailing past a fairway bunker or your second shot clearing the pond and landing safely on the green of a par 5 hole? You don't have to just dream anymore. *Scratch Golfer*, a golf simulation that makes use of text and Hi-Res screens, can make your dreams come true.

To begin playing the game, just load, run and press ENTER. You'll be on your way. (The program is long and a little complicated, so watch for typos if you typed it in.) Follow the screen prompts to enter all necessary information for each shot.

Scratch Golfer's objectives are the same as those of regular golf: To play the 18-hole round of golf in as few strokes as possible. With the exception of putts, all shots will be determined by data entered by the player. The number of putts taken by the player is determined by a system of percentages based on the distance between the ball and the hole once it lands on the green.



No matter which way you face, for a right-handed golfer, a draw curves to the left and a fade curves to the right.

Diagram 1: Draw and Fade

After the title screen appears, the computer determines if you have a disk drive connected. The computer will ask whether or not your computer will accept the speed-up poke. Press Y to answer *yes* and N to answer *no*. The program assumes that you are a right-handed golfer and will ask you to identify your normal shot. Since it is rare for a golfer to consistently hit a ball straight, you will need to indicate the direction in which the ball usually curves in the air. Press D for *Draw* and F for *Fade*.

Larry Duggins currently teaches fifth grade in Kettering, Ohio. He recently returned to school to work on a computer science degree. Larry enjoys golf and has a handicap of two.

Once you have answered these questions, the title screen is replaced by Screen 1, which contains data about the hole, wind conditions, lie of the ball, distance to the hole and average distances you can expect from each club if your yard length is six. At this screen, you will enter the information needed to play each shot. Screen 2 is a graphic representation of the hole. Toggle between screens 1 and 2 by pressing S.

Screen 3 appears after you have played a hole. It offers you statistics about the way you played the hole. Screen 4 is your scorecard. (Sorry, you can't tear it up if things are going badly.) The number to the right of your score is a running tab, identifying how far above or below par you are: A number in inverse video represent an under-par score; regular numbers represent over-par scores; and an E represents even par.

The final screen, Screen 5, appears at the end of the last hole. It displays the final statistics for each hole. This information can be saved to disk.

At the first screen, you will be prompted by a flashing question mark for four different values. The program first asks you to select a club. Make your selection and press ENTER. Next, you'll need to enter the initial direction of your shot. The program then asks for the length of arc. Values 2, 3 and 4 are chip and pitch swings, and values of 5, 6 and 7 are full swings. You cannot draw or fade with an arc value less than 5. Therefore, if you select a value of 4 or less, the program places an asterisk on the screen for "Type of Shot." If you choose a high value, you must respond to the prompt by pressing F for Fade or D for Draw. Your normal shot (entered while in Screen 1) is the best bet; however, if you like to gamble, enter the opposite shot. Since you are a scratch

Golf Gab

Terminology:

Draw: For a right-handed golfer, a draw is a shot that curves from right to left. (See Diagram 1.)

Fade: For a right-handed golfer, a fade is a shot that curves from left to right. Note: For a left-handed golfer, a draw and a fade are just the opposite.

Hazard: Any bunker or water hazard.

Bunker: An area of bare ground — often a depression — usually covered by sand. They are yellow in this simulation.

Water Hazard: Any sea, lake, pond, stream, ditch, etc. They are blue in this simulation.

Rough: Taller grasses bordering the fairway. These are large yellow areas.

Out of Bounds: Any shot that comes to rest off of the course. In this simulation, you are out of bounds when the ball goes off the graphics screen.

Teeing Grounds: A rectangle, two club lengths in depth, the front and side of which are defined by the outer limits of two markers. This is represented by the red rectangle.

Direction of Shot: The initial path the ball will take when first struck. You can enter any value from zero to 23. (See Diagram 2.)

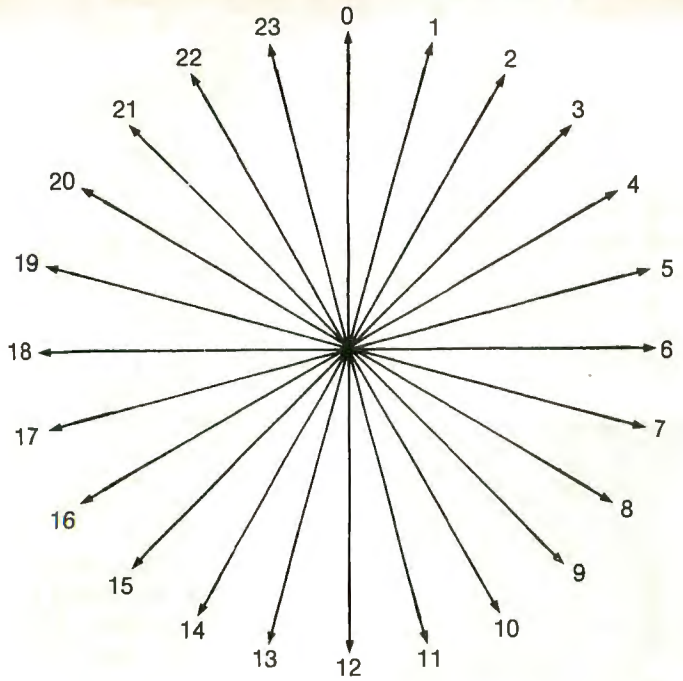
Length of Arc: The length of arc is determined by how far back you swing the club. Your choice of swing ranges from two to seven.

Lie: The lie of the ball refers to the degree of difficulty that enters into the shot caused by how the ball is resting on the ground. If the ball is nested in tall grass or plugged in the sand bunker, the shot is more difficult. There are three types of lies: good, fair or bad.

Penalties:

Water Hazard: If a ball lands in a water hazard, the player will be given a one-stroke penalty. The ball will be placed near the hazard on approximately the same line as the ball took upon entering the hazard.

Out of Bounds: The player takes a one-stroke penalty and must replay the ball from where it was originally struck.



This diagram shows you the initial direction the ball will move after you enter one of the 24 possible direction values.

Diagram 2: Swing Direction

golfer, you have a good chance with either swing. Once you have pressed the key corresponding to the type of shot, press ENTER if you are ready to begin or the space bar if you need to change any values.

Once you are ready to begin, the program will pause for a few seconds. The second screen appears, and you see your shot. After the ball lands, the program pauses while the ball flashes on the screen. Press S to return to the first screen to set up your next shot.

Philosophy, Hints and Strategies

To play this golf simulation, all you have to do is choose the club and the arc and direction of the screen. However, it's not that easy. The program takes into consideration a number of wild cards: missed and inaccurate shots, the lie of the ball, etc. For instance, I have designed a "distance-versus-accuracy" factor into the length of the swing. The farther you swing the club back, the farther the ball can go. However, the the greater the length arc, the greater the chance of a missed shot or of a greater curve than you expect. (See Table 1.)

Screen 1 offers the distances for each club as they apply to a good lie of the ball. Be careful if you have a fair or bad lie and intervening water. Note: If you have a bad lie with the message "Be Careful," the ball is either plugged in the sand or nestled in deep grass. In these instances, your only safe shot is with your #10 club.

Length of Arc	Possible accuracy	Potential distance	Possible amount distance can vary
5	Best	Fair	Least
6	Good	Good	↓
7	Fair	Best	Most

Table shows how full swing length of arc values influence accuracy and distance.

Table 1: Swing Length of Arc Values

The winds play a big part in club selection and the direction of the shot. Don't be concerned about mild winds, but consider the speed and direction of stronger winds when entering your data. In addition, you might want to try longer distance clubs and a short arc to get some of the distances under 120 yards. Finally, if you are having trouble choosing the direction of your swing, draw the direction chart shown in Diagram 2 on a clear sheet of plastic. Using this as a guide may help you make your decision.

Enjoy *Scratch Golfer* and I hope your game improves.

(Questions or comments about this program may be directed to the author at 2706 Symphony Way, West Carrollton, OH 45449. Please include an SASE when requesting a reply.) □

13	190	117	148	255	221
19	17	124	154	267	203
28	127	134	195	277	105
40	232	143	42	287	230
56	152	155	79	301	27
66	187	169	52	311	123
77	203	192	223	321	129
85	56	207	92	327	144
97	107	225	37	339	78
107	65	237	77	END	134

The Listing: GOLFER

```
Ø '       SCRATCH GOLFER
1 '  (C) 1986 BY LARRY DUGGINS
2 '       27Ø6 SYMPHONY WAY
3 '       W. CARROLLTON OH
   COPYRIGHT 1989, FALSOFT,INC
4 GOSUB342
5 CLS:PD=PEEK(&HCØØØ):IF PD=68 T
HEN INPUT"DOES YOUR COMPUTER ACC
EPT THE   SPEED UP POKE WITH YOU
R DRIVE   CONNECTED (Y/N)";AQ$EL
SE INPUT"DOES YOUR COMPUTER ACCE
PT THE   SPEED UP POKE (Y/N)";AQ
$
6 IF AQ$="Y"THEN POKE65495,Ø
7 X=RND(-TIMER):CLS:INPUT"WHAT T
YPE OF SHOT DO YOU WANT ASYOUR N
ORMAL ONE...PRESS (D) FOR DRAW
 (F) FOR FADE";SS$
```

```
8 IF SS$="D"OR SS$="F"THEN12ELSE
7
9 DATAØ,1,2,3,4,2,1,5,3,4,5,2,3,
4
1Ø DATA4,1,Ø,3,2,3,4,5,Ø,1
11 DATA5,536,4,468,5,596,3,152,4
,44Ø,4,416,4,424,3,212,4,376,4,4
2Ø,4,292,4,388,5,532,4,368,3,24Ø
,4,424,5,64Ø,3,164
12 WD=RND(7)+1:WS=RND(2Ø)+1:IF W
D=1 THEN WD$="N"ELSEIF WD=2 THEN
 WD$="NE"
13 IF WD=3 THEN WD$="E"ELSEIF WD
=4 THEN WD$="SE"
14 IF WD=5 THEN WD$="S"ELSEIF WD
=6 THEN WD$="SW"
15 IF WD=7 THEN WD$="W"ELSEIF WD
=8 THEN WD$="NW"
16 G$="H5L1H1L2H2U1H2U1L1H3L1H1L
1H1L1G1D1G1D1G1D1G1D1G1D1G2D1G2D
1F1D1F1D1F1D1F2D1F3D1F3D1F3R3F2R
3E2R3E5U3E3U3H3U2":F1$="G3D2G2D3
F3R4F3R4F6R3E4R3F2R2E4R4E3R5F14R
4F12R4F12R4F1ØR3F2R3F1R2E16R3E12
R3E1ØR3E8R3E8R3"
17 GW$="E2R2F3R2F3R2F2D2G5D2G2L3
G6L2H4U3H5U3E8":FW$="G14L2G6L2G4
D3G5D3G8D3G5D4G2D3G1D2G1D1F2D2F2
D2G2D2G1D3F2D3F3D2G1D2R2E1R3E4R2
U2E2U2E2U2H2U3E6U2H2U3H2U2H3U2E5
U2E7U2E4U2E4U2E3U2E4U2E6U2E2U2L3
":GS$="L2G2L2G3D3G3D3F4R4F2R4E3R
3U2E6U2H4U1H3G2L3
18 SR$="R3F2R3F2R3F2R1F2D2G3L2H3
L2H4L2H2U4":SF$="H3U2H2L2H2U2L2G
3D2G2D3F3D2F2R4F2R2E3U4":FB$="L3
G2L2G2L2G5D1G2D2F6":LB$="F3R3D2F
3R3E3U2H6L2H3L4H2L4G3L2G6L3G4L2G
2D6F4D3F4R6E3H4"
19 FT$="H1L1H1L2H2L1H2H3U2H4U2H3
L2G3L2G4D2F6R3F5R2F3R2F4R2U2R2E3
U2":SM$="H3L2H1L1G2L1G1D1G1D1F2R
1F1R2E2R2U1E2":SL$="H4L2H2L2D3L2
D3F3D2F3D2L2D2F3R3E3U2E2R2U3H8":
FL$="R2D5R4D3R5D2R6E2R7E2R5E3R5D
3R7F8R5F7R6F5R3E6R3E5R3E3F3D4R5E
7U4E8U3E7R5F9R3F1ØR4E7R5F1Ø
2Ø G4$="F9R2F4R2F3R2F1R4F1R3E1R2
E1R3E2R2E2U1H2U2H1U1H3U1L2H1L1H2
L2H2L4H1L2H1L2H4L1H2L1G2L2G4D2G2
D2":GR$="U2H2U1H2U1L3H1L3G2L2G2D
3F4D2F3R4E3R2E2U1"
21 CLS:PRINT@2ØØ,"***ONE MOMENT*
**":DIM LE(18),ST(18),TS(18),PS(
18),NP(18),WD(3Ø),PA(18),S1(18),
SC(18),TR(18):HO=1:CP=72:CT=1:RP
=1Ø9:PV=1134:SZ$=STRING$(32,131)
:BS$=STRING$(64,32):BL$="  ":AT$
=STRING$(32,42):GF=1
22 FOR X=Ø TO 23:WD(X)=X:NEXTX:F
OR X=1 TO 24:READ A:NEXT X:FOR X
=1 TO 18:READ PA(X),LE(X):NEXT X
:RESTORE
23 FX=Ø:FY=Ø:FT=Ø:GOSUB241
24 PMODE3,1:PCLS1:RF=.99:ON HO G
O SUB26,33,42,54,63,69,73,84,79,
88,92,95,1ØØ,1Ø4,1Ø7,11Ø,114,119
25 GOTO121
26 LINE(13,157)-(23,17Ø),PSET,BF
27 DRAW"BM7Ø,1Ø9;XF1$;BM7Ø,1Ø9;X
FL$;"
28 CIRCLE(23Ø,99),14,4:HX=226:HY
=1Ø3:CIRCLE(HX,HY),2,3
29 CIRCLE(1Ø4,138),5,2:CIRCLE(12
2,143),5,2:CIRCLE(12Ø,136),5,2:C
IRCLE(115,139),5,2:CIRCLE(11Ø,13
2),5,2
3Ø PAINT(21Ø,138),3,4
31 COLOR1,1:DRAW"BM1Ø,18Ø;XD1$;B
M7Ø,1Ø9;XF1$;BM7Ø,1Ø9;XFL$;"
32 GOTO121
33 HX=192:HY=125:LINE(26,41)-(42
,49),PSET,BF
34 CIRCLE(196,133),16,4,1.45:CIR
CLE(HX,HY),2,3
35 H$="L2U1L3U1L4U1H3U1L2H3U1L2U
1L5U1H2L4U1H2L7H1L4H2L4H1L5G2L4G
2L4H3L4H2L3G2L3"
36 R$="R2F2D3R5F5R4F4R4F2D2F2D2E
1U2R4F5R3E4R3E2R3E6R3E4"
37 DRAW"BM98,91;XR$;BM152,6Ø;A2;
XFT$;BM2Ø6,114;A3;XGW$;BM136,71;
XSM$;BM19Ø,113;AØXH$;BM128,75;XS
M$;":PAINT(17Ø,72),2,4:PAINT(218
,11Ø),3,4:PAINT(116,95),2,4
38 PAINT(12Ø,74),2,4:CIRCLE(17Ø,
1Ø8),24,4,1.45,.17,.49:PAINT(172
,13Ø),3,4
39 CIRCLE(17Ø,1Ø8),24,1,1.45,.17
,.49:PAINT(137,76),2,4
4Ø COLOR1,4:DRAW"BM152,6Ø;A2;XFT
$;BM2Ø6,114;A3;XGW$;BM98,91;AØ;X
R$;BM19Ø,113;XH$;BM136,71;A3;XSM
$;BM128,75;AØXSM$;"
41 GOTO121
42 HX=72:HY=18:CIRCLE(HX,HY),2,3
43 LINE(232,139)-(242,149),PSET,
BF
44 W$="F3D2F6D3F3D3F4D4G6L5G4L6U
3G2L4U4E4U3R2E2U3R4H4U2G1U4E2H4U
3H3"
45 DRAW"BM118,Ø;AØ;XW$;BM16Ø,1ØØ
;XSR$;BM166,95;XSL$;":PAINT(163,
1Ø3),2,4:PAINT(166,98),2,4:PAINT
(17Ø,1Ø6),2,4:PAINT(16Ø,1Ø7),2,4
46 PAINT(118,4),3,4
```

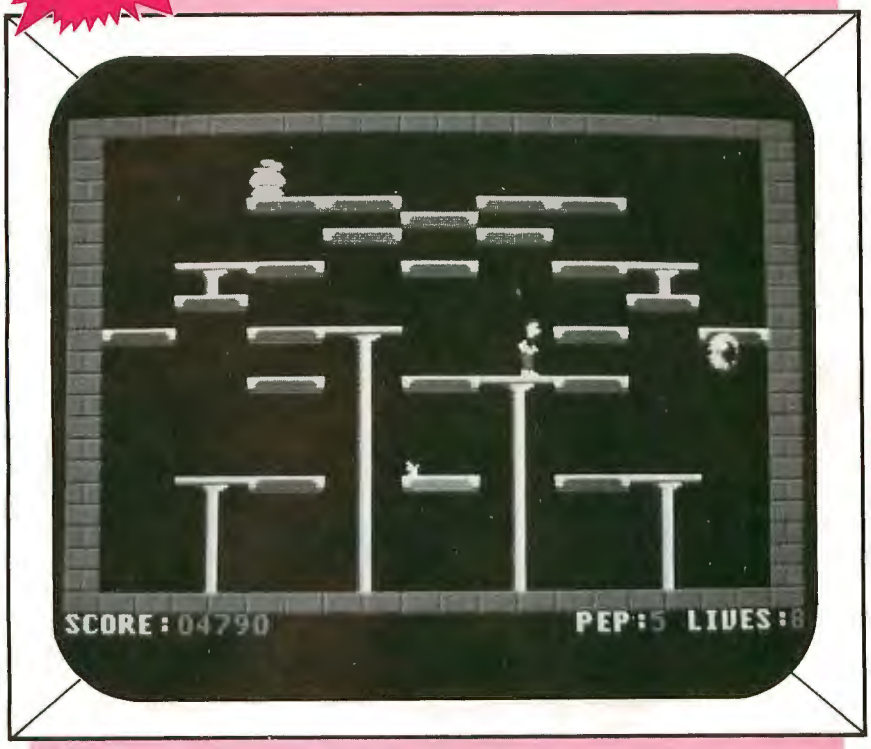
```
47 DRAW"BM76,33;A1;XG$;"
48 DRAW"BM176,82;A2XSF$;"
49 DRAW"BM138,9Ø;A1XFW$;"
5Ø PAINT(84,55),2,4:PAINT(18Ø,86
),2,4
51 CIRCLE(59,29),12,,1.22,.1Ø,.7
:PAINT(54,27),3,4:CIRCLE(59,29),
12,1,1.22,.1Ø,.7
52 COLOR1,1:DRAW"BM118,Ø;AØXW$;B
M138,9Ø;A1XFW$;BM16Ø,1ØØ;AØXSR$;
BM166,95;XSL$;BM176,82;A2XSF$;"
53 GOTO121
54 HX=11Ø:HY=76:CIRCLE(HX,HY),2,
3:LINE(52,1ØØ)-(59,1Ø8),PSET,BF
55 WL$="F3ØD4F1ØD4F1ØD3F7D2F9D5F
3D3F7R5F3R5F4R3E2U7"
56 WR$="F1ØD2F8R3F4D2F8R2F1ØR3F4
R3F1R4F2R5F4R3F2R4F1R5F1R3F1R3F1
R4"
57 WG$="D1F4R2F6R1F5D1F3R1F7R2F2
D2F3"
58 WB$="R5F2R5F1R6F2R4F2R6F3R5F1
R3F1R4E2U3H5"
59 DRAW"BM2Ø,Ø;AØXWL$;BM3Ø,Ø;XWR
$;BM82,6Ø;XWG$;BM82,6Ø;XWB$;":PA
INT(25,Ø),3,4
6Ø DRAW"BM12Ø,78;XGR$;"
61 COLOR1,1:DRAW"BM2Ø,Ø;XWL$;BM3
Ø,Ø;XWR$;BM82,6Ø;XWG$;BM82,6Ø;XW
B$;"
62 GOTO121
63 HX=85:HY=46:LINE(138,149)-(14
8,157),PSET,BF:CIRCLE(8Ø,4Ø),16,
4:CIRCLE(HX,HY),2,3
64 DRAW"BM111,86;S6;XSL$;":LS$="
H3L2H2G3D2L2F3R3F2R3E2U2":DRAW"B
M93,86;XLS$;":PAINT(112,95),2,4:
PAINT(93,89),2,4
65 DRAW"BM124,75;S8;XSR$;":PAINT
(142,86),2,4
66 GT$="G3D2G2D2F3R2F1R3F2D2F2R3
E2R2E3U2E2U3H2":DRAW"BM66,5Ø;S4;
XGT$;":TR$="E3R2E2R2F3R2F2D3R2D2
G3L2G2L2H1L3HL3H2":DRAW"BM96,43;
XTR$;":PAINT(66,55),2,4:PAINT(96
,47),2,4
67 COLOR1,1:DRAW"BM111,86;S6XSL$
;BM93,86;XLS$;BM124,75;S8XSR$;BM
66,5Ø;S4XGT$;BM96,43;XTR$;"
68 GOTO121
69 HX=62:HY=122:LINE(2Ø5,4Ø)-(2Ø
8,46),PSET,BF:CIRCLE(6Ø,124),12,
4:CIRCLE(HX,HY),2,3
7Ø DRAW"BM118,82;A1S6XSF$;BM134,
1Ø8;AØXSF$;BM63,1Ø6;A2XSF$;":PAI
NT(118,8Ø),2,4:PAINT(13Ø,11Ø),2,
4:PAINT(68,1Ø7),3,4
71 COLOR1,1:DRAW"BM118,82;A1;XSF
$;BM134,1Ø8;AØ;XSF$;BM63,1Ø6;A2;
XSF$;"
72 GOTO121
73 HX=166:HY=4Ø:LINE(5Ø,13Ø)-(58
,138),PSET,BF:CIRCLE(HX,HY),2,3:
CIRCLE(168,42),13,4
74 DRAW"BM1Ø4,89;A1;S4;XFT$;BM12
4,1Ø4;AØ;S6;XSM$;BM126,1Ø8;A2;XS
M$;BM126,88;A3;XSM$;BM151,79;A1;
XSR$;BM155,45;AØ;XSM$;BM154,39;A
1;XSM$;BM184,4Ø;XSM$;BM186,55;AØ
;XSM$;":PAINT(1Ø1,86),2,4
75 PAINT(117,1Ø5),2,4:PAINT(129,
1Ø8),2,4:PAINT(124,93),2,4
76 PAINT(148,84),2,4:PAINT(147,4
5),2,4:PAINT(15Ø,32),2,4:PAINT(1
83,37),2,4:PAINT(185,54),2,4
77 COLOR1,1:DRAW"BM1Ø4,89;A1;S4;
XFT$;BM124,1Ø4;AØ;S6;XSM$;BM126,
1Ø8;A2;XSM$;BM126,88;A3;XSM$;BM1
51,79;A1;XSR$;BM154,39;A1;XSM$;B
M184,4Ø;XSM$;BM155,45;AØ;XSM$;BM
186,55;AØ;XSM$;"
78 GOTO121
79 HX=6Ø:HY=122:CIRCLE(HX,HY),2,
3:LINE(17Ø,4Ø)-(179,5Ø),PSET,BF:
CIRCLE(58,121),11,4
8Ø DRAW"BM124,122;A1S4XSL$;":PAI
NT(12Ø,12Ø),2,4
81 DRAW"BM118,35;AØXFW$;BM54,1Ø1
;A2XSF$;BM14Ø,91;A1XSR$;BM119,99
;A3XSM$;BM1Ø8,112;A2XSM$;":PAINT
(111,111),2,4:PAINT(121,1Ø6),2,4
:PAINT(116,4Ø),3,4:PAINT(63,1Ø7)
,2,4:PAINT(138,94),2,4:COLOR1,1:
DRAW"BM118,35;AØXFW$;BM54,1Ø1;A2
XSF$;BM14Ø,91;A1XS$;
82 DRAW"BM119,99;A3;XSM$;BM1Ø8,1
12;A2;XSM$;BM124,122;A1;XSL$;BM1
4Ø,91;A1XSR$;
83 GOTO121
84 HX=68:HY=65:LINE(172,56)-(178
,64),PSET,BF:CIRCLE(68,62),1Ø,4:
CIRCLE(HX,HY),2,3
85 CIRCLE(75,75),4,2:CIRCLE(7Ø,7
8),4,2:CIRCLE(63,74),4,2:CIRCLE(
54,7Ø),4,2
86 DRAW"BM68,49;A2S4XFT$;":PAINT
(82,53),2,4:COLOR1,1:DRAW"BM68,4
9;XFT$;"
87 GOTO121
88 HX=1Ø7:HY=5Ø:CIRCLE(HX,HY),12
,4:LINE(139,148)-(151,158),PSET,
BF:CIRCLE(HX,HY),2,3
89 DRAW"BM1Ø8,37;AØXFB$;BM11Ø,37
;XLB$;BM122,81;S6;XSL$;BM146,91;
A2;XSM$;":PAINT(96,4Ø),2,4:PAINT
(118,87),2,4:PAINT(158,92),3,4
9Ø COLOR1,1:DRAW"BM1Ø8,37;AØ;S4;
XFB$;BM11Ø,37;XLB$;BM122,81;S6;X
```

```
SL$;BM146,91;A2;XSM$;"
91 GOTO121
92 HX=146:HY=4Ø:DRAW"BM157,42;AØ
S4XGR$;":LINE(14,7Ø)-(22,82),PSE
T,BF:CIRCLE(HX,HY),2,3
93 DRAW"BM9Ø,124;A2XFW$;BM166,38
;XSR$;":PAINT(164,35),2,4:PAINT(
11Ø,1Ø4),3,4:COLOR1,1:DRAW"BM9Ø,
124;A2;XFW$;BM166,38;XSR$;"
94 GOTO121
95 HX=48:HY=65:CIRCLE(HX,HY),2,3
:LINE(176,13Ø)-(184,14Ø),PSET,BF
:CIRCLE(5Ø,62),11,4
96 WO$="S6L2H3L6H3U4E3R2E3R6F6D4
G6":DRAW"BM1Ø6,99;AØXWO$;":PAINT
(1ØØ,91),3,4:DRAW"BM1Ø6,99;C1XWO
$;"
97 DRAW"BM38,63;C4A3S6XSM$;":CIR
CLE(96,1Ø1),4,2:PAINT(42,7Ø),2,4
98 COLOR1,1:DRAW"BM38,63;A3;XSM$
;BM7Ø,63;S4AØXWF$;"
99 GOTO121
1ØØ HX=198:HY=178:LINE(12Ø,45)-(
132,53),PSET,BF:CIRCLE(HX,HY),2,
3
1Ø1 DRAW"BM198,169;S4;XGS$;BM1Ø6
,123;A3;XFW$;BM18Ø,1Ø1;A3;XFT$;B
M177,128;A2XSM$;":PAINT(122,138)
,3,4:PAINT(182,1Ø4),2,4:PAINT(18
1,13Ø),2,4
1Ø2 COLOR1,1:DRAW"BM1Ø6,123;A3;X
FW$;BM18Ø,1Ø1A3XFT$;BM177,128;A2
XSM$;"
1Ø3 GOTO121
1Ø4 HX=1Ø5:HY=139:CIRCLE(HX,HY),
2,3:LINE(14Ø,42)-(15Ø,5Ø),PSET,B
F:CIRCLE(HX,HY),9,4,1.3
1Ø5 DRAW"BM126,129;S6AØXSL$;BM83
,12Ø;A3;S8;XSR$;BM132,121;S4;A2;
XGS$;":PAINT(134,118),2,4:PAINT(
124,14Ø),3,4:PAINT(9Ø,112),3,4:C
OLOR1,1:DRAW"BM126,129;S6AØXSL$;
BM83,12Ø;A3;S8;XSR$;BM132,121;S4
;A2;XGS$;"
1Ø6 GOTO121
1Ø7 HX=124:HY=128:CIRCLE(HX,HY),
2,3:CIRCLE(128,126),14,4,.66:LIN
E(124,64)-(132,72),PSET,BF
1Ø8 CIRCLE(11Ø,126),5,2:CIRCLE(1
1Ø,12Ø),5,2:CIRCLE(1Ø5,123),5,2:
CIRCLE(112,115),5,2:CIRCLE(113,1
31),5,2:CIRCLE(118,136),5,2:CIRC
```

```
LE(1Ø7,128),5,2:CIRCLE(126,138),
5,2
1Ø9 GOTO121
11Ø HX=1Ø8:HY=153:CIRCLE(HX,HY),
3,3:LINE(96,4Ø)-(112,48),PSET,BF
:CIRCLE(11Ø,152),11,4,1.33
111 C1$="H6U3H6U3H5L2U4E12U3E7U3
E12R3U3R4H8U4E15R2"
112 DRAW"BM9Ø,18Ø;S3;A3;XF1$;BM9
Ø,18Ø;S4;AØ;XC1$;":PAINT(95,175)
,3,4:COLOR1,1:DRAW"BM9Ø,18Ø;S3;A
3;XF1$;BM9Ø,18Ø;S4;AØ;XC1$;"
113 GOTO121
114 HX=1Ø8:HY=34:CIRCLE(HX,HY),2
,3:CIRCLE(11Ø,3Ø),13,4:LINE(24Ø,
175)-(252,183),PSET,BF
115 CIRCLE(192,114),5,2:CIRCLE(2
1Ø,124),5,2:CIRCLE(16Ø,12Ø),5,2:
CIRCLE(159,13Ø),5,2:CIRCLE(15Ø,1
23),5,2:CIRCLE(2Ø7,113),5,2
116 DRAW"BM14Ø,64;S8;A2;XSM$;BM1
16,56;A3;XSM$;BM13Ø,28;S4;XGR$;B
M88,41;A2;XGR$;":PAINT(12Ø,68),2
,4:PAINT(156,58),2,4:PAINT(1ØØ,4
6),2,4:PAINT(132,34),2,4
117 COLOR1,1:DRAW"BM14Ø,64;S8;A2
;XSM$;BM116,56;A3;XSM$;BM13Ø,28;
S4;XGR$;BM88,41;A2;XGR$;BM19Ø,12
4C3XSM$;":PAINT(196,122),3,3
118 GOTO121
119 HX=116:HY=94:CIRCLE(HX,HY),1
Ø,4:CIRCLE(HX,HY),2,3:LINE(15Ø,1
28)-(158,136),PSET,BF
12Ø WC$="G4D2G2D2F2D3F2D2F3R3F2R
3E3R3E3R2E2U3E2U3H6U2L3U2L4H2L2G
4":DRAW"BM1Ø6,79;S6AØXWC$;":PAIN
T(1Ø8,86),3,4:COLOR1,1:DRAW"BM1Ø
6,79;S6AØXWC$;"
121 CLS:OB=Ø:POKE1Ø24,191:PRINT@
1,"COURSE YARDAGE = 7,Ø88 YDS.":
POKE1Ø56,191:PRINT@33,"COURSE PA
R = 72"
122 POKE1Ø88,239:PRINT@65,"HOLE"
;HO;:POKE1Ø97,239:PRINT@74,"PAR"
;PA(HO):POKE11Ø5,239:PRINT@82,"L
ENGTH";LE(HO);"YDS"
123 POKE112Ø,175:PRINT@97,"WIND-
 SPEED";WS;"** DIRECTION ";WD$:P
OKE359,126:PRINT@128,SZ$;
124 PRINT@288,SZ$:PRINT@326,"AVE
RAGE DISTANCES";:PRINT@353,"WOOD
S: DR=265  3W=241";:PRINT@385,"I
RONS:  1=223  2=211  3=2Ø2";:P
RINT@425,"4=193  5=184  6=175"
;:PRINT@457,"7=166  8=157  9=1
48";:PRINT@482,"  1Ø=133";
125 TG=Ø:IF RF<>.99 THENPRINT@17
9,CHR$(175);"YOU HAVE A":IF RF=1
 THENPRINT@212,"GOOD LIE":GOTO12
9
126 IF RF=.99THEN129ELSEIF RF>.7
 AND RF<1THENPRINT@212,"FAIR LIE
":GOTO129
127 IF RF>.5 AND RF<.8THENPRINT@
212,"BAD LIE";:GOTO129
128 PRINT@179,CHR$(191);"BAD LIE
   ":PRINT@212,"BE CAREFUL":TG=1
129 IF RF<>.99 THENPRINT@243,CHR
$(239);"DISTANCE TO":PRINT@276,"
HOLE";DH*4;"YDS";
13Ø A$=INKEY$:IF A$=""THENPRINT@
161,"WHICH CLUB**** ";:FOR T=1 T
O 2Ø:NEXTT:POKE1198,127:FOR T=1
TO 8Ø:NEXTT:GOTO13Ø
131 IFA$=CHR$(83)THENSCREEN1,Ø:P
SET(SX,SY,3):FOR T=1 TO 5Ø:NEXTT
:PSET(SX,SY,2):FOR T=1 TO 5Ø:NEX
TT:B$=INKEY$:IF B$=""THEN131ELSE
SCREENØ,Ø:GOTO13Ø
132 SOUND3Ø,1:IF A$=CHR$(13)THEN
134ELSENN=NN+1:C$(NN)=A$:GOTO13Ø
133 FOR T=1 TO 4ØØ:NEXTT:POKE123
2,32:GOTO13Ø
134 FOR N=1 TO NN:C$=C$(1)+C$(2)
:NEXT N:PLAY"T23Ø;O5AO4BO5F":PRI
NT@176,C$;:IF FL=1 THEN IF SS$="
D"THEN SS$="F"ELSEIF SS$="F"THEN
 SS$="D"
135 IFTG<>1THEN138ELSEIF C$="DR"
ORC$="3W"THENRF=.2-RF:GOTO138
136 C=VAL(C$):IF C<5THENRF=.3-RF
:GOTO138
137 IF C<1ØTHENRF=.4-RF ELSERF=R
ND(4)+3:RF=RF/1Ø
138 A$=INKEY$:IF A$=""THENPRINT@
193,"DIRECTION***** ";:FOR T=1 T
O 2Ø:NEXTT:POKE123Ø,127:FOR T=1
TO 8Ø:NEXTT:GOTO138
139 IF A$=CHR$(83)THENSCREEN1,Ø:
PSET(SX,SY,3):FOR T=1 TO 1ØØ:NEX
TT:PSET(SX,SY,2):B$=INKEY$:IF B$
=""THEN139ELSESCREENØ,Ø:GOTO138
14Ø SOUND3Ø,1:IF A$=CHR$(13)THEN
141ELSE PR=PR+1:DR$(PR)=A$:GOTO1
38
141 FOR N=1 TO PR:DR$=DR$(1)+DR$
(2):NEXT N:PLAY"T23Ø;O5AO4BO5F":
PRINT@2Ø8,DR$;
142 A$=INKEY$:IF A$=""THENPRINT@
225,"LENGTH OF ARC* ";:FOR T=1 T
O 2Ø:NEXTT:POKE1262,127:FORT=1 T
O 8Ø:NEXTT:GOTO142
143 IF A$=CHR$(83)THENSCREEN1,Ø:
PSET(SX,SY,3):FOR T=1 TO 5Ø:NEXT
:PSET(SX,SY,2):FOR T=1 TO 5Ø:NEX
T:B$=INKEY$:IF B$=""THEN143ELSES
CREENØ,Ø:GOTO142
144 IF A$>"7"OR A$<"2"THENSOUND1
```

GAME POINT SOFTWARE

THIS MONTHS NEW Feature



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by Nickolas Marentes

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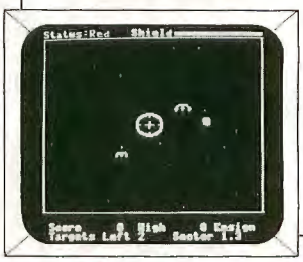

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bash

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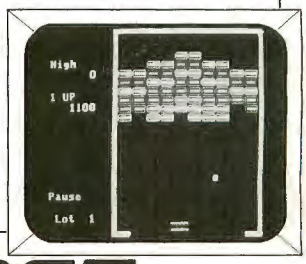

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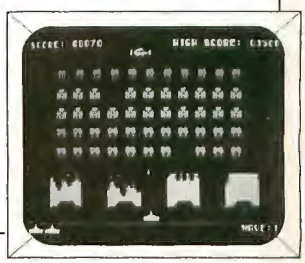

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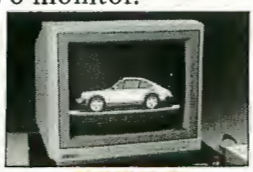
7622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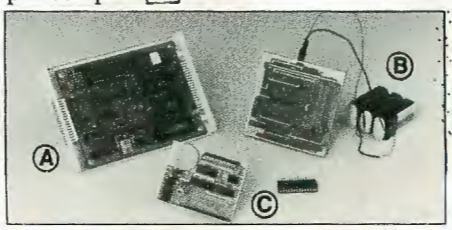

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,5:A$="":GOTO142
145 LA=VAL(A$):PLAY"T23Ø;O5AO4BO
5F":PRINT@239,LA;:IF LA<5THENTS$
="":PRINT@257,"TYPE OF SHOT** ";
:PRINT@272,"*";:GOTO15Ø
146 A$=INKEY$:IF A$=""THENPRINT@
257,"TYPE OF SHOT** ";:FOR T=1 T
O 2Ø:NEXTT:POKE1294,127:FORT=1 T
O 8Ø:NEXTT:GOTO146
147 IF A$=CHR$(83)THENSCREEN1,Ø:
B$=INKEY$:IF B$=""THEN147ELSESCR
EENØ,1:GOTO146
148 IF A$="F"OR A$="D"THEN149 EL
SE146
149 TS$=A$:PLAY"T23Ø;O5AO4BO5F":
PRINT@272,TS$;
15Ø PRINT@32Ø,BS$
151 PRINT@416,"*(PRESS <ENTER> T
O PLAY HOLE)":PRINT@448,"*(PRESS
 <SPACE BAR> TO CHANGE     ANY V
ALUES    ";
152 A$=INKEY$:IF A$=""GOTO152
153 IF A$=CHR$(13)THEN156
154 IF A$=CHR$(32)THENPRINT@176,
BL$;:PRINT@2Ø8,BL$;:PRINT@239,BL
$;:PRINT@271,BL$;:PR=Ø:NN=Ø:C$(1
)="":C$(2)="":DR$(1)="":DR$(2)="
":GOTO13Ø
155 PRINT@271,BL$;:GOTO146
156 DR=VAL(DR$):IF INT(WD/2)=WD/
2THEN163
157 IF WD=1 OR WD=5 THEN158ELSE1
6Ø
158 IF DR=Ø OR DR=1 OR DR=23 THE
NIF WD=1 THENDW=-2*WS ELSEDW=2*W
S
159 IF DR>1Ø AND DR<14 THENIFWD=
5 THENDW=-2*WS ELSEDW=2*WS
16Ø IF WD=3 OR WD=7 THEN161ELSE1
63
161 IF DR>4 AND DR<8 THENIFWD=3
THENDW=-2*WS ELSEDW=2*WS
162 IF DR>16 AND DR<2Ø THENIFWD=
7 THENDW=-2*WS ELSEDW=2*WS
163 IF WD=2 OR WD=6 THEN164 ELSE
166
164 IF DR>1 AND DR<5 THENIFWD=2
THENDW=-2*WS ELSEDW=2*WS
165 IF DR>13 AND DR<17 THENIFWD=
6 THENDW=-2*WS ELSEDW=2*WS
166 IF WD=4 OR WD=8 THEN167 ELSE
167 IF DR>7 AND DR<11 THENIFWD=4
 THENDW=-2*WS ELSEDW=2*WS
168 IF DR>19 AND DR<23 THENIFWD=
```

```
8 THENDW=-2*WS ELSEDW=2*WS
169 IN(1)=5:IN(2)=4:IN(3)=5:IN(4
)=5:IN(5)=4:IN(6)=5
17Ø IF WD=1THENX1(1)=2:X1(2)=5:X
1(3)=14:X1(4)=17
171 IF WD=2THENX1(1)=5:X1(2)=8:X
1(3)=17:X1(4)=2Ø
172 IF WD=3THENX1(1)=8:X1(2)=11:
X1(3)=2Ø:X1(4)=23
173 IF WD=4THENX1(1)=11:X1(2)=14
:X1(3)=23:X1(4)=2
174 IF WD=5THENX1(1)=14:X1(2)=17
:X1(3)=2:X1(4)=5
175 IF WD=6THENX1(1)=17:X1(2)=2Ø
:X1(3)=5:X1(4)=8
176 IF WD=7THENX1(1)=2Ø:X1(2)=23
:X1(3)=8:X1(4)=11
177 IF WD=8THENX1(1)=23:X1(2)=2:
X1(3)=11:X1(4)=14
178 IF C$="DR"THENCC=46Ø:IF ST>Ø
 THENGF=(RND(5)+5)/1Ø
179 IF C$="3W"THENCC=41Ø
18Ø IF C$="1"THENCC=38Ø
181 IF C$="2"THENCC=36Ø
182 IF C$="3"THENCC=345
183 IF C$="4"THENCC=33Ø
184 IF C$="5"THENCC=315
185 IF C$="6"THENCC=3ØØ
186 IF C$="7"THENCC=285
187 IF C$="8"THENCC=27Ø
188 IF C$="9"THENCC=255
189 IF C$="1Ø"THENCC=23Ø
19Ø IF LA=7THENR=RND(1ØØ):CO=-R
191 IF LA=6THENR=RND(4Ø):CO=R-25
192 IF LA=5THENR=RND(4Ø):CO=R
193 IF LA<5THENR=2Ø:CO=-(R)
194 IF LA>4 THENLF=1 ELSELF=.1
195 IF LA<5 THENNT=Ø:GOTO229
196 R1=RND(13)+1:IF TS$=SS$ THEN
R2=RND(9)+15:R3=RND(3):IF R3<>3T
HEN199
197 R4=RND(1Ø):IFR4<4THENTS$=SS$
:GOTO199
198 FOR N=1 TO R1:READNT:NEXTN:G
OTO2ØØ
199 FOR N=1 TO R2:READNT:NEXTN
2ØØ RESTORE
2Ø1 FOR X=X1(CT)TOX1(CT)+IN(CT):
IF WD(X)=DR THEN2Ø3ELSENEXTX
2Ø2 CT=CT+1:IF CT>6THEN CT=ØELSE
2Ø1
2Ø3 IF CT=2 OR CT=5 THEN AF=INT(
WS/4.1)ELSE AF=INT(WS/12+.3)
2Ø4 IF CT>3THEN IF TS$="F"THEN A
F=-AF
2Ø5 IF CT=Ø THEN2Ø6ELSEIF CT>Ø A
ND CT<4 THEN IF TS$="D"THEN AF=-
AF
2Ø6 CT=1:NT=INT(NT*LA/1Ø*1.92+AF
)
2Ø7 IF NT<ØTHEN FL=1:IF TS$="D"T
HEN TS$="F"ELSE IF TS$="F"THEN T
S$="D"
2Ø8 NT=ABS(NT):AF=Ø:C=VAL(C$)
2Ø9 IF C>6 AND C<11 THENIF NT>1
THEN NT=1
21Ø IF C>3 AND C<7 THENIFNT>2 TH
ENNT=2
211 IF C>Ø AND C<4 THENIF NT>3 T
HEN NT=3
212 IF TS$="F"THEN 221
213 IF INT(DR/2)<>DR/2THEN217
214 IFDR=Ø OR DR=2 OR DR=12 OR D
R=16THENXC=3:YC=6:GOTO229
215 IFDR=4 OR DR=1Ø OR DR=16 OR
DR=22THENXC=6:YC=6:GOTO229
216 IFDR=6 OR DR=8 OR DR=18 OR D
R=2ØTHENXC=8:YC=2:GOTO229
217 IFDR=1 OR DR=13THENXC=Ø:YC=9
:GOTO229
218 IFDR=3 OR DR=11 OR DR=17 OR
DR=23THENXC=4:YC=7:GOTO229
219 IFDR=5 OR DR=9 OR DR=15 OR D
R=21THENXC=7:YC=4:GOTO229
22Ø IFDR=7 OR DR=19THENXC=8:YC=Ø
:GOTO229
221 IF INT(DR/2)<>DR/2THEN225
222 IFDR=Ø OR DR=1Ø OR DR=12 OR
DR=22THENXC=2:YC=8:GOTO229
223 IFDR=2 OR DR=8 OR DR=14 OR D
R=2ØTHENXC=6:YC=6:GOTO229
224 IFDR=4 OR DR=6 OR DR=16 OR D
R=18THENXC=8:YC=2:GOTO229
225 IFDR=1 OR DR=9 OR DR=15 OR D
R=21THENXC=4:YC=7:GOTO229
226 IFDR=3 OR DR=7 OR DR=13 OR D
R=19THENXC=7:YC=4:GOTO229
227 IFDR=5 OR DR=17THENXC=8:YC=Ø
:GOTO229
228 IFDR=11 OR DR=23THENXC=Ø:YC=
9
229 IF INT(DR/2)=DR/2 THEN233
23Ø IF DR=5 OR DR=7 OR DR=17 OR
DR=19THENXI=1Ø:YI=2.34:GOTO237
231 IF DR=3 OR DR=9 OR DR=15 OR
DR=21THENXI=4.34:YI=4.345:GOTO23
7
232 IF DR=1 OR DR=11 OR DR=13 OR
 DR=23THENXI=1.34:YI=5.34:GOTO23
7
233 IF DR=Ø OR DR=12THENXI=Ø:YI=
5.34:GOTO237
234 IF DR=6 OR DR=18 THENXI=11:Y
I=Ø:GOTO237
235 IF DR=2 OR DR=1Ø OR DR=14 OR
 DR=22THENXI=3:YI=5.26:GOTO237
236 IF DR=4 OR DR=8 OR DR=16 OR
DR=2Ø THENXI=7:YI=3.34
```

Announcing a Great New Floppy Drive System for the Color Computer:

The New OWL-Ware Floppy Drive System

No Better System is Available at Any Price (But the Price is Great, too!)
Two New Products First Shown at Rainbowfest, Princeton 1988

DISK CONTROLLER

We at OWL-WARE are pleased to announce that we have purchased the rights to all of the Color Computer Products of J&M Systems. J&M has had more experience with CoCo controllers than any other supplier (except for Radio Shack® itself) and we are proud to add them to our nest! OWL-WARE will now be producing J&M controllers under the OWL brand. These controllers all use J&M's proven designs, with some minor improvements, and they will serve you for years to come.

- All gold contacts
- Works with all CoCo models (1,2,3)
- Holds 2 switchable ROMS
- Positive switching by simple jumper or optional external switch (No erratic software or pokes required)
- Buffered I/O lines to help prevent burn-out if unit accidentally pulled out with the system on
- Latching chips are socketed to speed repairs
- Does not use the WD1773 chip which caused problems with many CoCo 3 systems and is now discontinued
- Attractive all metal case
- Dealer inquiries now invited

CONTROLLER only $69. (without ROMs)

(Add $14.95 for RSDOS $19.95 RSDOS and OWLDOS)

See the next 2 pages for more drive and software specials from OWL-WARE

Disk drives are not our only business, but they sure are our main business! We have been selling hard and floppy drives for the CoCo longer than any other Rainbow advertiser. **Our double sided drives are brand new, half-heights with a full one year warranty!** The full-height drives offered cheap by our competition are *used or surplus!*

NEW! Keyboard Interface for the CoCo!

At last you can type on a real IBM® type professional computer keyboard. You can use the keyboard in your lap or a comfortable table and/or 6 to 12 feet from the CoCo. This interface allows the use of both user programmable function keys and programmed "quick keys". The cursor pad and the number keypad function like an IBM®. An on board ROM provides for different programmed keys for BASIC and OS-9. Easy to install and no soldering is required. Probably the most useful and pleasant addition to your CoCo and is much better than any keyboard extension or add-on keyboard. Includes easy to follow instructions. Use with any standard IBM® style keyboard or use ours.

Interface $119. **101-Key Keyboard only $45.**

CASE AND POWER SUPPLY

In recent months it has become very difficult to obtain dependable, safe power supply and cases for floppy drive systems. They just couldn't pass our quality control. OWL-WARE has now produced a case and power supply that you can be proud to own and use. We believe that this is the best and most attractive drive case available for any computer.

- Built in surge protector! (we believe that this feature is unique in CoCo drive cases)
- Sleek, modern design
- Heavy-duty power supply
- Fully shielded data cable
- Modular power supply construction for ease of repairs
- Stackable case design
- Dealer inquiries now invited

SPECIAL WINTER SALE
Double Sided Drives
Drive 0 System
Complete $199.
Drive 1
Only $129.

OWL-WARE
P.O. Box 116-A
Mertztown, PA 19539
— ORDER LINES (only) —
(800) 245-6228
(215) 682-6855 (PA)

Proven

On the Razor's Edge of

Basic and OS-9 Hard Drive Systems

Proven Performance for Demanding Home or Business Users

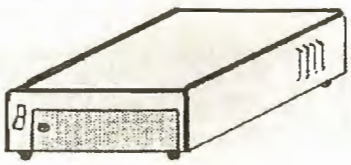
Every hard drive which has been produced by OWL-WARE during the last 3 years is **complete**. A system consists of software, hard drive, controller, heavy-duty power supply, and LR Tech Interface. There are no hidden costs for assembly or testing. When a drive system is ordered, we fully **assemble**, **test**, and **burn-in** the system for 3 full days. This ensures dependability and optimum performance.

We have now been supplying CoCo hard drive systems and parts for more than 3 years. This is the longest history in the CoCo market of any system. Some other advertisers are stating that they have one of the most reliable systems for the CoCo *with all of 4 months history in the CoCo hard drive market*! We have reached our position in the hard drive market by providing our customers with a quality product that they (and we) can be proud to own and use.

Because of many requests for a lower price system in kit form, we are now selling a kit of all parts at a significant discount compared to our regular prices. We recommend this kit (or any kits offered by any other supplier) only to those who have experience in electronic assembly and OS-9.

We have **LR Tech** and **Burke & Burke**

For OS-9 Levels 1 and 2



10 Meg.	20 Meg.	40 Meg.	80 Meg. (2 X 40 Meg.)
System Prices: (Includes Hard Drive, Controller, LR Tech Interface, Software. Fully assembled and tested.)			
$469.	**$599.**	**$725.**	**$1,069.**
Kit Prices: (LR Tech System as above but not assembled or tested.)			
$419.	**$549.**	**$659.**	**$ 999.**
Kit Prices: (As above but using Burke & Burke bus adapter)			
(na)	**$489.**	**$609.** (lower prices)	
30 Meg Kit:	**$539.** (Lowest prices anywhere)		

OWL Hard Drive BASIC 3

There have been several ads in this magazine about BASIC for Color Computer hard drive systems. These ads sometimes only tell a part of the story. Our BASIC system price includes **assembly**, **testing**, and **3-day burn-in** period. We do not require a Multi-pak to operate.

Our hard drive systems are fast, reliable, and reasonable in price. This has been proven by hundreds of users over the past 3 years. We do not have to turn off error checking for speed. We achieve high speed BASIC from a unique indexing method.

The table below will summarize some of the key points about our BASIC hard drive system and the B&B system. We believe that we have the best BASIC interface for CoCo hard drives available.

BASIC Hard Drive Systems*

Feature	OWL	B&B
Drive Portion Available at One Time	Entire	Partial (4 sections)
User Sets BASIC/OS-9 Partitions	YES	Yes
Add to Existing OS-9 Drive Without Reformat	YES	No(?)
Drives 0-3 Hard/Floppy	YES	No
Built in Park	YES	No
Speed*	FAST	Fast

*All feature details are believed to be true at time of writing and are subject to change. We believe that our BASIC hard drives are the fastest due to our indexing method, but both systems are fast and we sell both. On ours all BASIC commands work including DSKINI, DSKI$, and DSKO$.

Prices: With/Without Hard Drive

$35./$79.

Technology

the Color Computer Frontier

DISK DRIVES

Floppy Drive Systems

The Highest Quality for Years of Service

(We have located a number of unused, surplus single sided drives for those who wish a quality, inexpensive system.)

Drive 0 Systems (Half Height, Double Sided, Direct Drives) **$199.** (Same but Single sided) **$185**

Drive 0 systems complete with drive, controller, legal DOS, cable, case, power supply, and manual

Drive 1 Systems (Half Height, Double Sided, Direct Drives) **$129.** (Same but Single sided) **$115.**

New 3.5", 720K Drives for OS-9 with case & Power Supply **$179.**

Drive 1 Systems have drive, case, power supply. (You may require optional cable and/or DOS chip to use)

Special for 0/1 Combos (Drives 0,1,2,3) $295.

HALF- HEIGHT DRIVE UPGRADES FOR RS HORIZONTAL CASES

Why only double the capacity of your system when you can triple in the same case? Kit includes: double-sided to fit your case, chip to run both sides of new drive, hardware, and detailed instructions. Easy! Takes only 5 minutes!

Model 500 $119. **Model 501 or 502 $129.**

All drives are new and fully assembled. We ship only FULLY TESTED and CERTIFIED at these low prices. We use Fuji, YE Data, and other fine brands. No drives are used or surplus unless otherwise stated to you when you order. We appear to be the one of the few advertisers in Rainbow who can truly make this claim. We have 5 years experience in the CoCo disk drive market! We are able to provide support when you have a problem.

Drives 1 Year Warranty

OWL Phones

Order Numbers (only)

1-800-245-6228

1-215-682-6855

Technical Help

1-215-837-1917

OWL WARE Software Bundle

Disk Tutorial/Utilities/Games

DISK TUTOR Ver 1.1

Learn how to use your disk drive from this multi-lesson, machine language program. This tutor takes you through your lessons and corrects your mistakes for a quick, painless disk drive introduction. (This professionally written tutor is easily worth the bundle's total price.)

OWL DOS

An operating system that gives faster disk access and allows the use of double-sided drives. Corrects a floating point number error on early CoCo systems.

COPY-IT

Quickly copies selected programs between disks. A wild card option selects groups of programs to copy.

VERIFY

Verifies reading of each sector. Bad sectors are listed on the screen.

2 GAMES

We will select 2 games from our stock. These sold for more than $20 each.

If sold separately this is more than $125 worth of software!!

Do not mistake this software with cheap, non-professional "Public Domain" software which is being offered by others. All of this software is copyrighted and professional in quality. The tutor is unique with us and has helped thousands of new users learn their disk drive.

only $27.95
(or even better)
only $6.95 with
any Disk Drive Purchase!!

Our prices include a discount for cash but do not include shipping.

OWL-WARE has a liberal warranty policy. During the warranty period, all defective items will be repaired or replaced at our option at no cost to the buyer except for shipping costs. Call our tech number for return. Return of non-defective or unauthorized returns are subject to a service charge.

OWL-WARE
P.O. BOX 116
Mertztown, PA 19539

```
237 PRINT@176,BL$;:PRINT@2Ø8,BL$
;:PRINT@239,BL$;:PRINT@271,BL$;:
PRINT@416,BS$;:PMODE3,1:SCREEN1,
Ø:DI=INT(CC*LA/1Ø*RF*GF+(DW*LF))
+CO
238 RF=1:GF=1
239 AC=INT(AC*LA/1Ø*1.3+.5):PP=D
I/22:FP=PP-INT(PP):PP=INT(PP+.5)
24Ø IF FT=1THENGOTO26Ø
241 IF HO=1THENSX=18:SY=161:BX=S
X:BY=SY
242 IF HO=2THENSX=38:SY=45:BX=SX
:BY=SY
243 IFHO=3THENSX=236:SY=142:BX=S
X:BY=SY
244 IFHO=4THEN SX=57:SY=1Ø3:BX=S
X:BY=SY
245 IFHO=5THEN SX=145:SY=153:BX=
SX:BY=SY
246 IFHO=6THEN SX=2Ø4:SY=43:BX=S
X:BY=SY
247 IFHO=7THEN SX=56:SY=132:BX=S
X:BY=SY
248 IF HO=8THEN SX=174:SY=6Ø:BX=
SX:BY=SY
249 IFHO=9THEN SX=174:SY=46:BX=S
X:BY=SY
25Ø IFHO=1ØTHEN SX=145:SY=15Ø:BX
=SX:BY=SY
251 IFHO=11THEN SX=2Ø:SY=78:BX=S
X:BY=SY
252 IFHO=12THEN SX=178:SY=132:BX
=SX:BY=SY
253 IFHO=13THEN SX=126:SY=5Ø:BX=
SX:BY=SY
254 IFHO=14THEN SX=145:SY=47:BX=
SX:BY=SY
255 IFHO=15THEN SX=128:SY=68:BX=
SX:BY=SY
256 IFHO=16THENSX=1Ø4:SY=45:BX=S
X:BY=SY
257 IFHO=17THENSX=246:SY=179:BX=
SX:BY=SY
258 IFHO=18THENSX=155:SY=131:BX=
SX:BY=SY
259 IF FT=ØTHENFT=1:RETURN
26Ø IF DR>-1 AND DR<7 THEN QX=1:
QY=-1:GOTO264
261 IF DR>6 AND DR<13 THEN QX=1:
QY=1:GOTO264
262 IF DR>12 AND DR<19 THEN QX=-
1:QY=1:GOTO264
263 IF DR>18 AND DR<24 THEN QX=-
1:QY=-1
264 RX=SX:RY=SY:IY=YI-INT(YI):IX
=XI-INT(XI)
265 FOR T=1 TO 3ØØ:NEXT T:CX=PP-
NT:CX=PP-NT:TS(ST)=DI:PLAY"T1ØØV
31Ø4AB":PSET(SX,SY,1):PSET(BX,BY
,4)
266 FOR N=1 TO PP:CX=CX-1:IF CX<
ØTHEN SX=SX+XC*QX:SY=SY+YC*QY
267 IF CX>=Ø THEN SX=SX+(INT(XI+
IX+TX)*QX):TX=TX+IX:IF TX>1THENT
X=Ø
268 IF CX>=Ø THENSY=SY+(INT(YI+I
Y+TY)*QY):TY=IY+TY:IF TY>.66THEN
TY=Ø
269 IF SX<Ø OR SX>255 OR SY<Ø OR
 SY>191 THENSOUND1,5:CLS:PRINT@1
97,"****OUT OF BOUNDS****":FOR T
=1 TO 9ØØ:NEXTT:OB=1:PS=PS+1:SX=
RX:SY=RY:C$(1)="":C$(2)="":DR$(1
)="":DR$(2)="":NN=Ø:PR=Ø:IF ST=Ø
THENSX=BX:SY=BY:ST=ST+1:GOTO284:
ELSE284
27Ø IF PPOINT(SX,SY)=2THENPSET(S
X,SY):FOR T=1 TO8Ø:NEXT T:PSET(S
X,SY,2):NEXT N:TR(HO)=TR(HO)+1:R
F=RND(9):RF=RF/1Ø:GOTO293
271 IFPPOINT(SX,SY)=3THENPSET(SX
,SY,2):FORT=1 TO8Ø:NEXTT:PSET(SX
,SY,3):NEXTN:IFABS(HX-SX)<5 AND
ABS(HY-SY)<5 THEN273ELSEPLAY"T2Ø
Ø1ABO4CDO1EF":PS=PS+1:TW=TW+1:W
H=WH+1:CIRCLE(SX,SY),3,2:FORT=1
TO 3ØØ:NEXTT:CIRCLE(SX,SY),3,3:G
OTO29Ø
272 PSET(SX,SY):FOR T=1 TO 6Ø:NE
XT T:PRESET(SX,SY):NEXT N
273 PSET(SX,SY,2)
274 RF=RND(1ØØ):IF RF>92 THENRF=
.8 ELSE IF RF<4 THENRF=.6 ELSERF
=1
275 IF SX<HX THENSP=1ELSESP=-1
276 IF SY<HY THENSE=1ELSESE=-1
277 IF SX>HX+18 THENCX=HX+2Ø:GOT
O28Ø
278 IF SX<HX-18 THENCX=HX-2Ø:GOT
O28Ø
279 CX=SX
28Ø IF SY>HY+18 THENCY=HY+2Ø:GOT
O283
281 IF SY<HY-18 THENCY=HY-2Ø:GOT
O283
282 CY=SY
283 FOR NX=CX TO HX STEPSP:FOR N
Y=CY TO HY STEP SE:IF PPOINT(NX,
NY)=4 THEN FG=1 ELSE NEXT NY,NX:
FG=Ø
284 DD=Ø:LX=ABS(SX-HX):LY=ABS(SY
-HY):DH=INT(SQR(LX^2+LY^2)):DX=A
BS(BX-SX)/2:DY=ABS(BY-SY):DD=INT
(SQR(DX^2+DY^2)):DD=INT(DD*4+.5)
:TS(ST)=DD
285 LX=ABS(SX-HX):LY=ABS(SY-HY):
LX=LX/2:DH=INT(SQR(LX^2+LY^2)):I
F OB=1 THEN121
286 CIRCLE(SX,SY),1,4:ST=ST+1
287 A$=INKEY$:CIRCLE(SX,SY),1,2:
FOR T=1 TO 5Ø:NEXT T:CIRCLE(SX,S
Y),1,3:IF A$<>CHR$(83)THEN287ELS
```

```
EPR=Ø:DD=Ø:NN=Ø:C$(1)="":C$(2)="
":DR$(1)="":DR$(2)="":PRINT@18Ø,
"          ";:PRINT@212,"
  ";:PRINT@244,"            ";:PR
INT@276,"            ";
288 SCREENØ,Ø:IF FG=Ø THENCLS:LP
=DH:GOTO295
289 GOTO124
29Ø IF ST=Ø THENS1(HO)=1
291 IF CX>=Ø THENSX=SX-XI*QX:SY=
SY-YI*QY:IF PPOINT(SX,SY)<>3 AND
 (ABS(HX-SX)>11 OR ABS(HY-SY)>11
) THEN294 ELSE291
292 SX=SX-XC*QX:SY=SY-YC/2*QY:IF
 PPOINT(SX,SY)<>3 AND PPOINT(SX,
SY)<>2 AND (ABS(HX-SX)>11 OR ABS
(HY-SY)>11) THEN294ELSE CX=CX+1:
GOTO291
293 IF ST=ØTHENS1(HO)=1
294 GOTO275
295 DW=Ø:PS(HO)=PS:PG=RND(1ØØ):S
T(HO)=ST
296 IF PG>22 AND PG<28 THEN NP=1
:GOTO3Ø5
297 IF DH>1Ø AND PG>5Ø AND PG<54
 THENNP=4
298 IF DH=Ø THENPLAY"T8O5GBDO3FA
CO5CEG":SCREENØ,1:CLS:PRINT@1Ø2,
"YOU HOLED OUT!":FOR T=1 TO 6ØØ:
NEXTT:GOTO3Ø5
299 IF DH>Ø AND DH<3 THEN IF PG>
9 THENNP=1 ELSENP=2:GOTO3Ø5
3ØØ IF DH>2 AND DH<5 THEN IF PG>
49 THENNP=1 ELSENP=2:GOTO3Ø5
3Ø1 IF DH>4 AND DH<7 THEN IF PG>
69 THENNP=1 ELSENP=2:GOTO3Ø5
3Ø2 IF DH>6 AND DH<9 THEN IF PG>
29 THENNP=2 ELSENP=1:GOTO3Ø5
3Ø3 IF DH>8 AND DH<11 THEN IF PG
>49 THENNP=2 ELSENP=3:GOTO3Ø5
3Ø4 IF DH >1Ø THEN IF PG>69 THEN
NP=2 ELSENP=3:GOTO3Ø5
3Ø5 NP(HO)=NP:SC(HO)=ST+NP+PS:PT
=PT+NP
3Ø6 SCREENØ,Ø:CLS:PRINT@7,"STATS
 FOR HOLE ";HO;:PRINT@33,"PAR ";
PA(HO);"     LENGTH OF HOLE ";LE
(HO);:PRINT@64,SZ$;
3Ø7 PRINT@97,"PENALTY STROKES***
*********";PS:XP=XP+PS:PRINT@129
,"SCORE FOR THE HOLE*********";S
C(HO);:PRINT@16Ø,SZ$;
3Ø8 IF HO=4 OR HO=8 OR HO=15 OR
HO=18 THENPRINT@225,"DRIVE LAND
IN FAIRWAY?***** --";:GOTO31Ø
3Ø9 TL=TL+TS(Ø):PRINT@225,"DRIVE
 LAND IN FAIRWAY?***** ";:IF S1(
HO)=1 THENPRINT"NO"ELSEPRINT"YES
";:GD=GD+1
31Ø PRINT@193,"LENGTH OF TEE SHO
T*********";TS(Ø);
```

BACK ISSUE ORDER FORM

(See overleaf for instructions.)

Please send me the following back issues:

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MAR '88	Business	$3.95	☐
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	VOLUME 8		
AUG '88	Games	$3.95	☐
SEP '88	Education	$3.95	☐
OCT '88	Graphics	$3.95	☐
NOV '88	Data Comm.	$3.95	☐
DEC '88	Holiday	$3.95	☐
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```
311 PRINT@257,"# OF TIMES IN ROU
GH/TRAP***";TR(HO);:BR=BR+TR(HO)
:PRINT@289,"# OF TIMES IN WATER*
*******";WH;:PRINT@32Ø,SZ$;:PRIN
T@353,"REACHED GREEN IN REGULATI
ON ";:IF ST+PS<=PA(HO)-2 THENPRI
NT"YES":GR=GR+1ELSEPRINT"NO";
312 PRINT@385,"NUMBER OF PUTTS**
**********";NP;
313 IF HO<1Ø THENYF=YF+SC(HO)ELS
EYB=YB+SC(HO)
314 A$=INKEY$:IF A$=""THEN314ELS
EST=Ø:YS=YF+YB:CLS
315 PRINT@9,"***SCORECARD***":PR
INT@64,"HOLE  PAR SCR    HOLE  P
AR SCR";:FH=96:BH=113:FP=1Ø2:FS=
1Ø6:BP=119:BS=123
316 FOR X=1 TO 9:PRINT@FH,X:FH=F
H+32:PRINT@FP,PA(X):FP=FP+32:PRI
NT@FS,SC(X):FS=FS+32:NEXTX:PRINT
@384,"TOTAL  36 ";YF;
317 FOR X=1Ø TO 18:PRINT@BH,X:BH
=BH+32:PRINT@BP,PA(X):BP=BP+32:P
RINT@BS,SC(X):BS=BS+32:NEXTX:PRI
NT@4Ø1,"TOTAL  36 ";YB;
318 TP=TP+PA(HO):SR=YS-TP:IF SR<
Ø THENPOKEPV,ABS(SR)+48 ELSEIF S
R=Ø THENPRINT@RP," E";ELSEPRINT@
RP,SR;
319 IF HO=9 THENRP=93:PV=1118
32Ø RP=RP+32:PV=PV+32
321 A$=INKEY$:IF A$=""THEN321ELS
EIF HO=18 THEN322 ELSEHO=HO+1:PS
=Ø:NP=Ø:WH=Ø:GOTO23
322 CLS:PD=PEEK(&HCØØØ):IF PD<>6
8THEN326ELSEINPUT"DO YOU WANT  T
O SAVE YOUR STATS TO DISKETTE Y/
N";F1$:IF F1$="N"THEN325ELSEPRIN
T:INPUT"MAKE SURE YOUR DRIVE IS
ON AND  A DISK IS IN IT....PRESS
 RETURN WHEN READY";F2$
323 INPUT"IS THIS YOUR FIRST SAV
E OF THIS FILE Y/N";F3$:IF F3$="
N"THEN324ELSEZS=85:ZD=6:ZL=245:Z
G=6:ZP=36:ZG=1Ø:ZW=8:ZX=1Ø:OPEN"
O",#1,"FINLSTAT/DAT":WRITE#1,ZS,
ZD,ZL,ZG,ZP,ZR,ZW,ZX:CLOSE#1:GOT
O325
324 OPEN"I",#1,"FINLSTAT/DAT":IN
PUT#1,ZS,ZD,ZL,ZG,ZP,ZR,ZW,ZX:CL
OSE#1
325 CLS
326 PRINT@1Ø,"FINAL STATS":PRINT
@65,"SCORE**********************
";YS;:PRINT@97,"# OF DRIVES IN F
AIRWAY*****";GD;:PRINT@129,"AVER
AGE LENGTH OF DRIVE****";INT(TL/
14);:PRINT@161,"GREENS REACHED R
EGULATION**";GR;:PRINT@193,"# OF
 PUTTS****************";PT;
327 PRINT@225,"# OF TIMES IN ROU
```

```
GH / TRAPS";BR;:PRINT@257,"# OF
TIMES IN WATER********";TW;:PRIN
T@289,"PENALTY STROKES**********
**";XP
328 FOR T=1 TO 6ØØ:NEXTT:IFMT=3T
HEN34Ø
329 IF F1$="N"OR PD<>68 THEN34ØE
LSEPRINT@352,"**FLASHING ASTERIS
KS=NEW RECORD"
33Ø IF YS<ZS THENPRINT@93,"**";:
IFMT=2 THENZS=YS
331 IF GD>ZD THENPRINT@125,"**";
:IFMT=2 THENZD=GD
332 IF INT(TL/14)>ZL THENPRINT@1
57,"** ";:IFMT=2 THENZL=INT(TL/1
4)
333 IF GR>ZG THENPRINT@189,"**";
:IFMT=2 THENZG=GR
334 IF PT<ZP THENPRINT@221,"**";
:IFMT=2 THENZP=PT
335 IF BR<ZR THENPRINT@253,"**";
:IFMT=2 THENZR=BR
336 IF TW<ZW THENPRINT@285,"**";
:IFMT=2 THENZW=TW
337 IF XP<ZX THENPRINT@317,"**";
:IFMT=2 THENZX=XP
338 FOR T=1 TO 2ØØ:NEXTT
339 PRINT@352,"  ";
34Ø IF F1$="Y"THENMT=MT+1:IF MT<
4THEN326ELSEOPEN"O",#1,"FINLSTAT
/DAT":WRITE#1,ZS,ZD,ZL,ZG,ZP,ZR,
ZW,ZX:CLOSE#1
341 PRINT:PRINT:INPUT"PLAY AGAIN
 Y/N";F4$:IF F4$="Y"THENRUNØELSE
END
342 XB=1216:YY=1247:X=48Ø:CLS:A$
=STRING$(32,32):T1$="          SC
RATCH GOLFER":N$="          LARRY
 DUGGINS"
343 PRINT@X,T1$:X=X-32:IFX>193TH
ENFORT=1 TO 3Ø:NEXT:PLAY"T1ØØ;A"
:GOTO343
344 X=48Ø
345 PRINT@X,A$:X=X-32:IFX>129THE
NFORT=1 TO 3Ø:NEXT:PLAY"T16Ø;O2A
":GOTO345
346 FORT=1 TO 1ØØ:NEXT
347 FOR L=1 TO 16:PLAY"T19ØO5AED
":POKEXB-1,96:POKEYY+1,96:FORT=1
 TO 3Ø:NEXT:POKEXB,66:POKEYY,89:
XB=XB+1:YY=YY-1:NEXT
348 PLAY"T2ØØ":FORFT=1TO2Ø:PLAY"
T+CE":NEXTFT:PRINT@256,N$
349 FORT=1 TO 8ØØ:NEXT:RETURN
```

By Marty Goodman
Rainbow Contributing Editor

Hacking Is Required

I am about to release Extended ADOS, which will offer numerous added features including a Disk BASIC-compatible RAM disk. However, it requires that users burn it into a 27128 (16K) EPROM. I know the shortie controller for the FD 502 drive from Tandy has a 28-pin socket in it, but can one drop a 27128 EPROM into that socket and have it work? Or is some hardware hacking needed?

Art Flexser
(ARTFLEXSER)
Spectro Systems
Miami, Florida

Tandy insisted on wiring that socket so it only accepts 2764 chips. This is a shame because it could have been wired to accept both 2764 and 27128 chips without jumper changes. To fix the FD 502 controller to accept 27128 EPROMs, you must open the controller (voiding the warranty) and remove the printed circuit board. Remove the ground plane from the bottom of the board. Now look carefully at the 28-pin ROM socket. You'll note that pins 28, 27 and 26 are tied to each other with a trace on the solder side of the socket. You need to cut the trace joining Pin 26 to pins 27 and 28. Then jumper Pin 28 to the A13 contact on the 40-pin edge connector, which plugs into the CoCo or Multi-Pak Interface. If you look at the disk controller's top (component side) with the edge connector pointing up, Pin 37 is the second pin from the left.

Definite Differences

Can I use an FD 502 drive with a Commodore 64?

Brett Stafford
Franklinton, Louisiana

No. The Commodore uses a unique arrangement for talking to its disk drives and requires special logic boards for the drives. The CoCo uses industry-standard disk drives, like those used in PC compatibles and many older CP/M machines. You can't even read a disk written by a Commodore 64 using a normal (CoCo or IBM) disk drive. It is physically impossible.

Transfer Trouble

How can I transfer a binary file from a CoCo to an IBM PC, so I can burn it into an EPROM? I have access to an IBM PC with an EPROM burner and want to use it to burn a file I created and saved to disk on my CoCo.

Steve Imlay
(SIMLAY)
St. Joseph, Missouri

While possible, what you want to do is fraught with problems due to idiosyncrasies of the file structures of the CoCo and the IBM PC. Generally when you are saving binary data to disk on a CoCo (especially via BASIC), you are actually creating a binary program file. This file contains not only the data you are saving, but also an extra 10 bytes (five at the start and five at the end) of system information telling the CoCo where to put the file and where to execute it. You can bring such a file over to the IBM using a null modem cable, *CoCo Util*, or even MS-DOS-to-CoCo transfer programs. But you need to snip off the first and last five bytes of the file once it arrives on the IBM and before you burn it into an EPROM. I suggest you snip off the first five bytes first, retain as many bytes as you know the file should have, then discard everything following that. Some file transfer situations, like Xmodem and my transfer program, append garbage to the end of files they bring over.

Your question reminds me of an amusing situation where a well-known CoCo author tried to get a company he was working for to burn a CoCo ROM. He sent it an ML program file with multiple segments for the data. Such files (generated by the output of assemblers on the CoCo) are more difficult for other systems than a mere ML save from BASIC because they have not two, but many sets of five system bytes located at the ends of the file and scattered throughout it. Needless to say, the people at the company could not use the file as presented. But it took the CoCo author some time to realize his mistake.

No Software Solution

How can I put the game Rad Warrior *onto my disk drive? I don't want to damage my system by plugging and unplugging the cartridge and my disk controller.*

JD Cleveland
(JDCLEVELAND)
Lundberg, Nova Scotia
and Gabriel Paradis
Matapedia, Quebec

The new 32K ROM packs are very difficult to put onto disk, and none of the old ROM pack-to-disk utilities are capable of dealing with them. Even packs that were not *specifically* constructed to be difficult to transfer to disk (like *Rad Warrior* and *Silpheed*) are tricky because of the 32K-ROM and 128K-RAM environment of the CoCo 3. ROM packs like *Pitfall II*, whose author went to great lengths to prevent transfers to disk, are so hard to put on disk that I doubt anyone can do so using software alone. Frankly, I have not had time to figure out how to transfer these new-generation ROM packs to disk in a simple fashion.

However, with hardware (a static RAM-based emulator of ROM packs), it should be easy to put any ROM pack, 32K or less, onto disk, load the data

---

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online.

from the ROM pack into the emulator, and execute from there. While the ability to transfer ROM packs to disk opens the software up to piracy, forcing disk users to plug and unplug their controllers or jam cartridges in and out of their Multi-Pak Interfaces forces them to risk frying their CoCos. For this reason, a static RAM pack might become a legitimate commercial product someday.

New Sources for an Old Favorite

Now that the Deluxe RS-232 pack is unavailable, where can one get the hardware-UART capabilities it offered, which are needed by serious CoCo users?

John Burke
(JBURKE)
Fremont, California

There are two current sources of clones of the old (and now long discontinued) deluxe RS-232 pack. Disto/CRC makes one, and Orion makes two others. Disto's pack requires both positive and negative 12 volts, so a Multi-Pak Interface or a CoCo 1 is required. (Those voltages are not present on the CoCo 2 or 3 system bus.) Orion makes two versions of its RS-232 pack clone (called Telepak). One is similar to Disto's pack, but the other does not require a Multi-Pak to work on the CoCo 2 or 3. Like the old Tandy RS-232 pack, Orion's generates the extra voltages using DC-to-DC converter circuitry on board. See ads in RAINBOW.

Note that CRC, Owl-Ware, and Frank Hogg Laboratories all offer (or at one time offered) other RS-232 ports too, but these either use different UART chips or are addressed quite differently from the Tandy RS-232 pack. While these will work under OS-9, they necessitate rewriting all Disk BASIC software you want to use with them.

A Compatible Monitor

I have a Tandy 1000 and a CoCo 3. The ads in RAINBOW make the Magnavox 8CM515 look pretty good. They claim it will work with both computers (unlike the CM-8). Is this true?

Rick B. Morgan
(CONIBEAR)
Windsor, Connecticut

Yes. The Magnavox 8CM515 is a fine monitor, probably the best value today for those wanting to use the same monitor for the CoCo's RGB and the PC compatible's CGA system. I recommend it highly. I also recommend all RAINBOW advertisers who offer it.

A Good Program for a Different CoCo

I have a CoCo 2, a FD 501 drive and a DC Modem Pak from Tandy. I want to use GIMMESOFT's V-Term. *What other equipment do I need? I want to use* V-Term *because it offers VT-100 emulation, which I need to talk to my main frame.*

John V. Allen
(ALLENJOHNV)
Duncanville, Texas

V-Term is an excellent choice in terminal programs. However, it requires a CoCo 3. It cannot run on the CoCo 1 or 2. To do VT-100 emulation, you need an 80-column screen, unavailable on the CoCo 1 and 2. Either a Multi-Pak Interface or a Y cable are needed to use the DC Modem Pak with a CoCo 3 and a disk drive. I recommend a Multi-Pak. To use the Y cable you must remove the ROM from the DC Modem Pak, which can cause problems. I recommend you abandon the modem pack and use an RS-232 pack with a separate modem. The Tandy DC Modem Pak limits you to 300 baud and does not provide for future upgrades. With used 1200-baud modems available for $25 at computer swap meets and selling for about $90 brand new, the ability to use them or faster modems would seem to be quite important. See ads for CRC and Orion in RAINBOW. Also, note that Cer-Comp makes a terminal program for the CoCo 3 that emulates VT-100 terminals.

Your technical questions are welcomed. Please address them to CoCo Consultations, THE RAINBOW, P.O. Box 385, Prospect, KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Questions can also be sent to Marty through the Delphi CoCo SIG. From the CoCo SIG> prompt, pick Rainbow Magazine Services, then, at the RAINBOW> prompt, type ASK (for Ask the Experts) to arrive at the EXPERTS> prompt, where you can select the "CoCo Consultations" online form which has complete instructions.

NOVICES NICHE

THE RAINBOW is a teaching environment and we realize that the majority of our readers will always be beginners. In our continuing effort to always keep the new user in mind, and in addition to the many beginner feature articles and programs published in every issue, "Novices Niche" contains shorter BASIC program listings that entertain as well as help the new user gain expertise in all aspects of the Color Computer: graphics, music, games, utilities, education, programming, etc.

Graphics

Big Brother's Watching

By Kenneth R. Hill

32K
ECB

In response to your November appeal for more submissions to Novices Niche, here is a program I wrote in 1981 for the original 32K CoCo 1. It's called *Blink*, and it draws a big blue eye. Watch it closely while it's watching you — yes, it blinks! If you want your eye to blink a little faster, change the 400 in Line 270 to 100. For sound, add this line: 255 SOUND 250,1.

The Listing: BLINK

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1 'BLINK. by K.R.Hill
5 'Draws a blinking blue eye. Ty
pe CMP if a CM-8 monitor is in u
se.
1Ø PCLEAR 8
2Ø PMODE 3,5
3Ø PCLS
4Ø PMODE 3,1
5Ø PCLS
6Ø SCREEN 1,1
7Ø CIRCLE(128,191),156,8,1,.6Ø,.
91
8Ø CIRCLE(128,191),158,8,1,.6Ø,.
91
9Ø CIRCLE(128,Ø),16Ø,8,1,.1Ø,.4Ø
1ØØ CIRCLE(128,Ø),162,8,1,.1Ø,.4
Ø
11Ø CIRCLE(128,96),74,7,.8
12Ø CIRCLE(128,96),3Ø,7,.8
13Ø PAINT(128,15Ø),7,7
14Ø FOR N=1 TO 4
15Ø READ A,B
16Ø PCOPY A TO B
17Ø NEXT N
18Ø DATA 1,5,2,6,3,7,4,8
19Ø RESTORE
2ØØ PAINT(128,36),6,8
21Ø PMODE 3,5
22Ø SCREEN 1,1
23Ø FOR T=1 TO 2ØØØ:NEXT T
24Ø PMODE 3,1
25Ø SCREEN 1,1
26Ø PAINT(128,36),6,8
27Ø FOR T=1 TO 4ØØ:NEXT T
28Ø GOTO 21Ø
29Ø END
```

CoCo of Many Colors

CoCo 3

By Andy Wolstromer

CoColeidoscope uses random numbers, trigonometry and the PALETTE command to produce a colorful imitation of a kaleidoscope on your CoCo 3. Just type it in and run it. If you like to experiment, try changing the HLINE statement in Line 510 to draw HCIRCLEs, or you could even HDRAW a shape of your own. Also, try changing the way OX and OY are calculated. Just make sure that any changes you make stay in the range of the screen.

The Listing: COCOLEID

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1Ø 'CoColeid by Andy Wolstromer
2Ø POKE65497,Ø:ONBRKGOTO999
3Ø HSCREEN2
4Ø PALETTEØ,Ø
5Ø P4=ATN(1)
1ØØ R=RND(8Ø):AN=RND(Ø)*P4:C=RND
(15):SZ=RND(5)
11Ø OX=INT(COS(AN)*R):OY=INT(SIN
(AN)*R)
12Ø X=16Ø-OX:Y=96-OY:GOSUB5ØØ
13Ø X=16Ø-OX:Y=96+OY:GOSUB5ØØ
14Ø X=16Ø+OX:Y=96-OY:GOSUB5ØØ
15Ø X=16Ø+OX:Y=96+OY:GOSUB5ØØ
16Ø X=16Ø-OY:Y=96-OX:GOSUB5ØØ
17Ø X=16Ø-OY:Y=96+OX:GOSUB5ØØ
18Ø X=16Ø+OY:Y=96-OX:GOSUB5ØØ
19Ø X=16Ø+OY:Y=96+OX:GOSUB5ØØ
2ØØ GOTO1ØØ
5ØØ PALETTERND(15),RND(63)
51Ø HCOLORC:HLINE(X-SZ,Y-SZ)-(X+
SZ,Y+SZ),PSET,B
52Ø RETURN
999 RGB:POKE65496,Ø:END
```

Turning Text Graphics Into Title Screens

16K ECB

By Greg Bauer

ASCII Calc is a program to calculate the ASCII values of text graphics characters. These values may then be used in your programs in data lines to produce title screens, etc. In fact, this principle was used in the title screen of this program, beginning in Line 220. To save memory, the program subtracts 128 from the actual ASCII value and adds it back in the READ command, as shown in Line 240.

I use a PRINT @ sheet to plan my screens and then use this program for the data lines. Now you can easily dress up your programs for a pleasing effect.

The Listing: ASCICALC

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1Ø 'PROGRAM TO CALCULATE ASCII
    GRAPHICS FOR DATA LINES
2Ø 'GREG BAUER
3Ø '6411 SO. ALDER
4Ø 'TACOMA,WA. 984Ø9
5Ø GOSUB2ØØ
6Ø CLS
7Ø PRINT@42,"COLOR NUMBERS";:PRI
NT@1Ø1,"Ø=GREEN          1=YELLOW"
;:PRINT@165,"2=BLUE          3=RE
D";:PRINT@229,"4=BUFF          5=
CYAN";:PRINT@293,"6=MAGENTA
 7=ORANGE";
8Ø PRINT:PRINT:LINEINPUT"
   ENTER (Ø-7)";C$:C=VAL(C$):IFC
<Ø OR C>7 THEN8Ø
9Ø CLS
1ØØ PRINT@41,"PATTERN NUMBERS";
11Ø PRINT@1ØØ,CHR$(192)"=Ø";:PRI
NT@1Ø7,CHR$(193)"=1";:PRINT@114,
CHR$(194)"=2";:PRINT@121,CHR$(19
5)"=3";
12Ø PRINT@164,CHR$(196)"=4";:PRI
NT@171,CHR$(197)"=5";:PRINT@178,
CHR$(198)"=6";:PRINT@185,CHR$(19
9)"=7";
13Ø PRINT@228,CHR$(2ØØ)"=8";:PRI
NT@235,CHR$(2Ø1)"=9";:PRINT@242,
CHR$(2Ø2)"=1Ø";:PRINT@249,CHR$(2
Ø3)"=11";
14Ø PRINT@292,CHR$(2Ø4)"=12";:PR
INT@299,CHR$(2Ø5)"=13";:PRINT@3Ø
6,CHR$(2Ø6)"=14";:PRINT@313,CHR$
(2Ø7)"=15";
15Ø PRINT:PRINT:LINEINPUT"
    ENTER (Ø-15)";P$:P=VAL(P$)
16Ø IFP<Ø OR P>15THEN15Ø
17Ø CLS:A=(16*C)+P:PRINT@265,"AS
CII#-128=";A
18Ø INPUT"                AGAIN";A
$:IFA$="Y"THEN6ØELSEIFA$="N"THEN
19ØELSE18Ø
19Ø CLS:END
2ØØ CLSØ:FORI=1TO32:PRINTCHR$(12
8);:NEXT
21Ø FORI=1TO32:PRINTCHR$(2Ø4);:N
EXT
22Ø FORI=1TO96:READ A:PRINTCHR$(
128+A);:NEXT
23Ø FORI=1TO32:PRINTCHR$(195);:N
EXT
24Ø PRINT@266,"PRESENTED BY";:PR
INT@363,"GREG BAUER";:PRINT@455,
"COPYRIGHT (C) 1988";
25Ø FORX=1TO4ØØØ:NEXT:RETURN
26Ø DATAØ,,46,45,,46,44,,46,44,,
45,4Ø,36,46,,,,46,44,,46,45,,42,
,,46,44,,,Ø
27Ø DATAØ,,43,39,,44,45,,42,,,37
,,,42,,,,42,,,43,39,,42,,,42,,,,
Ø
28Ø DATAØ,,42,37,,35,39,,43,35,,
39,34,33,43,,,,43,35,,42,37,,43,
35,,43,35,,34,Ø
```

Five-Column Directories

CoCo 3

By Bill Bernico

Here's a handy little utility for CoCo 3 users, a program that will list the disk directory to either the screen or the printer in five-column format. Naturally, it works in the 80-column mode, so it looks best if run with an RGB monitor. The program is very easy to use: Just type it in, run it and when prompted, press S or P for output to screen or printer.

The Listing: 5-COLDIR

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1 '5 COLUMN DIRECTORY LISTER
   FOR THE COCO 3 (C)1988
   FROM BILL BERNICO SOFTWARE

2 CLEAR2ØØØ:DIMX$(75)
3 WIDTH8Ø:PALETTE1,Ø:ATTR3,1:CLS
:CLS:INPUT"OUTPUT TO SCREEN OR P
RINTER     (S/P) ";Y$
4 IFY$="S"THEND=ØELSEIFY$="P"THE
ND=-2ELSE3
5 CLS:FORX=3TO11:DSKI$Ø,17,X,A$,
B$:C$=A$+LEFT$(B$,127):FORQ=1TO2
55STEP32:IFMID$(C$,Q,1)=CHR$(Ø)T
HEN7ELSEIFMID$(C$,Q,1)=CHR$(255)
THEN8
6 X$(I+X-3)=MID$(C$,Q,11):I=I+1
7 NEXTQ,X
8 FORL=ØTO4:FORM=ØTOI+3:IFLEN(X$
(M))<>Ø THENPRINT#D,"  ";X$(M);"
   ";ELSE9
9 NEXTM:PRINT#D:PRINT#D:PRINT#D,
"  FREE GRANULES =";FREE(Ø):PRIN
T:PRINT"  ANOTHER DISK (Y/N)";
1Ø I$=INKEY$:IFI$="Y"THEN3ELSEIF
I$="N"THENWIDTH32:ENDELSE1Ø
```

Has Anyone Seen My String?

16K Disk

By Stephen Miller

ASC Search is a short and sweet way to find those variables, strings and comments that could be located anywhere throughout a BASIC program. Generally, I am a lazy individual — the more work I can get my computer to do for me, the better my life becomes. I got quite tired of trying to find where all those A$s are in my programs and decided to find a way for the computer to do it for me.

ASC Search can help you in finding bugs, variables, comments and any information that may be in a BASIC listing. These "comments" could range from a single letter to a complete word or sentence — but all of them must be within a program that has been saved in ASCII format in this fashion: SAVE"*filename*",A.

When run, *ASC Search* asks if you would like a hard copy of the results sent to the printer. The program then prompts you for the filename of the ASCII-saved program you want to search. (If the program is on another drive, type DRIVE *n* — DRIVE 1, for example, if the file is on Drive 1 — before running *ASC Search*.) When you separate the filename and extension, use the period (.) and not the slash (/). If you run the program again, you need not enter the filename again: *ASC Search* remembers the last filename used and displays this when you press ENTER.

Next you are asked for "target letters" — what you are searching for. This could be any string of letters you want. You are also offered a pause option, which will cause the computer to wait for a key press after every occurrence of the string it finds. However, don't use the pause option if you're searching for numbers or special characters (#$%&+@), as you'll be presented with an FC (Function Call) Error. Any other symbol is acceptable.

The file will be searched and displayed until the end is reached, or until the program has found more than 1,000 occurrences of the target string. Then it will stop and display a report of the results, giving you a hard copy if you selected the printer option. The report tells you how many occurrences of the target string there are, and also the lines in which they are found. It even tells you how many lines are in your program.

If the program is too slow for your tastes, you can add the speed-up poke to Line 11 (POKE 65495,Ø for the CoCo 2 and POKE 65497,Ø for the CoCo 3). But remember: The pokes affect printer operation (baud rate is changed); so if you're printing a hard copy, don't use the speed-up poke — you could add the slow-speed poke to lines 18 and 23 (not forgetting to add the speed-up poke again at the end of Line 18).

Use *ASC Search* to eliminate all that time spent squinting over a listing with a marker, looking for those A$s. Go watch a ball game instead!

The Listing: ASCSERCH

```
Ø 'ASCSERCH.BAS
1 '*****************************
2 '**   ASCII   FILE SEARCH   **
3 '**   VERSION 2.Ø  APR/88   **
4 '**   BY:  STEPHEN MILLER   **
5 '**  (C) 1989  FALSOFT,INC  **
6 '*****************************

11 CLEAR2Ø,&H7FØØ:CLEAR5ØØØ:DIMZ
$(2Ø):CLS:PRINTTAB(6)"ASCII PROG
RAM SEARCH":D$=INKEY$
12 PRINT@64,"PRINTER (Y/N) ? ";:
```

```
D$=INKEY$:IFD$=""THEN12ELSEIFD$=
"Y"THENPRINT"YES":D=-2ELSEPRINT"
NO":D=Ø
13 PRINT:LINEINPUT" FILENAME.EXT
 OF 'ASC' PROGRAM:  ";N$:IFN$=""
THENFORT=1TO12:N$=N$+CHR$(PEEK(&
H7FØØ+T)):NEXT:PRINT@161,N$:GOTO
16
14 A=A+1:IFMID$(N$,A,1)<>"."THEN
14ELSEN1$=LEFT$(N$,A-1):N2$=RIGH
T$(N$,3)
15 IFLEN(N1$)<8THENN1$=N1$+" ":G
OTO15ELSEN$=N1$+"."+N2$:FORT=1TO
12:POKE&H7FØØ+T,ASC(MID$(N$,T,1)
):NEXT
16 PRINT@224,"";:LINEINPUT"ENTER
 TARGET LETTERS (WORDS)    >";T$
:L=LEN(T$):IFL<1THEN16
17 PRINT@32Ø,"DO YOU WANT 'PAUSE
' (Y/N) ? ";:P$=INKEY$:IFP$=""TH
EN17ELSEIFP$="Y"THENPRINT"YES"EL
SEPRINT"NO"
18 IFD$="Y"THENPRINT#D,"ASCII FI
LESEARCH":PRINT#D,"SEARCHING FOR
 ";CHR$(34)T$CHR$(34):PRINT#D,"F
ILENAME:- "N$
19 OPEN"I",#1,N$
2Ø LINEINPUT#1,A$:NT=NT+1:CLS:PR
INTA$
21 FORT=1TOLEN(A$):IFMID$(A$,T,L
)=T$THENSOUND225,2:GOSUB25:GOSUB
26:TN=TN+1:IFLEN(Z$(W))>2ØØTHENW
=W+1:IFTN>1ØØØTHENPRINT"THERE AR
E FAR TOO MANY OCCURANCEOF "CHR$
(34)T$;CHR$(34)" TO CONTINUE.":G
OTO23
22 NEXT:IFEOF(1)THEN23ELSE2Ø
23 CLOSE#1:PRINT"<<finished>>":P
RINT#D:PRINT#D,"YOUR PROGRAM USE
S"NT-1"LINES":PRINT#D,"THERE WER
E"TN"OCCURANCES":PRINT#D,"IN LIN
ES ";:FORT=ØTOW:IFT=1THENPRINT"
 <ENTER> TO LIST MORE...":EXEC44
539:NEXTELSEPRINT#D,Z$(T):NEXT
24 PRINT"OF "CHR$(34)T$CHR$(34):
PRINT"IN YOUR "N$" PROGRAM":PRIN
T"  <L>IST AGAIN   OR   <R>UN";:
EXEC44539:N$=CHR$(PEEK(135)):IFN
$="L"THEN23ELSERUN
25 FORR=1TO6:Y$=MID$(A$,R,1):IFY
$=" "THEN Z$(W)=Z$(W)+",":RETURN
ELSEZ$(W)=Z$(W)+Y$:NEXT:RETURN
26 IFP$="Y"THENPOKE1Ø24+(T-1),AS
C(LEFT$(T$,1)):FORV=1TO5Ø:NEXT:I
FINKEY$=""THENPOKE1Ø24+(T-1),(AS
C(LEFT$(T$,1))-64):FORV=1TO5Ø:NE
XT:IFINKEY$=""THEN26
27 RETURN:ENDend
```

Science

The Mathematics of Chaos

16K
ECB

By John E. Phillips

Fractals are branching geometric forms whose details recur at different scales. Examples in nature include the veins in a leaf, the branches of a tree and the formation of an island chain. Fractal geometry, a recent branch of mathematics fathered by Benoit Mandelbrot, is a method of explaining random events.

While supercomputers are currently being used to produce fractal patterns, your CoCo can also generate fractals, though much more slowly (this program takes over an hour to produce the image). However, the CoCo is thousands of times less expensive!

Fractal creates its pattern by sending dots toward the center of the screen where a circle has been placed. When these randomly projected dots touch the circle or each other, they set to form the design. When the circle changes color, the program is finished. I have used the speed-up poke for the CoCo 3 in Line 100. If you have a CoCo 1 or 2, be sure to delete this poke or to supply the poke appropriate to your machine (`POKE 65495,0` for the CoCo 2).

The Listing: FRACTAL

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1ØØ POKE65497,Ø:PMODE3,1
11Ø PCLS:SCREEN1,1
12Ø CIRCLE(128,96),15,8
13Ø A=RND(255):X=A
14Ø IFY<99THENY=Ø
15Ø IFA<52THENX=X+1.3
```

```
16Ø IFA>52ANDA<=96THENX=X+.9
17Ø IFA>96ANDA<=114THENX=X+.5
18Ø IFA>114ANDA<=143THENX=X
19Ø IFA>143ANDA<=192THENX=X-.5
2ØØ IFA>192ANDA<=22ØTHENX=X-.9
21Ø IFA>22ØTHENX=X-1.3
22Ø Y=Y+1:PSET(X,Y)
23Ø IFPPOINT(X+1,Y+1)=8THEN13Ø
24Ø IFPPOINT(X-1,Y-1)=8THEN13Ø
25Ø IFPPOINT(X+1,Y-1)=8THEN13Ø
26Ø IFPPOINT(X-1,Y+1)=8THEN13Ø
27Ø PRESET(X,Y)
28Ø IFPPOINT(X,3)=8THEN3ØØ
29Ø IFY<99THEN15ØELSEY=Ø:GOTO13Ø
3ØØ PAINT(128,96),8:GOTO28Ø
```

Does Archimedes' Discovery Hold Water?

4K

By James Abell

Will It Float? is a program based on the principles outlined in the writings of Archimedes (287 to 212 B.C.). As the story goes, Archimedes was working on an invention and became so engrossed in thought that he forgot to eat and neglected his personal hygiene.

After days of such neglect, his friends decided to bathe him. While in the tub, Archimedes continued to think and suddenly jumped out of the tub and ran home, naked, screaming, "Eureka!" (i.e., "I've found it!") What he "found" was that a body displaces its own weight in water.

Using the CoCo and Archimedes' discovery, you can determine if objects around the house can hold their own in water. Type in the listing and save it to tape or disk. When you run the program, think of an object. You will be asked to provide the closest approximation of your object's shape (cylinder, sphere, etc.). Then CoCo will ask for the object's dimensions and its weight in pounds. Finally, CoCo will inform you whether or not the object will float, along with the percentage of buoyancy.

The Listing: WILFLOAT

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1 REM' WILL IT FLOAT?
2 REM' BY
3 REM' JAMES ABELL
4 PI=3.1415927
5 CLS:PRINT"          WILL IT FL
OAT":PRINT:PRINT"   FIRST,FIND T
HE VOLUMN.":PRINT" PICK THE SHAP
E CLOSEST TO YOUR OBJECT.":PRINT
"(1) CUBE (OR RECTANGLE)":PRINT"
(2) CYLINDER":PRINT"(3) SPHERE":
PRINT"(4) CONE":PRINT"(5) ELLIPT
ICAL TUBE"
6 PRINT"(6) TRIANGULAR(HALF OF A
 CUBE)"
7 INPUTA:ON A GOSUB 8,1Ø,12,14,1
6,18
8 CLS:PRINT"CUBE":PRINT"ENTER LE
NGTH":INPUTL:PRINT"ENTER WIDTH":
INPUTW:PRINT"ENTER HEIGHT":INPUT
H
9 A=L*W:V=A*H:GOTO2Ø
1Ø CLS:PRINT"CYLINDER":PRINT"ENT
ER DIAMETER":INPUTD:PRINT"ENTER
LENGTH":INPUTL
11 R=D/2:A=(R^2)*PI:V=A*L:GOTO2Ø
12 CLS:PRINT"SPHERE":PRINT"ENTER
 DIAMETER":INPUTD
13 R=D/2:V=((4/3)*PI)*(R^3):GOTO
2Ø
14 CLS:PRINT"CONE":PRINT"ENTER D
IAMETER":INPUTD:PRINT"ENTER LENG
TH":INPUTL
15 R=D/2:V=((R^2)*PI*L)/3:GOTO2Ø
16 CLS:PRINT"ELLIPTICAL TUBE":PR
INT"ENTER DIAMETER LONGEST SIDE"
:INPUTDA:PRINT"ENTER DIAMETER SH
ORTEST SIDE":INPUTDB:PRINT"ENTER
 LENGTH":INPUTL
17 RA=DA/2:RB=DB/2:A=RA*RB*PI:V=
A*L:GOTO2Ø
18 CLS:PRINT"TRIANGULAR(HALF OF
CUBE)":PRINT"ENTER LENGTH":INPUT
L:PRINT"ENTER WIDTH":INPUTW:PRIN
T"ENTER HIGHT":INPUTH
19 A=L*W:V=A*H:GOTO2Ø
2Ø CLS:PRINT"ENTER OBJECT WEIGHT
 IN POUNDS":INPUT WT:WW=62.5:PRI
NT"WERE THE DIMENSIONS IN (1) FE
ET OR (2) INCHES?":INPUTA:IFA=1T
HEN24 ELSE IF A=2 THEN 21
21 PRINT"INCHES":WI=62.5/1728:WZ
=WI*V:IF WT>WZ THEN 22 ELSE IF W
T<WZ THEN 23
22 PRINT"IT WILL SINK!":P=(WZ/WT
)*1ØØ:P=1ØØ-P:PRINT" IT IS"P"% T
OO HEAVY":GOTO27
23 PRINT"IT WILL FLOAT!":P=(WT/W
Z)*1ØØ:P=1ØØ-P:PRINT" IT IS"P"%
BOUYANT":GOTO 27
24 PRINT"FEET":WI=62.5:WZ=WI*V:I
F WT>WZ THEN 25 ELSE IF WT<WZ TH
EN 26
25 PRINT"IT WILL SINK!":P=(WZ/WT
)*1ØØ:P=1ØØ-P:PRINT"IT IS"P"% TO
O HEAVY":GOTO27
26 PRINT"IT WILL FLOAT!":P=(WT/W
Z)*1ØØ:P=1ØØ-P:PRINT"IT IS"P"% B
OUYANT":GOTO27
27 PRINT:PRINT"  PRESS ENTER TO
RETURN...":INPUTA$:GOTO5
```

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If you have an idea for the "Wishing Well," submit it to Fred c/o THE RAINBOW. Remember, keep your ideas specific, and don't forget this is BASIC. All programs resulting from your wishes are for your use, but remain the property of the author.

Simulate a numeric keypad

From Keyboard to Keypad

By Fred B. Scerbo
Rainbow Contributing Editor

Ask any CoCo owner what feature he or she would most like to see added to our wonder machine. Nine out of 10 owners will say they want a numeric keypad. While newer Tandy computers have this feature included as a standard, there are no plans to add it to our trusty Color Computer.

Still, what Tandy cannot give us in hardware, we can accomplish in software. I am going to show you how to use your CoCo like a pocket calculator. The program *Q-Lator* will do this with great precision. However, that is all it will do. (Don't expect to combine it with a spreadsheet program.)

One Step Forward, Two Steps Back?

Many of you already own pocket calculators, so why would you want to use your CoCo for one? Believe it or not, there are times when you don't have that calculator on hand. I can recall many times at the computer when I wanted to work out some calculation, but I didn't want to type `? 24.56-11.73` just to do a simple math function, either.

That is where *Q-Lator* comes in. Let's say you need to check your child's math problems. Pop in *Q-Lator*, and you have a fully functioning calculator at your fingertips. Granted, it will not do SIN/COS/TAN and other advanced functions of some calculators. However, it will add, subtract, multiply, divide and do square roots.

The Listing

The listing may appear long for a program that appears to do so little, but there are several reasons for this. First, I wanted to be sure that we had an attractive screen. By using `PMODE 0`, we get large, vibrant black and white graphics that are not confusing. When a key is pressed for a number, the key will also flash on the screen. (This makes it an excellent training tool for those just learning to use a pocket calculator.)

Second, I needed to write subroutines that worked a certain way one time and a different way the next time. This could be accomplished with a ton of `IF/THEN` statements, but it would also slow down the program. Even though `PMODE 0` will work with lightening speed, we don't need anything slowing down the subroutines.

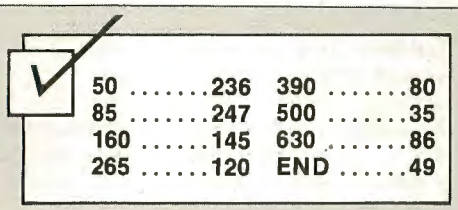
That is why you will find some subroutines duplicated with their necessary variations — it allows them to be executed more rapidly.

When you type in the listing, make sure you enter all the `DATA` statements correctly. Most bugs in the programs people write to me about come from a failure to get the typing done correctly.

Using the Program

When you run the program, you will see a familiar title screen. Press ENTER to start the program. You will see a calculator pictured on the entire screen. Although not pictured, the minus sign (-) is used for a negative value. If you want to enter the number -25, press the

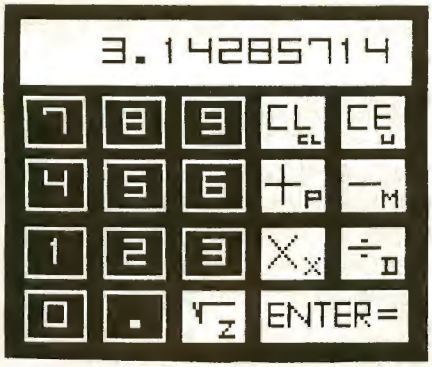
Fred Scerbo is a special needs instructor for the North Adams Public Schools in North Adams, Massachusetts. He holds a master's in education and has published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.



50	236	390	80
85	247	500	35
160	145	630	86
265	120	END	49

The Listing: `QLATOR`

```
1 REM*****************************
2 REM*       CO CO Q-LATOR       *
3 REM*    KEYBOARD CALCULATOR    *
4 REM*      BY FRED B.SCERBO     *
5 REM*     COPYRIGHT (C) 1988    *
6 REM*       60 HARDING AVE      *
7 REM*    NORTH ADAMS,MA Ø1247   *
8 REM*****************************
9 CLEAR2ØØØ
1Ø CLSØ:PRINTSTRING$(64,188);
15 FORI=1TO 256 :READ A:PRINTCHR
$(A+128);:NEXT
2Ø PRINTSTRING$(32,188);
25 PRINT@39Ø," KEYBOARD CALCULAT
OR ";:PRINT@422,"  BY FRED B. SC
ERBO  ";:PRINT@454," COPYRIGHT
(C) 1988 ";
3Ø DATA3Ø,28,26,3Ø,28,26,37,44,4
4,44,45,32,32,1ØØ,11Ø,96,96,1Ø1,
1Ø8,1Ø8,1Ø6,11Ø,1Ø9,1Ø8,1Ø6,11Ø,
1Ø8,1Ø9,1Ø1,1Ø8,1Ø8,1Ø9
35 DATA26,,16,26,,26,37,32,,,37,
,32,,1Ø6,96,,1Ø1,,96,1Ø6,1Ø4,1Ø1
,96,1Ø4,1Ø6,96,1Ø1,1Ø1,96,,1Ø1
4Ø DATA27,19,26,27,19,26,37,32,,
,37,,32,16,1Ø6,96,,1Ø1,,96,1Ø6,9
6,1Ø1,,96,1Ø6,96,1Ø1,1Ø1,96,96,1
Ø1
```



negative sign (or hyphen) on the keyboard to assign the negative value. This is not the same as the subtraction (minus) key, which will be designated by the letter M for minus.

The CLEAR key works just as it does on any calculator. However, to clear a single entry (clear entry), you must press U (for undo). Clear entry prevents having to re-enter a long list of numbers when you make an error. It clears only the last number entered.

The four math function — addition, subtraction, multiplication and division — are represented by the letters P, M, X and D. They are as follows:

Add:	P for plus
Subtract:	M for minus
Multiply:	X for times
Divide:	D for divide

Z gives you the square root function. To perform the "equals" function, press ENTER. You do not need to remember these functions since each key on the screen has the letter it represents in that box.

That's all there is to it. You can continue to perform math functions on any answer *Q-Lator* generates. If a number is too large, you will get an Overflow Error. Sorry, I didn't include exponents on this calculator. In addition, the keyboard can take no number longer than 10 digits, so keep the numbers short.

Conclusion

I think you will find *Q-Lator* handy. I have already put it to good use with my students. Next month, I hope to offer a program that anyone who runs a small business will be thrilled to use.

Keep those ideas coming in. □

```
45 DATA19,19,18,19,19,18,37,32,,
,37,68,76,64,1Ø6,96,,1Ø1,1Ø8,1Ø8
,1Ø6,96,1Ø1,,96,1Ø6,96,1Ø1,1Ø1,1
Ø8,1Ø9,1Ø8
5Ø DATA26,,24,26,,26,37,32,35,32
,37,,32,,1Ø6,96,,1Ø1,,96,1Ø6,96,
1Ø1,,96,1Ø6,96,1Ø1,1Ø1,96,1ØØ,1Ø
6
55 DATA26,,18,26,,26,37,32,36,43
,37,,32,,1Ø6,96,97,1Ø1,96,96,1Ø6
,96,1Ø1,,96,1Ø6,96,1Ø1,1Ø1,96,,1
Ø9
6Ø DATA28,28,24,28,28,24,36,44,4
4,44,47,32,32,1ØØ,1Ø8,1Ø8,1Ø8,1Ø
Ø,96,96,1Ø4,96,1Ø8,1Ø4,96,1Ø8,1Ø
8,1Ø8,1ØØ,1Ø4,96,1ØØ
```

```
65 DATA6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6
Ø,,36,4Ø,,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6
Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,6Ø,
6Ø
7Ø X$=INKEY$:IFX$<>CHR$(13)THEN7
Ø
75 DIM S$(5),A$(11),A(9),B(9),N$
(11)
8Ø FORI=ØTO11:READA$(I):NEXT:FOR
I=1TO5:READS$(I):NEXT:FORI=ØTO9:
READA(I),B(I):NEXT
85 DATA U12L12D12NR12BL6,BL6U12N
G2D12BL1Ø,L12U6R12U6L12BD12BL6,N
L12U6NL12U6L12BD12BL6,U12D6L12NU
6BD6BL6,NL12U6L12U6NR12BD12BL6
9Ø DATA NU6L12U6NR12U6NR12D12BL6
,U12L12D2BD1ØBL6,U12L12D6NR12D6N
R12BL6,NL12U6NL12U6L12D6BD6BL6,B
L6NL4U2L4D2BL8,BU6L12BD6BL6,BU6R
12,BU6R6NU6ND6R6,E6NH6NE6F6,BU6R
6NR8BU4NR2BD8R2,"BU1ØM+4,+1ØU1ØR
12"
95 DATA 1Ø,153,1Ø,118,58,118,1Ø6
,118,1Ø,83,58,83,1Ø6,83,1Ø,48,58
,48,1Ø6,48
1ØØ PMODEØ,1:PCLS1:SCREEN1,1:PMO
DEØ,4:PCLSØ
1Ø5 LINE(1Ø,8)-(244,42),PSET,BF
11Ø FORI=ØTO23ØSTEP48
115 FORY=ØTO12ØSTEP35
12Ø LINE(12+I,5Ø+Y)-(48+I,76+Y),
PSET,B:NEXTY,I
125 LINE(156,155)-(242,181),PSET
,BF
13Ø FORI=158TO23ØSTEP48:FORY=54T
O126STEP35
135 PAINT(Ø+I,Ø+Y),1,1
14Ø NEXTY,I
145 PAINT(136,175),1,1
15Ø DRAW"BM16Ø,172CØNR8U6NR8U6R8
BR4ND12F12U12BR4R4ND12R4BR4NR8D6
NR8D6R8BR4U12R8D6L8R2F6BR6BU4NR1
ØBU4R1Ø"
155 DRAW"BM16Ø,14ØE8NF8NH8NE8BF1
ØBR4BU6F4NE4NF4NG4BE1ØBR12R8NR1Ø
BU4NR2BD8R2BR1ØBD2R8D8L8R2U8"
16Ø DRAW"BM168,96NU1ØND1ØNL1ØR1Ø
BD4BR4R8D4L8U4D8BE12BR14R18BR2BD
4ND8F4E4D8"
165 DRAW"BM16Ø,66NR1ØU12R1ØBR6D1
2R8BG4BL2NR4D4R4BR4NU4R4"
17Ø DRAW"BM2Ø8,66NR1ØU12R1ØBR6NR
8D6NR8D6R8BG4D4R6U4"
175 DRAW"BM138,16ØL2ØD1ØM-4,-1ØB
F1ØBR6R8G8R8"
18Ø DRAW"BM36,172C1"+A$(Ø)
185 DRAW"BM36,138"+A$(1)
19Ø DRAW"BM84,138"+A$(2)
195 DRAW"BM132,138"+A$(3)
2ØØ DRAW"BM36,1Ø3"+A$(4)
2Ø5 DRAW"BM84,1Ø3"+A$(5)
21Ø DRAW"BM132,1Ø3"+A$(6)
215 DRAW"BM36,68"+A$(7)
22Ø DRAW"BM84,68"+A$(8)
225 DRAW"BM132,68"+A$(9)
23Ø DRAW"BM76,172R4U2L4"
235 PCOPY4TO1:PCOPY4TO3
24Ø PMODEØ,1:DRAW"BM23Ø,3ØCØ"+A$
(Ø):PMODEØ,4
245 F$="":S$="":AN$="":D=Ø:E=Ø:G
S=Ø:R=Ø:FORP=1TO1Ø
25Ø GOSUB54Ø
255 IFX$=CHR$(12)THEN235
26Ø N$(P)=CHR$(48+X)
265 DRAW"BM23Ø,3ØCØ"
27Ø FORQ=P TO 1STEP-1
275 PMODEØ,3:QQ=ASC(N$(Q))-48:DR
AW"CØ"+ A$(QQ):NEXTQ:PCOPY3TO1
28Ø PCOPY4TO3
285 IFR>ØTHEN295
29Ø NEXTP:P=P-1:IFP=1ØTHEN GS=1:
GOSUB54Ø
295 GOSUB7ØØ
3ØØ FORI=1TOP:IF ASC(N$(I))=58TH
EN N$(I)="."
3Ø5 IF ASC(N$(I))=59THEN N$(I)="
-"
31Ø F$=F$+N$(I):NEXTI
315 IF R=5 THEN 4ØØ
32Ø GOSUB7ØØ
325 D=Ø:E=Ø:FORP=1TO1Ø
33Ø PCOPY4TO3:PMODEØ,3
335 GOSUB635
34Ø IFX$=CHR$(12)THEN235
345 IFX$="U"THEN:PCOPY4TO1:PMODE
Ø,1:DRAW"BM23Ø,3ØCØ"+A$(Ø):GOTO3
25
35Ø N$(P)=CHR$(48+X)
355 IFX$=CHR$(13)THEN385
36Ø DRAW"BM23Ø,3ØCØ"
365 FORQ=P TO 1STEP-1
37Ø PMODEØ,3:QQ=ASC(N$(Q))-48:DR
AW"CØ"+ A$(QQ):NEXTQ:PCOPY3TO1
375 PCOPY4TO3
38Ø NEXTP
385 PCOPY4TO1:P=P-1:FORI=1TOP:IF
 ASC(N$(I))=58THEN N$(I)="."
39Ø IF ASC(N$(I))=59THEN N$(I)="
-"
395 S$=S$+N$(I):NEXTI
4ØØ F=VAL(F$):S=VAL(S$)
4Ø5 IF R=1 THEN AN=F-S:GOTO435
41Ø IF R=2 THEN AN=F+S:GOTO435
415 IF R=3 THEN AN=F*S:GOTO435
42Ø IF R=4 AND S=Ø THEN 7Ø5
425 IF R=4 THEN AN=F/S
43Ø IF R=5 THEN AN=SQR(F)
435 PCOPY4TO3
44Ø AN$=STR$(AN):IF AN=>Ø THEN P
=LEN(AN$)-1:AN$=RIGHT$(AN$,P):EL
SE P=LEN(AN$)
445 IF P>1ØTHEN7Ø5
```

```
45Ø DRAW"BM23Ø,3Ø"
455 FORQ=P TO 1STEP-1
46Ø PMODEØ,3:QQ=ASC(MID$(AN$,Q,1
))-48:IF QQ=-2THENQQ=1Ø
465 IF QQ=-3THENQQ=11
47Ø IFQQ=21THEN7Ø5
475 IFQQ=-5THEN7Ø5
48Ø DRAW"CØ"+A$(QQ):NEXTQ:PCOPY3
TO1
485 FORI=1TO1Ø:N$(I)="":NEXT
49Ø F$=AN$:S$="":F=Ø:S=Ø
495 X$=INKEY$:IFX$=""THEN495
5ØØ IFX$=CHR$(12)THEN235
5Ø5 IFX$="U"THEN235
51Ø IFX$="M"THEN R=1:GOTO32Ø
515 IFX$="P"THEN R=2:GOTO32Ø
52Ø IFX$="X"THEN R=3:GOTO32Ø
525 IFX$="D"THEN R=4:GOTO32Ø
53Ø IFX$="Z"THEN R=5:GOTO4ØØ
535 GOTO495
54Ø X$=INKEY$:IFX$=""THEN54Ø
545 IFP=1THEN585
55Ø IFX$="M"THEN R=1:P=P-1:RETUR
N
555 IFX$="P"THEN R=2:P=P-1:RETUR
N
56Ø IFX$="X"THEN R=3:P=P-1:RETUR
N
565 IFX$="D"THEN R=4:P=P-1:RETUR
N
57Ø IFX$="Z"THEN R=5:P=P-1:RETUR
N
575 IFE=1THEN585
58Ø IFX$="-"AND P=1 THEN X=11:E=
1:RETURN
585 IFX$=CHR$(12)THENRETURN
59Ø IF GS=1THEN54Ø
595 IFD=1 AND X$="."THEN54Ø
6ØØ IFX$="."THEN X=1Ø:D=1:RETURN
6Ø5 XX=ASC(X$):XX=XX-48
61Ø IFXX<ØTHEN54Ø
615 IFXX>9THEN54Ø
62Ø X=XX
625 PMODEØ,1:LINE(A(X),B(X))-(A(
X)+4Ø,B(X)+3Ø),PSET,B:PLAY"P36":
LINE-(A(X),B(X)),PRESET,B:PMODEØ
,3
63Ø RETURN
635 X$=INKEY$:IFX$=""THEN635
64Ø IFX$=CHR$(12)THENRETURN
645 IFX$="U"THENRETURN
65Ø IFE=1THEN66Ø
655 IFX$="-"AND P=1 THEN X=11:E=
1:RETURN
66Ø IFD=1 AND X$="."THEN54Ø
665 IFX$="."THEN X=1Ø:D=1:RETURN
67Ø X=ASC(X$):X=X-48
675 IFX$=CHR$(13)THENRETURN
68Ø IFX<ØTHEN635
685 IFX>9THEN635
69Ø PMODEØ,1:LINE(A(X),B(X))-(A(
X)+4Ø,B(X)+3Ø),PSET,B:PLAY"P32":
LINE-(A(X),B(X)),PRESET,B:PMODEØ
,3
695 RETURN
7ØØ PMODEØ,1:DRAW"BM24,3ØCØ"+S$(
R):RETURN
7Ø5 PMODEØ,1:DRAW"BM56,3ØCØU12R1
2D12NL12BR6BU12M+6,+12M+6,-12BR6
NR12D6NR12D6R12BR6U12R12D6L12R6F
6BR6U6NR12U6R12BR6D12R12BR6U12R1
2D12NL12BR6NU12R6NU6R6U12"
71Ø X$=INKEY$:IFX$=""THEN71Ø
715 IFX$=CHR$(12)THEN235
72Ø IFX$="U"THEN235
725 GOTO71Ø
```

The second in a series of tutorials on designing a database

Designing Your Own Money Management System

By Richard Perlman

When writing your own database, you don't have to be an experienced programmer. You don't have to know about databases, and you don't have to know much about disks. All you must do is read this series of articles and follow the programs as they are explained. If you have read the first article on subroutines, loops and arrays, (January '89, Page 36), you are ready to move ahead to this database which will help you manage your money. This month, let's discuss a new topic: system design.

How to Design a System

System Design is not that difficult to figure out. You begin by deciding what you want your system to do. I want this system to help me manage my money — to keep track of bills and expenses, to make sure I don't run out of cash, and to budget and save for the future. The system must be able to record money coming in, money going out and money that must be paid. It will have to place this information into records and store these records on the disk. (These records will be referred to as deposits, checks and bills.) I must be able to change entries if I make a minor mistake and delete them if I make a major mistake. I will also want to examine the records and run reports about the information stored in them. This is what my system will do, so the first step in the design process has been completed.

But how will it work? I must describe the items of information needed and write this down in a way that will be easy to understand both now and in the future. This is called creating a "Data Dictionary," and this dictionary will be the blueprint for everything else that follows. My Data Dictionary is shown in Figure 1.

Since the items needed for a check, bill or deposit are just about the same, I can put the same items in each record. Each record will have this information in the order shown; therefore, I have formed one of the rules to follow when using this database. I've completed the second design step.

By describing the items I will store in the database, this blueprint tells me what I need to know to construct and run the system. It tells me what each item is, the name I'll use for it in the programs, what type of information it is, where it will appear in each record, and its allowable range of values. Except for the *key* field and the *separator*, all the data items are fully described in this dictionary. Let's examine them.

The first item in my Data Dictionary is the date. I need to know this for each type of record — check, bill or deposit. Next, the record type identifies whether this information refers to a check, bill or deposit. Following the record type, I have included an identifying number. For a check I will use the check number, and for a bill or deposit I will create and use a number for identification purposes.

I also have included in each record an indicator that tells me a transaction has cleared. When you deposit someone else's check or write one of your own, you have to know whether it has cleared your account. If this is a bill record, the indicator will identify whether you have paid the bill. In addition, you must know the amount — anything from $.01 to $999,999.99. Last, but not least, you must record the purpose of the transaction, and who or what else is involved with it.

In the Dictionary there are two references to the *separator*. It is described as `CHR$(127)`. A `CHR$(127)` is a special

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character that cannot be typed at the keyboard. Insert it at the end of items that will not have the same length in every record. Then you can tell exactly where each item ends. You must use a special character — otherwise you could type the separator in the middle of something and cause the computer to process the information incorrectly. It is no problem to create this special character, and you can choose from many. The following program generates special characters for you:

```
100 CLEAR 500:CLS
120 FOR I= 49 TO 132
130 PRINT @64,"I EQUALS ==> ";I
140 A$= CHR$(I)
150 PRINT "THIS DISPLAYS AS ==>";A$
160 FOR J= 1 TO 250:NEXT J
170 NEXT I
180 GOTO 120
```

I used the CHR$ instruction on Line 140 to create characters. Some were special, and some were not. If you want to see the possible range of characters, change Line 120 to vary I from 1 to 255. Some special characters do not print at all, others produce strange shapes, and still others are letters and numbers. Of all the characters, I chose CHR$(127) as my separator because it is dark and has a pointer in it, which makes it easy to spot if I have to look directly at my data. Line 160 adds a pause to the program, so the display doesn't change too quickly for the eye to follow.

The Data Dictionary identifies that each database record will have *Amount*, *To-or-From* and *Purpose* entries. The Amount entry uses between three and nine characters. The To-or-From entry, describing money's points of origin and destination, can be between one and 30 characters long. The Purpose entry indicates why the money changes hands and can be up to 50 characters long. To figure out when an entry ends, I have placed a separator character between each entry.

Listing 1 shows how this is done. I use the data-entry Subroutine 9020 created last time to enter three items. One of them is a decimal number between 1.00 and 999,999.00. The other two are names of varying length. I use this listing to enter the three items separately, verify that they are in the correct ranges and use separators to combine the items into one record. Next I display the entire record, including the separators, and separate the record into its three original parts.

I used SS$ to hold the separator character, so I wouldn't have to recreate it each time I needed it. I also used the Subroutine 9020 to control the input. Here are the variables in use at this time:

Description/Program ID	Key	Type	Length	Range
Date/CD$	Yes	Number	4	mmdd: *mm=01-12* dd=01-31
Record type/TP$	Yes	Alpha	1	c,d or b c=check d=deposit b=bill
Number/RN$	Yes	Number	4	nnnn 9999>nnnn>1000
Cleared/CL$	No	Alpha	1	y or n y=cleared n=not cleared
Amount/AM$	No	Decimal Number	4-9	nnn.nn
Separator/SS$	No	Alpha	1	CHR$(127)
To or From/DS$	No	Alpha	<=30	characters long
Separator/SS$	No	Alpha	1	CHR$(127)
Purpose/CT$	No	Alpha	<=50	characters long

Figure 1: Data Dictionary

P$: Holds the input instructions

SL: Holds the screen location

VT$: Identifies the type of input (Numeric Non-Decimal, Decimal with two places or Alphanumeric)

HV: Holds the highest acceptable value

LV: Holds the lowest acceptable value

I built the NN$ record as I went along, adding to it each time I had some more information (see lines 124, 145 and 165). You might think it is unusual to add characters, such as C$=A$+B$, but this is not the same as adding numbers. When you add character variables to one another, you are really tacking the beginning of the next one to the end of the last one. This technique also allows you to place the separator character SS$ at the correct spot in the record.

In Line 145 I used Variable NN$ on both sides of the equal sign. This may not make sense, but when the computer sees an equal sign, it reacts by figuring out the value to the right of the sign. Then it sets the left side of the sign to that value.

You have seen the MID$ instruction before. Here you also show the LEFT$ and RIGHT$ instructions (see lines 124, 190 and 240). They are all useful in slicing up and putting together strings of characters. The INSTR instruction in Line 180 is new. It identifies where *in* the *str*ing the separator characters are located, so you can then divide NN$ to reveal its three parts.

In addition to letting you put together and take apart information, the separator character can also be used to save space on the disk. The standard CoCo disk holds about 150,000 characters. There is a limit to the amount of information that can be held on one disk, and the smaller the size of the record, the more records you can fit in the database. For long names I allowed a maximum of 32 characters for both the first and last names. If I didn't use separators and reserve a fixed space of 32 characters for both the first and last names, all records would be about 70 characters. However, in most cases, a name is less than seven characters long, so a lot of space would be wasted. By using separators, you can write records of considerably shorter length no matter what the length of a person's first or last name. I also saved space by not storing the decimal point (see Line 124). You know where it must be, and can recreate a decimal number that is entered.

Next, look at the LEFT$ and RIGHT$ statements on lines 190 and 240. The number I-5 in the LEFT$ statement does the same thing as the expression LEN(NN$)-1 in the RIGHT$ statement. It specifies the number of characters to be selected from either the left or right of NN$. Using the expression instead of a

number is a shorthand coding technique that saves both time and space.

How to Use the Disk

The disk is used like a file cabinet — you can add files and remove them. The actual filing of data is done by the CoCo disk controller. The program sends simple instructions, like WRITE, to the controller, and the controller does the complicated things — turning the drive motor and red indicator light on and off, finding information already on the disk, figuring out which parts of the disk are available to write on, and transferring information between the disk and computer memory. Remember: The disk can hold approximately 150,000 characters of information (which is either a lot or a little, depending upon how you use it). Be careful when attaching the controller to your computer. It must not be inserted, removed or adjusted when the computer is on, or you might find yourself with a burned-out controller.

When you use a file folder, you write a description on it. Like file folders, each disk file must have a filename. A filename has two parts, separated by a slash (/) or a period (.). You can use almost any name you want, as long as the left side of the filename is no more than eight characters and the right side no more than three characters. Before using a disk for the first time, you must prepare it for accepting data from the computer system by allowing the controller to write special information on it. This is called *disk initialization*. To initialize, place a blank disk in Drive 0, enter DSKINI0 and wait. It takes about a minute to complete. This procedure needs to be done only once. A used disk can be reformatted, however, it will erase any information already on the disk so be careful when you use the DSKINI command.

You have to open a file cabinet before using it, and before you use a disk file you must open it, too. If your program tries to use a file that isn't open, the controller will stop the program. Therefore, you use an OPEN statement to tell the controller the name of the file to be opened. This statement also tells the controller whether it is to read from or write to this file and gives the file a number, so the controller can identify it later in the program. For example, to open the MARBLES/RED file for writing (or output), use the following statement:

```
OPEN "O",#1,"MARBLES/RED"
```

To open the same file for reading (or input), use this statement:

```
OPEN "I",#1,"MARBLES/RED"
```

Remember: You can't open a file that is open already.

Reading from or writing to a disk file is not difficult. Listing 2 shows how to write ten records to a file and then read them back. This listing shows you a lot about disk and display operations. Look at the PRINT statements in the listing. They are almost all different in format. Some end in a semicolon (lines 110 and 120), which means that after printing, the display position will remain exactly where it is. After displaying the information in a PRINT statement that does not end in a semicolon, the computer will display the item on the beginning of the next line. Lines 110 and 140 use the PRINT @ format, which tells the computer where to start the display, regardless of where the last line ended.

More Disk Operations

The OPEN statements in lines 110 and 150 can use the Character Variable NA$ instead of a filename in quotes. You can use this technique in most disk operations.

The CLOSE statements in lines 140 and 190 should be used after you are finished with a file. CLOSE is required on Line 140 because you cannot use the same file for both I (Input) and O (Output) without closing and reopening it. The CLOSE statement on Line 140 has a number in it while the one in 190 does not. The CLOSE statement without a number will close all files still open. The one with a number closes only the file opened with that number.

The INPUT statement in Line 170 reads two data items at a time. Make sure you know just what you are reading when reading a file. Try changing Line 170 to INPUT #1,IN$, and see what you get. Now try changing it to LINE INPUT #1,IN$. See what I mean about being careful?

Line 210 includes the disk statement KILL. This does exactly what you think it does; it *kills* the possibility of using the file again. The controller doesn't actually erase the information. It marks the file as unusable. It then allows new information to be written over that which was killed. However, if no new information was written and you know how to do it, you can *unkill* this file. Don't try it unless you know exactly what you are doing. You will need to know a lot more about how the controller operates than we can go into here. One last point: A file must be closed before you kill it.

When you read files, you won't know how many records each file contains, and this number will change each time you add or delete a record. Fortunately, the disk controller can tell you when we are at the end of a file — no matter how many records the file contains. It does this by setting an end-of-file indicator. You can ask the controller what the value of this indicator is by using the EOF (End Of File) statement in our program. The code on lines 160 and 190 was changed to include such a statement and is shown in the following example:

```
160 IF EOF(1) = -1 GOTO 190
170 INPUT #1,IN$,NB
180 PRINT "===> ";IN$;NB
190 CLOSE
```

Make these changes in Listing 2 and rerun the listing.

The program reads the file in the same way, but now you don't have to know the value of IX used to create the file. In fact, you can change the value of IX in Line 120 to anything you want, and all the records will still be read. Another note of caution: If you don't check EOF before you read a record, don't think the controller will save your information. If you read past the end of the file, the controller will stop your program.

What's the Secret?

The secret of the system is really no secret at all. You will use files like the one we created in the example. These are called *sequential* files because the records follow each other in the sequence they were written. When you use the OPEN command to create a file, the disk controller finds an unused space on your disk for the file and uses only the space you need. Your program does not have to worry about the file's location on the disk because the controller does this automatically. After you have closed the file, the controller needs to know its name to get it back for you.

A disk file can occupy space on the outside, middle, or inside of the disk. As you add to it, it becomes larger and larger, and although a computer is a fast machine, it will be slowed to a crawl if you force it to start looking at the beginning of an ever-longer file each time you are looking for a particular point in that file. The database will

Listing 1: SEPARATE

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1ØØ CLEAR 5ØØ:SS$=CHR$(127)
1Ø5 CLS:PRINT "- ENTER, COMBINE, AND SEPARATE -"
11Ø P$="ENTER A DECIMAL NUMBER":VT$="D"
12Ø HV=999999:LV=1:SL=64:GOSUB 9Ø2Ø
124 NN$=LEFT$(VA$,LEN(VA$)-3)+RIGHT$(VA$,2)
13Ø P$="ENTER YOUR FIRST NAME":VT$="A"
14Ø HV=32:SL=128:GOSUB 9Ø2Ø
145 NN$=NN$+SS$+VA$+SS$
15Ø P$="NOW YOUR LAST NAME, DON'T BE SHY":VT$="A"
16Ø HV=32:SL=192:GOSUB 9Ø2Ø
165 NN$=NN$+VA$
167 PRINT:PRINT "---- THE ENTIRE RECORD IS ----"
17Ø PRINT NN$
18Ø I= INSTR(1,NN$,SS$):J= INSTR(I+1,NN$,SS$)
185 PRINT:PRINT "---- THE PARTS ARE ----------"
19Ø NB$=LEFT$(NN$,I-3)+"."+MID$(NN$,I-2,2)
2ØØ PRINT "NUMBER ------>";NB$
23Ø PRINT "FIRST NAME -->";MID$(NN$,I+1,J-I-1)
24Ø PRINT "LAST NAME --->";RIGHT$(NN$,LEN(NN$)-J)
25Ø PRINT:PRINT "TOUCH 'ENTER' TO CONTINUE";:INPUT CT$:GOTO 1Ø5
9Ø2Ø PRINT @SL,P$:PRINT @SL+32," ":PRINT @SL+32,"";
9Ø26 LINE INPUT "==> ";VA$ 'INPUT THE VARIABLE
9Ø28 LA= LEN(VA$):IF VT$= "A" GOTO 9Ø44
9Ø3Ø VV= VAL(VA$):IF VT$= "D" GOTO 9Ø38
9Ø34 IF INT(VV) <> VV GOTO 9Ø2Ø ELSE GOTO 9Ø42
9Ø38 IF LA > 9 OR LA < 3 GOTO 9Ø2Ø
9Ø4Ø IF MID$(VA$,LA-2,1) <> "." GOTO 9Ø2Ø
9Ø42 IF VV < LV OR VV > HV GOTO 9Ø2Ø
9Ø44 IF LA > HV GOTO 9Ø2Ø ELSE RETURN
```

Listing 2: RITEREAD

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1ØØ CLS:NA$="RECORDS/DAT"
1Ø5 PRINT "--- TEN RECORDS ON A FILE ------"
11Ø OPEN "O",#1,NA$:PRINT @32,"+++ WRITING ==>";
12Ø FOR IX = 1 TO 1Ø:PRINT " ";IX;
13Ø WRITE #1,"RECORD NUMBER:",IX
14Ø NEXT IX:CLOSE #1:PRINT @96,"++++ READING BACK ++++"
15Ø OPEN "I",#1,NA$
16Ø FOR IX = 1 TO 1Ø
17Ø INPUT #1,IN$,NB
18Ø PRINT "==> ";IN$;NB
19Ø NEXT IX:CLOSE
2ØØ LINE INPUT "ERASE THE FILE? Y/N ";KF$
21Ø IF KF$ = "N" GOTO 25Ø ELSE KILL NA$
25Ø LINE INPUT "RUN IT AGAIN? Y/N ";MT$
26Ø IF MT$ = "N" THEN END ELSE GOTO 1ØØ
```

Listing 3: TIMER

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1 CLEAR 5ØØ:CLS
2 PRINT "-- READ/CALCULATE COMPARISON --
4 OPEN "O",#1,"RECORDS/DAT"
6 A$ = STRING$(15Ø,"X"):FOR ID = 1 TO 2Ø
8 WRITE #1,A$:NEXT ID:CLOSE
1Ø OPEN "I",#1,"RECORDS/DAT"
2Ø TIMER = Ø
3Ø FOR ID = 1 TO 2Ø
4Ø LINE INPUT #1,IN$
```

work much faster if you can split the information into smaller files and find an easy way to see which file you should open when we are looking for specific information.

This is called *indexing*, and it is like using an index in a textbook. With the book, you look in the index for a topic, and the index tells you where to locate the information. In this program, the index will tell you which file to open. Since each of the records contain a date, use the date as an index and put all the information for a group of dates in its own file. Then create an index subroutine that opens the correct file when you give it the date.

Listing 3 gives you an idea how much faster your program will run by using indexing. It uses the internal TIMER of the CoCo to time the operation of reading a disk file. As in Listing 2, the program creates a file (this time, of 20 records), reads the records back one at a time and times how long this takes. It then times the processing of a set of arithmetic instructions for comparison.

Lines 1 to 8 create the file; lines 10 to 50 read the file; and Line 60 tells how long it took to read the records. Line 70 resets the timer to do the comparison. You will see that reading one record from the disk file took longer than executing the lines of code from 90 through 110, including 13 arithmetic instructions and a FOR/NEXT loop. It really is worth the extra effort to index information.

Creation: The Empty Database

The disk controller does a lot of good things, but it will not put more than 72 files on a single disk. This prevents the use of a daily file system because you cannot have 365 files. We could have a weekly system of 52 files, a monthly system of 12 files or a bimonthly system with 24. How about using a weekly system? How would you like to write a program that puts each week's information in the proper month, splitting each week at the month's end and working perfectly well on leap years? I wouldn't, so I discarded the 52-file system. I also didn't want to read through an entire month's data just to find one record, so I discarded the 12-file system. I settled on 24 files, using two files for each month. The first file holds everything from the first to the 15th and the second, from the 16th to the end of the month — whenever that might be. To identify these files as a database, I named them M..D../CHK and wrote Listing 4 to create the empty database.

Run Listing 4 once on an empty or nearly empty disk. It creates the 24-file empty database. If you run it again, it destroys any existing database, replacing it with an empty one. To make sure the database is there, you can enter various combinations of months and days to see which file is selected. Be careful: The program will not reject invalid input (December 43, anyone?) and may try to open a nonexistent file. If this happens, the program ends with an NE (Non Existent File) Error, but the database is still there.

The Key to It All

Part of the information of each record in the database serves as its Index Key. This key identifies the record's location on the database. Together with the indexing subroutine, it tells you in which file the record belongs and the location of the record in the file. Listing 5 shows how this is done. It adds records to the database, using one subroutine to open the correct database file and another to add individual records. A database (empty or not) must already be in place on the disk you use.

This program lets you add check records to the database. Option 2 stops the program. To restart it enter RUN. You are asked to supply the information required to build the record on lines 380 to 440. After you have typed it in — but before going any further — you are forced to make a final check of the information before you add it (Line 480). You can indicate that it is OK as is or you can change anything you want until you like it. This is one of the additional steps taken to ensure that no garbage gets into the database. After you indicate that the information is correct (Line 520), the program constructs an Output Key, OK$, on Line 522 and a Write Record, WR$ on Line 524.

The output key is that part of the record used to determine where in the database this record is stored. Each record written to a file must have a higher key than the one before it. No duplicate keys are allowed. Therefore, only one record in the entire database can have a key with this information. Part of the key (the date) identifies the file the record will be on. The rest of the key (record type, and record number) tells you where on the file this record is placed.

Subroutine 9070 opens the correct database file, and the Subroutine 9100 adds the record. Later, the 9100 subroutine will be used to change and delete records. If a value of zero is placed into

```
5Ø NEXT ID
6Ø PRINT "READING TOOK ";TIMER
7Ø TIMER = Ø
9Ø FOR ID = 1 TO 2Ø
1ØØ Z = Z + 1: X = X + 2:Y = Z + X
1Ø3 W = 3 * Y:V = W - Z:U = 365 * V
1Ø6 T = (U+V+W+X+Y+Z)/24.3
1Ø7 FOR DD = 1 TO 4
1Ø8 S = S+1:NEXT DD
11Ø NEXT ID
12Ø PRINT "PROGRAM TOOK ";TIMER
13Ø CLOSE:END
```

Listing 4: CREATE

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1ØØ CLEAR 5ØØ:CLS
1Ø5 PRINT "-----  CREATE THE DATABASE -----
11Ø FOR I = 1 TO 12
115 A$= RIGHT$(STR$(I),1)
12Ø IF I > 9 THEN A$= "1"+A$ ELSE A$= "Ø" + A$
13Ø F1$ = "M"+A$ +"DØ1/CHK"
14Ø F2$ = "M"+A$ +"D15/CHK"
15Ø PRINT "CREATE ";F1$;" AND ";F2$
16Ø OPEN "O",#1,F1$:OPEN "O",#2,F2$:CLOSE
17Ø NEXT I
175 CLS
18Ø PRINT:PRINT "DATABASE CREATED LET'S CHECK"
19Ø PRINT @256,"ENTER THE MONTH Ø1-12"
2ØØ INPUT MM$
21Ø PRINT "ENTER THE DAY Ø1 TO 31"
22Ø INPUT DD$
23Ø IF DD$ > "15" THEN FD$="15" ELSE FD$="Ø1"
24Ø SG$= "M"+MM$+"D"+FD$+"/CHK"
245 CLOSE
25Ø OPEN "I",#1,SG$
26Ø PRINT "FILE "SG$" IS THERE":GOTO 19Ø
```

Listing 5: ADDRECRD

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
5Ø FILES 3,1ØØØ
1ØØ CLEAR 75Ø:DIM LI$(7):SS$=CHR$(127)
15Ø CLSØ:PRINT @Ø,"--- MONEY MANAGER DATA BASE ---a
2ØØ LI$(1)="1= ADD INFORMATION
2Ø3 LI$(2)="2= END SESSION
21Ø SL=128:NL=2:AD=Ø:GOSUB 9ØØØ
25Ø ON A GOTO 32Ø,26Ø
26Ø PRINT @385,STRING$(3Ø,"*");
262 PRINT @417,"SESSION IS OVER - BYE FOR NOW ";
265 PRINT @449,STRING$(3Ø,"*");
266 FOR I=1 TO 18ØØ:NEXT I:CLS:END
32Ø CLSØ:PRINT "--- ADDING INFO TO DATABASE ---b"
321 AD=1:LI$(1)="1= ENTER A CHECK
33Ø LI$(2)="2= RETURN TO THE FIRST MENU a
34Ø LI$(3)="3= END THIS SESSION":NL=3
345 SL=128:GOSUB 9ØØØ:ON A GOTO 37Ø,15Ø,26Ø
37Ø CLSØ:PRINT @Ø,"-----  CHECK INFORMATION ------c
375 GOSUB 38Ø:GOSUB 4ØØ:GOSUB 4Ø6:GOSUB 41Ø:GOSUB 414:GOTO 43Ø
38Ø P$="1= ENTER THE MONTH:  1-12":LV=1:HV=12:SL=64
39Ø VT$="N":GOSUB 9Ø2Ø:MM$=RIGHT$("Ø"+VA$,2):RETURN
4ØØ P$="2= ENTER THE DAY: 1-31":LV=1:HV=31:SL=128
4Ø2 VT$="N":GOSUB 9Ø2Ø:DD$=RIGHT$("Ø"+VA$,2):RETURN
4Ø6 P$="3= ENTER CHECK NUMBER: 1ØØØ-9999":LV=1ØØØ:HV=9999
4Ø8 SL=192:VT$="N":GOSUB 9Ø2Ø:CN$=VA$:RETURN
```

```
41Ø P$="4= ENTER THE AMOUNT: NNNNNN.NN":LV=1.ØØ:HV=999999.99
412 VT$ ="D":SL=256:GOSUB 9Ø2Ø
413 AM$=LEFT$(VA$,LEN(VA$)-3)+RIGHT$(VA$,2):RETURN
414 P$="5= ENTER WHO CHECK WAS PAID TO":SL=32Ø:VT$="A
42Ø HV=31:GOSUB 9Ø2Ø:CP$=VA$:RETURN
43Ø P$="6= ENTER WHAT CHECK WAS FOR":SL=384:VT$="A
44Ø HV=58:GOSUB 9Ø2Ø:CF$=VA$
47Ø PRINT @Ø,"---  FINAL O.K.  OR CHANGE ----d
48Ø PRINT @32,">TYPE 'Y' IF ALL ITEMS ARE O.K.<";
481 FOR I = 1 TO 22Ø
482 A$=INKEY$:IF A$ <> "" GOTO 49Ø ELSE NEXT I
484 PRINT @32," OR TYPE LINE NUMBER TO CHANGE  ";:FOR I=1 TO 3ØØ
486 A$=INKEY$:IF A$ <> "" GOTO 49Ø ELSE NEXT I:GOTO 48Ø
49Ø IF A$ = "Y" GOTO 52Ø
5ØØ A = VAL(A$):IF A > Ø AND A <7 GOTO 51Ø ELSE GOTO 47Ø
51Ø ON A GOSUB 38Ø,4ØØ,4Ø6,41Ø,414,43Ø:GOTO 48Ø
52Ø CLS:PRINT "------- ADDING THE CHECK ------e"
522 PRINT "     P L E A S E    W A I T":OK$= MM$+DD$+"C"+CN$
524 WR$ = OK$+"*"+AM$+SS$+CP$+SS$+CF$
526 GOSUB 9Ø7Ø:GOSUB 91ØØ:CLSØ
53Ø IF GE =1 THEN PRINT "----  CHECK WAS ADDED    ------f"
ELSE PRINT "** DUPLICATE CHECK NOT AD DED **d
54Ø LI$(1)="1= ADD ANOTHER CHECK
55Ø LI$(2)="2= RETURN TO THE FIRST MENU a
557 LI$(3)="3= END THIS SESSION RIGHT NOW
56Ø SL=96:NL= 3:GOSUB 9ØØØ:ON A GOTO 37Ø,15Ø,26Ø
9ØØØ FOR I= 1 TO NL:PRINT @SL,LI$(I)
9ØØ1 SL= SL+32:NEXT I
9ØØ5 PRINT @32,"*   SELECT FROM THE FOLLOWING
9ØØ6 FOR I = 1 TO 2ØØ
9ØØ7 A$ = INKEY$:IF A$ <> "" GOTO 9Ø12 ELSE NEXT I
9ØØ8 PRINT @32," *":FOR I = 1 TO 65
9ØØ9 A$ = INKEY$:IF A$ <> "" GOTO 9Ø12 ELSE NEXT I
9Ø1Ø GOTO 9ØØ5
9Ø12 A = VAL(A$):IF A > Ø AND A < NL+1 THEN RETURN
9Ø13 GOTO 9ØØ5
9Ø2Ø PRINT @SL,P$ :PRINT @SL+32," " 'PROMPT
9Ø24 PRINT @SL+32,""; 'REPOSITION
9Ø26 LINE INPUT "> ";VA$ 'INPUT
9Ø28 LA= LEN(VA$):IF VT$ = "D" GOTO 9Ø44
9Ø3Ø IF VT$ = "N" GOTO 9Ø36
9Ø32 IF LA > HV GOTO 9Ø2Ø
9Ø34 RETURN 'VARIABLE IS IN RANGE
9Ø36 VV= VAL(VA$):IF VV < LV OR VV > HV GOTO 9Ø2Ø
9Ø38 IF VT$="D" GOTO 9Ø34
9Ø39 IF RIGHT$(VA$,1)< "Ø" OR RIGHT$(VA$,1)> "9" GOTO 9Ø2Ø
9Ø4Ø IF VV <> INT(VV) GOTO 9Ø2Ø ELSE GOTO 9Ø34
9Ø44 IF LA > 9 OR LA < 3 GOTO 9Ø2Ø
9Ø46 IF MID$(VA$,LA-2,1) <> "." GOTO 9Ø2Ø
9Ø48 GOTO 9Ø36
9Ø7Ø IF DD$ > "15" THEN DF$ = "15" ELSE DF$ = "Ø1
9Ø72 SG$= "M"+ MM$+ "D"+ DF$+ "/CHK"
9Ø96 CLOSE:OPEN "I",#1,SG$:OPEN "O",#2,"WORK/CHK":RETURN
91ØØ IF EOF(1) = -1 GOTO 913Ø
91Ø5 INPUT #1,LI$:IK$ = LEFT$(LI$,9)
911Ø IF IK$< OK$ THEN WRITE #2,LI$ ELSE GOTO 916Ø
912Ø GOTO 91ØØ
913Ø ON RA GOTO 9132:ON AD GOTO 9131,9134,9134
9131 WRITE #2,WR$
9132 RA=Ø:CLOSE:KILL SG$:COPY "WORK/CHK" TO SG$:GE=1:RETURN
9134 RA=Ø:GE=2:CLOSE:RETURN
916Ø IF IK$ > OK$ GOTO 92ØØ: 'INPUT >=OUTPUT
9162 ON AD GOTO 9134,917Ø,917Ø  'INPUT =OUTPT
917Ø GE=1:RETURN 'CHANGE
92ØØ ON AD GOTO 92Ø2,922Ø,922Ø: 'INPUT > OUTPUT
92Ø2 ON RA GOTO 921Ø:WRITE #2,WR$:WRITE #2,LI$:RA=1:GOTO 91ØØ
921Ø WRITE #2,LI$:GOTO 91ØØ
922Ø ON RA GOTO 921Ø:GOTO 9134
```

the variable AD, the subroutine assumes that you are using it to add a record (WR$) with the key (OK$).

The detailed working of this subroutine will be explained in the next article. What should be noted here is the way the subroutine uses the GE (Good Ending) variable. It is possible that the record to be added (WR$) will be added correctly. It is also possible that there will be some problem (such as a duplicate key), and it will not be added. The program must take different action depending upon the result. If the record is successfully added, the subroutine places a value of 1 into Variable GE. If there was a problem and the record was not added, then a value of 0 or 2 is placed in the variable. When the subroutine returns control to Line 530, the program tests the value of GE to determine which message to display. You can then add more records or stop the program.

That's all for this month. By now you know a good deal about how to use your disk. [For more detailed information on disk operation, see Bill Barden's "Delving Into the CoCo Disk" (January '88, Page 180).] In the next article, I'll go into more detail about the 9100 subroutine and show you the complete program, which adds, deletes and changes both checks, deposits and bills. See you next time.

(Questions or comments about this tutorial may be directed to the author at 83-34 169 Street, Jamaica, NY 11432. Please include an SASE when requesting a reply.)

Losing the Picture

I have a 128K CoCo 3 with an FD 502 disk drive. I am having problems saving HSCREEN 2 *pictures to disk and loading them back into BASIC. I use* SAVEM *"filename", 3584,9727,3584 to save them. To reload, I use* LOADM *"filename":*POKE &HE6C6,&HSCREEN 2, *but this process doesn't work. It will reload properly right after being saved, but after I re-power the computer, I get nothing but garbage. Can you help?*

Cory Burgess
Tullahoma, Tennessee

Rx You are having problems because BASIC is using more than 64K by bank switching in the HSCREEN memory when it is needed and then switching it out when it is not. The following two BASIC programs allow you to save and load HSCREEN images:

HISAVE

```
10 INPUT"NAME:;"N$
20 FOR I=&H70 TO &H73
30 POKE &HFFA2,I
40 F$=N$+"/HR"+CHR$(I-64)
50 SAVEMF$,&H4000,&H5FFF,44539
60 NEXTI
70 POKE &HFFA2,&H7A
```

HILOAD

```
10 INPUT"NAME:;"N$
20 INPUT"HSCREEN#;"H
30 HSCREEN H
40 FOR I=&H70 TO &H73
50 POKE &HFFA2,I
60 F$=N$+"/HR"+CHR$(I-64)
70 LOADMF$
80 NEXTI
90 POKE &HFFA2,$H7A
```

Assembly Language References

I recently went to my local Radio Shack store and purchased an Editor/Assembler with ZBUG (Cat. No. 26-3250) for use with my CoCo 2. At the time I was buying this, I did not know that this product had been discontinued. After I got it home, I started reading the manual and found it would not teach me how to program in assembly language. The manual referred to a book (Cat. No. 62-2077), which would teach me this. I returned to Radio Shack only to find that the book had been discontinued as well, and there was no possible way for me to get a copy of it. Could you suggest a place where I can purchase this book? If not, could you recommend another book that would serve the same purpose?

Chay Wesley
Danville, Kentucky

Rx The best source for technical information on assembly language is *6809 Assembly Language Programming*, by Lance Leventhal, Osborne/McGraw-Hill ($16.95, 562 pages). Three other assembly language references are: *Assembly Language Graphics for the TRS-80 Color Computer*, by Don Inman, Reston ($14.95, 280 pages); *The MC6809 Cookbook*, by Carl Warren, TAB Books, Inc. ($6.95, 162 pages); and *Programming the 6809*, by Rodnay Zaks, Sybex ($14.95, 362 pages). Also, see the ad for Tepco in this issue.

Pascal Problems

I recently purchased a copy of OS-9 Pascal *Version 2.00 for use with OS-9 Level II. After creating a short source program, I attempted to direct it to the computer. I received a Pascal Error 203, or OS-9 File Error, followed by an OS-9 Error 216 (pathname not found). I got the same result when I tried to compile the sample program included on the disk. What pathname is the compiler looking for? Isn't this package compatible with Level II?*

Jonathan Roorda
Holland, Michigan

Rx Thanks to Greg Law for the following information: In the program *Pascal*, there is a minor bug in the specification of the access mode for the open calls of the two files Pascal-Compiler and PascalErrs. As distributed, those two files are in the execution directory. When *Pascal* opens those two files in the READ mode, it attempts to locate them in the current DATA directory. The following patch changes the access modes of the open calls to EXECUTE+READ, so they are correctly located in the current execution directory.

```
load pascal
modpatch -s
1 Pascal
c 0697 21 25
c 1692 21 25
v
```

After the patch is made, use the Level I Save utility, which is Level II-compatible, to put the patched version of *Pascal* on disk.

Keep It Accessible

Some time ago RAINBOW had an article that explained how to keep a Multi-Pak Interface and a CoCo together by attaching them to a board. The cases are screwed together at the bottom, so how do you get the cases back together after they are secured to the board?

Joseph J. Diovanni
Laurence Harbor, New Jersey

Rx Drill access holes in the board to get at the screws.

By Richard E. Esposito
Rainbow Contributing Editor
with Richard W. Libra

Richard Esposito is the principal engineer for BDM Corporation. He holds bachelor's, master's and doctorate degrees from Polytechnic Institute of Brooklyn. He has been writing about microcomputers since 1980.

Richard Libra is a simulator test operator for Singer Link Simulation Systems Division.

A Drive Patch

I read your September '88 column (Page 138). I can add a bit to your response to the person unable to access double-sided drives with the TW-80 Telewriter *patcher under ADOS-3.* TW-80 *must be configured to work with double-sided drives. (Unpatched* Telewriter *works fine with double-sided drives.) There is provision for this in* TW-80*'s configure program,* CONFIG.BAS. *However, Doug Masten, the author of* TW-80*, told me he chose not to "officially" support double-sided drives because he had none of his own and was unable to test this feature properly. To get* TW-80 *to recognize double-sided drives (with or without ADOS-3), look at the following in* CONFIG.BAS*:*

```
350 GOSUB 3890:D0=A 'disk drive se-
lect table
360 GOSUB 3890:D1=A
370 GOSUB 3890:D2=A
380 GOSUB 3890:D3=A
```

For double-sided drives, change D2=A *to* D2=&H41 *and* D3=A to D3=&H42 *in lines 370 and 380. This makes the program recognize Drive 2 as the back side of Drive 0 and Drive 3 as the back of Drive 1. After making these changes, run* CONFIG.BAS *to save the configuration file that lets* TW-80 *recognize the double-sided drives from then on.*

Art Flexser
SpectroSystems

Rx Thanks for the information.

Changing Terminals

Is it possible to hook my Televideo 910 terminal to my CoCo via OS-9 Level II /t2*? My system includes an MPI and a Deluxe RS-232 pack.*

Bert A. Challenor
Albuquerque, New Mexico

Rx On each of two DB-25 connectors, wire pins 4, 5 and 8 together. Do the same with pins 6 and 20. Then, using a three-wire cable, wire Pin 7 (ground) on one DB-25 to Pin 7 on the other DB-25. Connect Pin 2 (transmit) on one DB-25 to the wire on Pin 3 (receive) on the other DB-25. Wire Pin 3 on the first DB-25 to Pin 2 on the second, so you can transmit and receive in both directions.

Only Your Vendor Knows

I have a Tandy FD 501 disk drive. Will any half-height drive work as a second drive? How hard is a second drive to install? If I expand my CoCo 2 to 128K, how would I use the extra memory as a print spooler or RAM disk? How would I get my CoCo to auto-boot a program when I power up? Is there a Color Computer equivalent to MS-DOS's autoexec.bat*? Also, how can I transfer ML programs from tape to disk if I don't know the start, end or exec?*

Albert Noah

Rx Using the extra 64K of memory on an upgraded CoCo 2 requires special software to use it as a RAM disk. J&R Electronics supplies this software with its Banker CoCo 2 memory upgrade. Since memory beyond 64K on a CoCo 2 was never officially supported by Tandy, those upgrades from various manufacturers all work differently, hence each CoCo 2 upgrade requires its own vendor-specific software.

Direct Access in Disk BASIC

How do you locate and change the sequence of bytes of VIP Calc*, so it will work on a CoCo 3?*

Lionel Boucher
Mont Saint-Hilaire, Quebec

Rx Any BASIC file including machine language files can be read and written to as direct access files in Disk Color BASIC. Set the record length to one byte. Then a simple BASIC program can loop through all the bytes that make up the program and rewrite the new bytes when the proper sequence is found.

Looking for a Common Sequence

I have RGB Patch *by Spectral Associates, and I use it with my CM-8. When I load* One-On-One*, the opening screen is in color, but after the game loads and begins, it goes to black & white. How can this be fixed to display color? The patch seems to work fine with other games.*

Jeff P. Szczerba
Sturtevant, Wisconsin

Rx *RGB Patch* is a program that looks for common sequences of bytes that denote PMODE 4 in machine language. It then changes them to a sequence of bytes that denote PMODE 3. If a program uses a sequence of bytes that the author did not anticipate, the program will not be fixed. The only alternative in such a case is to disassemble the code, analyze it and come up with your own custom fix on a case-by-case basis.

To Upgrade or not to Upgrade

What advantages are there in upgrading to the latest versions of Burke & Burke's hard disk software drivers?

Joe Schmitz
Detroit

Rx The upgrade to Version 2.3 lets you run two different-sized hard drives and does a much better job of reporting errors. It also turns off automatic retries during formatting, so it will lock out more marginal sectors during the verify pass. The best thing about Version 2.3 is that it includes *EZGen*, a handy boot-file editor. *Hyper-I/O* 2.5 is CDOS-compatible. However, on a CoCo 3 CDOS system, there is a problem in the startup message. There will probably be a *Hyper-I/O* 2.6 that corrects this and eliminates the limit on MSA size for drives 2 and 3. *XT-ROM* 2.3 does not require any jumpers on the controller or any special DEBUG patches to the boot module, and it has a version of *Life* that you can actually play instead of just watching.

Changing Levels

Is there a quick fix to get DynaCalc *to run on the CoCo 3? It's a great program, but it hangs up when I try to run it on my CoCo 3.*

Al Bilinski
Selkirk, Manitoba

Rx If you have the OS-9 version, copy it over to an OS-9 Level II disk. The OS-9 Level I boot that came with the program is not CoCo 3-compatible.

For a quicker response, your questions may also be submitted through RAINBOW's CoCo SIG on Delphi. From the CoCo SIG> prompt, pick Rainbow Magazine Services, then, at the RAINBOW> prompt, type ASK for "Ask the Experts" to arrive at the EXPERTS> prompt, where you can select the "Doctor ASCII" online form which has complete instructions.

New commands, virus demonstrations and more on Delphi

What's Goin' On?

By Don Hutchison
Rainbow CoCo SIG
Database Manager

For the last few weeks, we've been really active on the Delphi SIGs, and many things have been happening online. We've changed some commands, developed a virus (don't worry, it's not contagious), and added a Delphi terminal program. Let me give you a few details.

New Database Commands

The UPLOAD and DOWNLOAD commands have been changed. These commands formerly applied only to text files, but now you can choose from several file transfer methods, which work with both text files and other kinds of files. Use the UPLOAD command to upload a file and the DOWNLOAD command to download a file. If you want to use a method of file transfer different from the one you usually use, you can type UPLOAD MENU or DOWNLOAD MENU. You can also use one of the commands not visible on the Workspace menu.

UPLOAD and DOWNLOAD display menus of file transfer protocols. To upload or download the way these commands used to work, select Buffer Capture as your protocol. You can make this file transfer method a permanent selection by following the instructions shown after completing a successful transfer. Once you have done that, type UPLOAD MENU or DOWNLOAD MENU if you want to change your mind. For a brief explanation of other file transfer protocols available, type OTHER at the WS> prompt.

Uploading Files to the CoCo SIG

Uploading to the database of a SIG consists of a two-step process: First upload the file to your workspace, then submit the file to the staff of a given SIG for publication. You can reach your workspace from the CoCo Sig> prompt or from within the database by typing WO. You can reach it from any SIG on Delphi. Once in your workspace, tell Delphi you want to upload a file using the Xmodem, Ymodem or Kermit protocol. (Naturally, your terminal program must also support the file transfer protocol you use.)

To upload using Xmodem, type XUP; to use Ymodem, type YUP. Use KUP for a Kermit upload or KERMIT to invoke the Kermit server. Using HELP and the question mark (?), you can find more information about this. You can also set up your default settings to a specific file transfer protocol and modify other file transfer parameters. You will be prompted by Delphi for a filename, and you'll be asked whether or not the file is a text file. If you are uploading BASIC programs to Delphi, please make sure you have already saved them to tape or disk in ASCII format in this manner:

```
(C)SAVE "filename",A
```

After you answer the prompted questions, Delphi will tell you to begin sending your file, and it will wait for your upload. Initiate the file transfer sequence (which will be found in the instructions for the terminal program you're using). You can upload as many files as you like by following this procedure repeatedly.

When all the files you want to submit are in your workspace, you are ready to submit the file or files to the SIG. To do this, you must be in that SIG. From your workspace or from the DBASES> prompt, enter the SUBMIT command. You'll be asked for the number of files in the group you want to publish. Identify the number. Delphi has a tree-structured database, where sets of files (e.g., programs and documentation)

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Database Report

The holiday rush is over and the New Year is off to a great start. We've gained many new CoCo users because of gifts, and the uploading activity has been great on Delphi. Let's look at what's new on the Rainbow SIGs.

OS-9 Online

In the General topic of the database, **Paul Ward** (PKW) sent us the start of a new OS-9 "buglist." **Jay Truesdale** (JAYTRUESDALE) uploaded a text file describing a new bus-based system from Frank Hogg Laboratories, and **Keith Alphonso** (ALPHASOFT) posted a text file containing various notes about BBS operation. Finally, **Mike Stute** (GRIDBUG) sent us some notes on computer viruses.

The Applications topic brings us **Chris Burke** (COCOXT), who uploaded a fix for auto-linefeed printers under the *RSB* operating system. **John Barrett** (JBARRETT) sent us a program for designing highway curve layouts, and **Don Thrash** (DONTHRASH) posted his DS.INIT.MAKER file.

In the Utilities topic, **Warren Moore** (WJMOORE) uploaded a utility to strip leading/trailing spaces from a text file and a utility to strip any column range from a printer. While **John Beveridge** (JOHNTORONTO) sent us a program to help keep disks virus-free, **Greg Jandl**

can be grouped together.

Once this is finished, you'll be prompted for a description of the file's or files' purpose. (A note of the filenames should be in your Workspace when you upload them.) You must specify an extension for all files submitted to the CoCo SIG. Just as CoCo Disk BASIC uses filenames and extensions, so does Delphi. You will now be prompted for other information as the procedure continues. You'll be asked for the name of each file and the name you want them to bear when seen by the public. After the submission process is over, the files will appear as a group in a place visible to the SIG staff, who will review them and then make them visible to the public. Delphi will also thank you for your submission. During the submission process, you will be asked if you want to have the file in your workspace deleted. I suggest you answer no until the submission is complete and published — then delete the files from your workspace. If you are interrupted for any reason and bounced offline, the submission process will be terminated, and you'll have to upload the files that have been deleted again. (Call waiting is a common example of such an interruption.)

Please do not submit files to the SIG that you also intend to submit to RAINBOW for possible publication. Once a program is published online, it can't be accepted by THE RAINBOW. The single exception here would be CoCo Gallery pictures.

Naturally, programs and material that have a copyright can be published online only with the owner's permission. *MikeyTerm* is an example of such a program that is available on Delphi with the author's permission. However, a program such as *V-Term* would not be acceptable online because it has a copyright and is distributed commercially.

More About Viruses

Delphi CoCo SIG members are developing our own, special virus online. This is something new and interesting to many users because the CoCo's ROM-based operating system is more virus-proof than other systems.

However, **Steve Bjork** (6809ER) reports that while "a true virus cannot be placed in a ROM system, you can have a virus that replicates itself from disk to disk." Steve also mentioned that he's writing a demonstration program, which will enter the CoCo's system inside a program and hide until a write is done to the directory track. At that point, it will reformat Track 17 to put another virus on the disk that automatically introduces a new virus into the system any time the user enters the DIR command or loads a file. Naturally, Steve's code is intended only for demonstration purposes and will not cause any damage or disruption to a user's system. Further, Steve comments, "Because of the way the new virus is placed on Track 17, you can make a backup without spreading it. In other words, you can cure a virus-infected disk by making a backup of it."

All of us on the CoCo SIG are looking forward to seeing Steve's demonstration program. (Interested users may follow the thread starting with Forum Message #46032 for further details and more specific information.) This demonstration could help us learn more about protecting ourselves from viruses. Thanks, Steve.

In spite of intense media attention,

viruses are still very rare. However, viral-protection programs may also serve as disaster-prevention programs. In other words, they might keep you from accidently reformatting a disk. They might also protect you from a program with a conventional bug or from some hardware glitch fouling up your file-allocation table. This side benefit could be more important than the intended purpose of vaccine programs.

DelphiTerm Now Available

Rick Adams (RICKADAMS) has released *DelphiTerm*. Previously called *RickeyTerm*, this data communications package runs on the Tandy Color Computer 3. You need a Color Computer 3, disk drive and modem to run *DelphiTerm*. A printer, a Deluxe RS-232 Pak and a color monitor would be very useful, but are not essential.

Users of *RickeyTerm* will note that *DelphiTerm*'s new features include automatic log-on to Delphi, Ymodem downloading and printer support for RS-232 pack owners. *DelphiTerm* and its supporting files are available for downloading in the Telecommunications topic of the database.

I hope you'll join us in the fun and excitement online on Delphi, and I'll see you next month. □

(DAMIONGREY) posted a directory utility supporting wild cards, and **Zack Sessions** (ZACKSESSIONS) sent a Unix-like word-count utility. **Marc Genois** (MARCGENOIS) sent in a program for loading script files into memory as you do a module.

The Patches topic includes **Mike Sweet** (DODGECOLT), who sent a patch for the Disto hard drive that corrects a bug in the interrupt handling, and **Gary Lynch** (GARYLYNCH), who uploaded a patch for *King's Quest 3* that fixes the monitor bug. In addition, **Dave Archer** (DAVEARCHER) posted his patch for *DynaCalc* to work in a 105-column graphics window, and **Karl Quinn** (QKQ) uploaded a patch for Epson printers using *PhantomGraph*. Finally, **Jim Johnson** (REINDEER) sent in a descriptive text file concerning porting *Multi-Vue* to a hard disk.

In the Telcom topic, **Bill Brady** (OS9UGED) posted WIZZER02.CCB, WPXMOD16.CCB, WIZCONFIG 1.2 and WIZCONFIG 1.2/COCOBIN. These files are for use with *The Wiz*. **Michael Schneider** (MSCHNEIDER) uploaded the *OSTerm* package, and Keith Alphonso uploaded *QuikTerm*.

Graphics & Music has **Steve Clark** (STEVECLARK) uploading a graphics-clock program written in C. **Glen Hathaway** (HATHAWAY) posted two music files for *UltiMuse*, and **Kevin Darling** (KDARLING) uploaded a *MAX9* paint program. While Warren Moore uploaded a program for displaying artifact colors on an RGB monitor, **Mike Knudsen** (RAGTIMER) posted several new files for *UltiMuse* and a documentation file describing how to construct a simple, inexpensive cable to hook your CoCo to a MIDI synthesizer. **Andy Duplay** (KB8BMN) uploaded VEF pictures of the *Mona Lisa* and Samantha Fox.

In the Programmers Den, **Merle Kemmerly** (TOOK3) sent the C source code for a procs-like utility. Zack Sessions posted a Tic-Tac-Toe game, and Mike Stute posted some D&D hints and tips.

CoCo SIG

In the General topic, **Marty Goodman** (MARTYGOODMAN) posted two extensive articles about October's RAINBOWfest. Marty also posted a text file describing the future of the CoCo 3. **Jerome Kalkhof** (GRUMCLUB) posted some further thoughts on the future of the CoCo 3.

I posted the CoCo Gallery pictures for the months of November and December in the CoCo 3 Graphics topic of the database. **John Malon** (JOHNLM) sent us a picture of Madonna and another picture of King Tut in Atari ST format. **Richard Gonzales** (DRIFTY) sent us a digitized picture of Mr. Spock from *Star Trek*, and **Richard Trasborg** (TRAS) posted more famous women as characterized by Mike Trammell. While **John Lancas** (DUSTIN) sent digitized pictures of Marilyn Chambers and *ET*, **Jim Tatarka** (TATARCOCO) sent *The Creature* and *Bambi* (what a combination!). **Howard Rouse** (HOWARDC) sent two pictures drawn using *The Rat*, and **Donald Ricketts** (STEVEPDX) posted a 16-level patch for *MAX-10*'s *PixTran* program.

In Utilities & Applications, **Eric Parish** (ERICPAR) uploaded his *Mandelbrot Numbers* program and an interesting astronomy program. **Ken Halter** (KENHALTER) posted a utility for searching BASIC programs, and **Donald Jereczek** (DONJERE) posted his program for tracking school grades. **Alan DeKok** (ALANDEKOK) sent his fine custom CoCo BASIC programs, and **Roger Carlson** (PERCH) sent us several programs for statistical analysis. Zack Sessions sent us his video library catalog program while **Marc Genois** (MARCGENOIS) sent a spooler program for the CoCo 3.

The Hardware Hacking topic gives us Terry Blackwell posting a collection of software for the Green Mountain Micro EPROM burner, and the Games topic includes Eric Parish posting his Checkers game, and Zack Sessions with a *Star Trek* game for the CoCo 2 and 3.

In the Classic Graphics topic, **Steven Imlay** (SIMLAY) uploaded some Atari pictures he had converted into RLE format, and I posted the CoCo Gallery pictures for the months of November and December.

In the Music & Sound topic, **Lester Hands** (LHANDS) provided *CM3Demo*, a demonstration of a MIDI sequencer program soon available commercially. Lester also uploaded *LMRDemo*, a MIDI recorder program. Mike Stute posted his "Classical Breakdown" and "Inside" by Van Halen. **John Sebella** (FORBINI) sent a sample of the music from *Star Trek* and a simple waltz.

The Archives topic presents Polls Manager **Dick White** (DICKWHITE), who published twelve new archived polls from the CoCo SIG's Polls section.

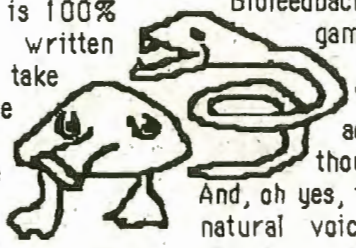
In the Data Communications topic of the database, **Ernest Schwaegerl** (PENROSE) uploaded a set of weather images for use with WEFAX, and **Rick Adams** (RICKADAMS) uploaded *DelphiTerm*, his latest version of the popular *RickeyTerm* program. Watch for new versions as Rick adds special graphics abilities to this version. See you next month.

Dr. Preble's Programs

For Color Computer Software Since 1983

Pyramix

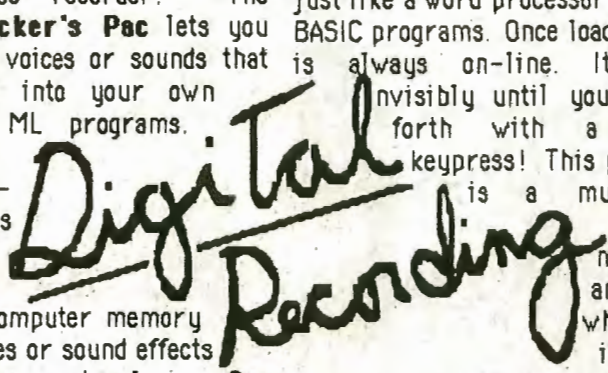
This fascinating CoCo 3 game continues to be one of our best sellers. **Pyramix** is 100% machine language written exclusively to take advantage of all the power in your 128K CoCo 3. The Colors are brilliant, the graphics sharp, the action fast. Written by Jordon Tsvetkoff and a product of **ColorVenture.**



The Freedom Series

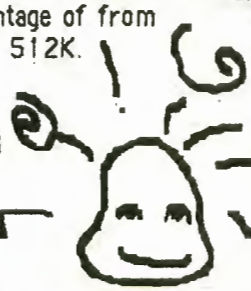
Vocal Freedom

I've got to admit, this is one nifty computer program. **Vocal Freedom** turns your computer into a digital voice recorder. The optional **Hacker's Pac** lets you incorporate voices or sounds that you record into your own BASIC or ML programs. This is not a synthesizer. Sounds are digitized directly into computer memory so that voices or sound effects sound very natural. One "off-the-shelf" application for Vocal Freedom is an automatic message minder. Record a message for your family into memory. Set Vocal Freedom on automatic. When Vocal Freedom "hears" any noise in the room, it plays the pre-recorded message! Disk operations are supported. VF also tests memory to take advantage of from 64K up to a full 512K. Requires low cost amplifier (RS cat. #277-1008) and any microphone.



Mental Freedom

Would your friends be impressed if your computer could read their minds? **Mental Freedom** uses the techniques of Biofeedback to control video game action on the screen. Telekinesis? Yes, you control the action with your thoughts and emotions. And, oh yes, it talks in a perfectly natural voice without using a speech synthesizer! Requires Radio Shack's low cost Biofeedback monitor, Cat. #63-675.



BASIC Freedom

Do you ever type in BASIC programs, manually? If you do, you know it can be a real chore. **Basic Freedom** changes all that. It gives you a full screen editor just like a word processor, but for BASIC programs. Once loaded in, it is always on-line. It hides invisibly until you call it forth with a single keypress! This program is a must for programmers or anyone who types in programs. By Chris Babcock and a product of **ColorVenture.**

Lightning Series

These three utilities give real power to your CoCo 3.

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This is the best Ramdisk available. It lets you have up to 4 mechanical disk drives and 2 Ram drives on-line and is fully compatible with our printer spooler below

Printer Lightning

Load it and forget it--except for the versatility it gives you. Never wait for your printer again! Printer runs at high speed while you continue to work at the keyboard!

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This utility requires 512K. Reads your master disk once and then makes superfast multiple disk backups on all your dirves! No need to format blank disks first! Supports 35, 40 or 80 track drives.

COCO Braille

Produce standard grade 2 Braille on a **Brother** daisy wheel printer. Easy to use for sighted or blind user. No knowledge of Braille is necessary. Call for free sample.

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Ram Disk Lightning, Disk	$19.95
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Backup Lightning, Disk	$19.95
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CoCo 2 or 3 only

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VDOS, The Undisk, ramdisk for the CoCo 1 or 2 only, Tape	$24.95
VDUMP, backup Undisk files to single tape file, Tape	$14.95
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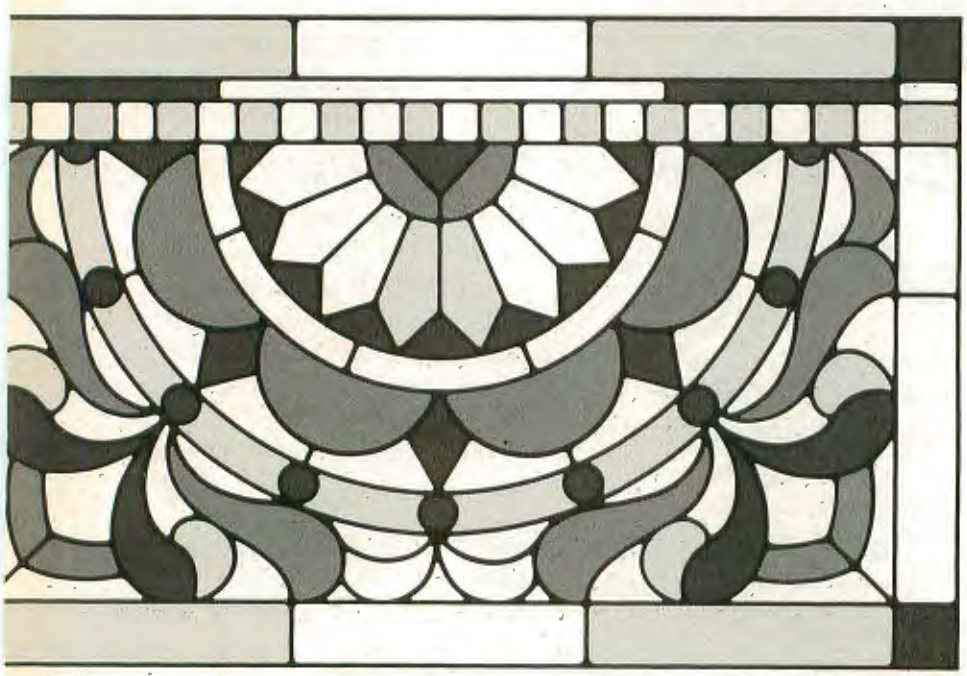
Add a point-and-click interface, complete with windows and pull-down menus, to your BASIC programs

CoCo Does Windows and a Whole Lot More

By Tony Zamora

Recently commercial programs such as *CoCo Max*, *Lyra* and *Multi-Vue* have introduced the CoCo Community to the power of pull-down menus, pop-up windows and a point-and-click user interface. However, we have had no easy way to incorporate these features into a BASIC program. *CoCo Desktop* is a set of routines for the CoCo 3 allowing you to add the power of a point-and-click interface, complete with windows and pull-down menus, to your own BASIC programs.



Tony Zamora is currently a computer science major at Rose-Hulman Institute of Technology. When he's not programming, Tony enjoys reading, music and distance running.

Just Point and Click

A point-and-click interface allows users to work the way they think. Instead of remembering long commands or cryptic control codes, users use a mouse (or joystick) to move a cursor around the screen. When they want to do something, they point the cursor at an object on the screen and press the mouse button.

When *CoCo Desktop* is run, a list of menus appears at the top of a high-resolution graphics screen. You will see a small, arrow-shaped cursor on the screen. With the mouse plugged into the right-joystick port, move this cursor onto one of the menu titles and press the mouse button. A list of menu choices will pop up, and you will be able to select one of the items by moving the arrow up and down the menu. When you select an item, it is highlighted in reverse video. To choose the highlighted option, release the button. If you release the button when no option is highlighted, no selection is made.

Menus Made Easy

It is easy to create your own menus. All you need to do is put the names of the menus and the list of options you want to appear in the menu in DATA statements near the beginning of your program. Put the menu title first, followed by the choices in the order you want them to appear. The list should end with a special choice called END (all uppercase). For example, if you wanted

to create an Option menu containing the choices Send, Receive, Clear Buffer and Baud Rate, you would write a line like the following:

```
100 DATA Options, Send, Receive,
Clear Buffer, Baud Rate, END
```

After the last menu has been put in a DATA statement, you need to denote the end of the menus with another DATA statement containing only END.

You can use two special options when creating menus. The first separates menu choices with a dotted line. To do this, enter a hyphen as one of your menu options, so it appears between the two choices you want separated. This feature is useful when you want to group a set of choices together or isolate an option. If you want the options Send and Receive grouped together in the menu, the DATA statement appears as follows:

```
100 DATA Options, Send, Receive, -,
Clear Buffer, Baud Rate, END
```

When the Options menu is chosen, a dotted line appears between the options Receive and Clear Buffer. The second feature defines a special menu title that looks like a rainbow. When you use it, place it in the first menu in your DATA statements so it appears at the top left of the menu bar. This menu contains a list of small subroutines, called desk accessories, which perform actions that may be unrelated to the main program. For example, a pop-up calculator or a mini-text editor for making notes would be a useful desk accessory. In order to get the rainbow menu to appear instead of a menu title, put two @ signs in the DATA statements, as is done in the following example:

```
100 DATA @@, Calculator, Note Pad,
Get Info, END
```

Adding Windows and Dialog Boxes

CoCo Desktop has some subroutines that let you use windows anywhere on the screen. The first of these starts at Line 12000. This routine draws a window on the screen. It automatically saves what was on the screen, so you don't have to worry about losing anything. Variables WX and WY tell *CoCo Desktop* where to draw the window. The x coordinate for the top left corner of the window goes in WX(1), and the y coordinate for the top left corner goes in WY(1). The coordinates for the bottom right-hand corner go in variables WX(2) and WY(2). After setting these variables, use a GOSUB 12000 statement to draw the window on the screen. To erase a window and replace the part of the screen it covered, call the subroutine at Line 13000.

A dialog box is similar to a window, but it contains an area in which you can type a response. Usually this kind of window is used to get input from the user. Because there are several different kinds of input (strings, numbers, etc.), *CoCo Desktop* provides a general structure, which can be modified to handle any kind of input. The dialog routine in the program draws a window and an area in which the user can type. It allows a user to enter a string consisting of digits. The part of the program calling this routine converts the string to a number and checks to see if the input is in the desired range. By modifying the

subroutine to accept characters instead of digits, dialog boxes can process string input.

The dialog routine contains some statements that draw a blinking cursor in the area where the user types. There is a provision for checking if the user clicked on buttons marked "OK" and "Cancel." Often people choose a menu option that pops up a dialog box and then decide they did not want to change anything. A Cancel button lets this person abort without any ill effects. The OK button is an alternative to pressing ENTER when finished typing. It can also be used to accept a default value displayed in the dialog box.

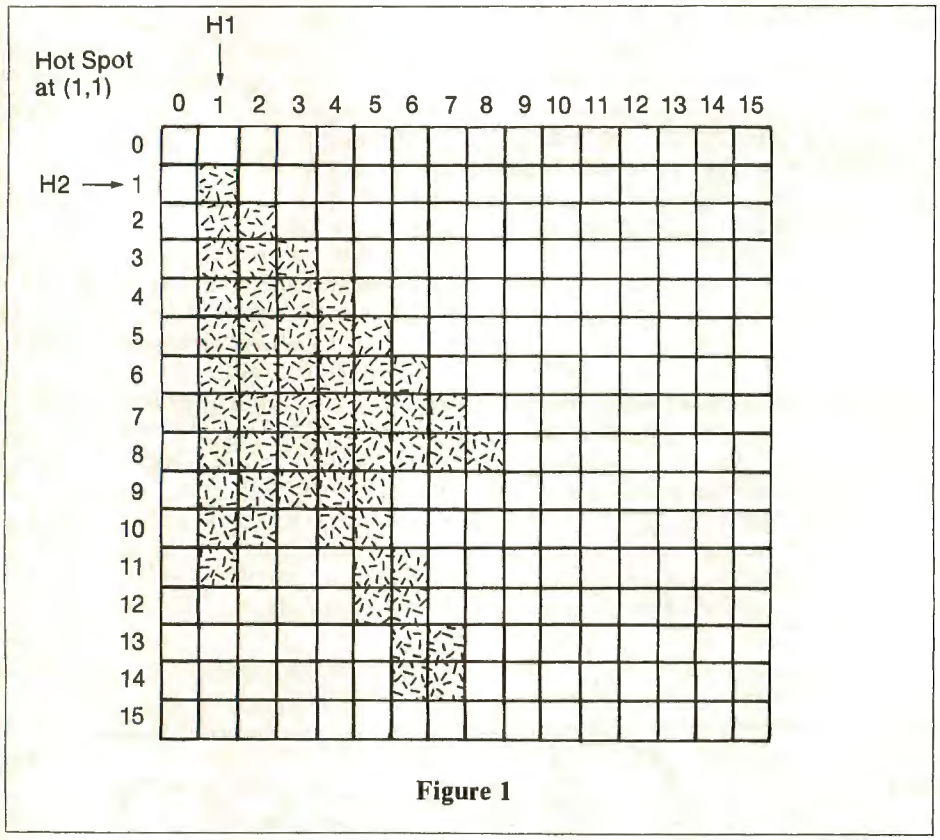


Figure 1

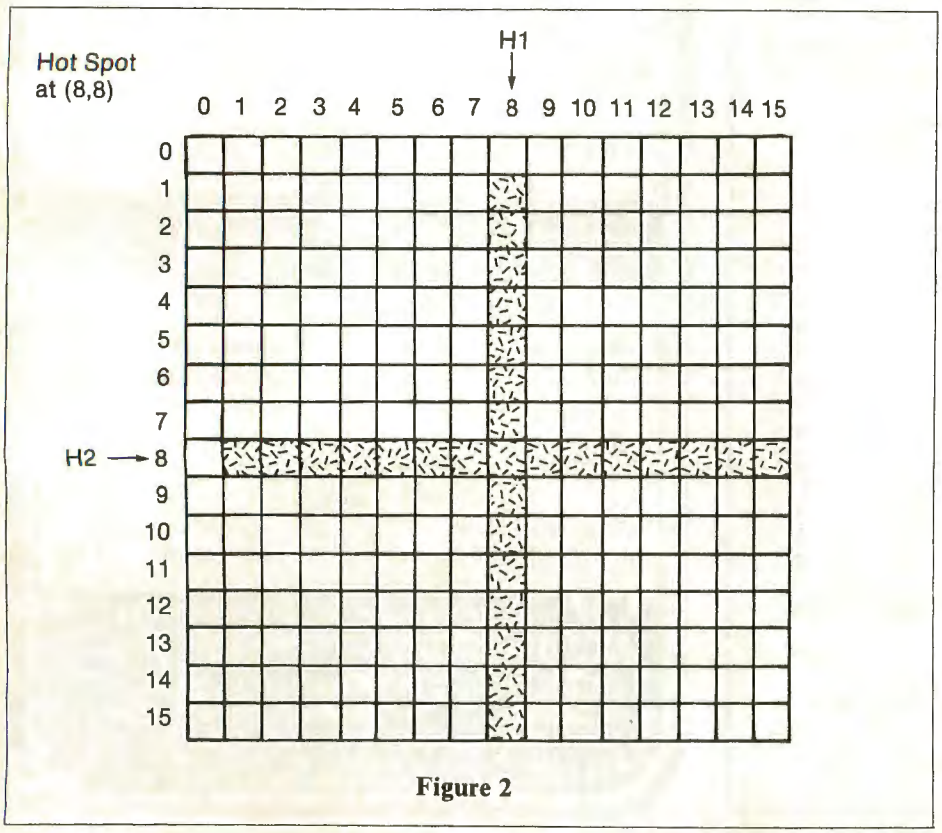


Figure 2

To create a dialog box, draw a window where you want the box to appear. Then you draw the box where the user will type. Do this with the HLINE command with the ,B option. Once everything has been drawn in the window, set variables P, PY and L. P is the horizontal screen coordinate where the user will type; PY is the vertical coordinate; and L is the maximum length of the string the user can enter. Note: P and PY must be between 0 and 79 because they are used in an HPRINT command. Study lines 1000 through 1240 to see an example of the use of the dialog routines.

Moving Around

The workhorse of *CoCo Desktop* is a routine at Line 10000, which checks the mouse and draws the arrow-shaped cursor on the screen. This routine works like BASIC's INKEY$ command. The difference is that instead of getting a key press, the subroutine at Line 10000 gets a mouse event. A mouse event is a signal that the mouse was moved or the user clicked. If the user moved the mouse, the routine moves the cursor to its new position and returns. If the button was pressed, the routine responds by setting variables CX and CY. CX and CY are used to return to the place on the screen where the button was pressed. For example, if the user clicked at screen position (300,45), CX is 300 and CY is 45. If the user moved the mouse but did not click, CX and CY both have the value negative one (-1).

When you click in the menu bar at the top of the screen, a menu pops up, and you can select one of the choices. If you select any of the options, a variable called SELECT is assigned a number based on the order of the choices. For instance, if you choose the first option of the first menu, SELECT will be assigned the number one. If you choose the second option, SELECT will be two. If the first menu contains four options, and you choose the first option in the second menu, SELECT will have the value five. The numbers are assigned in the order in which they appear in the DATA statements. If there is a dotted line in the menu, it does not count as a choice. If the user does not select anything, SELECT will be zero.

When you call Line 10000 in your program and want to respond to the choice made, use an ON SELECT GOTO or ON SELECT GOSUB statement. If SELECT is zero, none of the line numbers in the ON

GOTO statement will be executed, and the program will drop through to the next statement.

Other Features

In some applications, you will need to clear the screen. So you don't have to worry about redrawing the menu titles, Line 14000 contains a routine that clears the screen and redraws the menu bar. Using this routine instead of the CLS command will keep you from having to worry about maintaining the menus.

Once you have created a window, use it for any purpose. Nothing drawn in a window affects any object outside or under the window. When you close the window, everything in the window will be erased, and the screen will appear as it did before the window was opened. However, if you draw outside the window, those changes remain intact even when you close the window. If part of an object is not in the window when the window is closed, only the part of the object in the window will be erased. This also applies to text drawn with the HPRINT command.

Problems can arise when you draw objects on the screen. When a window is opened over the cursor or a shape is drawn on top of the cursor, part of the object or window will be erased when the cursor is moved. This happens because of the way the cursor is displayed. Whenever the cursor is drawn, it saves part of the screen. If you draw on the screen without erasing the cursor, the cursor replaces the portion of the screen it saved, wiping out whatever you just drew. Therefore, erase the cursor before you draw anything, and replace it when you are done. This will prevent the cursor from destroying any of your work. A subroutine at Line 15000 will clear the cursor and replace the area it covered. The routine at Line 16000 redraws the cursor. Using these routines guarantees the screen is redrawn correctly.

The subroutines that draw the cursor use Variable CURSOR$. This variable contains a string used by the DRAW statement to draw the cursor. By creating different strings and assigning them to CURSOR$, you can have several different cursors. A cursor must not be larger than 16-by-16 pixels, and you must define the cursor's *hot spot* (the point of the cursor aligned with the mouse). For example, the hot spot for the arrow cursor is (1,1) near the upper-left corner. If you define a cursor shaped like a cross-hair, the hot spot would probably be (8,8), close to the center of the grid (see Figures 1 and 2). Store the horizontal component of the hot spot in Variable H1 and the vertical component in H2. When creating your own cursors, define the DRAW string so it will start at the hot spot. If you switch between several cursors in the same program, erase the old cursor with the routine at Line 15000 before calling Line 16000 to draw the new cursor.

Special Notes

You need to be careful about using some aspects of *CoCo Desktop*. The program uses the high-speed poke, so if your program does disk I/O, make sure you slow down the CoCo with POKE 65496,0 before each disk access. You can speed it up again with POKE 65497,0 when you are done.

When windows are drawn or menus are popped up, the area of the screen covered is saved in an HGET buffer. Because of this, it is possible to crash the program if menu options are too long or you try to create too-large windows.

If the windows get too large, the buffer will not be big enough to save the

entire area, causing an ?FC (Function Call) Error. One possible solution to this is to reserve larger buffers with the HBUFF command. The commands that allocate the buffers are in Line 50. Buffer 1 is used to store the area under the cursor. Buffers 2, 3 and 4 are used for menus, and Buffer 5 keeps the part of the screen under the windows. The values for these buffers allow moderately large windows and menus. If you use small menus, you may be able to decrease the buffer for menus and increase the buffer for windows.

If you use long menus, you may need to increase the DIM statements in Line 150. Variable MENU$ holds the menu titles. It currently holds 10 menu titles. If you need more than 10, increase the dimension of the array. CHOICE$ keeps the names of the menu options. NU stores the number of the menu, which is returned in SELECT. NU should have the same dimensions as CHOICE$. HEIGHT must be dimensioned to the maximum number of menu choices, and WI and RANGE must have the same dimension as MENU$.

I chose HSCREEN 3 as the graphics mode because it provides high resolution without using a lot of memory. *CoCo Desktop* can be modified to use other graphics modes with more colors. If you make this modification, be careful: The other graphics modes use more memory to provide the extra colors, so you will not have as much memory for windows and menus. If you are using medium-sized windows, this should not be a problem. However, big windows might need more memory, so make sure your windows don't get too big.

If you are using DATA statements in your program, be careful that your data values do not conflict with the values containing the menu options. As long as your DATA statements come after the DATA statements containing the menu choices, there should be no problems. There is only one exception: When you use a RESTORE statement to reread your data, the statement will restore not only your data but also data for the menu items. You will have to use some dummy READ statements to skip the menu choices, so you can read your own data.

Using Variables

In order to minimize conflict between your variables and the variables used by the program, the variables *CoCo Desktop* uses all start with the letters *CD* or the letter *C*, followed by a digit. As long as your program does not use any variables with these names, everything should work fine. However, there are some variables the program uses to communicate with your program that you must avoid as well. These are SELECT, CX, CY, WX, WY, CURSOR$, RAINBOW$, ARROW$, MENU$, CHOICE$, NU, HEIGHT, WI and RANGE. (See Table 1 for an explanation of the variables.) When selecting variable names, remember that only the first two letters of a variable are significant in BASIC.

C1, C2, C3, C4	Loop Variables
C5	Unused
C6	Unused
C7	Current x-position of cursor
C8	Current y-position of cursor
C9	Previous x-position of cursor
C0	Previous y-position of cursor
CD(0)	Counts the number of menu items
CD(1)	Checks if the routine has been entered
CD(2)	Unused
CD(3)	Unused
CD(4)	Loop Variable
CD(5)	Length of the menu option
CD(6)	Left margin of menu
CD(7)	Number of menus
CD(8)	Vertical position of dotted line
CD(9)	Unused
CD(10)	Unused
CD(11)	Scaling factor for menus
CD(12)	Unused
CD(13)	Right margin of menu
CD(14)	The menu that was chosen
CD(15)	Scaling factor for menus
CD(16)	Scaling factor for menus
CD(17)	Scaling factor for menus
CD(18)	Top margin of menu
CD(19)	Number of characters in the menu bar
CD(20)	Loop Variable
CD(21)	Loop Variable
CD(22)	Bottom margin of menu

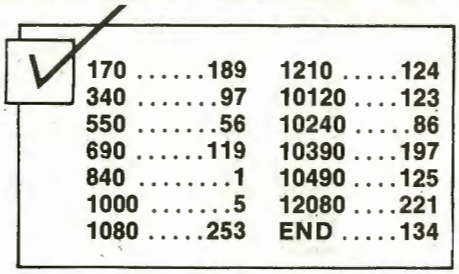
Table 1: Program Variables

Conclusion

The listing includes all the *Desktop* routines and a demonstration program using these routines to create a point-and-click Tic-tac-toe game. The game is for two players and does not recognize wins and losses because the demo program was designed to demonstrate the use of windows and pull-down menus. By studying the program, you will be able to get an idea of how the routines work and how to better use them in your own programs. Experiment with the program and feel free to modify it to suit your particular needs.

The routines in *CoCo Desktop* should let you use menus and windows in your programs with a minimum of problems. There are many ways the program can provide a friendly user interface. These range from painting and drawing programs, to point-and-click spreadsheets, to mouse-driven word processors. If you have a collection of short programs, you can draw icons for each one and have them execute when the user clicks on the icon. This provides a nice alternative to the traditional text menus. Alternate high-resolution fonts for the HPRINT command can add individuality and style to your program. The possibilities are limited only by your imagination. Be creative and have fun.

(Questions or comments about the program may be directed to the author at 5500 Wabash Avenue, Box 568, Terre Haute, IN 47803. Please enclose an SASE when requesting a reply.) □



170	189	1210	124
340	97	10120	123
550	56	10240	86
690	119	10390	197
840	1	10490	125
1000	5	12080	221
1080	253	END	134

The Listing: DESKTOP

```
Ø ' COPYRIGHT 1989  FALSOFT,INC
1Ø POKE&HFØ15,&H21 'MAKE SOLID H
PRINT CHARACTERS
2Ø POKE65497,Ø
3Ø PALETTE Ø,63:PALETTE1,Ø
4Ø PCLEAR1
5Ø HBUFF 1,512:HBUFF 2,2256:HBUF
F3,512:HBUFF4,512:HBUFF5,4Ø96
6Ø HCOLOR1
7Ø HSCREEN3
8Ø POKE&HFF9A,63 'SET BORDER TO
WHITE
9Ø CLEAR 2Ø96
1ØØ DATA @@,About The Desktop,Ge
t Info,Key Caps,Music,END
11Ø DATA File,New Game,-,Quit,EN
D
12Ø DATA Edit,Undo,-,Cut,Copy,Pa
ste,END
13Ø DATA Options,Foreground,Back
ground,END
14Ø DATA END
15Ø DIM CD(22),MENU$(1Ø),CHOICE$
(1Ø,2Ø),NU(1Ø,2Ø),HEIGHT(2Ø),WI(
1Ø),RANGE(1Ø)
16Ø ARROW$="CØD13M+3,-3M+1,+1DM+
1,+1D2R3U2M-1,-1U2M-1,+1U2R4M-9,
-9DC1D1ØM+1,-1U8M+1,+1D6RDRD2RD2
RULU2LU2LU5M+1,+1D3RU2M+1,+1DR"
17Ø RAINBOW$="D3R1U3M+1,-1URDUM+
1,-1R3M+1,-1R7M+1,+1R3M+1,+1DRUD
M+1,+1RD3LU3D3BL3U2LD2U2M-1,-1LU
RLM-1,-1L7M-1,+1LDRLM-1,+1LD2RU2
D2BR3U2RD2U2M+1,-1R3M+1,+1D2RU2"
18Ø CURSOR$=ARROW$:H1=1:H2=1
19Ø CD(1)=1
2ØØ CD(18)=16
21Ø CD(7)=1:CD(Ø)=1
22Ø READ MENU$(CD(7))
23Ø IF MENU$(CD(7))="END" GOTO 3
5Ø
24Ø HEIGHT(CD(7))=1
25Ø WI(CD(7))=Ø
26Ø READ CHOICE$(CD(7),HEIGHT(CD
(7)))
27Ø CD(5)=LEN(CHOICE$(CD(7),HEIG
HT(CD(7))))
28Ø IF CHOICE$(CD(7),HEIGHT(CD(7
)))="END" GOTO 33Ø
29Ø IF CD(5)>WI(CD(7)) THEN WI(C
D(7))=CD(5)
3ØØ IF CHOICE$(CD(7),HEIGHT(CD(7
)))<>"-" THEN NU(CD(7),HEIGHT(CD
(7)))=CD(Ø):CD(Ø)=CD(Ø)+1
31Ø HEIGHT(CD(7))=HEIGHT(CD(7))+
1
32Ø GOTO 26Ø
33Ø CD(7)=CD(7)+1
34Ø GOTO 22Ø
35Ø CD(7)=CD(7)-1:RANGE(Ø)=8
36Ø FOR C1=1 TO CD(7)
37Ø HEIGHT(C1)=HEIGHT(C1)-1
38Ø CD(19)=CD(19)+LEN(MENU$(C1))
+2
39Ø RANGE(C1)=RANGE(C1-1)+(LEN(M
ENU$(C1))+2)*8
4ØØ NEXT
41Ø RANGE(C1)=64Ø
42Ø IF CD(19)>8Ø THEN PRINT"Menu
bar Options Too Long":END
43Ø FOR C1=1 TO CD(7)
44Ø FOR C2=1 TO HEIGHT(C1)
45Ø IF CHOICE$(C1,C2)<>"-" THEN
CHOICE$(C1,C2)=" "+CHOICE$(C1,C2
)+STRING$((WI(C1)-LEN(CHOICE$(C1
,C2)))+1,32)
46Ø NEXT C2
47Ø NEXT C1
48Ø GOSUB 17ØØØ 'DRAW MENUBAR
49Ø ''' END MENU STEUP
5ØØ ''' YOUR PROGRAM STARTS HERE
51Ø DIM GR(2,2)
52Ø TURN$="X":FOR T=Ø TO 2:FOR T
2=Ø TO 2:GR(T,T2)=Ø:NEXT T2,T
53Ø HLINE(2ØØ,75)-(44Ø,75),PSET:
HLINE(2ØØ,115)-(44Ø,115),PSET
54Ø HLINE(28Ø,35)-(28Ø,155),PSET
:HLINE(36Ø,35)-(36Ø,155),PSET
55Ø GOSUB 1ØØØØ
56Ø ON SELECT GOTO 93Ø,7ØØ,79Ø,7
7Ø,9ØØ,99Ø,91Ø,66Ø,66Ø,66Ø,1ØØØ,
1ØØØ
57Ø IF CX<2ØØ OR CX>44Ø OR CY<35
 OR CY>155 GOTO 55Ø
58Ø IF CX=28Ø OR CX=36Ø OR CY=75
 OR CY=115 GOTO 55Ø
59Ø XI=INT((CX-2ØØ)/8Ø):YI=INT((
CY-35)/4Ø)
```

```
6ØØ IF GR(XI,YI) THEN SOUND 55,1
:GOTO 55Ø ELSE GR(XI,YI)=1
61Ø A=XI*8Ø+2ØØ:B=YI*4Ø+35:MOVE=
1:LX=XI:LY=YI
62Ø GOSUB 15ØØØ
63Ø IF TURN$="X" THEN HLINE(A+1Ø
,B+5)-(A+7Ø,B+35),PSET:HLINE(A+1
Ø,B+35)-(A+7Ø,B+5),PSET:TURN$="O
" ELSE HCIRCLE(A+4Ø,B+2Ø),3Ø:TUR
N$="X"
64Ø GOSUB 16ØØØ
65Ø GOTO 55Ø
66Ø WX(1)=2Ø8:WY(1)=7Ø:WX(2)=43Ø
:WY(2)=12Ø:GOSUB 12ØØØ
67Ø GOSUB 15ØØØ:SOUND 55,1:HPRIN
T(29,11),"Sorry, not implemented
":HPRINT(31,12),"Click to contin
ue":GOSUB 16ØØØ
68Ø GOSUB 1ØØØØ:IF CX=-1 AND CY=
-1 AND SELECT=Ø GOTO 68Ø
69Ø GOSUB 13ØØØ:GOTO 56Ø
7ØØ WX(1)=17Ø:WY(1)=7Ø:WX(2)=47Ø
:WY(2)=13Ø:GOSUB 12ØØØ:GOSUB 15Ø
ØØ
71Ø HPRINT(23,1Ø),"The CoCo Desk
top - A programming"
72Ø HPRINT(23,11),"environment w
hich supports Pop-Up"
73Ø HPRINT(23,12),"Windows and P
ull-Down Menus.":HPRINT(23,14),"
Available Memory :":HPRINT(42,14
),MEM:HPRINT(49,14),"Bytes"
74Ø GOSUB 16ØØØ
75Ø GOSUB 1ØØØØ:IF CX=-1 AND CY=
-1 AND SELECT=Ø GOTO 75Ø
76Ø GOSUB 13ØØØ:GOTO 56Ø
77Ø POKE65496,Ø:PLAY"T3L2FL8GB-A
GL4O4CCL8CDO3AB-L4GGL8GB-AGFO4CO
3GAL4F":POKE65497,Ø
78Ø GOTO 55Ø
79Ø WX(1)=7Ø:WY(1)=6Ø:WX(2)=31Ø:
WY(2)=112:GOSUB 12ØØØ:GOSUB 15ØØ
Ø
8ØØ FOR C=65 TO 9Ø:HPRINT(11+C-6
5,9),CHR$(C):NEXT
81Ø FOR C=97 TO 122:HPRINT(11+C-
97,1Ø),CHR$(C):NEXT
82Ø FOR C=33 TO 58:HPRINT(11+C-3
3,11),CHR$(C):NEXT
83Ø FOR C=59 TO 64:HPRINT(11+C-5
9,12),CHR$(C):NEXT
84Ø FOR C=91 TO 96:HPRINT(17+C-9
1,12),CHR$(C):NEXT
85Ø FOR C=123 TO 126:HPRINT(23+C
-123,12),CHR$(C):NEXT
86Ø GOSUB 16ØØØ
87Ø GOSUB 1ØØØØ:IF CX=-1 AND CY=
-1 AND SELECT=Ø GOTO 87Ø
88Ø GOSUB 13ØØØ:GOTO 56Ø
89Ø GOTO 55Ø
9ØØ GOSUB 14ØØØ:GOTO 52Ø 'CLEAR
SCREEN AND REDRAW MENUBAR
91Ø IF MOVE=1 THEN GR(LX,LY)=Ø:M
OVE=Ø:IF TURN$="O" THEN TURN$="X
":HLINE(A+1Ø,B+5)-(A+7Ø,B+35),PR
ESET:HLINE(A+1Ø,B+35)-(A+7Ø,B+5)
,PRESET ELSE TURN$="O":HCIRCLE(A
+4Ø,B+2Ø),3Ø,Ø
92Ø GOTO 55Ø
93Ø WX(1)=228:WY(1)=3Ø:WX(2)=41Ø
:WY(2)=9Ø:GOSUB 12ØØØ
94Ø GOSUB 15ØØØ 'CLEAR CURSOR
95Ø HPRINT(32,5),"The CoCo Deskt
op":HPRINT(33,7),"By Tony Zamora
":HPRINT(33,9),"Copyright 1988"
96Ø GOSUB 16ØØØ 'DRAW CURSOR
97Ø GOSUB 1ØØØØ:IF CX=-1 AND CY=
-1 AND SELECT=Ø GOTO 97Ø
98Ø GOSUB 13ØØØ:GOTO 56Ø
99Ø POKE 65496,Ø:CLS:RGB:END
1ØØØ TEMP=SELECT:WX(1)=144:WY(1)
=16:WX(2)=496:WY(2)=64:GOSUB 12Ø
ØØ:GOSUB 15ØØØ
1Ø1Ø IF TEMP=11 THEN HPRINT(2Ø,3
),"Enter the new foreground colo
r." ELSE HPRINT(2Ø,3),"Enter the
 new background color."
1Ø2Ø HPRINT(53,3),"Cancel":HPRIN
T(55,5),"OK"
1Ø3Ø HCIRCLE(421,25),8,,1,.5,.75
:HLINE(421,21)-(471,21),PSET:HLI
NE(421,34)-(471,34),PSET:HCIRCLE
(421,3Ø),8,,1,.25,.5:HCIRCLE(471
,25),8,,1,.75,Ø:HCIRCLE(471,3Ø),
8,,1,Ø,.25:HLINE(413,26)-(413,29
),PSET:HLINE(479,26)-(479,29),PS
ET
1Ø4Ø HCIRCLE(421,41),8,,1,.5,.75
:HLINE(421,37)-(471,37),PSET:HLI
NE(421,5Ø)-(471,5Ø),PSET:HCIRCLE
(421,46),8,,1,.25,.5:HCIRCLE(471
,41),8,,1,.75,Ø:HCIRCLE(471,46),
8,,1,Ø,.25:HLINE(413,42)-(413,45
),PSET:HLINE(479,42)-(479,45),PS
ET
1Ø5Ø HLINE(157,37)-(352,5Ø),PSET
,B:GOSUB 16ØØØ
1Ø6Ø P=2Ø:PY=5:L=23:GOSUB 111Ø '
INPUT THE COLOR
1Ø7Ø IF ST$<>STRING$(L," ") THEN
 ST=VAL(ST$) ELSE 11ØØ
1Ø8Ø IF ST>63 THEN SOUND 55,1:GO
TO 1Ø6Ø
1Ø9Ø IF TEMP=11 THEN PALETTE 1,S
T ELSE PALETTE Ø,ST:POKE&HFF9A,S
T
11ØØ GOSUB 13ØØØ:IF SELECT=Ø THE
N GOTO 55Ø ELSE GOTO 56Ø
111Ø R=P:ST$=STRING$(L," "):GOSU
B15ØØØ:HPRINT(R,PY),ST$:GOSUB16Ø
ØØ
112Ø GOSUB 1ØØØØ:K$=INKEY$:TR=TI
```

```
MER:IF TR-INT(TR/3)*3=Ø THEN HLI
NE(R*8,PY*8-1)-(R*8+1,PY*8+8),PS
ET,B
113Ø IF SELECT<>Ø THEN ST$=STRIN
G$(L," "):RETURN
114Ø 'CHECK TO SEE IF THEY CHOSE
 "CANCEL" OR "OK"
115Ø IF CX>=421 AND CX<=471 AND
CY>=21 AND CY<=3Ø THEN ST$=STRIN
G$(L," "):RETURN
116Ø IF CX>=421 AND CX<=471 AND
CY>=37 AND CY<=46 THEN RETURN
117Ø HLINE(R*8,PY*8-1)-(R*8+1,PY
*8+8),PRESET,B
118Ø IF K$="" GOTO 112Ø
119Ø IF K$<>CHR$(8) GOTO 122Ø
12ØØ R=R-1:IF R<P THEN R=P
121Ø MID$(ST$,R-P+1,1)=" ":GOSUB
15ØØØ:HPRINT(R,PY)," ":GOSUB16ØØ
Ø:GOTO 112Ø
122Ø IF K$=CHR$(13) THEN RETURN
123Ø IF K$>="Ø" AND K$<="9" THEN
 IF R<L+P THEN MID$(ST$,R-P+1,1)
=K$:GOSUB15ØØØ:HPRINT(R,PY),K$:G
OSUB16ØØØ:R=R+1:IF R>L+P THEN R=
L+P
124Ø GOTO 112Ø
9999 'GET A MOUSE EVENT
1ØØØØ SELECT=Ø
1ØØ1Ø C7=INT(JOYSTK(Ø)*9.9+H1):C
8=INT(JOYSTK(1)*2.783+H2)
1ØØ2Ø IF BUTTON(Ø)<>Ø AND C8<1Ø
AND CD(1)<>1 THEN HPUT(C9-H1,CØ-
H2)-(C9-H1+16,CØ-H2+16),1:GOSUB
1Ø12Ø:CX=-1:CY=-1:RETURN
1ØØ3Ø IF C7=C9 AND C8=CØ GOTO 1Ø
1ØØ
1ØØ4Ø IF CD(1)<>1 THEN HPUT(C9-H
1,CØ-H2)-(C9-H1+16,CØ-H2+16),1
1ØØ5Ø IF C7-H1<Ø THEN C7=H1
1ØØ6Ø IF C8-H2<Ø THEN C8=H2
1ØØ7Ø HGET(C7-H1,C8-H2)-(C7-H1+1
6,C8-H2+16),1
1ØØ8Ø HDRAW "BM"+STR$(C7)+","+ST
R$(C8)+CURSOR$
1ØØ9Ø C9=C7:CØ=C8:CD(1)=Ø
1Ø1ØØ IF BUTTON(Ø)<>Ø AND C8>=1Ø
 THEN CX=C7:CY=C8:RETURN
1Ø11Ø CX=-1:CY=-1:RETURN
1Ø12Ø CD(14)=1:SELECT=Ø:C7=INT(J
OYSTK(Ø)*9.9+H1)
1Ø13Ø IF C7>RANGE(CD(14)) THEN C
D(14)=CD(14)+1:GOTO 1Ø13Ø
1Ø14Ø IF CD(14)>CD(7) GOTO 1Ø53Ø
1Ø15Ø CD(6)=RANGE(CD(14)-1):CD(1
3)=(WI(CD(14))+2)*8+CD(6)-1:CD(2
2)=HEIGHT(CD(14))*8+15
1Ø16Ø HGET(CD(6)-1,11)-(CD(13)+1
,CD(22)+1),2
1Ø17Ø HLINE(CD(6)-1,1Ø)-(CD(13)+
1,CD(22)+1),PSET,B:HGET(CD(6),Ø)
-(RANGE(CD(14))-1,9),3:HPUT(CD(6
),Ø)-(RANGE(CD(14))-1,9),3,PRESE
T
1Ø18Ø HLINE(CD(6)-1,Ø)-(CD(6)-1,
9),PSET
1Ø19Ø HCOLORØ:HLINE(CD(6),11)-(C
D(13),15),PSET,BF:HCOLOR1
1Ø2ØØ HLINE(CD(13)+2,12)-(CD(13)
+2,CD(22)+1),PSET
1Ø21Ø CD(4)=CD(6)/8
1Ø22Ø FOR C3=1 TO HEIGHT(CD(14))
1Ø23Ø IF CHOICE$(CD(14),C3)="-"
THEN HPRINT(CD(4),C3+1),STRING$(
WI(CD(14))+2," "):CD(8)=(C3+1)*8
+3:FOR C4=CD(6) TO CD(13) STEP 2
:HSET(C4,CD(8)):NEXT:GOTO1Ø25Ø
1Ø24Ø HPRINT(CD(4),C3+1),CHOICE$
(CD(14),C3)
1Ø25Ø NEXT
1Ø26Ø GOTO 1Ø43Ø
1Ø27Ø IF BUTTON(Ø)=Ø GOTO 1Ø48Ø
1Ø28Ø C7=INT(JOYSTK(Ø)*9.9+H1):C
8=INT(JOYSTK(1)*2.783+H2)
1Ø29Ø IF C7=C9 AND C8=CØ GOTO 1Ø
27Ø
1Ø3ØØ IF C8<9 AND (C7<RANGE(CD(1
4)-1) OR C7>RANGE(CD(14))) AND C
```

```
7>8 GOTO 1Ø48Ø
1Ø31Ø CD(15)=FIX((C8-8)/8)
1Ø32Ø CD(17)=FIX((CØ-8)/8)
1Ø33Ø CD(16)=CD(15)*8+8
1Ø34Ø CD(11)=CD(17)*8+8
1Ø35Ø HPUT(C9-H1,CØ-H2)-(C9-H1+1
6,CØ-H2+16),1
1Ø36Ø IF C7<CD(6) OR C7>CD(13) O
R C8<CD(18) OR C8>CD(22) GOTO 1Ø
42Ø 'IF C7 IS OUTSIDE, GOTO
1Ø37Ø IF C9<CD(6) OR C9>CD(13) O
R CØ<CD(18) OR CØ>CD(22) THEN IF
 CHOICE$(CD(14),CD(15))<>"-" THE
N HGET(CD(6),CD(16))-(CD(13),CD(
16)+7),4:HPUT(CD(6),CD(16))-(CD(
13),CD(16)+7),4,PRESET:GOTO 1Ø43
Ø ELSE GOTO 1Ø43Ø
1Ø38Ø IF CD(16)=CD(11) GOTO 1Ø43
Ø
1Ø39Ø IF CHOICE$(CD(14),CD(15))=
"-" THEN HGET(CD(6),CD(11))-(CD(
13),CD(11)+7),4:HPUT(CD(6),CD(11
))-(CD(13),CD(11)+7),4,PRESET:GO
TO 1Ø43Ø
1Ø4ØØ IF CHOICE$(CD(14),CD(17))=
"-" THEN HGET(CD(6),CD(16))-(CD(
13),CD(16)+7),4:HPUT(CD(6),CD(16
))-(CD(13),CD(16)+7),4,PRESET:GO
TO 1Ø43Ø
1Ø41Ø HGET(CD(6),CD(11))-(CD(13)
,CD(11)+7),4:HPUT(CD(6),CD(11))-
(CD(13),CD(11)+7),4,PRESET:HGET(
CD(6),CD(16))-(CD(13),CD(16)+7),
4:HPUT(CD(6),CD(16))-(CD(13),CD(
16)+7),4,PRESET:GOTO 1Ø43Ø
1Ø42Ø IF C9>=CD(6) AND C9<=CD(13
) AND CØ>=CD(18) AND CØ<=CD(22)
THEN IF CHOICE$(CD(14),CD(17))<>
"-" THEN HGET(CD(6),CD(11))-(CD(
13),CD(11)+7),4:HPUT(CD(6),CD(11
))-(CD(13),CD(11)+7),4,PRESET
1Ø43Ø IF C7-H1<Ø THEN C7=H1
1Ø44Ø IF C8-H2<Ø THEN C8=H2
1Ø45Ø HGET(C7-H1,C8-H2)-(C7-H1+1
6,C8-H2+16),1
1Ø46Ø HDRAW "BM"+STR$(C7)+","+ST
R$(C8)+CURSOR$
1Ø47Ø C9=C7:CØ=C8:GOTO 1Ø27Ø
1Ø48Ø HPUT(C9-H1,CØ-H2)-(C9-H1+1
6,CØ-H2+16),1
1Ø49Ø HPUT(CD(6)-1,11)-(CD(13)+1
,CD(22)+1),2:HGET(CD(6),Ø)-(RANG
E(CD(14))-1,9),3:HPUT(CD(6),Ø)-(
RANGE(CD(14))-1,9),3,PRESET
1Ø5ØØ HLINE(CD(6)-1,Ø)-(CD(6)-1,
9),PRESET
1Ø51Ø IF C7-H1<Ø THEN C7=H1
1Ø52Ø IF C8-H2<Ø THEN C8=H2
1Ø53Ø HGET(C7-H1,C8-H2)-(C7-H1+1
6,C8-H2+16),1
1Ø54Ø HDRAW "BM"+STR$(C7)+","+ST
R$(C8)+CURSOR$
1Ø55Ø C9=C7:CØ=C8
1Ø56Ø C7=INT(JOYSTK(Ø)*9.9+H1):C
8=INT(JOYSTK(1)*2.783+H2)
1Ø57Ø IF C7>=CD(6) AND C7<=CD(13
) AND C8>=CD(18) AND C8<=CD(22)
THEN SELECT=NU(CD(14),CD(15))
1Ø58Ø RETURN
11999 'POP UP A WINDOW
12ØØØ GOSUB 15ØØØ
12Ø1Ø HGET(WX(1),WY(1))-(WX(2),W
Y(2)),5
12Ø2Ø HLINE(WX(1),WY(1))-(WX(2),
WY(2)),PSET,B
12Ø3Ø HCOLORØ
12Ø4Ø HLINE(WX(1)+1,WY(1)+1)-(WX
(2)-1,WY(2)-1),PSET,BF
12Ø5Ø HCOLOR1
12Ø6Ø HLINE(WX(1)+4,WY(1)+2)-(WX
(2)-4,WY(2)-2),PSET,B
12Ø7Ø HLINE(WX(1)+5,WY(1)+2)-(WX
(1)+5,WY(2)-2),PSET
12Ø8Ø HLINE(WX(2)-5,WY(1)+2)-(WX
(2)-5,WY(2)-2),PSET
12Ø9Ø GOSUB 16ØØØ
121ØØ RETURN
12999 'ERASE THE CURRENT WINDOW
13ØØØ GOSUB15ØØØ:HPUT(WX(1),WY(1
))-(WX(2),WY(2)),5:GOSUB16ØØØ:RE
TURN
13999 'CLEAR THE SCREEN AND REDR
AW THE MENUBAR
14ØØØ HCLS:GOSUB17ØØØ:CD(1)=1:C9
=-1:CØ=-1:RETURN
14999 'ERASE THE CURSOR
15ØØØ HPUT(C9-H1,CØ-H2)-(C9-H1+1
6,CØ-H2+16),1:RETURN
15999 'REDRAW THE CURSOR
16ØØØ HGET(C9-H1,CØ-H2)-(C9-H1+1
6,CØ-H2+16),1
16Ø1Ø HDRAW"BM"+STR$(C9)+","+STR
$(CØ)+CURSOR$
16Ø2Ø RETURN
16999 'DRAW MENUBAR
17ØØØ HLINE(Ø,1Ø)-(639,1Ø),PSET
17Ø1Ø IF MENU$(1)="@@" THEN HDRA
W"BM12,4"+RAINBOW$ ELSE HPRINT(2
,Ø),MENU$(1)
17Ø2Ø C2=2:C1=2
17Ø3Ø C1=C1+LEN(MENU$(C2-1))+2
17Ø4Ø IF C2>CD(7) THEN RETURN
17Ø5Ø HPRINT(C1,Ø),MENU$(C2)
17Ø6Ø C2=C2+1
17Ø7Ø GOTO 17Ø3Ø
```

XTEAM & OS-9

XTERM

OS-9 Communications program

- Menu oriented
- Upload/download Ascii or XMODEM protocol
- Execute OS-9 commands from within XTERM
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- Works with standard serial port, RS232 Pak, or PBJ 2SP Pack, Includes all drivers
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$59.95

ACCOUNTS PAYABLE

Designed for the maintenance of vendor and A/P invoice files. The system prints checks, voids checks, cancels checks, deletes cancelled checks, and deletes paid A/P invoices. The user can run a Vendor List, Vendor Status report, Vendor Aged report, and an A/P Check Register. This package can be used either as a standalone A/P system or can be integrated with the Small Business Accounting Package.

$59.95

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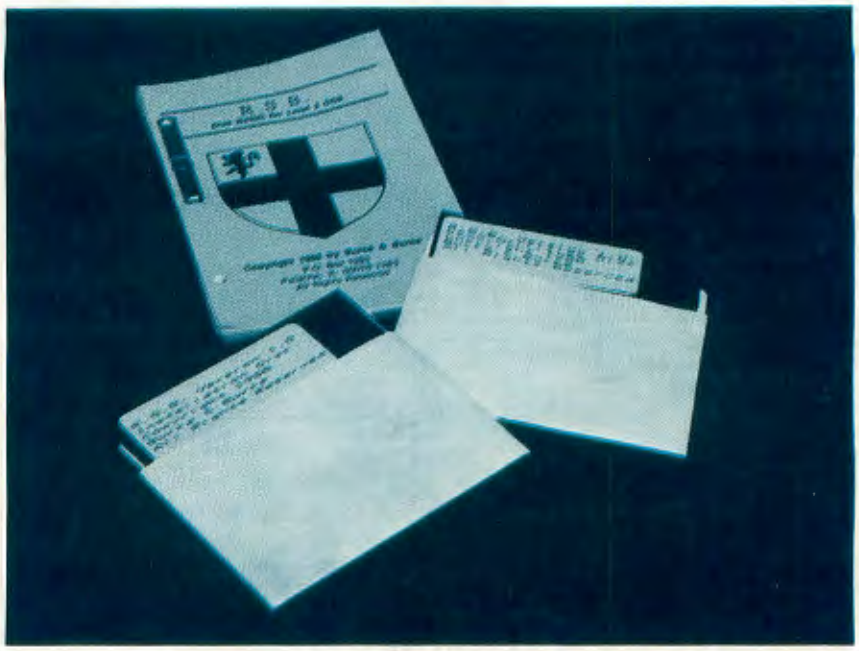


Software CoCo 3 OS-9 Level II

R.S.B.— Real BASIC Under OS-9

You've had your Color Computer 3 for some time now and keep hearing about OS-9. You know that you'll have to try it sooner or later, but you'd rather not just yet —OS-9 sounds so unfriendly. If you could just run all of the programs you've written in BASIC it would make the experience a *lot* easier. But don't you have to learn BASIC09 to write under OS-9? Not anymore, thanks to Burke & Burke.

Now you can run the programs you've written under Disk BASIC and write new ones that take full advantage of OS-9 without having to learn a new language. How is this possible? Burke & Burke have made it easy with the introduction of *R.S.B.*

R.S.B. is an implementation of Disk BASIC under OS-9. To run, it needs a Color Computer 3 (minimum of 128K), a monitor or TV, a disk drive, OS-9 Level II and a floppy controller with one of the following ROMs: Disk Extended Color BASIC 1.0, 1.1, 2.0, 2.1 or Disto CoCo 3 CDOS Disk BASIC. It also supports a printer, multiple floppy drives, hard drives, a mouse and joystick, Speech/Sound Pak or Super Voice, RS-232 Pak, and *Multi-Vue*. It will even work with a cassette recorder. A 512K CoCo is recommended, though, if you really want to take advantage of graphics or run BASIC programs longer than 100 lines.

So how does it work? *R.S.B.* comes with two disks, one labeled Installation Disk and the other Demo/Utilities Disk. After backing up both disks, the user merely inserts the Installation Disk in drive `/d0` and types `install`. Of course, the execution and data directories must have been previously switched to `/d0` with `chd /d0`, `chx /d0`. Also, `Install` must be run from a high-resolution window, not the default VDG screen.

The `Install` program reads the Color Computer's BASIC interpreter from ROM and writes it on the disk. It then modifies certain portions of the program to allow it to run under OS-9. This process uses all of the computer's power and takes about 10 minutes. Once `Install` has been run, *R.S.B.* can be copied into the normal execution directory and run any time.

R.S.B. can be run from the command line in either a VDG or a true window, or it can be executed from the *Multi-Vue* environment by clicking on its icon, which, along with an AIF, is included on the disk. *R.S.B.* can be called with just one parameter,

-g, which tells it not to allocate a VDG graphics screen at startup. Because Lo-Res graphics will still run in a Hi-Res window even if -g is specified, it is a good idea to use it if you don't run *R.S.B.* from a VDG screen. The -g option saves about 6K of RAM. *R.S.B.* can also be called with a program name that it will load and execute automatically.

The documentation is excellent. The first few chapters explain the process of installation and execution. The later chapters and appendices detail the differences between standard Disk BASIC and *R.S.B.* and give instructions on how to use the utilities. The manual also goes into detail about the program's internal operation and memory map.

The program itself starts up with a black-on-green copyright notice followed by the standard Disk BASIC message. Operation from this point on is almost exactly like disk BASIC, except that all commands can be entered in lowercase. This feature is similar to BASIC09, and, as with BASIC09, all keywords entered in lowercase are capitalized, including hexadecimal numbers.

"All of the graphics routines in R.S.B. have been modified to use OS-9's graphics commands."

The Demo/Utilities Disk contains several short demonstration programs in BASIC. All of these worked fine, with one exception — `Joy.bas`. This program constantly calls `JOYSTK(0)`, `JOYSTK(1)`, `JOYSTK(2)` and `JOYSTK(3)` and prints their values onscreen. Those familiar with Extended BASIC know that `JOYSTK(0)` refers to the horizontal axis of the right joystick and `JOYSTK(1)` refers to its vertical axis. This is also what the *R.S.B.* manual indicates. However, it seems that `JOYSTK(0)` returns the vertical position of the left joystick and `JOYSTK(1)` returns its horizontal value. For review I had available Version 1.1. Version 1.2 is out now, and I've been informed that this version fixes the joystick problem.

I tried to run one of my own programs, in which the user flies a helicopter around the screen with the right joystick. After several minutes of frustration, I figured out that if I used the left joystick and pushed left and right in order to go up and down, and up and down in order to go left and right, everything worked fine — almost. The helicopter was one solid color, the color that its windshield should have been, and the animation was incredibly slow, as was the sound. The differing color is explained by the fact that, as the manual states, the way the coordinates are scaled causes the lines in `DRAW` commands not always to meet as expected. This caused my painting of the windscreen to fill the entire helicopter. Also the `HPAINT` command works differently under *R.S.B.* because it uses OS-9's `Fill` command. The slowness of animation and sound is caused by OS-9's multitasking, and thus the computer is constantly interrupting the BASIC program in order to check for other tasks. Chris Burke has corrected this slight bug, also, and posted a fix on Delphi. It is fixed in Version 1.2.

Two years ago, before I had OS-9, I wrote a program to solve *n* equations of *n* unknowns using Gaussian elimination. When I got OS-9, I never bothered to rewrite the program and always ran it from BASIC. Now, I'm happy to say, I can run it from OS-9 and don't have to keep rebooting. In fact, the only programs that I have had trouble running involve graphics. For instance, I have trouble with a

OS-9 for the Common Man

Last year at the Princeton RAINBOWfest, Burke & Burke celebrated one year of providing excellent products for OS-9 and the CoCo. Their first offerings made hard drives affordable, and now their latest product makes OS-9 usable.

What is this product? *R.S.B.*, Disk Extended BASIC for OS-9. Now users can run their old Disk Extended BASIC programs under OS-9 — and write new ones, using all of OS-9's power in the old, familiar language.

Why bring BASIC to OS-9? Chris Burke, *R.S.B.*'s developer, says that OS-9 is important to the survival of the Color Computer, and that if people are going to get the most out of their CoCos, they are going to have to start using OS-9. However, many people don't like OS-9 or are afraid to try it because they think it is so unfriendly. Besides, they've written a lot of neat programs in Disk BASIC. So Chris produced *R.S.B.* to "bridge the gap" between the familiar environment of Disk BASIC and the hostile environment of OS-9.

As interesting as the products Burke & Burke comes out with is Burke & Burke itself — or themselves — Chris, a hardware/software engineer for a major electronics company, and Trisha, a flight attendant. Shortly after their marriage two years ago, Trisha says, Chris was looking into adding a hard drive setup to his CoCo. The whole system from Radio Shack would cost about $800, and Chris wondered why he couldn't build an interface for PC-compatible hardware to put together a system more cheaply.

He built it, calling it the CoCo XT Interface. This interface allowed him to assemble a comparable hard drive system for between $400 and $600 — almost half of Radio Shack's price. He realized other people were thinking along the same lines when he saw a question in Marty Goodman's "CoCo Consultations" column asking about the possibilities of interfaces and cheaper PC equipment. This realization sparked the teamup of husband and wife in a venture to market the interface: Trisha, with her business background, would take care of management, and Chris would handle the programming/designing end. Burke & Burke's fledgling product was successful, for it scratched an ever-increasing itch among the CoCo Community. The interface is still available for its original price of $69.95 ($99.95 for a version with a clock).

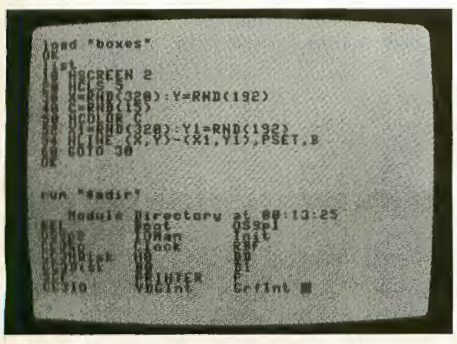
Trisha says the couple works around the clock, getting only five to six hours of sleep at night. "It never ceases to amaze me that he never tires of this," Trisha said of Chris. "He'll spend eight hours at work and come home and work eight hours more. I just cannot keep pace with him." In those midnight vigils Chris and Trisha manage to fill all their orders and plan and develop new products, too. The couple is planning a move from Illinois to Washington state, where they will devote their full time to running Burke & Burke and developing new CoCo products.

What great future products are they currently working on? As far as hardware is concerned, they're designing an IBM bus adapter that will allow CoCo users to plug in expansion cards made for the PC and clones — possibly even graphics cards. In the software area, they are working on a multiuser OS-9 game. They are also considering writing an OS-9 arcade game, and are checking into the possibility of converting one of the current non-OS-9 word processors to OS-9. I think this last project, especially, will fill a real need, and will again make the user's introduction to OS-9 *just* that much easier. □

graphing program I wrote. The problem revolves around a modification I made to the HSCREEN routine so that it doesn't clear the graphics screen. This allows me to graph multiple equations on the same screen. This patch did not work under *R.S.B.*, but the manual gave an equivalent patch. So I changed all of my POKE *x,y* commands to reflect that change in address of the routines, with the result that the INKEY$ function stopped working. This problem is caused by the fact that all of the graphics routines in *R.S.B.* have been modified to use OS-9's graphics commands.

R.S.B. does all of its disk I/O in standard OS-9 format. This means that one can't simply insert a Disk BASIC disk and type LOAD"*filename*". Programs are ported to OS-9 using the utilities that are included on the Demo/Utilities Disk. These are SKITZO, HDIR, HCOPY, HDEL and WIDTH. WIDTH merely changes the window format from 80 to 40 to 32 columns. The other utilities are for file transfers.

The first utility, SKITZO, formats a disk so that the first half is in OS-9 format and the last half is in Disk BASIC format. Once a disk's personality has been split with SKITZO, one merely copies programs onto it from Disk BASIC. SKITZO is amazingly simple to use — just put a newly formatted disk in a drive and type skitzo /d0 or skitzo /d1 (or /d2 or /d3, depending on how many drives you have and which one you put the disk in). When the files to be transferred have been copied onto the disk, and OS-9 has again been booted, you can copy the Disk BASIC files onto the OS-9 half of the disk, or OS-9 files onto the Disk BASIC half with HCOPY. HDIR is used to get a directory of the Disk BASIC portion of the disk, and HDEL is for deleting files from the Disk BASIC half.



SKITZO and WIDTH worked perfectly on my system, but I had to reformat my disk with only 35 tracks for the other three to work. So I could either reformat my disk with only 35 tracks, or I could use a nifty utility that can have several options passed to it on the command line. One of these, -t, is used to set the number of tracks. When I called utilities with -t40, they all worked perfectly. Passing the -? parameter to a utility will give a listing of all the options available with that utility.

I think that *R.S.B.* is an excellent package, and I highly recommend it. It will allow beginners to step easily into OS-9, and let experienced users run the old programs they wrote in Disk BASIC. I hope it will draw many new users to OS-9.

(Burke & Burke, P.O. Box 1283, Palatine, IL 60078, 312-397-2898; $39.95)

—Robert Marsa

Software CoCo 1, 2 & 3

ZoomDump— Versatility at an Attractive Price

Have you ever wanted your dot-matrix printer to print out your CoCo PMODE 3 and PMODE 4 graphics screens at specific sizes? Or have you wished your current screen dump software could do more than simply print out an entire PMODE graphics screen? If you've been yearning for greater control over the way your PMODE graphics are printed on the page, then *ZoomDump* may have the features you've been looking for.

ZoomDump is a machine language program with an easy-to-use BASIC driver. The program comes on disk or tape and prints out PMODE 3 and 4 graphics while you control the printout size and height-to-width ratio. In addition, the program gives you a choice between printing out the full PMODE screen or just a rectangular portion. To run *ZoomDump*, you need any version Extended Color BASIC CoCo, a dot-matrix printer (DMP-105, DMP-106 or compatible) and a disk drive or CoCo-compatible tape recorder. The program is not copy-protected.

I began my evaluation by reading the two pages of documentation that come with the program. On the first page, there are two paragraphs outlining the easiest method for using *ZoomDump* via the BASIC driver, which is a program written in Extended Color BASIC that simplifies entering the printout parameters and running the program. The second page of *ZoomDump*'s documentation contains information covering the use of *ZoomDump* without the BASIC driver. This method lets you pass commands directly to the program's machine language routine using Extended Color BASIC's USR function. While not as convenient to use as the BASIC driver, entering commands in this way allows more control over *ZoomDump*'s operations. It would be interesting to those with some knowledge of machine language procedures.

Running the program from the BASIC driver was simple and straightforward. I began my first screen dump by selecting a PMODE screen graphic from which to work. I chose an image that was drawn on the PMODE 4,1 screen (a 256-by-192 pixel, two-color screen on PMODE pages 1 through 4). The documentation lists a one-line BASIC command sequence that may be typed in, so you can have a look at what's on the current PMODE screen before printing it out. I ran the one-liner, and once I was confident the PMODE image I wanted was in memory, I put the *ZoomDump* disk in Drive 0, typed RUN "Z" and pressed ENTER. The program installed itself quickly and began with a request for the first of 10 options that would determine just what, where and how the screen would be printed.


M. Hawkins T. Harris T. Earles

The available options include the selection of height and width (in inches) of the printed graphic, the graphic's distance from the left margin, and whether all or only a rectangular portion of the screen should be printed. If you decide to print only a portion of the screen, you can select the size and location of the print area at the resolution of a PMODE 4 screen (196-by-255 pixels). With this control, it is easy to select even a small section of the screen and "blow" it up to fill a full sheet of paper.

Once I had answered the prompts and pressed ENTER for the last time, my DMP-105 printer sprang to life. My 4-by-5-inch graphic took about 13 minutes to print at 600 baud. The result was a clean, accurate print of the current PMODE screen in 4-by-5 inches, centered on the paper. Everything was just as I had specified.

Working from the BASIC driver, I explored other options that offered further control over my printout. There is a "Sideways" option with which you may print the screen graphic on its side so that the bottom of the PMODE screen is parallel to the left margin of the paper. While 7.9

inches is the maximum allowable horizontal width, there is no upper limit given on how many pages "long" a print may be. *ZoomDump* had no problem when I gave it a two-page, 7.8-by-18-inch full-screen graphic to print.

The program also had no problem printing sections of screens at the desired proportions and dimensions. It easily printed such extreme proportions as 1-by-7 inches, where images are stretched and squashed to create interesting effects. The best prints came from `PMODE 4` graphics when the foreground was black and the background was white. While `PMODE 3` graphics may also be printed, they come out as they appear on the `PMODE 4` screen — with limited shading values. Blues and yellows and magentas and cyans are indistinguishable on the print.

I was somewhat confused by the behavior of the option that allows switching of the foreground and background colors for a positive or negative print. Selecting negative did not always print a negative of what I saw on the screen, and selecting positive did not always print a positive image of the screen. Due to the different ways in which the video hardware and the printer interpret a bit as output color, an image that "looks negative" on the screen may not necessarily "look negative" on the paper. Usually I kept my eye on the printer to see what was actually printing out so that I could abort the dump if the image was not what I wanted. Because there is no option to stop the program in the middle of a printout, aborting the procedure requires resetting the CoCo 3 by pressing the Reset button.

I was happy to see that the program implemented a one-minute pause every five minutes of continuous printing. This "duty cycle" pause keeps the printer head from becoming too warm and is perfect for the DMP-105. You cannot use the BASIC driver to adjust the duty cycle for other types of printers; however, adjustment is possible by passing variables to *ZoomDump* via Extended Color BASIC's `USR` function.

To run *ZoomDump* using the `USR` function instead of the BASIC driver required a little more work, but the lines of code can be entered as a simple BASIC program and then saved to disk. It is then a simple matter to run the small program as many times as you want with all the printout options already in place. This option kept me from answering all the prompts that come with each run of the BASIC driver.

Overall, *ZoomDump* performed very well for the price, and I can recommend it with enthusiasm to all CoCo users.

(Codis Enterprises, 2301-C Central Drive, Suite 684, Bedford, TX 76021; $14)

—Walter Myers

CoCo 3

Software

GAT Backup— Fast Disk Duplication for the CoCo 3

I have to admit, I like hardware. As soon as I bought my Color Computer 3, I was looking for a 512K upgrade. I run two Tandy 1000 double-sided drives with a popular optional operating system. I've had my RGB monitor for years. And I like programs that use my accessories to their maximum. So when I picked up a certain CoCo 3 512K backup program that would work with up to three 40-track, double-sided drives at the Princeton RAINBOWfest, I was in heaven. This program would duplicate disks at "lightning" speed in a single pass. It ran so fast I couldn't keep up with it.

Let's face it: The typical CoCo 3 disk user has only 128K and usually one drive, which Disk Extended Color BASIC addresses as single-sided, 35-track. Our average user is probably getting a little tired of the archaic BACKUP command, which hasn't changed since the CoCo 1 days. It's slow and takes *seven passes* to copy a disk. In addition, you have to physically swap your original and copy disks at each pass. (I can't remember how many times I've gotten confused and tried to back up the target disk to the source.) To say that this procedure is frustrating would be an understatement.

Enter GSW Software's *GAT Backup*. The company claims its product can back up a 35-track disk in two passes, a section of a disk or only the granules used. A *Gatling gun* for the CoCo 3, the program does all that — and more.

GSW's menu-driven operation allows first-time users to go directly to work. After running the simple BASIC loader, G/BAS, the screen displays an easy-to-read menu:

1) GAT backup
2) Section backup
3) Entire disk backup
4) Directory
5) Format a disk
6) Set number of copies

If you haven't already run DSKINI 0 on your blank disks, you're in luck. Option 5 instructs you to insert the disk to format and press ENTER. Want to make sure there's nothing important on that disk? Option 4 offers information about the disk, calling up a disk directory.

The formatting function is no ball of fire; it's clearly linked to the DSKINI command and is here for your convenience. When you're ready to start the fireworks, press 3 to back up your disk. The program will ask you to enter the source disk and press ENTER. The disk drive then comes to life and the numbers of the tracks and sectors being read into memory flash by on the screen. If there is an error of any kind, the program gives you the option of skipping the affected granule, trying it again, or returning to the main menu to do something else.

After it finishes reading, the computer asks you to replace the source (original) disk with your target (copy). Again the drive spins and the numbers whiz by. The procedure is then repeated to copy the other half of the source to your target. The time and frustration saved on the entire disk backup is worth the $15 price tag alone, but there's more.

With *GAT Backup*, it's possible to copy selected sectors of the disk. Option 2 asks the user to identify the starting track and sector and the ending track and sector. The program then reads the appropriate granules to memory. Although not for the casual user, this function can be very useful for hackers.

While these options are wonderful in themselves, Option 1 is what makes the program shine. It works exactly like Entire Disk Backup, but it ignores blank tracks, copying only the granules actually used. I've never seen anything like it; if you have a regular 67-granule disk (type FREE(0) sometime to find out how many granules you have left) with only 20 or 30 granules in use, why copy the whole thing? *GAT Backup* zips through only the parts of the disk you actually used and ignores the rest. Indeed, the program copied the disk it was supplied on so fast I wasn't sure it worked. The three granules were copied in seconds.

The Set Number of Copies option asks you how many copies you want to make. You'd better have a pile of blanks ready to use; it will read your original and then have you put every copy disk in once for each of the two passes.

The company has even included an "oops" key: If you make a mistake or want to cancel an option before it does its work, pressing the ESC and BREAK keys brings the query, "Do you want to abort to the menu?" The program can also be terminated from the menu with the ESC/BREAK combination. The program will ask if you are ready to exit. If you press Y, the program will execute a warm restart.

Like any other disk backup program, *GAT Backup* cannot and should not be used to copy protected software, nor is it

intended to be used to back up your latest copyrighted games and applications for your friends; but if, like me, you make up a "club disk" for your users group every month, it can be a great time saver.

I can think of one change I'd suggest for this program; I would like the addition of a multiple-drive option because it assumes you just have Drive 0. With two drives, *GAT Backup* would become almost automatic, writing to Drive 1 in record time.

GAT Backup is a well-conceived, finely executed program. It is simple enough for a novice user yet lends flexibility to the seasoned hacker, and it delivers what it promises for a very reasonable price.

(GSW Software, 8345 Glenwood, Overland Park, KS 66212, 913-341-3411; $15; software source, $5: First product review for this company appearing in THE RAINBOW.)

—Fred Toon

Software CoCo 2 & 3

Silpheed— Space-Age Dogfighting

Silpheed is billed by Radio Shack as "The Hit Japanese Arcade Game." Well, after playing it with my 11-year-old daughter, I can see why it's so popular. In *Silpheed* (who comes up with these names?) you are the pilot of a super space-age dogfighter in an intergalactic war to defend the United Universe from an evil empire. If you can survive 16 levels of attack, you get to engage in the ultimate battle for control of the galaxy. Sixteen? We're only up to seven, but we're having a ball trying.

"A lot of programming effort went into creating some neat effects. I like the wobbly movement of my ship when I receive several hits."

Silpheed is supplied on a ROM pack and can be plugged into either the cartridge slot of your computer or into a vacant slot on your Multi-Pak Interface. The program works on both the CoCo 2 and 3, but the graphics are much sharper and detailed with the CoCo 3. The graphics and sound effects were excellent on my CoCo 3 and CM-8 monitor. Provisions are made to run it on a composite color monitor, as well.

A lot of programming effort went into creating some neat effects. I like the wobbly movement of my ship when I receive several hits. Other handy features include the ability to toggle the sound on or off and to pause the action while you try to collect your wits. The game works OK with the arrow keys, but I recommend a joystick, as the fighter is very responsive to joystick control. The action is very fast and furious. I was impressed with the 3-D-like screen, complete with stars that seem to rush past the spacecraft.

An interesting feature in this game is the ability for players to choose specific armament for their fighter. In addition to the various enemy crafts you will encounter, there are also a number of little square-lettered boxes that you will want to try to collect, although they, too, are quite evasive. Hitting these little blocks results in various features to assist you in battle. Hitting B provides a temporary barrier. The D will destroy all enemies on the present screen. Finding F results in automatic fire. The H key advances your shield, and I provides temporary invincibility. I was constantly seeking the R block, which repaired all my ship's damage. Hitting S will result in a warp-like speed, and W allows you to select your weapons as displayed in an overhead expanded view of your ship. Onscreen scoring is provided, as well as other game data and screens survived.

Silpheed is a fun-packed arcade game.

It's right for all ages of CoCo lovers and is sure to provide hours of entertainment during the long winter nights.

(Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX 76102; $29.95: Available in Radio Shack stores nationwide.)

—Jerry Semones

Software OS-9 levels I & II

L1+L2 Combination Pak—Utilities for OS-9

Today, most computer owners use their machines for application programs — word processors, spreadsheets, databases, etc. However, as good as these applications may be, they are never able to do all things for all people. Enter the world of the utility! Two software packages from D.P. Johnson, *L1* and *L2* (not to be confused with the OS-9 levels I and II), provide utilities to do just about everything — if you are willing to spend time reading the manual. I can't emphasize this too much.

An examination of tables 1 and 2, which list all of the utilities contained in the *L1* and *L2* packages, will confirm the above statement on the necessity of reading the manuals. It should also be evident that space does not permit a discussion of all these utilities. For this review I have selected several utilities that should be of interest to beginning and intermediate OS-9 users.

L1 Utility Pak

Of all the utilities contained in this package, `MacGen` is an important one to start off with because it provides you with the capability to build additional utilities from existing ones.

`MacGen` is a command macro generator that will build new commands out of existing executable program modules. Users with a UNIX background will appreciate `MacGen` because it adds capability that is found in the Bourne shell. Among `MacGen`'s many features are shell variables and control structures such as `FOR/NEXT`, `REPEAT/UNTIL`, `IFNUL/ELSE/ENDIF` and a number of other features. In essence, `MacGen` provides an extension to shell programming that allows the development of fairly complex shell scripts without having the user resort to a major programming effort.

The `LS` command is in many respects the heart of the *L1* Pak. In its simplest form it provides a single-column listing of files in the current directory. It supports the standard wildcard characters (* and ?) as well as a character range (all the files whose names begin with the letters A to G, for example). `LS` can also list files based on ownership, date and attribute. For date, `LS` can select on year, month, day or hour, etc. The output of `LS` is often used in a pipe as a source of data for many of the other utilities.

`CP` copies files from the default working directory to the destination path. This is a multiple-file copying utility; Tandy's is a single-file copying command. Options include the following: the ability to update a file if its modification date is older than the file being copied; straight replacement of an existing file; and the options to ignore filenames not found (great for poor typists who have just typed a long list of filenames).

The combination of the `LS` command with the `CP` command provides tremendous file manipulation capability. For example, the command

```
LS | cp -u /h0/archive
```

copies all of the files in the current directory to the archive directory on the hard disk. Should any of the files already exist in the archive directory, they will be up-

Access used within a macro to determine if a pathname exists.
AFMT assembly source code formatter.
Append copies a source file to the end of an existing file.
Bell sounds the bell.
Buf reads the standard input until an eof or the buffer is full; then writes to standard output.
Confirm writes a text message to standard output and waits for a key to be pressed.
CP copies files from standard working directory to destination pathname.
DisInp disassembles file listed from standard input to standard output.
DL reads a list of names from standard input that are assumed to be files in the current directory, and deletes them.
Eat reads lines of text from standard input and deletes the first n characters from each line.
FF sends a form feed to the printer.
Filter copies standard input to standard output, removing all occurrences of a specified character.
FixCRC updates the CRC value of a memory-resident module.
FList reads a list of filenames and lists each file to standard output.
Fold reads lines of characters from standard input and moves n characters at the beginning of the line to the end of the line.
ForceError causes an error number to be returned to the shell. Useful in macros for flow control.
GRep reads lines of characters from a file and passes only those lines that meet the specified match criteria to a standard output.
Info for a given file, displays the owner, creation date, modification date, attributes and byte count.
ListTFDS lists the 256-byte file descriptor.
LS lists filenames, one name per line to standard output.
MacGen command macro generator that allows the building of new commands from existing commands.
Mecho a multi-line echo command that allows listing what would normally be several lines of input on one command line. Mecho translates the tilde character to a carriage return.
MemList provides a listing of memory in unformatted binary.
MemLoad reads standard input into memory beginning at the specified absolute memory address.
ModBuster breaks a file containing several modules into separate files.
MV moves a file from one directory to another without physically moving the file, i.e., copying.
NullDevice contains driver and descriptor to implement a null device or "bit bucket."
Pag formats standard input as to top, bottom, left and right margins and sends to output.
Rep provides the capability to make any OS-9 command repetitive.
ResMem reserves an area of memory for special use.
ReWrite writes standard input to specified pathnames at a specified offset. Provides ability to overwrite a file.
SectEdit a menu-driven sector edchanges
Sell changes ownership of a file.
SetAt changes attributes of a file while preserving currently set values.
Size reports size of specified file.
Sort a filter that sorts filenames.
Split splits a file into multiple files according to a specified number of lines or bytes.
Touch changes the modification of filenames specified on standard input.
Unload repeatedly unlinks memory-resident modules until their memory is freed.

Table 1: *L1* Utility Pak

dated. In another example using wildcards, all C source files could be copied to the archive with the following:

```
LS *.c | cp -u /h0/archive
```

As a final example, the following command line will copy all files created with today's modification date:

```
LS -t | cp /h0/archive
```

MV is another useful utility. MV moves files in the current data directory to the specified directory. Using the -i option, MV will ignore existing files in the specified directory that have the same name as those being moved. This command comes to be quite useful, especially after you have just copied 20 files to the wrong directory! The following example illustrates the use of LS and Sort with MV:

```
LS | sort |mv /d1/cmds.sorted
```

In this example, LS will list all files in the current directory, Sort will sort them alphabetically, and MV will move the filenames in the sorted order to the /d1/CMDS.SORTED directory. It is important to note that MV does not physically move the files but merely updates the appropriate directory.

The Rep command is a way of making any OS-9 command repetitive. This is a much-needed feature that, unfortunately, Microware left out of OS-9. The following example best illustrates the use of Rep:

```
LS | REP ident $
```

In this example, Rep repetitively runs the Ident command for each filename passed to it by the LS command. The $ tells Rep to read one line from the standard input and insert the text at that point.

GRep provides the capability to extract lines of data from a text file according to a specified matching criteria. The wildcards * and ? are supported. In addition,

OS9P3 a module that provides the "Print Error" function to Level II, an English translation of the OS-9 error number.
RAMDisk the modules C and Cache provide the capability to create a RAM disk for any memory size.
Clone provides multiple links to the same file so that duplicate copies do not have to be maintained in separate directories.
DPRM provides a Hex memory dump of a process ID's memory to standard output.
Dump produces a formatted Hex/ASCII dump of a file to standard output.
DumpMem dumps memory to standard output.
DumpPR dumps a process descriptor to standard output.
FLS reduced version of LS from the *L1* package.
GrabMap dumps system memory block map to standard output.
ImageCopy duplicates partially full diskettes.
ImageSave stores partially full diskettes.
MakeRRMod generates the data module used by the Print Error function.
MSave copies the list of memory modules to standard output.
OS9Genz an improved OS9Gen command.
Remove deletes cloned file directory entries.
WhoAmI prints your user ID number on the terminal.

Table 2: L2 Utility Pak

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MULTI-LABEL III (CoCo III only) See July '87 review. An easy to use, versatile label creating program including many new CoCo III features. Print multiple fonts on each label! This one's a MUST for the CoCo III!! Disk $16.95

FKEYS III (CoCo I/II/III) See April '87 review. A user friendly, programmable function key utility that creates up to 20 function keys. EDITOR, DOS mods, Single or Double sided, 35/40 tracks, DISABLE, and it's EPROMable!. Disk .. $19.95

SIXDRIVE (CoCo I/II/III) This machine language utility modifies DECB 1.0, 1.1, FKEYS III, or ADOS to allow the use of 3 double-sided drives (or 2 D/S drives and **J&R's RAMDISKS**) as 6 S/S drives. Disk $16.95

AUTO DIM (CoCo III only) See Jan. '88 review. This hardware device protects your monitor, or TV from IMAGE BURN after a few minutes of inactivity from your keyboard. Illustrated and easy to install. Hardware $29.95

MPI-CoCo Locking Plate (CoCo III only) See Sept '88 review. Protects your CoCo III and Multi Pak Interface from destroying each other! Please specify MPI number 26-3024 or 26-3124 when ordering! SALE $7.95

NEW **Warrior King** (CoCo III only) Become Rastann, Warrior King, on the quest to regain his rightful crown hidden deep within a sinister land. Battle monsters, gain magic & weapons, and travel thru harsh wilderness & dark castle dungeons in this medieval realm. From the creator of Kung-Fu Dude comes this awesome arcade game for the CoCo III! Uses the most detailed 320 x 200 16 color graphics & high speed ML code to vault you into a world of fantasy! Dare ye challange the many perils ahead to become Warrior King? Requires 128k CoCo III, Disk drive, and Joystick $29.95

HALL OF THE KING TRILOGY (CoCo I/II/III) See December 1988 Rainbow review. The epic adventure is back! The largest adventure campaign ever seen for the CoCo is again available. A total of 6 DISK SIDES of intense graphics adventure will have you playing for weeks! Each section is a 2 disk stand alone adventure, but all 3 together form an epic saga! Quest for the legendary Earthstone in the ancient dwelling of the dwarves while you enjoy the classic graphics that made this trilogy famous! Each adventure can be purchased separately for only $29.95, the lowest price ever, or you can SAVE and purchase the entire set for only $74.95. Requires 64k, Disk drive, (and composite monitor for the CoCo III). Please specify HALL of the King I, II, or III ..... $29.95 each or the entire 6 DISK Trilogy for only $74.95

In Quest of the Star Lord (CoCo III only) See Aug '88 review. This is **THE** graphics adventure for the CoCo III! Unparalleled 320 x 200 animated graphics will leave you gasping for more! You quest for the Phoenix Crossbow in this post-holocaust world of science and fantasy. Full **4 Disk sides** of mind-numbing adventure! Requires 128k CoCo III and Disk drive. **HINT SHEET** ..... $3.95 (+ $1.00 S&H by itself) Disk $34.95

KUNG-FU DUDE (CoCo I/II/III) See Feb. '88 review. An exciting arcade game. The **BEST** karate game ever for the CoCo! Destroy opponents and evade obstacles as you grow ever closer to your ultimate objective! Spectacular graphics, sound effects, and animation! Requires 64k, Disk drive, and Joystick. Now displays color on CM8. Disk $24.95

PYRAMIX (CoCo III only) See Dec. '87 review. Brilliant colors, sharp graphics, and hot action in this 100% ML arcade game. You'll enjoy hopping Kubix around the pyramid, avoiding Kaderf, Smack, Smuck, & the Death Square! Disk .. $19.95

NEW **AD&D Character's Companion** (CoCo I/II/III) This great timesaving utility helps create compatible AD&D characters. Includes dice rolling routine, pick ability, race & class. Buy from the Players Handbook, magic items & spell materials. Save, load, and print character info. 3 Disk sides $24.95

White Fire of Eternity (CoCo I/II/III) See Dec '86 review. Enter the era of monsters & magic. Search for the legendary power of White Fire throughout the Forbidden Wood & Dark Caverns in this 64k animated adventure! Disk..$19.95

Champion (CoCo I/II/III) See May '87 review. Become a superhero in this action adventure! Disk..$19.95

Dragon Blade (CoCo I/II/III) See Nov '86 review. Slay evil dragon in this 64k animated adventure! Disk..$19.95

GRep can select from either the beginning or the end of a line according to the specified search pattern. GRep could actually be used as a very simple database — for keeping lists of phone numbers, for example. This command would find the phone number for Smith in the file phone.list:

```
GRep ^Smith phone.list
```

L2 Pak

In addition to the utilities listed in Table 2, the *L2* package contains two modules that can be added to OS9Boot —OS9P3 and a RAM disk. In the original OS-9 Level I system, as delivered by Tandy, there was a "print error" command that caused OS-9 to print an English message whenever an error occurred. This capability was never included in Level II; however, with the OS9P3 module and the associated print error command, Johnson has restored this capability. But this version allows the user to turn this capability on or off, something the original Level I version did not. Of course, the addition of this capability requires the generation of a new Boot, which for many can be a trying experience.

The modules Cache and C provide the capability for a RAM disk. To set up a RAM disk, these two modules must be added to OS9Boot. Once the new boot is made, the RAM disk can be established by simply entering the OS-9 command Iniz /C. A very nice feature of this RAM disk is that it is adjustable. Using the provided CSize command, you can change the size or the name of the RAM disk before it is Iniz'd. Some users may prefer /R0 or /M0 instead of the default /C, or a different size from the default 96K. Another advantage of Johnson's RAM disk is that it can be removed with the Amputate command, returning the memory to the free system memory pool. To my knowledge, this capability is not possible with Tandy's RAM disk that is included in the *Development* package.

The utilities Clone and Remove are particularly worth noting, especially for users with hard disks. As an example, I currently have three execution directories on my hard disk: /h0/CMDS, /h0/APPL and /h0/ETC. While these directories are useful for organizing all of my programs, there are times when I am in one directory and need something from another. Clone makes a new directory entry for a file that's in another directory.

Well, this review has grown quite long, and as I said in the beginning, it is impossible to discuss all the utilities provided in these two software packages. So, look over the two tables for the contents of both packages. Many of you have probably recognized a number of similar utilities available on Delphi or from the OS-9 Users Group. The advantage of buying Johnson's software packages is that they are supported with very good documentation. And they *work*, which is something you can't always say for the public domain counterparts. As many of you know, D.P. Johnson is the author of *SDisk* and has a reputation for excellent software.

One really nice feature of Johnson's software is the way he packages it. The disk is contained in a sealed envelope, while the documentation is "available" to allow the purchaser to read everything about the software. If you decide that the package is not for you, you can return it and obtain a full refund (as long as you don't open the envelope!). To me this is an excellent way of selling software — it protects the author from piracy and gives the purchaser the opportunity to get a good view of the package before deciding to accept it. I wish that all software companies would adopt this approach, as we would all be better off for it.

For those just starting OS-9, as well as for the more advanced user, I strongly recommend buying *L1* and *L2*. This is good software, with very good documentation, and is a must for any serious OS-9 user.

(D.P. Johnson, 7655 Cedarcrest St., Portland, OR 97223, 503-244-8152; $49.95 for *L1 Utility Pak*, $39.95 for *L2 Utility Pak*, $75 for *L1+L2 Utility Pak*)

—Donald Dollberg

CoCo 3

Software

Football II— Running in the End Zone

Football II is a one-player football simulation for the CoCo 3. Unlike most other football games that give you just a blimp's view — that of looking down on the field — *Football II* gives two views. The left half of the screen is at ground level, letting you see the game from a player's viewpoint. The right half of the screen is from high in the end zone.

The first thing to do is draft the teams. You can either choose your opponent's team or let the computer pick its own. You then decide which team you want to coach; every team has its strengths and weaknesses. There are 20 different teams to pick from. Next you get to decide whether you want a game with 15-minute quarters or short 7 1/2-minute quarters. (If you choose the 15-minute quarters, you are allotted 30 seconds to make a play selection. If you choose the shorter quarters, you have 15 seconds to make your plays.) Once the preliminaries are decided, it's time to play ball!

The computer always starts the game by kicking off. This is the only break you can count on the computer giving. From then on, it is unmerciful. After you have returned the kickoff, you choose from eight offensive formations. You can run almost any play you can think of from these eight basic formations. Just remember the 15- or 30-second play selection time.

The referees also give no breaks. They will deal out "delay of game" penalties all day. The onscreen scoreboard gives indications of the plays. It shows the penalties along with other good and bad announcements — "Punt in the Air," "Ball Is Snapped," "Completed Pass," etc. So there are many things to do and watch out for, so many things going on at the same time. You can watch the left half of the screen as the defense smothers you. You could really use an extra pair of eyes in order to track all that is going on. It's going to take some long hours with a joystick in hand to master this one.

Football II requires a CoCo 3 and a joystick, a TV or a monitor. However, I found the detail on the TV not very sharp at all, and this makes the game even more difficult to follow. It is hard enough with a monitor on which you can see everything going on. For a TV, I would have rather had just the overhead view increased in detail. So, I highly recommend running the game with a monitor, not a TV. Overall, I find the game very challenging.

(Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX 76102; $29.95: Available in Radio Shack stores nationwide.)

—Dale Shell

Yahtzzz and *Quantum**Leap*— Take-Offs on Dice Games

I was pleasantly surprised when I came home from work and found a package from RAINBOW waiting on the table — *Yahtzzz* and *Quantum**Leap* from JR & JR Softstuff. I sat down in front of the CoCo, poked a disk in the drive and made the recommended backups. Yes, that's right, these programs are not copy-protected, and the publishers recommend making backups. In fact, the original diskettes come with write-protect tabs already in place, to prevent accidents. And since both programs maintain a high-score log on the program disk, they *must* be backed up before playing.

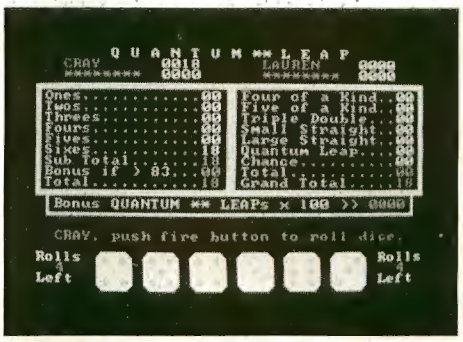
Yahtzzz, as you might have guessed from the title, is a clone of a popular dice game. *Yahtzzz* requires a 32K CoCo 1, 2 or 3. A score sheet is placed on the screen, along with five dice. The keyboard or joystick is used to roll, to discard dice and to pick the scoring box to enter the result in. Almost everyone has played this type of game at some time, in some incarnation. *Yahtzzz* is programmed in BASIC, with some machine language routines.

*Quantum**Leap* is a somewhat similar dice game for the CoCo 3. It uses the 16-color screen, mixing text and graphics with lots of colors. On startup, you are asked if you are using an RGB or a composite monitor, and then you are thrust into the game. Once in, there is no way out without either playing a complete game or pressing the reset button.

The biggest difference between *Quantum**Leap* and *Yahtzzz*, though, is that *Quantum**Leap* is played not with five dice, but with six! As you can imagine, this changes the strategy of play more than a little...but lest things get *too* impossible, you are allowed four rolls instead of three to try to accomplish your scores. Scores are much higher, and some of the rolls are *much* more difficult.

Since *Quantum**Leap* is strictly for the CoCo 3, I ran it first. I quickly discovered that something in the machine language of the game conflicts with modifications I routinely load into Disk BASIC when I start up my CoCo. However, when I rebooted and ran the program from unmodified Disk BASIC 2.1, everything worked OK.

The game is fun, interesting and much fresher than I would have expected from yet another *Yahtzee* clone. The six dice make more difference than I would have credited at first glance. On completion of a game, the score is automatically entered in the "Top Ten" and saved to disk.



Eyestrain might get to you unless you try the RGB color set; it is much more readable on my monitor. The only other difficulty with *Quantum**Leap* arose when I left it for my wife to play with during the day. I came home to discover she had been unable to get the program to load. There was a minor error in the instructions, telling users to `LOADM"QUANTUM**LEAP"`

— a command any seasoned hacker would have instantly recognized as erroneous, but which could trip up beginners.

When I ran *Yahtzzz*, I tried it both on the CoCo 3 and on my backup machine, a CoCo 2B. I found, first, that CoCo 3 users who have RGB analog monitors will see this game in black-and-white because it uses the artifact color set. This will not affect play of the game, however, because all text and graphics are in black and buff, and will display adequately regardless of display options.

The second thing I found was that the program would crash immediately on finishing the first game whenever I ran it on the CoCo 2, but would change to high speed at the same point when running on the CoCo 3. When I listed the BASIC portion of the program, I found what I had suspected: `POKE 65497`, a CoCo 3 high-speed poke. This is an easy error to make when developing programs on a CoCo 3 to be run on an older CoCo, since the old poke to 65495 will not work on the CoCo 3. Furthermore, the user is not even prompted for use of the high-speed poke, even though many of the older CoCos will lock up when it is used. Fortunately, anyone who is aware of this situation can fix the problem very easily by removing the offending pokes wherever they appear, because the BASIC portion of *Yahtzzz* is not listing-hidden.

Also, *Yahtzzz* turned out to be incompatible with my modified BASIC, but that was no real surprise — the modifications I installed use practically every byte of memory not used by the BASIC interpreter itself. When I rebooted, I found that *Yahtzzz*, too, was stable and bug-free, both with keyboard and with joystick, when running under both Disk BASIC 2.1 and 1.1, aside from the already mentioned high-speed problem. [JR & JR Softstuff has reported that these bugs have been fixed in a corrected version.]

With *Quantum**Leap* priced at $19.95, and *Yahtzzz* at $12.95, neither game is priced too high for the entertainment delivered. The first time I loaded the games, I found myself playing for nearly four hours, just trying to get the Quantum Leap — six of a kind. While I have seen a five-dice game in the public domain, the graphics and sound are nothing to compare with *Yahtzzz*, and I have never seen a six-dice game from any source.

(JR & JR Softstuff, P.O. Box 118, Lompoc, CA 93438, 805-735-3889; $19.95 for *QuantumLeap*, $12.95 for *Yahtzzz*, $3 for S/H)**

—Don Qualls

Hardware

Disto Assortment— A Smorgasbord of Products

Our friends at CRC/Disto have released a variety of hardware products for the CoCo. Included in this group are Super Controllers I and II, the RS-232 Super Pack, the RS-232 Switcher, and an RGB-Mono Video and Audio Interface. All of these products are worth considering if you are in the market for hardware additions for your CoCo.

"The RGB-Mono Video and Audio Interface is a fine product and provides much better video resolution on a composite monochrome monitor than is available through the composite jack on the back of the CoCo 3."

Super Controller I: a floppy disk controller that employs the latest state-of-the-art technology and is compatible with all versions of the Color Computer. It is housed in a rugged metal case, utilizes gold-plated contacts and the Western Digital WD1773. It contains four 28-pin sockets, which can be fitted with either 2764 or 27128 EPROMs, and comes with C-DOS installed. Each socket is software-selectable with a simple `POKE 65345,`*x* (where *x* is a number between zero and three).

There are no adjustments to be made, so nothing needs to be calibrated to maintain reliable operation. The Super Controller I also incorporates a mini-expansion bus connector that lets you add other Disto products (i.e., a real-time clock calendar, a hard disk adapter, an EPROM programmer and other user-oriented projects). As an option, you can add a parallel printer port that can be used with a Centronics-compatible printer under OS-9. The controller operates at 16 MHz, so it's fast. It needs only +5 VDC, which it picks up from your CoCo's expansion slot or Multi-Pak Interface. Because it doesn't need the 12 volts used on the older CoCo disk controllers, it doesn't draw as much current.

Although the Super Controller I is memory-mapped to be compatible with the Radio Shack controller, it has differences that accommodate the extra features. The controller's 10-page instruction booklet shows the memory map and SCS select pin. The I/O select is mapped at $FF40 (65344) to $FF5F (65376).

Each of the four available sockets is made to use either an 8K EPROM, like a 2764, or a 16K EPROM 27128. If you use the high-speed poke, the maximum access time for the EPROM is 300ns; otherwise, a 450ns EPROM will work. Each of the sockets will access either 8K or 16K, depending on whether an 8K or a 16K EPROM is used. The memory map of this area is from $C000 (49152) to $FEFF (65279) for a 16K EPROM and $C000 (49152) to $DFFF (57343) for an 8K EPROM. Since all four sockets are mapped to the same area, only one chip can be active at any time. The active-chip byte determines this. Any socket and DOS can be selected at any time even from within your BASIC or machine language program. Although specific instructions are provided on how to do this, I prefer to boot up a specific DOS from a warm start.

The Super Controller I is a fine product and will provide even the most demanding CoCo user with fast and reliable disk operation. It sells for $99.95.

Super Controller II: This controller is similar to the Super Controller I but contains only one 24- or 28-pin socket for an 8K ROM or EPROM or for 16K EPROMs. It too incorporates an internal mini-expansion bus for any of the available Disto add-ons. The big difference, however, is that under OS-9 this controller uses a buffered read/write scheme to allow read/write I/O without halting the computer's CPU. This translates into *speed* as well as continual use of the CoCo keyboard — even while the disk is reading or writing. It also means that the system clock will no longer lose time during these read/write operations. The controller is completely interrupt-driven to allow fast, smooth multitasking operations — something some PC compatibles can't do.

The Super Controller II is the best choice

if you are into OS-9 programming. It sells for $130.

RS-232 Super Pack: This is Disto's answer to the Tandy Deluxe RS-232 Pak. It is housed in a black plastic case only about half the size of the older Tandy product but containing no software. I tried the Disto Super Pack with *MikeyTerm*, *Greg-E-Term* and *RickeyTerm* and was very impressed with its operation. It requires the use of a Multi-Pak and provides a true RS-232 serial port.

Although I did not try it with OS-9, Disto claims its Super Pack is compatible with OS-9 ACIA software. It comes ready to go and includes a DB-25 cable. My only complaint is that the supplied cable is about 8 inches long. I'd like to see it about 3 feet long, so it could be plugged right into my modem without requiring an extender cable.

The RS-232 Super Pack sells for $49.95.

RS-232 Switcher: This handy gadget is a must if you use a serial printer along with a modem or other serial device. It's housed in an attractive off-white case to match the color of the CoCo 2 and 3. A three-position rotary switch is used to select any one of three serial devices. Four 3-foot cables are routed out the back of the switcher, and each is terminated with the appropriate DIN connector. One of the cables has a male DIN connector that plugs into the back of your CoCo serial port. The other three cables have a female DIN connector, so your serial-to-parallel adapter can be hooked up. The box measures 4.5 inches long, 2.5 inches deep and 1.25 inches high. The RS-232 Switcher sells for $19.95.

RGB-Mono Video and Audio Interface: This product is made just for the CoCo 3 and lets you use a composite monochrome monitor with that Color Computer. What's different here is that while you can hook a composite monochrome monitor directly to the back of the CoCo 3, the computer puts out a color signal. Although this is satisfactory, it is not as good as what you can get using this gadget. This interface plugs into the 10-pin RGB socket on the bottom of the CoCo 3 and provides exceptionally crisp, clear text or graphics.

In addition, this interface has a built-in speaker and volume control, so you can obtain sound at the same time. Although the results are worth the effort, you do have to open your CoCo 3 case to add this interface. If you are concerned about this, it may be best to wait until your warranty has expired and then get a friend with technical experience to help out. A little red clip has to be connected to a diode inside the computer. The directions are quite clear, and I had no trouble making this solderless connection. The interface itself is 4 1/2-inches long, 2 1/2-inches wide and 1 1/2-inches high, and it sits outside the computer. Three cables come out of one side of the off-white plastic case. While the one with the red clip is about 2-feet long, the one that plugs into your monitor's composite video jack is almost 6-feet long and has a standard RCA plug on the end. The last of the three is a 2-foot, 10-conductor ribbon cable, which plugs into the RGB connector on the bottom of your CoCo 3. After it's all hooked up, there's plenty of cable length to allow you to put the interface in a convenient spot near your computer.

The RGB-Mono Video and Audio Interface is a fine product and provides much better video resolution on a composite monochrome monitor than is available through the composite jack on the back of the CoCo 3. It sells for $29.95.

All of these Disto products performed as advertised and were well documented. The quality is first class, and I see no

indication of shortcuts in their design or operation.

(CRC Computers, Inc. 10802 Lajeunesse, Montreal, Quebec Canada, H3L 3E8; 514-383-5293)

—Robert Gray

Software CoCo 3

Leonardo's Paintbox— What Would da Vinci Have Done With a CoCo 3?

Do you hate trying to program Hi-Res graphics in BASIC? I mean, do you really hate spending hours plotting and planning down to the last point to keep the PAINT from going outside the lines? Have you had it with trying to figure out your starting point to make sure the whole picture fits and then finding out it won't? Wouldn't you love to sit down with your joystick, draw the picture and have the BASIC program magically appear on your disk? If you answered "yes" to any of these questions, get ready to open *Leonardo's Paintbox* because — believe it or not — this little program lets you do just that.

Requiring a CoCo 3, 128K and a disk drive, *Paintbox* is accompanied by six unassuming pages of instructions. The recommended drawing tool is a self-centering joystick. The instructions are broken into five parts: Starting the Graphic, Drawing Mode, Painting Mode, Adding Dots of Color and Saving the Graphic.

Starting the Graphic is just that: You center your joystick and then select 16 colors from your palette to use when creating your drawing.

Moving on to Part 2 is really complicated — press the space bar. You are now ready to draw. (Like I said, *really* complicated.) Drawing is accomplished by moving the cursor to the starting position on the screen. To draw, press the red fire button, and you're drawing. To stop drawing, let go of the button. Did someone say you can't use Radio Shack's joysticks for Hi-Res? Wrong! I used not only my standard sticks, but an Atari stick and even a Koala pad — all with good results. You can even draw from the keyboard for point-by-point accuracy. If you do manage to make a mistake, there is an Undo feature to undo your mistake. Finally, a Redraw option lets you redraw the picture from the beginning to repair gaps that may occur if your "undo" line crosses another line.

Let's move on to Part 3, painting. This is the hard part, right? True, it's more difficult than pressing the space bar. Now you must press and hold F1 until the Part 3 title appears. Next, press the space bar, and you're ready to paint. Your palette of 16 colors, located at the bottom of the screen, is ready for you. Use the joystick to select a color and then move the cursor to the area to be painted. Press the firebutton again, and it's painted. What if the paint spills into the next area? No problem. Use Redraw to return to the draw mode and plug the "leak." Now press F1 to return to the Paint mode.

Have you finished painting? Then it's time to learn a new command. Press F2 to leave the Paint mode, and you're ready for Part 4 or 5. If you are satisfied with your picture, you can save it, or you can add texture, shading, highlights and more detail to your graphic by using the dots of color available. Again, simply click onto the color of your choice, using the stick or the keyboard to place dots of color on your graphic. This really gives the graphic some style.

When do we get to the hard part? Hold on, it's coming. To save the graphic, press B. You are now asked for a name for the picture. Type in your selected name and press ENTER. *Paintbox* begins writing the BASIC program — in ASCII format — to your disk.

Now for the hard part.

The instructions ask you to wait while the program is created. I found this to be the hardest part. I hate to wait for anything! The more complex your graphic, the longer this will take. It took about two minutes for the drawing I made. Once the program is created and stored on disk, you'll be asked if you want to run the BASIC program.

If you press Y, the program runs, and your graphic is reproduced from BASIC using PALETTE, HDRAW, HPAINT and HSET commands with variables stored in data statements within the routine, or in a separate data file saved on the disk along with the routine.

Is there anything this program can't do? Unfortunately, yes. There is no easy way to clear the screen and start the drawing over again. To start over, you must reach back to the old reset button and rerun the program. A one- or two-keystroke command, like CTRL-C, to clear the screen would have been a lot more convenient.

Now if — like me — you have no artistic talents, you probably think you can't do anything with *Paintbox* because you can't draw. Wrong again. One of the helpful hints on the last page of the instructions suggests tracing a picture on clear plastic wrap and using it as a guide. I traced a picture from my daughter's coloring book onto a clear plastic sheet, placed it on the monitor screen and used *Paintbox* to trace the tracing. I couldn't believe my eyes. I *can* draw. (Is this fantastic or what?) This is a great program and worth the price.

(E.Z. Friendly, 118 Corlies Ave., Poughkeepsie, NY 12601, 914-485-8150; $26.95 plus $1.50 S/H, introductory price; $29.95 regularly)

—Randy Cassel

Software CoCo 1, 2 & 3

I Ching— The Whims of Fortune

I know, I know. You don't *really* believe in this fortune-telling stuff. You're a cosmopolitan person living in the 20th century. You know where you're going and you don't need anyone or anything to help you solve your problems or tell you where you're headed. You just bought this as a...*party game*. That's it. That's why I asked to review *I Ching*. I enjoy fortune-telling. It's a great ice-breaker — a conversation piece.

Sure it is.

According to an Eastern philosophy, our universe is bipolar (i.e., the universe is composed of opposites — light and dark, life and death, male and female, yin and yang). However, these opposing forces are not constant; the universe changes — night becomes day, and day becomes night again. Followers of this philosophy saw a pattern in these changes. They documented these changes in the *I Ching* — the *Book of Changes*. By asking questions and tossing sticks, which symbolized the opposing forces of yin and yang, these people believed they could predict future events — see the pattern of change in their futures.

The people at Tothian realized that this pattern of change was binary in nature and that it would be simple to emulate this pattern with the Color Computer. With this in mind, they created *I Ching*, which runs on any 32K CoCo (disk or tape). The program offers five different ways to peer into the future (or break the ice at a party), and onscreen instructions make it easy to use. In addition, the program's documentation offers a brief history of the *Book of Changes*. The manual explains the various symbols and how this manner of divination works.

Like any fortune-teller, CoCo cannot gaze into your future without help from you. The program requires user response. You are offered five options for determining the appropriate responses. You may toss coins, use yarrow sticks, shuffle cards, swing a pendulum or use your intuition. In each instance, the program offers detailed instructions to the novice but lets the experienced user avoid the instructions and just enter the appropriate data.

I tried all the available options. I am lazy, so I preferred the simplest option, Option 5, which asks the user to enter six random numbers (from 1 to 100). Option 1, tossing coins, wasn't bad either because I only had to toss three coins six times — no problem, I had that much change in my pocket.

"I asked if I would someday be rich and famous, entering the numbers as requested. The program then computed my hexagram (my present situation) and a second hexagram (my path of change — my future). It concluded with the hexagram representing initial difficulty but ultimate success. (And just think, you'll be able to say you knew me when....)"

Option 3, which uses cards, required that I make four cards before I began, and the pendulum (Option 4) required that I draw a diagram and make a pendulum before I could start the process. Of course, none of these tasks was too difficult for someone who wanted to ponder the secrets of...um, I mean, *review* this program.

However, Option 2 was too time-consuming for me to try more than once. The program asks for 49 yarrow sticks, but it will settle for 49 of something else. I had a roll of pennies to use, so I gave it a try. This process requires an elaborate series of selections. Although the program supplies instructions, you must complete this process of elimination *six* times. OK, maybe I want to know the secrets to the universe, but not *that* much.

Once you have entered all the requested information, the program determines the two hexagrams representing your present and future conditions. For instance, I asked if I would someday be rich and famous, entering the numbers as requested. The program then computed my hexagram (my present situation) and a second hexagram (my path of change — my future). The program responded with the hexagram representing incomplete action (i.e., I haven't started on the path to wealth). It concluded with the hexagram representing initial difficulty but ultimate success. (And just think, you'll be able to say you knew me when....) The program's an-

swers are, of course, rather cryptic, but you can use them to formulate your own theories about the future.

When you have seen the results, you can save the judgment in a file or add it to a previous file. You also have the option to print a copy of the program's prediction. Finally, you can review earlier prophecies and edit them. Yes, that's right. You can change the hexagrams the question originally offered to something you find more suitable. Who says you can't change the future?

(Tothian Software, Inc., Box 663, Rimersburg, PA 16248; $24.95.)

—Beth Haendiges

Hardware CoCo 1, 2 & 3

SolidDrive— Get Six Floppy Drives on a Card

Imagine turning on your CoCo and in less than two seconds — with no disks clattering and rumbling — having 1 megabyte of disk space available, running with sub-second response faster than even a hard drive. Now imagine grabbing a metal cartridge the size of a disk controller and taking it to work with you to use on your OS-9 system at the office.

That's not good enough for you?

OK. Turn on the computer again, but hold down the space bar this time. There you are in Disk BASIC — SolidDrive Version S1.1. Now you have six floppy disks available to you, drives 4 through 9. Go ahead. Run your graphics programs at blistering speed. Edit text faster than you could have imagined. Is this a CoCo? Now take the pack out and go to a friend's house to show him or her your new desktop publishing creation.

Still not good enough?

OK. Let's run a little utility that'll format a megabyte of RAM disk in under 30 seconds. Now let's split it up: three logical drives, say — 4, 5 and 6 — to RS-DOS, and drives 7, 8 and 9 to OS-9. You have Level I at home and Level II at work? No problem. Split it any way you like. Have a separate boot file for each.

This is no fantasy. This is SolidDrive from Vidicom Corporation, a fast-access, high-speed RAM cartridge that can be configured for either half a megabyte or a full megabyte of RAM to emulate either three or six floppy disk drives. It is not an "actual" disk drive but a hardware cartridge that plugs into a Multi-Pak Interface or a Y-cable; it consists of RAM chips and circuitry. There are also several software programs required to make SolidDrive work; also available is an optional EPROM chip for your disk controller to make SolidDrive come to life when you start the computer.

SolidDrive is not a "real" disk drive — it just thinks it is. In actuality it is a bank of RAM chips organized in such a way that they are split up and assigned disk drive numbers, just like real disk drives. With a conventional disk drive (and OS-9 users know this all too well), when you ask the computer to go and get something or to load something or store something, you're in for a wait. Like a tired old janitor, it tells the disk drive to wake up, then goes and seeks (and seeks and seeks) a program or a file, and then loads or saves it, and then unloads what it loaded...you get the picture. Even with a hard drive running at 10 times the speed of a floppy drive, multiple seeks, reads and writes take time.

The RAM chip, however, is online and standing by, as if it were already in memory. If it is not, but needs to be loaded, there is no mechanical or physical process involved: We simply have a circuit-to-circuit transfer that no electro-mechanical process can match, because what you are looking for is already there! It is for this reason that a super-fast RAM cartridge can be called the Jaguar of disk drives. In addition, the SolidDrive has an on-board battery backup, so you won't have to worry about a power failure or accidental power-down. The moment power is removed from the system, SolidDrive write-protects itself, keeping all the data alive and well. Just plug it into a cartridge slot again, and off you go. The battery is good for at least two years, and the unit will shut itself down several days before critical power loss, allowing you time for battery replacement.

SolidDrive can be used for OS-9 and Disk BASIC both. It fills the gap between the hard drive and the floppy, or just boosts your floppy power with more speed and storage. Certainly in terms of users with applications that involve a lot of disk access, like programs that deal with integrated text and graphics. It can really boost productivity with its reliability, speed, storage and portability. OS-9 users who are relying heavily on applications that go through a lot of disk seeks and reads would find this an invaluable tool, and in conjunction with a hard drive, well, it could probably beat the pants off most PCs! If you are an OS-9 power user, this product is most definitely for you.

SolidDrive comes with excellent, well-organized documentation in *extra large print*. It tells you everything you need to know about installing and using SolidDrive, from how to change its memory locations to how to use it in auto-boot mode. It gives you hints on allocating drive space and even troubleshooting. Vidicom Corporation warranties SolidDrive for two years with a limited warranty. You are invited to call the company if trouble arises that you cannot handle. A word of caution to the curious: Breaking the case seal will void the warranty!

Inexperienced users should be careful when allocating which logical disk drives are to be used for Disk BASIC and which for OS-9 if you intend to use both operating systems. There is a utility included with SolidDrive called `SMap`, but as is the case with all utilities, one must know how to use it properly! It is possible to confuse the software in such a way that you would need to reformat SolidDrive. Careful planning will avoid this risk.

For those users who want SolidDrive available the moment they turn the CoCo on, there is an optional EPROM for $19 that can be purchased from Vidicom. You can also load the software drivers from disk, but this will not give you instant access to SolidDrive. Be sure to specify either the 24- or 28-pin EPROM when ordering. I highly recommend the EPROM. If you are investing in the SolidDrive, the EPROM is a must.

I think this is an outstanding product. I received my unit with physical damage in evidence (probably from dropping or banging), but when I plugged it in it worked flawlessly and has continued to do so ever since. This is one tough, reliable unit, and it is a must for serious users. For those who cannot or do not want to make the investment in a full megabyte of memory, the unit can be later upgraded at the factory. When you consider the cost of the equivalent hard drive or multiple floppy disk drives, this is an excellent value for the money. The service available when problems arise is excellent. I had a damaged disk and a wrecked EPROM, along with the damaged unit when it arrived; after a quick, courteous and helpful phone conversation with the owner of Vidicom, I received replacement equipment the next day, and it functioned flawlessly. This company and its products are a model for the entire CoCo Community. On a scale of 1 to 10, this product rates a 10.

(Vidicom Corporation, 20 E. Main St., Suite 710, Mesa, AZ 85201, 602-827-0107; $395 for 512K version, $695 for 1-Meg version, $4 S/H)

—Jeffrey S. Parker

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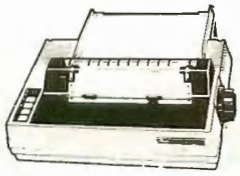

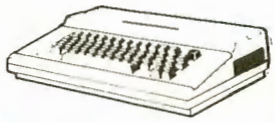

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Received and Certified

The following products have recently been received by THE RAINBOW, examined by our magazine staff and issued the Rainbow Seal of Certification, your assurance that we have seen the product and have ascertained that it is what it purports to be.

Black Grid, a computer adaptation of the "Black Box" game in which the computer hides from two to nine blocks inside a black grid. Players must locate them by shooting "rays" into the grid. Three different play modes are available. Requires a CoCo 3 and a disk drive. *SPORTSware, 1251 S. Reynolds Road, Suite 414, Toledo, OH 43615, (419) 389-1515; $21.*

Calendar and Convert, two OS-9 Level II programs on one disk. *Calendar* (32K required) creates an 800-year calendar for the years 1600 through 2400. Printing out selected monthly calendars requires a printer capable of elongated type. *Convert* (24K required) is a utility to convert numbers to and from decimal, binary and hexadecimal. It also converts ASCII characters to decimal, and decimal to ASCII. Both programs create and erase their own overlay windows; they come on a 35-track disk. *Alan Hanusiak, 37 Grand Ave., Rockville, CT 06066, (203) 875-2027; $24.*

CoCo 3 Wheel of Fortune, an upgrade of the CoCo 2 version of the popular TV game show. (The CoCo 2 version is still available.) Requires a CoCo 3 and a disk drive. *SPORTSware, 1251 S. Reynolds Road, Suite 414, Toledo, OH 43615, (419) 389-1515; $21.*

CoCo Stereo Headphone Amplifier, an audio amplifier that plugs into the rear cassette port. It makes game sounds or music audible through one or two headphones that have 1/8-inch stereo plugs (headphones not included). For the CoCo 1, 2 and 3. *Mike Forrest, 2501 Summer Tree Lane, #1096, Arlington, TX 76006, (817) 860-3885; $39.95.*

Disk Handyman, a CoCo 3 disk utility that performs 128/512K backups for one- or two-drive systems, and can perform backups between two Drive 0s using the Multi-Pak Interface. It will also verify a disk, encode the DOS track to auto-start a program, and "lock out" bad granules, permitting use of a disk with errors. *Micro Data Systems, P.O. Box 462, Princeton, KY 42445, (502) 365-0206; $24.95 plus $3 S/H.*

KJV Disk #35: The Book of Acts, the Book of Acts from the King James version of the Bible, in ASCII files. For the CoCo 1, 2 and 3 and a word processor. *BDS Software, P.O. Box 485, Glenview, IL 60025, (312) 998-1656; $3.*

Lyra 2.6, an upgraded version of the menu-driven CoCo music composition program that can work with MIDI. A graphic display allows entry and editing of a music score with up to eight independent parts. Requires any model CoCo that has at least 64K, a disk drive (Disk Extended Color BASIC 1.0, 1.1, 2.0 or 2.1) and a mouse or joystick. Optional equipment includes a MIDI synthesizer and a connecting cable. *Rulaford Research, P.O. Box 143, Imperial Beach, CA 92032, (619) 690-3648; $59.95.*

Nine-Digit Calculator, a BASIC program that emulates a handheld, nine-digit calculator. It uses Reverse Polish Notation, with an entry pad, a six-register stack and 100 memory locations. For the CoCo 1, 2 and 3. *BDS Software, P.O. Box 485, Glenview, IL 60025, (312) 998-1656; $10.*

Omni Utility, a menu-driven disk utility that offers such functions as printing and alphabetizing disk directories, performing backups, editing sectors, and copying, moving, executing, killing and renaming files. For the CoCo 3. *GSW Software, 8345 Glenwood, Overland Park, KS 66212, (913) 341-3411; $20.*

Public Domain's Disk #22, a collection of 32 public domain games, including *Othello, Subchase, Gammon and HogJowl.* Other disks available; send $1 for a catalog. *Public Domain Software Copying Company, 33 Gold St., Suite L-3, New York, NY 10038, (800) 221-7372; $10 plus $4.50 S/H.*

Simply Better, A command-driven CoCo 3 word processor with pop-up windows. Features include onscreen underlining, a window allowing two documents to be open at the same time, index and table of contents creation, macros, sorting, display of five print fonts, forms fill-in, automatic print spooling, a spelling checker, mail merge and more. On the 128K CoCo 3 it provides 90K of text storage; on the 512K it provides 480K. *Simply Better Software, P.O. Box 20726, Portland, OR 97220, (503) 254-7225; $29.95.*

WHEELER.BIN and GAMEGEN.BIN, two machine language programs for lottery players. `WHEELER.BIN` lets users wheel from seven to 19 different numbers for their state's lottery games. `GAMEGEN.BIN` outputs random games. For CoCos 2 and 3, disk drive required, printer optional. *Davisson, 13733 Celestial Road, Poway, CA 92064, (619) 748-7441; $19.50 plus $2.50 S/H.*

Zebra's Picture Disks #2, #3 and #4, a set of disks each containing 120 pictures for use with *CoCo Graphics Designer Plus, CoCo Graphics Designer, CoCo Max, CoCo Max II* and *Max-10.* An instruction manual and 15 custom disk labels are provided. Each disk covers four "topics": Disk 2 — Sports, America, Party and Office; Disk 3 — Animals, Nature, Religion and Travel; Disk 4 covers holidays — Popular, National, Christian and Jewish. Upgrades from earlier picture disks are available for $5 plus $3 S/H and return of the original, serial-numbered disk. *Zebra Systems, Inc., 78-06 Jamaica Ave., Woodhaven, NY 11421, (718) 296-2385; $14.95 each plus $3 S/H.*

First product received from this company

The *Seal of Certification* is open to all manufacturers of products for the Tandy Color Computer, regardless of whether they advertise in THE RAINBOW.

By awarding a *Seal*, the magazine certifies the program does *exist* — that we have examined it and have a sample copy — but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW reviewers for evaluation.

—Lauren Willoughby

Sugar Software

☞ New for 1989 - 30 Brand New Calligrapher Fonts! ☜

Save $10.00 when you order the new Calligrapher Economy Font Package #5, known as the *Typewriter* fonts. The introductory price of **just $19.95** is available through Feb. 28, 1989. Specify RSDOS or OS9.

CALLIGRAPHER

CoCo Calligrapher - Turn your CoCo and dot-matrix printer into a calligrapher's quill. Make beautiful invitations, flyers, certificates, labels and more. Includes 3 fonts: *Gay Nineties, Old English* and *Cartoon*. The letters are ½ inch high and variably spaced. Works with many printers such as Epson, Gemini and Radio Shack. Additional fonts are available (see below). Tape/Disk; **$24.95**.

OS9 Calligrapher - Prints all the same fonts as the CoCo Calligrapher. It reads a standard text file which contains text and formatting codes. You may specify the font to use, change fonts at any time, centering, left, right or full justify, line fill, margin, line width, page size, page break and indentation. Similar to *troff* on UNIX systems. Includes the same 3 fonts and additional fonts are available (see below). Disk only; OS9 Level I or II; **$24.95**.

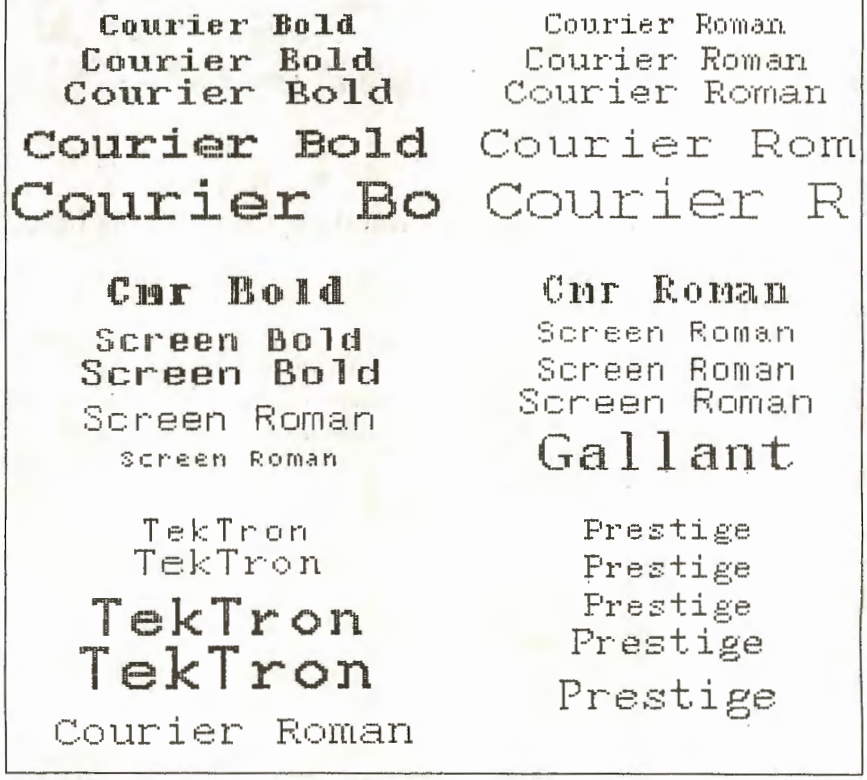
Calligrapher Fonts - Requires Calligrapher above. Each set on tape or disk; specify RSDOS or OS9 version; **$14.95** each. **Set #1** (9 fonts) Reduced and reversed versions of Gay Nineties, Old English and Cartoon; **Set #2** (8 fonts) Old Style and Broadway; **Set #3** (8 fonts) Antique and Business; **Set #4** (8 fonts) Wild West and Checkers; **Set #5** (10 fonts) Stars, Hebrew and Victorian; **Set #6** (8 fonts) Block and Computer; **Set #7** (5 *small* fonts) Roman, Italics, Cubes, Digital and Old World; **Set #10** (8 fonts) several Roman styles; **Set #11** (10 fonts) Gothic and Script; **Set #12** (10 fonts) more Roman and Italic.

Economy Font Packages on disk; specify RSDOS or OS9; **29.95** each or **$59.95** for all three: **Font Pkg #1** - Above font sets 1, 2 and 3 (25 fonts). **Font Pkg #2** - Above font sets 4, 5 and 6 (26 fonts). **Font Pkg #4** (also known as the *Hershey* fonts) - Above font sets 10, 11 and 12 (28 fonts). **Font Pkg #5** - See description to the right.

Calligrapher Combo Package - Includes the Calligrapher and Economy Font Packages #1 and #2, 54 fonts in all; specify RSDOS or OS9; **$69.95.**

New! TYPEWRITER Fonts Now Available For the Calligrapher!

These 30 fonts are known as the *Typewriter* fonts. As displayed below, each set contains several styles of the fonts in different sizes and boldness. These fonts all all fixed width. **Set #13** includes 10 Courier fonts in Roman and Bold. **Set #14** includes 10 CMR, Screen and Gallant fonts. **Set #15** includes 10 TekTron, Prestige and Courier fonts. Each set is **$14.95**. Sets 13, 14 and 15 on one disk make up the **Economy Font Pkg #5**, (30 fonts) for **$29.95**. *See special offer above.*



The OS9 Font Massager - This OS9 utility program allows you to do many things to Calligrapher font files. You may create new fonts, modify existing fonts, invert fonts, compress fonts, double the height and/or width, halve the height and/or width and convert between OS9 and RSDOS formats. **$19.95.**

This is a sample of the dot-matrix printer output from the OS9 Calligrapher set to full-justify the text within a 2.1 inch wide column. The font used is the 11-point Prestige font from the font set #15 or font package #5.

For a complete catalog of Sugar Software products and fonts, send a stamp and a label.

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By Bill Bernico
Rainbow Contributing Editor

The Start of Something Big

Dear Bill:

I have a 128K CoCo 3 and Magnavox 8-CM515 monitor. I'd like to write a slot-machine game, but I'm not quite sure where to start. Any help you can offer would be appreciated.

Harold Tetzlaff
Jasper, Tennessee

Here's a 21-line program (Listing 1) to start you down the path to the programmer's hall of fame. It contains enough information to provide the core of a pretty good slot-machine game. You'll have to spruce up the graphics to make the slot machine *look* like a slot machine. I've also left the scoring and prize-collection routines in your hands. All I want to show you is a way to make the different symbols show up in the three windows.

For my example, I've used plain circles with the numbers one through seven in them. You'll want to substitute pictures of cherries, oranges, lemons, bells, etc. in place of these circles, but the procedure for storing them will be about the same.

First, in Line 10 I've set the screen resolution, cleared it to white and defined my foreground and background colors. Next, in order to store my seven symbols or circles, I have to define their buffers. Since I'm using seven circles (pictures in your case), I have to define buffers one through seven and describe their size. This is done in Line 20. I could have written the following:

```
20 HBUFF 1,300:HBUFF 2,300:HBUFF 3,300 (etc.)
```

However, I decided to save a little space and memory by putting all seven in a loop.

My next step would naturally be to draw each of the seven pictures and then store them in their respective buffers for later use. Again, I could have drawn and painted and stored each one on its own line, but to save space I used a FOR/NEXT loop again. In either case, the steps are as follows: DRAW the object and PAINT it. HGET the area around the object, clear the screen and then move on to the next object.

After you HDRAW and HPAINT the first object, you have to HGET that object and number it like this:

```
HGET (24, 0)-(44,20),1
```

The next object would also go through the HGET routine, but you'd end up that statement with a 2, and so on.

Line 90 draws a simple window for your objects to appear in. You must retrieve your objects from their buffers and position them in those windows. The three windows are filled by lines 100 through 110, 120 through 130 and 140 through 150. The even-numbered lines put the objects in the windows while the odd-numbered lines make the clicking sound and include a GOSUB to the pause routine.

In order to make each object appear at random in a window, you have to use RND(7) after the HPUT command. That will retrieve one of the seven pictures and place it in the window. Line 160 is a counter, which makes the objects shift ten times before the program jumps to Line 200. There, a prompt appears on the screen telling you to press ENTER to simulate pulling the one-armed bandit's lever.

Line 210 pauses, clears the screen and sets the counter (A) to zero before returning to Line 90 to start spinning the windows again.

There's your core, Harold. I'll be looking forward to seeing your completed slot machine in the near future.

Listing 1: SLOTCORE

```
10 HSCREEN2:HCLS4:HCOLOR8,4:RGB
20 FOR B=1 TO 7:HBUFF B, 300:NEXTB
30 FOR C=1 TO 7
40 HCIRCLE (35,11),9
50 HPAINT(35,11),C,B
60 HPRINT(3,1),C
70 HGET(24,0)-(44,20),C
80 HCLS 4:NEXT C
90 HDRAW"BM46,46R90D30L90U30R30N
D30R30D30"
100 HPUT(50,50)-(70,70),RND(7),P
SET
110 EXEC 43345:GOSUB 180
120 HPUT(80,50)-(100,70),RND(7),
PSET
130 EXEC 43345:GOSUB 180
140 HPUT(110,50)-(130,70),RND(7)
,PSET
150 EXEC 43345:GOSUB 180
160 A=A+1: IF A=10 THEN 200
170 GOTO 100
180 Y=RND(40)
190 FOR X=1 TO Y:NEXT X:RETURN
200 HPRINT(3,20),"Hit (ENTER) to
pull lever"
210 EXEC44539:HCLS4:A=0:GOTO90
```

Line Connections

Dear Bill:

For some time I have been trying to teach myself BASIC. *The CoCo 3 manual says the colon (:) may be used in place of a line number as long as the total characters following a line number do not exceed 249. On the basis of this, I have assumed that the converse is true (i.e., a colon may be substituted by a line number). I now find this is not true. In the November '88 issue of* RAINBOW, *Page 168, Listing 1, Line 220, if the colons are replaced by line numbers, the program does not run correctly.*

Can you please tell me under what conditions it is necessary to join two commands by a colon rather than sequential line numbers, or under what conditions you may not replace colons

---

Bill Bernico is the author of over 200 Color Computer programs and is a frequent RAINBOW contributor whose hobbies include golf, writing music and programming. Bill is a drummer in a rock band and lives in Sheboygan, Wisconsin.

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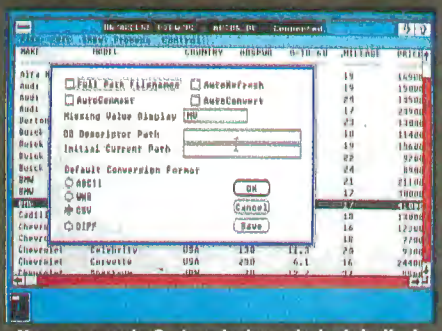

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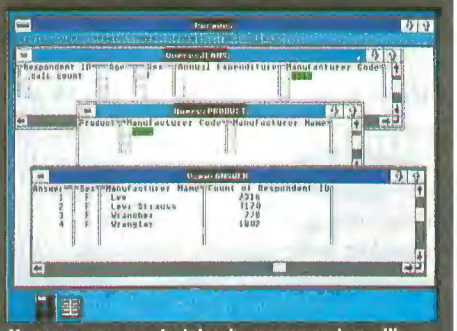

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with line numbers? It seems there is a subtlety of programming in BASIC *that is not explained anywhere I have looked so far.*

J.S. Smith
Ennismore, Ontario

It's nice to see that you don't simply follow the rules without questioning them. If you make a programming mistake and learn from it, it is worth the effort.

As a rule of thumb, you can combine commands on a single line with a colon, provided none of those commands has to work independent of the others. Look at the following example:

```
100 PRINT A$
110 IF B=2 THEN GOTO 350
120 C$=INKEY$:IF C$=""THEN 120
130 X=X+1:GOTO 70
```

In this example, these commands cannot be joined with a colon if you expect the program to branch accordingly. Now look at this modification of our example:

```
100 PRINT A$:IF B=2 THEN GOTO 35
0:C$=INKEY$:IF C$=""THEN 120:X=X+
1:GOTO 70
```

If the line looked like this, you'd have one heck of a time getting each command to work. In the first example, Line 110 contains an IF/THEN statement. Generally, you want to leave this type of statement in a line all its own. There are examples where several commands will work on the same line, but a logical step must be followed. You may combine IF/THEN statements in the following fashion:

```
110 IF B=2 THEN GOTO 350 ELSE IF
B=3 THEN GOTO 450 ELSE GOTO 110
```

The word ELSE provides an alternative if the conditions of the first part of the statement are not met. You could also have written this command in the following manner:

```
110 IF B=2 THEN GOTO 250
111 IF B=3 THEN GOTO 450
112 IF B<2 or B>3 THEN GOTO 110
```

However, this method uses up precious space and memory as well as three separate line numbers. Whenever you're working with a larger program where space and memory are likely to approach the limits, combine statements wherever you can. If the program is short and you want to include lots of REM statements and easily trace certain steps, it won't hurt to make separate lines out of each command.

Another problem with using colons is when a program branches *back* from a higher line number to a lower number. In Listing 1, Line 210 branches back to Line 90. If Line 90 had been combined with several other statements in Line 100, there would be nowhere for your program to go when it reached Line 210, resulting in a UL (Undefined Line) Error. This is a common mistake made when trying to condense an already-written program.

You can replace the colons from a combined statement with line numbers, provided those numbers are on their own lines. Look at the following modification of the first example:

```
100 PRINT A$ 110 IF B=2 THEN GOT
O 350
120 C$=INKEY$:IF C$=""THEN 120
130 X=X+1:GOTO 70
```

In this example when your program gets to Line 100, it prints out the contents of A$. You then get an error message because you're telling the computer to do something it doesn't understand.

There are quite a few examples of alternate programming not explained in the manuals. I guess it's similar to a dictionary not endorsing slang words and terms. You can get by with them, but it's not proper.

As far as the 249-character limit is concerned, you may be able to squeeze a couple more characters onto the line by typing EDIT *yy* (*yy* is the line number) and then pressing X to extend to the end of the line. This allows you to enter more characters but if you type RENUM, some lines may be too long and you'll lose the last character or two, so use caution with this method.

Keeping Score

Dear Bill,

I'm trying to write a CoCo 3 graphics program using the HPRINT *command to display a player's name and score. According to my CoCo 3 manual, you can write lines like this:*

```
HPRINT (0,20), "The Score is", SC

HPRINT (0,0), "Your name is"; A$

HPRINT (10,10), A$+B$
```

I've tried all of these samples and only the third one works properly. The only solution I can come up with is this:

```
HPRINT (0,20), "The Score is": HPR
INT(12,10),SC
```

While it does work, it takes a separate HPRINT *statement each time I want to display statistics. Is there an easier way?*

Owen Cornell
Twenty-Nine Palms, California

I think a bug crept into Tandy's files in Fort Worth. As written, the first two examples will not work. It's probably just a typo, but if you change the semicolon in the second example to a plus sign (+), it will display your name as well as "your name is." This will work providing that A$ was defined earlier in the program as containing your name. You must change the first example to:

```
HPRINT (0,20), "The Score is"+STR$ (SC)
```

By changing the numeric variable SC to a string variable, using the STR$ command, you make everything on that line compatible. If you wanted to add the score to the end of the last line you'd write:

```
HPRINT (10,10), A$+B$+STR$ (SC)
```

Or you may want to define the whole line early in your program with D$="Your Score Is:"+STR$(SC). Then when your program gets to the part where scores are displayed or updated, all you have to put is HPRINT (10,10),D$ and the text as well as the score will appear.

Questions about specific BASIC programming problems can be addressed to BASICally Speaking, THE RAINBOW, P.O. Box 385, Prospect KY 40059.

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Adding input devices to an expansion board

Do You Read Me?

By Tony DiStefano
Rainbow Contributing Editor

Part 1 of this project (November '88, Page 157) explained the basics of start up. We started with a big project board and put two TTL circuits and a few LEDs on it. I used the first part of this project to show you how to output to the board and turn each LED on and off. In Part 2 (December '88, Page 146), I expanded the board to control things that required more current (like relays, buzzers and motors). This required another TTL chip like those used in Part 1 and an additional chip capable of carrying more current.

The first two parts of the project dealt only with outputs. You could turn devices on and off, but then you could not read the condition of the devices (like switches). In order to do that, you need a circuit able to read in data via the data lines D0 to D7. This, in turn, requires the proper decoding circuitry and a device that will buffer the switches. Study the circuit in Figure 1. It is a continuation of the circuit used in the last part of our project. In order to save space, I removed the details of the first and second parts. Any parts that will not be changed, I removed. The LEDs of Part 1 and the motors and buzzers of Part 2 have been removed. I left the buffer chips there, so you can see how the circuits work.

The first thing we need in order to be able to read in some data is a decoder able to decode the Read/Write (R/$\overline{W}$) line. Chip U2 of Figure 1 is the decoder chip we have been using. It is a 74LS138, a three-to-eight decoder. By now, you should be familiar with this chip, but let's review what lines are connected to it. The most important line is the SCS from the computer. This is connected to one of the *select* lines of U2, the G2B. This line is used to select a block of memory from $FF40 to $FF5F, which is the normal I/O area for disk drives. The second line going to G2A is an *address* line. Since this is an active low input, when A4 is low, the chip will be selected. When A4 is high, the chip de-selects. This limits our memory area to 16 bytes and leaves the other 16 for future expansions. The third connection to our chip is the E clock from the CPU. It connects to G1 of our chip. This is an active high input. So when the E clock is high, our chip is selected again. The E clock signal from the CPU is sort of a "data valid" indication. All data is valid when the CPU is writing to a device and the E clock is high. When the CPU is reading, the data is latched (or swallowed) on the falling edge of the E clock.

Those three signals control the selecting of the chip. The next three lines I describe determine which of the eight outputs will be selected, a three-to-eight decoder. Inputs A and B are connected to A0 and A1, respectively. Two address lines in binary represent four locations. The third line is connected to the R/$\overline{W}$ line of the CPU. Connected to the C input, it divides the eight outputs into two groups of four. The R/$\overline{W}$ line of the CPU is high for reading and low for writing. This makes one group a write-only select and another group a read-only select. Y0 to Y3 is the write-only group. We know this because we have already used two of the four lines with the controls for the LEDs and motors. The other group, Y4 to Y7, are read-only selects. We will use one of these read-only lines today, to read in data.

That takes care of the decoding part of today's project. We now have a read-only chip select. For the second part, we need a chip we can use as a buffer. Since this chip interfaces to the CPU's data bus, it must conform to some rules. The main rule is that when it is not selected, it must not interfere with the data bus. This condition is called *tri-state*. That means when the chip is not selected, it must be electrically disconnected (high impedance). Since the CoCo uses an 8-bit bus, we might as well use an 8-bit buffer. Looking through the TTL parts manual, I came across a chip that meets all our requirements — a 74LS244. It is an 8-bit, tri-state buffer.

U4 in Figure 1 is a 74LS244. It has eight outputs connected to the CPU's data bus. It also has eight inputs. These are our eight readable bits. Let's look at the two control lines. There are two because this chip can be controlled as both two 4-bit buffers and one 8-bit buffer. This makes the chip a little more versatile. For our project, we want it to be a single 8-bit buffer, so we will tie both control lines together. The TTL manual states that when the control line of a 74LS244 is high, the outputs are in tri-state mode. This is good because when the 74LS138 is disabled, all outputs are high. The manual also states that when the control line of this chip is low, the signal level appearing on the chip's inputs will appear on the chip's output. This is perfect for our project.

When the CPU is reading the proper location, the 74LS138 will respond by putting Y4 low. This will cause the 74LS244 to generate whatever level (high or low) it has on its inputs to the CPU. If we tied all the inputs of the 74LS244 to ground, the CPU would read $00 or all zeroes. On the other hand, if we tied the inputs to +5 volts, the CPU would read $FF or all ones. This is good, but soldering the wires to this chip every time we want to change the condition is a drag. Let's use a switch instead. SW1 in Figure 1 is a quad switch. The diagram shows that it is a PC board-mount DIP switch. This type of switch is generally found on a modem or printer as an option switch, and you can get them at a good electronic shop.

A switch is not the only thing needed for this project. You also need a resistor. Look at the diagram again, and you'll see why. One side of the switch is connected to the input of the 74LS244, and the other is connected to ground. When the switch is on, a direct connection to ground is made. The chip will see that as low, but when the switch is off, no connection is made anywhere. The input to the 74LS244 is just floating — a condition of uncertainty. When the chip is called upon to give the state of

Tony DiStefano is a well-known early specialist in computer hardware projects. He lives in Laval Ouest, Quebec. Tony's username on Delphi is DISTO.

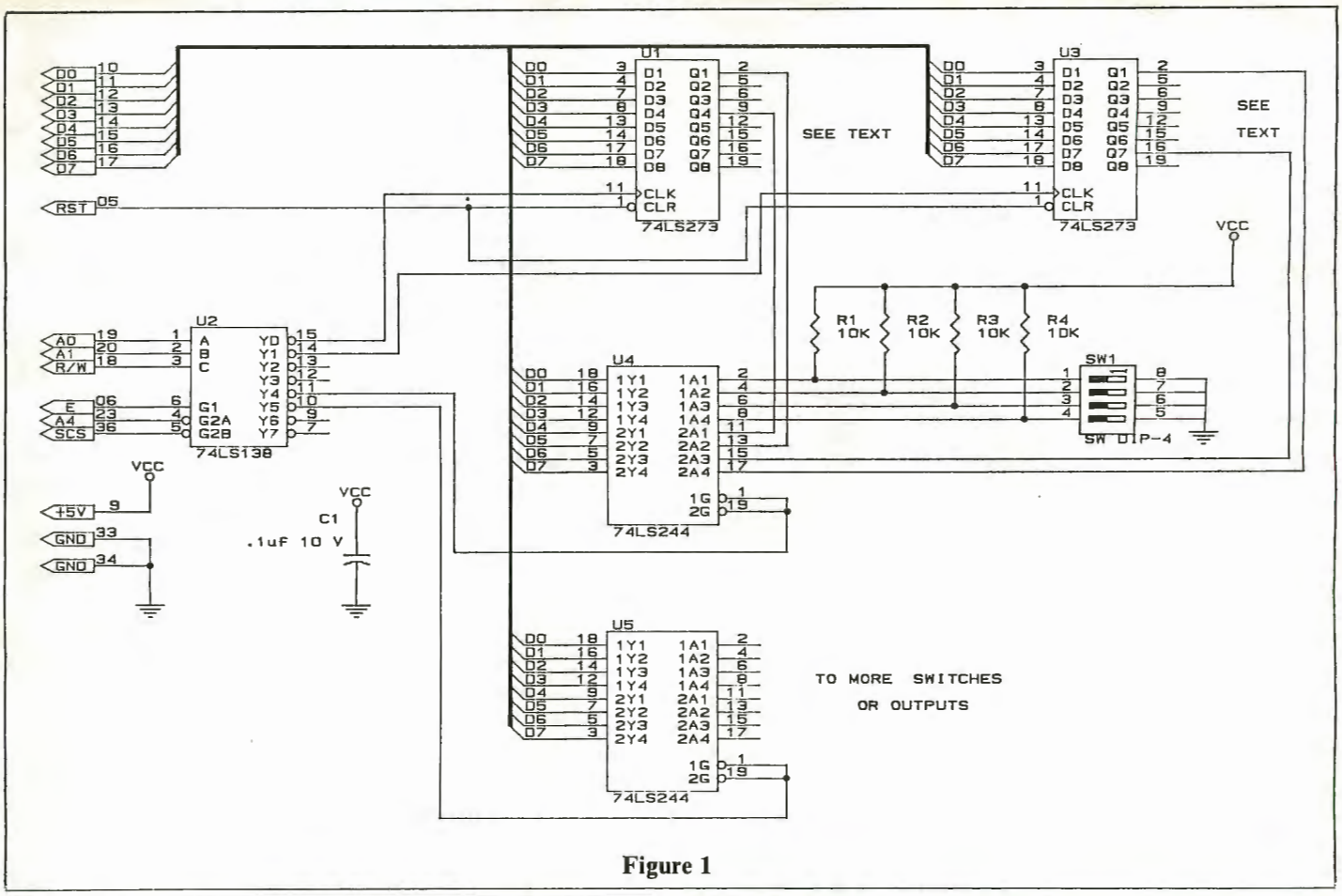

Figure 1

the input, it may give a reading of high or low. It all depends on exterior conditions, such as how close it is to another wire. In order to make sure the input is high, we use a resistor to tie it high. Therefore, when the switch is off, the resistor supplies +5 volts to the input of 74LS244, and the chip reads high. When the switch is on, the current is shunted to ground, and 74LS244 reads low.

The SW1 switch is only a quad switch. That means there are only four switches in that package. The 74LS244 chip has eight inputs. As you can see in Figure 1, I have connected the other four inputs to the outputs of the other chips. This is a way to monitor the output conditions of the other circuits in this project. The wiring in Figure 1 is just an example. You may not want to monitor the LEDs or motors I have selected; you can make any changes you want. For instance, you have a program that turns the first LED on and off in U1 in several places. (See Part 1 of this project for proper connections of the LEDs.) Using this read-only circuit, you are not certain at any time if the LED is on or off. Using the circuitry discussed in this column, you may now determine the condition of your LED. The same can be done with motors and buzzers.

Now that the theory is clear (I hope), let's look at the construction. You will need different parts for any application, so I'll just describe them and let you decide what you need. First, you need the board you used for the first two parts. For this application, you need one or two 74LS244 chips and one or two 20-pin sockets, depending on how many bits you need to read. For 1 to 8 bits, you need one; for 9 to 16, you need two.

Next, you'll need switches. You can use any quantity of DIP switches. The diagram shows four, but you can use any number from one to 16. You can also use individual switches and run them off the board, but the wires should be no longer than about 10 feet. In addition, don't run the wires outside. If lightning hits the switches, you'll find yourself shopping for a new computer. You'll need one resistor for every switch you use. As the diagram says, a 10K, ¼-watt resistor will do.

Bit	Decimal	Hex	Binary
D0	1	01	00000001
D1	2	02	00000010
D2	4	04	00000100
D3	8	08	00001000
D4	16	10	00010000
D5	32	20	00100000
D6	64	40	01000000
D7	128	80	10000000

Table 1: Bit Values

Mount the ICs, switches and resistors close to each other and close to the CPU's data bus. Construction is not too critical, but keep your work neat — it's better for trouble shooting. Try not to spread out your work. Next month I'll add something you might want to add as well. Check your work before turning on the computer. If something feels wrong, turn the computer off right away and check it again. Remember, my diagram does not include power and ground to the ICs; they must be connected. The two ICs you are adding this time require +5 volts at Pin 20 and ground at Pin 10. Also, use two more .1uf capacitors close to the ICs.

Finally, let's discuss the software. This project uses the CoCo's SCS pin. This maps all I/O from $FF40 to $FF5F. (Remember, the dollar sign means it's a Hex number.) To enter a Hex number on the CoCo, just put the characters &H in front of the number. Now, when you want to read the 8 bits connected to U4, the address is $FF40. The following is an example of a line in BASIC to read the 8 bits at U4:

```
100 X = PEEK(&HFF40)
```

The value returned in X is a value from zero to 255 or $FF. Each of the 8 bits contribute to the value. If the value returned is zero, then all bits on that IC (U4) are off. In order to find out which particular bit is on or off, you can use the AND command in BASIC to mask the other bits. This command will change any bit that is zero to zero. A full explanation of the AND command can be found in your BASIC manual; I will not go into detail here. I will, however, give you an example of how to do it. Look at U4 in Figure 1. I have connected Pin 13 of U4 to Pin 2 of U1. That means reading U4 and looking at D4 will give you the condition of whatever you poked at U1 D0. If U1 Pin 1 is high, then when you read U4, D4 will also be high. The following is an example of this:

```
10 POKE &HFF40,1
20 X=PEEK(&HFF40)
30 IF X AND &H8 <> 0 THEN PRINT "D4 IS HI"
```

The first line makes D0 of U1 high; the second line reads U4; and the third line masks all bits except D4. If D4 is equal to zero, then there is something wrong. To check other bits one at a time, use the values in Table 1 with the AND command.

That's it for now. See you next time when we'll add new input devices.

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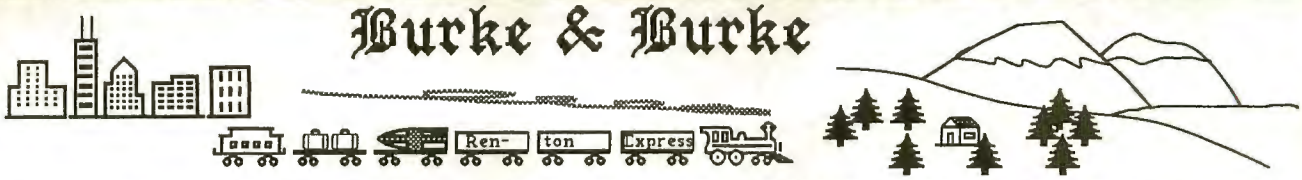

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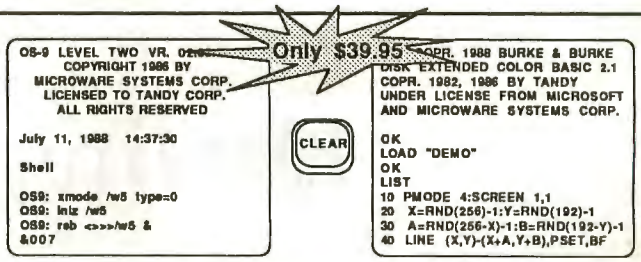

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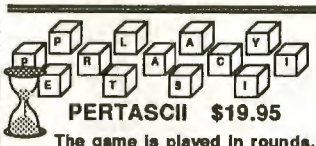

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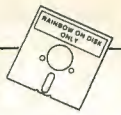

Programs to tempt the DECB user

Moving to OS-9

By By Dale L. Puckett
Rainbow Contributing Editor

It's been a long wait, but we may have an easy path for Disk BASIC users who want to try OS-9. *RSB*, written by Chris Burke of Burke & Burke, modifies the code in your Color Computer's Disk BASIC ROM so it can run under OS-9. This month, let's take a look at *RSB*. Then, with the help of John Alan Lind, I'll follow Bill Barden's lead and give you another tool that makes your Color Computer an important part of amateur radio.

RSB stands for Radio Shack BASIC

I first mentioned *RSB* in this column after speaking with Chris Burke at last spring's Chicago RAINBOWfest. At the Princeton show, I had the opportunity to pick up a copy of Burke's product. *RSB* may be the incentive needed to interest more Disk BASIC users in the OS-9 operating system. If you agree, please tell your Color Computer friends about it.

Since Chris Burke believes most people are more comfortable when working in a familiar environment, he tried to recreate the Disk BASIC environment in OS-9 Level II. Chris felt that once people started running their favorite Disk Extended Color BASIC (DECB) programs on the OS-9 platform, they would begin to explore the powerful operating system. Chris feels they'll be hooked on OS-9 once they take this step and start to observe the system's power first-hand.

RSB is a version of DECB, modified to be compatible with OS-9 Level II. Because of Burke's modification, it is fully re-entrant and relocatable. At first, Color Computer BASIC users might not care that *RSB* is re-entrant and relocatable, but once they start running different BASIC programs in various OS-9 Level II windows, they'll take notice.

RSB sports a command syntax identical to that found in Disk BASIC. In addition, you'll find several new verbs that let you access OS-9 directly. *RSB* will also accept commands typed using either upper- or lowercase characters.

Burke uses OS-9 system calls for all I/O operations. With these, you can use VDG graphics screens or OS-9 Level II windows. *RSB* lets you use a Tandy Color Mouse in place of your joystick. You'll have a reason to do so — *RSB* is *Multi-Vue*-compatible. In fact, Burke ships a *Multi-Vue* `AIF` file and several icons with the program.

RSB can convert Disk Extended BASIC versions 1.0, 1.1, 2.0, 2.1 and the Disto CoCo 3 CDOS Disk BASIC to run on OS-9. There's only one catch — Burke recommends you have 512K of RAM in your Color Computer when running the program. This is a standard requirement for all OS-9 programs designed to do any real work. However, *RSB* will run in a 128K CoCo.

Installing the program is a snap. You run an install procedure supplied on the disk. After this, edit the *RSB* environment file to tell your new OS-9 BASIC interpreter about the hardware you have attached to your Color Computer. Start by making a backup of the original installation disk. Then create an OS-9 window. You can set up an OS-9 window with the following commands:

```
OS9: shell i=/w7&
&005
OS9:
```

Press CLEAR and these command lines assume the device descriptor for Window Device `/w7` is installed in your `OS9Boot` file. The process number of your new shell is 005. The shell will print it on your screen. You'll see the new screen with the word "Shell" and an OS9: prompt in the upper-left corner after you press CLEAR. Once you see the prompt, you can place your backup copy of the installation disk in Drive 0 and type the following commands:

```
chd /d0
chx /d0
install
```

You'll see a few messages, and about 10 minutes later your Color Computer will report, "Installation complete." After running the installation procedure, copy the file named `RSB` from your

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disk in Drive 0 to the CMDS directory of your normal system disk. The following two commands lines will do this for you:

```
copy /d0/rsb /d1/cmds/rsb

copy /d0/sys/rsb_env.file /d1/sys/
rsb_env.file
```

After you have copied these files to your system disk you can run your new OS-9 based interpreter by entering rsb. This command line will give you 8K of memory for the program. The interpreter uses 3K of memory for its own variables, which leaves 5K for your BASIC program. If you are working with a longer program, you can ask OS-9 for more memory when you run *RSB* in this manner:

```
rsb #20K
```

You can also tell the program not to allocate a VDG graphics screen when it starts up. This will save 6K. If you want to run an *RSB* program from an OS-9 command line, enter a line similar to this:

```
rsb /d0/basic/mydemo #20K
```

Under *RSB*, loading a BASIC program from a disk file is just like doing so under DECB. However, with *RSB*, Run can unlock the universe. *RSB* lets you run OS-9 commands from within BASIC. When you get ready to return to OS-9, type dos.

If you move to OS-9 through *RSB*, you'll be right at home. Moving from OS-9 to DECB via *RSB*, I was occasionally at a loss for commands. (I had misplaced my DECB command summary card.) However, with a little coaxing from Burke's *RSB* manual, I was able to use the DECB syntax to open and close BASIC files. For example, the Open command Open "O",1, "Saveit:3, opens Path Number 1 to a file named Saveit on Drive 3. It took me a while to get used to the plot here also. Instead of typing chd to change my current data directory and tell OS-9 where I wanted to read or store data, I opened a drive to a directory. Look at the following example:

```
open drive 2, "/d0/games"
```

After typing this command line in *RSB*, you can load or run any program in the OS-9 directory /d0/games as you would with DECB. After opening the drive already described, the following command lines could be used:

```
dir 2
load "program:2"
run "demoit:2"
```

One of the big advantages of *RSB* is that it gives you a way to communicate with any device attached to your computer. The only requirement is an OS-9 device driver and descriptor. These usually come with the hardware from commercial vendors. To send output from an *RSB* program to your printer, use a sequence like this:

```
100 open "O",1,"/p"
200 print #1, "Hello, is the printer
working?"
```

Burke gives you a number of OS-9 utility commands to move your old DECB commands over to OS-9 files and *RSB*. A special command named Skitzo gives you a freshly formatted disk with a split personality. After you run the utility, half of the disk is recognized by OS-9, and the other half is used by Disk BASIC. Skitzo works with a 35-track, single-sided disk. Once you have

made a Skitzo disk, you can use Burke's HDel, HDir and HCopy commands to move files between OS-9 and DECB.

That's it — a new toy for OS-9 hackers and a painless introduction to OS-9 for DECB programmers. Pass the word. Maybe a giant congregation of DECB programmers will join us this year.

About Those Satellites . . .

John Alan Lind (KD7XG), of Corona, California, is back this month with *TrakSat* — a BASIC09 program that tracks satellites in low-earth orbit. It's fascinating and it's fast. Lind believes *TrakSat* fills two needs: It gives him a vehicle to develop a satellite tracking program in a compiler-based language like C or Pascal; and, because *TrakSat* is written in BASIC09, a working program that everyone with OS-9 Level II can run and enjoy now can be published. If he had used Pascal, you would have to purchase OS-9 Pascal to run the program because you would need the run-time support files that come with the compiler.

TrakSat uses the general tracking strategy developed by Dr. Tom Clark (W3IWI) in his *Orbits* program. Lind has enhanced nearly all portions of the code by making use of many BASIC09 features. Lind has simplified data entry, created an improved output display, eliminated tables containing constants that expire beyond a certain date, and added the ability to make predictions in one year, based on Keplerian data from the previous year.

Lind has also made it possible to correctly compute sidereal time into the next millennium — beyond the year 2000 — and has made it easier to update the Keplerian element sets. This makes computation much faster. Lind was nice enough to let THE RAINBOW *and* me publish his copyrighted program, so you can take advantage of the educational material it contains. He has also given us permission to distribute it with RAINBOW ON DISK and on Delphi. Although *TrakSat* is a copyrighted program, Lind wants it distributed free of charge for non-commercial use in the amateur radio and OS-9 communities. Your non-profit users group may charge its members a reimbursement fee for the cost of copying the program.

To run *TrakSat*, you need to load the source code published here into BASIC09. (See Listing 1.) Then, use the BASIC09 Pack command to store a

```
UO-9
88
285.Ø977435
Ø
Ø
Ø
Ø327-1Ø/11/88
97.6Ø54
321.6Ø8Ø
Ø.ØØØ1255
Ø34.4121
325.7259
15.3611Ø723
2.57Ø9E-Ø4
39Ø51
Ø
145.825
AO-1Ø
88
279.1313234
Ø
Ø
Ø
Ø358-1Ø/Ø5/88
27.1Ø79
3Ø1.3539
Ø.6Ø34945
342.1Ø45
ØØ3.6398
2.Ø588Ø749
-8.2E-Ø7
3996
Ø
145.8Ø9
UO-11
88
279.14Ø2Ø83
Ø
Ø
Ø
Ø352-1Ø/Ø5/88
98.Ø439
339.Ø661
Ø.ØØ14642
Ø44.5398
315.7Ø23
14.62461626
+1.2Ø7E-Ø5
24525
Ø
145.826
FO-12
88
279.2684671
Ø
Ø
Ø
Ø115-1Ø/Ø5/88
5Ø.Ø147
ØØ1.9211
Ø.ØØ11139
Ø58.6669
3Ø1.5254
12.44395542
-2.5E-Ø7
Ø9766
Ø
435.Ø
AO-13
88
273.7266Ø81
Ø
Ø
Ø
ØØ19-Ø9/3Ø/88
57.5382
237.559Ø
Ø.6578369
191.36Ø1
139.7626
2.Ø9697959
+3.ØE-Ø7
Ø226
Ø
145.812
RS-1Ø
88
284.828Ø217
Ø
Ø
Ø
Ø536-1Ø/1Ø/88
82.5333
Ø62.3349
Ø.ØØ12382
Ø3Ø.1296
33Ø.Ø614
13.7191Ø488
+1.189E-Ø5
652Ø
Ø
29.5
RS-11
88
284.828Ø217
Ø
Ø
Ø
Ø536-1Ø/1Ø/88
82.5333
Ø62.3349
Ø.ØØ12382
Ø3Ø.1296
33Ø.Ø614
13.7191Ø488
+1.189E-Ø5
652Ø
Ø
29.5
MIR
88
291.6451331
Ø
Ø
Ø
Ø46Ø-1Ø/17/88
51.615Ø
158.4827
Ø.ØØ24915
2Ø2.3449
157.7286
15.741711Ø2
3.3749E-Ø4
15311
Ø
145.ØØØ
DATEND
```

Figure 1: Satellite_dat

Satellite name
Epoch year
Epoch Julian date, either decimal or integer
Epoch hour if date is integer, or 0 if date is decimal
Epoch minute if date is integer, or 0 if date is decimal
Epoch second in decimal if date is integer, or 0 if date is decimal
Element set number and calendar date of element set
Inclination of orbit
RAAN: Right Ascension of the Ascending Node
Eccentricity of orbit
Argument of Perigee
Mean Anomaly
Mean Motion
Orbit Decay rate in rev/day^2
Revolution # of satellite at Epoch
Semi-major Axis of orbit, may also be 0
Beacon frequency, or mid-frequency of transponder down-link passband
DATEND

Table 1: Satellite_dat format

Call sign
Name
Ground Station Latitude in decimal degrees
Ground Station West Longitude in decimal degrees
Altitude above Sea Level in meters
Angle of horizon in degrees above horizontal (usually, 0)
OS-9 printer device name (usually, /P)

Table 2: Station_dat format

Listing 1: TrakSat

```
PROCEDURE traksat
ØØØØ
ØØØ1        (*
ØØØ4        (* TRAKSAT - A program for computing a satellite's azimuth and
ØØ42        (* elevation from a specific point on the Earth's surface over
ØØ8Ø        (* a specified time period.  This program is written for the
ØØBC        (* Tandy Color Computer 3 under the OS-9 Level II operating
ØØF7        (* system using a high resolution monitor.  The main algorithms
Ø136        (* used by this program are adaptations of the algorithms used
Ø174        (* by Dr. Tom Clark, W3IWI, in his noted ORBITS program.  His
Ø1B1        (* original program written in BASIC inspired the creation of
Ø1EE        (* this program for the Color Computer 3 and OS-9.  Numerous
Ø22A        (* improvements to the algorithms have been made to increase
Ø266        (* speed and further modularize them.  The amateur satellite
Ø2A2        (* community owes a debt of gratitude to Dr. Clark whose
Ø2DA        (* original program has inspired many other orbit calculation
Ø317        (* programs for various micro-computers and numerous operating
Ø355        (* systems.
Ø36Ø        (*
Ø363        (* Copyright (c) 1988 by:
Ø37C        (* John A. Lind, KD7XG
Ø392        (* 2194 Conejo Street
Ø3A7        (* Corona, California  91720-4ØØ1
Ø3C8        (*
Ø3CB        (* Distributed as "freeware" to the amateur radio community.
Ø4Ø7        (* Except as provided for in this copyright notice, this software
Ø448        (* may not be sold.  The copyright notice must remain unchanged
Ø487        (* in the software and source code.
Ø4AA        (*
Ø4AD        (* Specific permission is granted for:
Ø4D3        (* 1.  Upload and distribution through commercial on-line services
Ø515        (* such as CompuServe and Delphi.
Ø536        (* 2.  Distribution by the OS-9 User's Group as part of their
Ø573        (* library of software.
Ø58A        (* 3.  Distribution by the Amateur Satellite Corporation (AMSAT)
Ø5CA        (* any proceeds from which may be used by AMSAT for their
Ø6Ø3        (* operations.
Ø611        (* 4.  Publication of the source code in periodicals for the
```

packed version of *TrakSat* in your current execution directory — /dd/cmds. RunB, the BASIC09 run-time package, must also be in your current execution directory.

```
KD7XG
John
33.87
117.43
6ØØ
Ø
/P1
```

Figure 2: Station_dat

Two additional files, Satellite_dat and Station_dat must be present in your current data directory when you run *TrakSat*. (See figures 1 and 2.) Satellite_dat contains Keplerian element sets for many amateur radio satellites. You may edit this file to add data for additional satellites or delete data for those in which you are not interested. The format of Satellite_dat is specific and must remain the same; however, the number of satellites listed in the file does not matter. The last line *must* be DATEND. The program looks for this word and knows the end of the file has been reached when it is found. The entire format for Keplerian element sets is listed in Table 1.

Keplerian Data Sets

You will find the data you need to fill in the blanks in Table 1 in *QST* or the *Amateur Satellite Report*. It is also distributed by packet radio bulletins and ARRL RTTY bulletins. These publications provide the data in the same general order listed in Table 1. The element sets come from NASA. They should be no more than 90 days old, if accurate predictions are needed, and no more than 180 days old in most amateur radio applications. The element sets shown in Figure 1 were released during the first week of October '88.

The station data provided in Figure 2 (and defined in Table 2) is for Lind's location in Corona, California. You must use your own location to get the predictions for your location. If you are not an amateur radio operator and don't have an amateur call sign, leave the first line blank. However, *do not* delete the line because *TrakSat* expects seven lines in the Station_dat file.

To run *TrakSat*, you must have at

least one window device available. *TrakSat* uses Window Device /w to open the next available window in an 80-by-24 text (Type 2) screen. When you first run the program, you will be greeted by a copyright message, and you'll hear the disk drives click while the program reads your Station_dat file. You will then be prompted for a start date and time. After you enter the start date, you will be asked for a duration in hours and minutes. (Lind recommends using 48 or 72 hours because this gives you several days' predictions at a time.) After you supply the duration, you will be asked for a step time in minutes. The step time is used to step the program from the start time through the chosen duration. A step time of 10 minutes is more than adequate for Phase III satellites such as AO-10 and AO-13 since these machines have orbital periods of close to half a day. If you are tracking the low-altitude Phase II satellites with orbital periods of one or two hours, you might want to use a step of one or two minutes.

TrakSat reads your Satellite_dat file and then asks you which satellite you would like to track. After you pick one from a menu, the program will display the orbital elements for your selection. (If you plan to ask the program to output its data to your printer, make sure you have turned your printer on and placed it online before you select the printer.) You will notice a short delay between orbit passes. BASIC09 runs *TrakSat* four to five times faster than the original DECB program, *Orbits*. Look at the source code to get an idea of the number-crunching going on in *TrakSat*.


```
964D    (* purpose of furthering program distribution.
967B    (*
967E    (* If you like this program give it to a friend.  This program
96BC    (* may not be sold and the copyright notice must be retained in
96FB    (* the program code.  Commercial/business use of this software
9739    (* is strictly prohibited.
9753    (*
9756    (* REVISION HISTORY:
976A    (*
976D    (* Revision      Comments
9786    (* ------------------------------------------------------------
97C4    (* 1.0           Truly bare-bones "strawman" just to get things
98Ø3    (* working!  Uses GOSUBS (yecccch!), but gives
9831    (* results comparable to other predicion methods.
9862    (*
9865    (* 1.1           Replaced GOSUBS with separate procedures.
989F    (* Keplerian element sets and sidereal time table
98DØ    (* are still embedded as DATA statements.  This
98FF    (* was OK for standard BASIC (oh what a pun!) but
993Ø    (* is unacceptable for BASICØ9.  You can't edit
995F    (* I-code with a text editor.
997C    (*
997F    (* 1.2           Replaced sidereal time table with procedure to
99BE    (* compute it as needed for the prediction year.
99EE    (* Still need to get the Keplerian elements out of
9A2Ø    (* the DATA statements!
9A37    (*
9A3A    (* 2.Ø           Not only removed the Keplerian element sets to
9A79    (* a separate text file, station data for the user
9AAB    (* is now in its own text file as well.  This
9AD8    (* eliminates the need to ask for it at the beginning
9BØD    (* of the program.  I need to revise the SKIPMUF
9B3D    (* program to read the same user station file.  The
9B7Ø    (* file name is different and this one has an extra
9BA3    (* line in it for horizon data.
9BC2    (*
9BC5    (* 2.1           Fixed a minor bug in paginating the print-out portion
9C9B    (* of the code.  Fixed the sidereal procedure to compute
9C43    (* correctly into the next millenium.  Users would have
9C7A    (* had an interesting surprise using a sidereal time con-
9CB3    (* stant for 19ØØ in the year 2ØØØ!
9CD6    (*
9CD9    (* 2.2           Added code to allow computation of orbits using
9D19    (* element sets from the previous year.  This solves
9D4D    (* the Jan/Feb agony every year.  Also added code to
9D81    (* display and print the calendar date instead of the
9DB6    (* Julian date in the output.  This was definitely not
9DEC    (* easy, epecially when combined with having to be able
9E23    (* to use the previous year's element sets.  I never
9E57    (* did like the Julian date in the output, though.  Most
9E8F    (* of us are used to thinking in calendar dates and Julian
9EC9    (* dates are too confusing, especially in leap years.
9EFE    (* It makes more sense to let the computer worry about
9F34    (* what day it really is and do all the conversion work.
9F6C    (* I may just burn my Julian date cheat sheet now.
9F9E    (*
9FA1    (* 2.3           Fixed the problem of the doppler shift being wacko on
9FE7    (* the first line of output.  It was an easy fix and has
1ØlF    (* bugged me for some time.  I don't know why I didn't do
1Ø58    (* it before now.  Also tidied up some of the output in
1Ø8F    (* the portions of code that interact with the user to
1ØC5    (* request data.
1ØD5    (*
1ØD8    (* 2.4           Decided to have program open its own 8Øx24 text screen.
1129    (* Sooner or later someone would try to run it on a 4Øx24
1159    (* graphics screen or some other bizzare combination and
1191    (* get strange results.  Now opens a white on blue stan-
11C9    (* dard screen and resets the palette registers to the
11FF    (* default.  Discovered in the process that the MultiView
1238    (* gshell does strange things to the palette registers when
1273    (* it reads the "stock" env.file during initialization.
12AA    (* Had to rewrite the env.file for MultiView to set the
12E1    (* palette to its standard colors.  Whoever set the palette
131C    (* up in the "stock" env.file must have strange taste in
1354    (* colors - either that or I have strange tastes.  This
138B    (* looks like it will be the last rev in BASICØ9.  Unless
13C4    (* I discover a serious bug, anything else that comes to
13FC    (* mind will have to wait until I rewrite it in OS-9
143Ø    (* Pascal or C.
143F    (*
1442    DIM ABORT,FLAG1,FLAG2,FLAG3,PV,FIRSTRUN:BOOLEAN
145D    DIM GG,I,J,LN,PG,PRN,SCRN:INTEGER
147C    DIM A,AØ,A9,CC,C(3,2),C8,C9,D,D3,D9,DC,DD,E,EØ,E1,E8,F,F1:REAL
14DØ    DIM F9,GØ,G1,G2,H,H1,H3,H4,H9,IØ,JULCAL(13),K,KØ,K7,L5,L9:REAL
1518    DIM M,MØ,M1,M2,M3,M4,N,NØ,N1,O,OØ,PØ,QØ,R,RØ,R5,R6,R8,S3,S4

         :REAL
156B    DIM S8,S9,T,TØ,T1,T2,T3,T6,T7,T8,T9,W,WØ,W5,W9,X,X9,Y,Y3,Y9

         ,Z,Z9:REAL
15C6    DIM DASTART,MOSTART,YRSTART:REAL
15D5    DIM DANOW,MONOW,YRNOW:REAL
15E4    DIM AA$:STRING[1]
15FØ    DIM C$:STRING[6]
15FC    DIM DATEN$:STRING[8]
```

```
16Ø8      DIM DATORB1$:STRING[52]
1614      DIM DATORB2$:STRING[11]
162Ø      DIM DD$:STRING[12]
162C      DIM DNOW$:STRING[2]
1638      DIM H$:STRING[2]
1644      DIM H4$:STRING[2]
165Ø      DIM I$:STRING[4Ø]
165C      DIM MNOW$:STRING[2]
1668      DIM M4$:STRING[2]
1674      DIM N$:STRING[2Ø]
168Ø      DIM PRNPATH:STRING[32]
168C      DIM S$:STRING[4Ø]
1698      DIM S4$:STRING[2]
16A4      DIM TNOW$:STRING[7]
16BØ      DIM WNDW$:STRING[2]
16BC      DIM YNOW$:STRING[2]
16C8
16C9      FOR I:=1 TO 13
16D9        READ JULCAL(I)
16E2      NEXT I
16ED      R8:=.Ø
16F8      T6:=.Ø
17Ø3      CC:=299792.5
17ØE      RØ:=6378.16
1719      F:=1./298.25
172B      GØ:=7.5369793E+13
1736      G1:=1.ØØ273791
1741      PØ:=PI/18Ø.
174E      DATORB1$:="T9,'----------- DATE: ',S8,' -------- ORBIT #',R7.Ø>"
1789      DATORB2$:="-----------"
179B      WNDW$:="/W"
17A4
17A5      SCRN:=Ø
17AC      OPEN #SCRN,WNDW$:UPDATE
17B8      PRINT #SCRN,CHR$($1B); CHR$($2Ø); CHR$(2); CHR$(Ø); CHR$(Ø)

           ;
17D5      PRINT #SCRN,CHR$(8Ø); CHR$(24); CHR$(Ø); CHR$(1); CHR$(1);
17FØ      PRINT #SCRN,CHR$($1B); CHR$($3Ø);
18Ø1      PRINT #SCRN,CHR$($1B); CHR$($21);
1812
1813      RUN LOGO(SCRN)
181D
181E      RUN INIT1(C$,N$,L9,W9,H9,E8,PRNPATH)
1846
```

If you get hooked on satellite tracking after running *TrakSat*, Lind says *The Satellite Experimenter's Handbook* is the best beginner's book on the subject. If you really love the subject, he recommends the current *Astronomical Almanac* from the U.S. Government Printing Office and *Fundamentals of Astrodynamics*, published by Dover.

If you are an active ham, you can send a message to Lind's packet bulletin board. His address is KD7XG @ KD7XG. Lind runs the following packet bulletin boards: KD7XG-0, a packet gateway for Southern California operating in the 20-meter (14-Meg) amateur radio band; KD7XG-1, a packet bulletin board system on 145.05 Meg; and KD7XG-2, a packet bulletin board system on 223.42 Meg.

A few nights on packet radio will make you a believer. I recently received a message at my home bulletin board (KØHYD @ N4QQ) containing a request for a portion of some C source code accidentally deleted from "KISSable OS-9" last spring. I found the code and sent it back up to Bob (KC2WZ @ NN2Z) in New York. The next day, I got a message saying he had received the source code and all was working well.

I hope by the time you read this the manufacturer of my packet radio termi-

nal node controller will have upgraded my firmware and I will have a personal mailbox running 24 hours a day. (I'll give you the details when I get the firmware.) However, if you want to get a head start and would like to chat live via packet radio, try to connect with KOHYD via DCA4 — one of the NetROM nodes run by K3AF in Washington, D.C.

A Modified Echo from Goldberg

I received a note and another contribution from Steve Goldberg in Bethpage, New York. I can't say enough about Goldberg's utilities. I have them all loaded on my hard drive and use them quite often. Steve has made a fantastic contribution to the OS-9 community.

This month THE RAINBOW and I are publishing an enhanced version of the Echo command that delivers some of the features found in the UNIX version. The new features are as follows:

\n	Go to a new line
\c	Terminate display without a new line
\f	Clear the screen (form feed)
\\	Print a backslash (\)
\###	Print the character with an ASCII value of ###

The following is a sample command line:

```
echo \f\7Now is the time\nfor all good men\nto come to the aid\nof their party.\n\nThe date and time are: \c;date t
```

If you enter the preceding example, Echo will clear your screen, sound your Color Computer bell and display the following message on the screen:

Now is the time
for all good men
to come to the aid
of their party.
The date and time are:
December 14, 1988 21:30:25

Kenneth-Leigh Enterprises is run by author Paul Ward, who tells me his second edition of *Start OS-9* should be out by the time you read this. He has designed this edition to fit better on your desk and be easier to use. Give it a try.

That's about all for March. If I find the time, I plan to develop a FindFile utility for OS-9 Level II. (I better find time, I need the utility.) Till then, keep on hacking! □

```
1847      REPEAT
1849        REPEAT
184B          REPEAT
184D
184E            PG:=0
1855            LN:=0
185C
185D            PRINT #SCRN,CHR$(12);
1868            PRINT #SCRN,TAB(26); "KD7XG Orbit Prediction Program"
1893            PRINT #SCRN,
189A            PRINT #SCRN,
18A1
18A2            PRINT #SCRN,TAB(25);
18AD            PRINT #SCRN,"Input data for initialization:"
18D4            PRINT #SCRN,TAB(25);
18DF            INPUT #SCRN," Start:   Year = ",YRSTART
18FD            YRSTART:=INT(100.*(YRSTART/100.-INT(YRSTART/100.))+.1

                 )
1927            FLAG1:=YRSTART/4.=INT(YRSTART/4.)
1942            FLAG3:=FLAG1
194A            YRNOW:=YRSTART
1952            RUN STRNGNUM(YNOW$,YRNOW)
1961
1962            REPEAT
1964              PRINT #SCRN,TAB(25);
196F              INPUT #SCRN,"         Month = ",MOSTART
198D            UNTIL MOSTART>=1. AND MOSTART<=12.
19A7            MONOW:=MOSTART
19AF            RUN STRNGNUM(MNOW$,MONOW)
19BE
19BF            REPEAT
19C1              PRINT #SCRN,TAB(25);
19CC              INPUT #SCRN,"           Day = ",DASTART
19EA            UNTIL DASTART>=1. AND DASTART<=31.
1A04            DANOW:=DASTART
1A0C            RUN STRNGNUM(DNOW$,DANOW)
1A1B
1A1C            DATEN$:=MNOW$+"/"+DNOW$+"/"+YNOW$
1A34
1A35            T1:=DASTART+JULCAL(FIX(MOSTART))
1A45            IF FLAG1 AND MOSTART>2. THEN
1A59              T1:=T1+1.
1A68            ENDIF
1A6A
1A6B            REPEAT
1A6D              PRINT #SCRN,TAB(25);
1A78              INPUT #SCRN," Start:  Hours = ",H
1A96            UNTIL H>=.0 AND H<=24.
1AB0
1AB1            REPEAT
1AB3              PRINT #SCRN,TAB(25);
1ABE              INPUT #SCRN,"       Minutes = ",M
1ADC            UNTIL M>=.0 AND M<=59.
1AF6            T1:=T1+H/24.+M/1440.
1B14
1B15            REPEAT
1B17              PRINT #SCRN,TAB(25);
1B22              INPUT #SCRN," Duration: Hours = ",H1
1B42            UNTIL H1>=.0
1B51            REPEAT
1B53              PRINT #SCRN,TAB(25);
1B5E              INPUT #SCRN,"       Minutes = ",M1
1B7E            UNTIL M1>=.0 AND M1<=59.
1B98            T2:=T1+H1/24.+M1/1440.
1BB6
1BB7            REPEAT
1BB9              PRINT #SCRN,TAB(25);
1BC4              INPUT #SCRN," Step:   Minutes = ",M2
1BE4            UNTIL M2>.0 AND M2<=60.
1BFE            T9:=M2/1440.
1C0D
1C0E            PRINT #SCRN,TAB(25);
1C19            INPUT #SCRN,"Is above data correct? ",AA$
1C3D          UNTIL AA$<>"N" AND AA$<>"n"
1C51
1C52          PRINT #SCRN,TAB(25);
1C5D          PRINT #SCRN USING "X5,'Start time = ',R9.4>",T1
1C82          PRINT #SCRN,TAB(25);
1C8D          PRINT #SCRN USING "X6,'Stop time = ',R9.4>",T2
1CB1          PRINT #SCRN,TAB(25);
1CBC          INPUT #SCRN,"To continue press ENTER ",AA$
1CE1
1CE2          RUN GEOCENTR(C8,C9,F,H9,L9,P0,R0,S8,S9,W9,X9,Y9,Z9)
1D28
1D29          PRINT #SCRN,CHR$(12);
1D34          PRINT #SCRN,TAB(34); "STATION: "; C$
1D4E          PRINT #SCRN USING "T29,'LAT: ',R6.2>,' LONG: ',R7.2>",L9

               ,W9
1D80          PRINT #SCRN USING "T26,'ELEV:',R6.0>,'  MIN HORIZON:',R5.1>"

               ,H9,E8
1DB9          PRINT #SCRN,
1DC0
1DC1          RUN GETDAT(SCRN,S$,I$,Y3,D3,H3,M3,S3,I0,O0,E0,W0,M0,N0,
```

```
            N1,K@,A@,F1)
1E2@
1E21        FLAG2:=Y3/4.-INT(Y3/4.)
1E3C
1E3D        ABORT:=FALSE
1E43        IF Y3<>YRSTART THEN
1E5@          IF Y3=YRSTART-1 OR YRSTART=@ AND Y3=99 THEN
1E71            IF FLAG2 THEN
1E7A              T7:=T1+366.
1E89              T8:=T2+366.
1E98            ELSE
1E9C              T7:=T1+365.
1EAB              T8:=T2+365.
1EBA            ENDIF
1EBC            RUN SIDEREAL(Y3,G2)
1ECB          ELSE
1ECF            PRINT #SCRN,CHR$(12);
1EDA            FOR I:=1 TO 7
1EEA              PRINT #SCRN,
1EF1            NEXT I
1EFC            PRINT #SCRN,TAB(14); "This satellite's element set is OVER A YEAR OLD!!"
1F3A            PRINT #SCRN,TAB(19); "Update element set for this satellite."
1F6D            PRINT #SCRN,TAB(27); CHR$($1F); CHR$($24); "Aborting this run!"

                 ; CHR$($1F); CHR$($25)
1FA@            ABORT:=TRUE
1FA6            PRINT #SCRN,
1FAD            REPEAT
1FAF              PRINT #SCRN,TAB(2@); "Do you want to quit now (Y/N)"

                  ;
1FDA              INPUT #SCRN,AA$
1FE4            UNTIL AA$="y" OR AA$="n" OR AA$="Y" OR AA$="N"
2@@8            IF AA$="y" OR AA$="Y" THEN
2@1D              CLOSE #SCRN
2@23              END "TRAKSAT aborted"
2@36            ENDIF
2@38          ENDIF
2@3A        ELSE
2@3E          T7:=T1
2@46          T8:=T2
2@4E          RUN SIDEREAL(Y3,G2)
2@5D        ENDIF
2@5F      UNTIL NOT(ABORT)
2@68
2@69      PRINT #SCRN,CHR$(12);
2@74      REPEAT
2@76        FOR I:=1 TO 7
2@86          PRINT #SCRN,
2@8D        NEXT I
2@98        PRINT #SCRN,TAB(18);
2@A3        INPUT #SCRN,"Output to printer or screen (enter P or S)? "

             ,AA$
2@DC      UNTIL AA$="P" OR AA$="p" OR AA$="S" OR AA$="s"
21@@      IF AA$="P" OR AA$="p" THEN
2115        PV:=TRUE
211B        PRINT #SCRN,
2122        PRINT #SCRN,TAB(22); CHR$($1F); CHR$($24);
2137        PRINT #SCRN,"Make sure printer is on and ready!"; CHR$(

             $1F); CHR$($25)
216C        PRINT #SCRN,
2173        PRINT #SCRN,TAB(27);
217E        INPUT #SCRN,"Press ENTER to continue",AA$
21A2        PRN:=@
21A9        OPEN #PRN,PRNPATH:UPDATE
21B5      ELSE
21B9        PV:=FALSE
21BF      ENDIF
21C1
21C2      IF D3=INT(D3) THEN
21D@        T@:=D3+H3/24.+M3/144@.+S3/8640@.
21F9      ELSE
21FD        T@:=D3
2205      ENDIF
2207
2208      T:=T7-T9
2214      RUN ELEMUPDT(A,A@,C,E@,E1,G@,I@,K@,M@,N,N@,N1,O,O@,P@,Q@,

           R@,T,T@,W,W@)
2282      RUN MEANANOM(K,M,M9,N@,N1,Q,Q@,T,T@)
22B4      RUN TRUEANOM(A@,C,E@,E1,G1,G2,M,R,T,X,Y,Z)
22F5      RUN AZELRNGE(A9,C8,C9,E9,L5,P@,R,R5,R6,R8,S8,S9,T,T6,W5,X
           ,X9,Y,Y9,Z,Z9)
2363      T:=T7
236B      RUN ELEMUPDT(A,A@,C,E@,E1,G@,I@,K@,M@,N,N@,N1,O,O@,P@,Q@,

           R@,T,T@,W,W@)
23D9      RUN MEANANOM(K,M,M9,N@,N1,Q,Q@,T,T@)
24@B      PRINT #SCRN,CHR$(12);
2416      PRINT #SCRN,TAB(14); "Elements for: "; S$
2435      PRINT #SCRN,TAB(13); "Element set: "; I$
2453      PRINT #SCRN,TAB(13); "=================================================="
2494      PRINT #SCRN,TAB(13); "Element            Reference         Starting"
24CF      PRINT #SCRN,TAB(13); "--------------------------------------------------"
```

Submitting Material To Rainbow

Contributions to THE RAINBOW are welcome from everyone. We like to run a variety of programs that are useful/helpful/fun for other CoCo owners.

WHAT TO WRITE: We are interested in what you may wish to tell our readers. We accept for consideration anything that is well-written and has a practical application for the Tandy Color Computer. If it interests you, it will probably interest lots of others. However, we vastly prefer articles with accompanying programs which can be entered and run. The more unique the idea, the more the appeal. We have a continuing need for short articles with short listings. These are especially appealing to our many beginners.

FORMAT: Program submissions must be on tape or disk, and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs and debug our typing errors. All programs should be supported by some editorial commentary explaining how the program works. We also prefer that editorial copy be included on the tape or disk using any of the word processors currently available for the Color Computer. Also, please include a double-spaced printout of your editorial material and program listing. Do not send text in all capital letters; use upper- and lowercase.

COMPENSATION: We do pay for submissions, based on a number of criteria. Those wishing remuneration should *so state* when making submissions.

For the benefit of those who wish more detailed information on making submissions, please send a self-addressed, stamped envelope (SASE) to: Submission Guidelines, THE RAINBOW, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. We will send you comprehensive guidelines.

Please do not submit material currently submitted to another publication.

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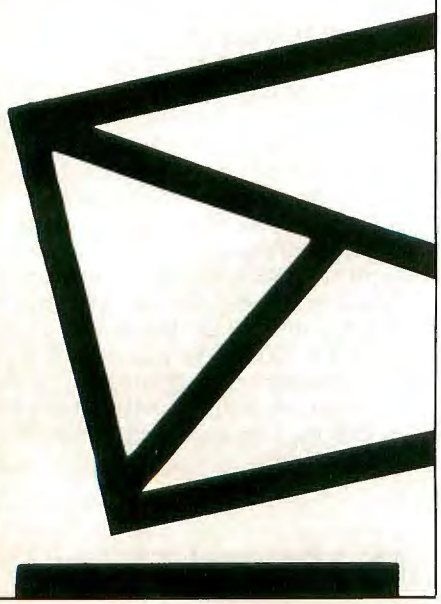


```
251Ø       PRINT #SCRN,TAB(13); "Epoch"; TAB(34); Y3; "+"; TØ; TAB(52
            ); YRSTART; "+"; T1
2542       PRINT #SCRN,TAB(13); "Incl of Orbit"; TAB(34); IØ; TAB(52
            ); IØ
256C       PRINT #SCRN,TAB(13); "RAAN"; TAB(34); OØ; TAB(52); O
258D       PRINT #SCRN,TAB(13); "Eccentricity"; TAB(34); EØ; TAB(52)
            ; EØ
25B6       PRINT #SCRN,TAB(13); "Arg of Perigee"; TAB(34); WØ; TAB(52
            ); W
25E1       PRINT #SCRN,TAB(13); "Mean Anomaly"; TAB(34); MØ; TAB(52)
            ; M/PØ
26ØE       PRINT #SCRN,TAB(13); "Mean Motion"; TAB(34); NØ; TAB(52); NØ
2636       PRINT #SCRN,TAB(13); "Decay Rate"; TAB(34); N1; TAB(52); N1
265D       PRINT #SCRN,TAB(13); "Ref Orbit #"; TAB(34); KØ; TAB(52); K
2685       PRINT #SCRN,TAB(13); "Semi-Maj Axis"; TAB(34); AØ; TAB(52
            ); AØ
26AF       PRINT #SCRN,TAB(13); "Beacon Freq"; TAB(34); F1; TAB(52); F1
26D7       PRINT #SCRN,
26DE       IF T7-TØ<=9Ø. THEN
26F2         PRINT #SCRN,TAB(13); "Element set is "; FIX(T7-TØ); " days old."
2724         PRINT #SCRN,
272B       ELSE
272F         IF T7-TØ<=18Ø. THEN
2743           PRINT #SCRN,TAB(13); "Element set is "; CHR$($1F); CHR$
                ($24); FIX(T7-TØ);
2773           PRINT #SCRN,CHR$($1F); CHR$($25); " days old."
279Ø           PRINT #SCRN,
2797         ELSE
279B           PRINT #SCRN,TAB(13); CHR$($1F); CHR$($24);
27BØ           PRINT #SCRN,"WARNING: Element set is "; FIX(T7-TØ); " days old."
                ;
27E8           PRINT #SCRN,CHR$($1F); CHR$($25)
27F8           PRINT #SCRN,
27FF         ENDIF
28Ø1       ENDIF
28Ø3       PRINT #SCRN,TAB(13);
28ØE       INPUT #SCRN,"Press ENTER to start ",AA$
283Ø       PRINT #SCRN,
2837       PRINT #SCRN,CHR$($1F); CHR$($24);
2848       PRINT #SCRN,TAB(13); "Performing calculations ..."
287Ø       PRINT #SCRN,CHR$($1F); CHR$($25);
2881
2882       K9:=9.ØE+Ø9
288D       K8:=9.ØE+Ø9
2898       DØ:=2.
28A3       FIRSTRUN:=TRUE
28A9       PG:=1
28BØ       LN:=Ø
28B7       T3:=T1
28BF       FOR T:=T7 TO T8 STEP T9
28D7
28D8         IF K7<>INT(T3) THEN
28E6           IF T3>=366. AND NOT(FLAG3) OR T3>=367. THEN
29Ø6             IF FLAG3 THEN
29ØF               T3:=T3-366.
291E             ELSE
2922               T3:=T3-365.
2931             ENDIF
2933             IF YRNOW=99. THEN
2943               YRNOW:=.Ø
294E             ELSE
2952               YRNOW:=YRNOW+1.
2961             ENDIF
2963             FLAG3:=YRNOW/4.=INT(YRNOW/4.)
297E             RUN STRNGNUM(YNOW$,YRNOW)
298D           ENDIF
298F           I:=Ø
2996           DANOW:=INT(T3)
299F           REPEAT
29A1             I:=I+1
29AC             IF FLAG3 AND I=2 THEN
29BC               DANOW:=DANOW-1.
29CB             ENDIF
29CD           UNTIL JULCAL(I+1)>=DANOW
29DF           MONOW:=FLOAT(I)
29E8           DANOW:=DANOW-JULCAL(I)
29F7           IF FLAG3 AND I=2 THEN
2AØ7             DANOW:=DANOW+1.
2A16           ENDIF
2A18           RUN STRNGNUM(MNOW$,MONOW)
2A27           RUN STRNGNUM(DNOW$,DANOW)
2A36           DATEN$:=MNOW$+"/"+DNOW$+"/"+YNOW$
2A4E           K7:=INT(T3)
2A57         ENDIF
2A59
2A5A         RUN MEANANOM(K,M,M9,NØ,N1,Q,QØ,T,TØ)
2A8C         IF DØ=Ø AND K<>K9 THEN
2AA1           RUN ELEMUPDT(A,AØ,C,EØ,E1,GØ,IØ,KØ,MØ,N,NØ,N1,O,OØ,PØ
```

```
                ,QØ,RØ,T,TØ,W,WØ)
2BØF          K8:=9.ØE+Ø9
2B1A          K9:=9.ØE+Ø9
2B25        ENDIF
2B27        RUN TRUEANOM(AØ,C,EØ,E1,G1,G2,M,R,T,X,Y,Z)
2B68        RUN AZELRNGE(A9,C8,C9,E9,L5,PØ,R,R5,R6,R8,S8,S9,T,T6,W5

                ,X,X9,Y,Y9,Z,Z9)
2BD6        D:=E9-E8
2BE2        IF D<.Ø THEN
2BF2          IF DØ<>1 THEN
2BFF            D:=R5*D*D*.ØØØØØØØØ1
2C16            DØ:=Ø
2C1E            IF D>.2/NØ THEN
2C32              T:=T+.2/NØ
2C45              T3:=T3+.2/NØ
2C58            ELSE
2C5C              T:=T+D
2C68              T3:=T3+D
2C74            ENDIF
2C76          ENDIF
2C78        ELSE
2C7C          IF DØ=Ø THEN
2C89            IF T3>=T1 THEN
2C96              T3:=T1+T9*INT((T-T7)/T9-2.)
2CB6            ELSE
2CBA              IF FLAG1 THEN
2CC3                T3:=T1+T9*INT((T-T7)/T9-2.)-366.
2CEA              ELSE
2CEE                T3:=T1+T9*INT((T-T7)/T9-2.)-365.
2D15              ENDIF
2D17            ENDIF
2D19            T:=T7+T9*INT((T-T7)/T9-2.)
2D39            DØ:=1
2D41          ELSE
2D45            DØ:=2
2D4D            IF K7<>K8 OR K<>K9 THEN
2D62              IF K<>K9 AND FIRSTRUN THEN
2D73                K9:=K
2D7B                RUN SCRNHDR(SCRN,C$,DATEN$,DATORB1$,DATORB2$,S$

                      ,GG,LN,K)
2DAD                IF PV THEN
2DB6                  RUN PRNTRHDR(PRN,LN,PG,E8,F1,H9,K,L9,W9,C$,DATEN$

                        ,DATORB1$,DATORB2$,S$)
2ØE1                ENDIF
2ØE3                FIRSTRUN:=FALSE
2ØE9              ELSE
2ØED                IF K<>K9 THEN
2E1A                  K9:=K
2E22                ENDIF
2E24                PRINT #SCRN USING DATORB1$,DATEN$,K;
2E37                PRINT #SCRN,DATORB2$
2E41                GG:=GG+1
2E4G                IF GG=23 THEN
2E58                  RUN SCRNCONT(SCRN,PV)
2E67                  RUN SCRNHDR(SCRN,C$,DATEN$,DATORB1$,DATORB2$,

                        S$,GG,LN,K)
2E99                ENDIF
2E9B                IF PV THEN
2EA4                  IF LN>=59 THEN
2EBØ                    PRINT #PRN,
2EB7                    LN:=Ø
2EBE                    PG:=PG+1
2EC9                    RUN PRNTRHDR(PRN,LN,PG,E8,F1,H9,K,L9,W9,C$,

                          DATEN$,DATORB1$,DATORB2$,S$)
2F14                  ELSE
2F18                    PRINT #PRN USING DATORB1$,DATEN$,K;
2F2B                    PRINT #PRN,DATORB2$
2F35                    LN:=LN+1
2F4Ø                  ENDIF
2F42                ENDIF
2F44              ENDIF
2F46            ENDIF
2F48
2F49            K8:=K7
2F51            T4:=T-INT(T)
2F5E            S4:=INT(T4*864ØØ.+.5)
2F75            H4:=INT(S4/36ØØ.+.ØØØØØ1)
2F8C            M4:=INT((S4-H4*36ØØ.)/6Ø.+.ØØØØØ1)
2FAE            S4:=S4-36ØØ.*H4-6Ø.*M4
2FCC            F9:=-(F1)*1ØØØØØØ.*R8/CC
2FE4            RUN STRNGNUM(H4$,H4)
2FF3            RUN STRNGNUM(M4$,M4)
3ØØ2            RUN STRNGNUM(S4$,S4)
3Ø11            TNOW$:=H4$+M4$+":"+S4$
3Ø25
3Ø26            PRINT #SCRN USING "T8,S7>,T17,R5.Ø>,T24,R4.Ø>,T28,R7.Ø>,T37,R7.Ø>"

                  ,TNOW$,A9,E9,F9,R5;
3Ø72            PRINT #SCRN USING "T44,R7.Ø>,T52,R4.Ø>,T58,R5.Ø>,T67,R5.Ø>"

                  ,R-RØ,L5,W5,M9
```

About The One-Liner Contest . . .

THE RAINBOW's One-Liner Contest has now been expanded to include programs of either one or two lines. This means a new dimension and new opportunity for those who have "really neat" programs that simply just won't fit in one line.

Here are the guidelines: The program must work in Extended BASIC, have only one or two line numbers and be entirely self-contained — no loading other programs, no calling ROM routines, no poked-in machine language code. The program has to run when typed in directly (since that's how our readers will use it). Make sure your line, or lines, aren't packed so tightly that the program won't list completely. Finally, any instructions needed should be *very* short.

Send your entry (preferably on cassette or disk) to:

THE RAINBOW
One-Liner Contest
P.O. Box 385
Prospect, KY 40059

```
3ØB6              GG:=GG+1
3ØC1              IF GG=23 THEN
3ØCD                RUN SCRNCONT(SCRN,PV)
3ØDC                RUN SCRNHDR(SCRN,C$,DATEN$,DATORB1$,DATORB2$,S$,GG

                      ,LN,K)
31ØE              ENDIF
3111
3111              IF PV THEN
311A                PRINT #PRN USING "T8,S7>,T17,R5.Ø>,T24,R4.Ø>,T28,R7.Ø>,T37,R7.Ø>"

                      ,TNOW$,A9,E9,F9,R5;
3166                PRINT #PRN USING "T44,R7.Ø>,T52,R4.Ø>,T58,R5.Ø>,T67,R5.Ø>"

                      ,R-RØ,L5,W5,M9
31AA                LN:=LN+1
31B5                IF LN>=6Ø THEN
31C1                  LN:=Ø
31C8                  PG:=PG+1
31D3                  RUN PRNTRHDR(PRN,LN,PG,E8,F1,H9,K,L9,W9,C$,DATEN$

                        ,DATORB1$,DATORB2$,S$)
321E                ENDIF
3220              ENDIF
3222
3223            ENDIF
3225          ENDIF
3227          T3:=T3+T9
3233        NEXT T
323E
323F        PRINT #SCRN,"End of "; S$; " calculations.  ";
3267        IF PV AND LN<61 THEN
3277          REPEAT
3279            PRINT #PRN,
328Ø            LN:=LN+1
328B          UNTIL LN>=63
3296        ENDIF
3298        PRINT #SCRN,"Enter Q to quit, any other key to continue. "

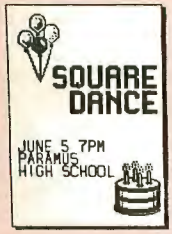
            ;
32CE        INPUT #SCRN,AA$
32D8      UNTIL AA$="q" OR AA$="Q"
32EC
32ED      IF PV THEN
32F6        CLOSE #PRN
32FC      ENDIF
32FE      CLOSE #SCRN
33Ø4      END
33Ø6
33Ø7      DATA .Ø,31.,59.,9Ø.,12Ø.,151.,181.,212.,243.,273.,3Ø4.,334.

            ,365.
3366      END
3368
PROCEDURE logo
ØØØØ
ØØØ1      PARAM SCRN:INTEGER
ØØØ8      PRINT #SCRN,CHR$(12);
ØØ13      FOR I:=1 TO 5
ØØ25        PRINT #SCRN,
ØØ2C      NEXT I
ØØ37      PRINT #SCRN,TAB(33); "TRAKSAT  v 2.4"
ØØ52      PRINT #SCRN,TAB(28); "Orbit Prediction Program"
ØØ77      PRINT #SCRN,
ØØ7E      PRINT #SCRN,TAB(29); "Copyright (c) 1988  by"
ØØA1      PRINT #SCRN,TAB(3Ø); "John A. Lind,  KD7XG"
ØØC2      PRINT #SCRN,TAB(31); "Corona, California"
ØØE1      FOR I:=1 TO 16ØØØ
ØØF4      NEXT I
ØØFF      PRINT #SCRN,CHR$(12);
Ø1ØA      END
Ø1ØC
PROCEDURE initl
ØØØØ
ØØØ1      PARAM C$:STRING[6]; N$:STRING[2Ø]; L9,W9,H9,E8:REAL; PRNPATH

            :STRING[32]
ØØ35      DIM INPATH:BYTE
ØØ3C      OPEN #INPATH,"station_dat":READ
ØØ52      READ #INPATH,C$
ØØ5C      READ #INPATH,N$
ØØ66      READ #INPATH,L9
ØØ7Ø      READ #INPATH,W9
ØØ7A      READ #INPATH,H9
ØØ84      READ #INPATH,E8
ØØ8E      READ #INPATH,PRNPATH
ØØ98      CLOSE #INPATH
ØØ9E      END
ØØAØ
PROCEDURE getdat
ØØØØ
ØØØ1      PARAM SCRN:INTEGER; S$,I$:STRING[4Ø]; Y3,D3,H3,M3,S3,IØ,OØ,

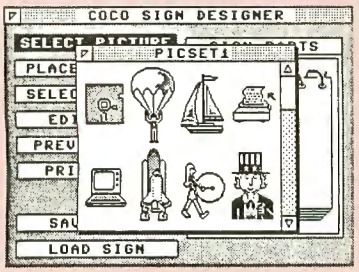
            EØ,WØ,MØ,NØ,N1,KØ,AØ,F1:REAL
ØØ55      DIM INPATH:BYTE
```

The Coco Graphics Designer Plus $29.95



Makes Signs, Banners, Greeting Cards

Super easy-to-use point and click graphical interface, features windows, scroll bars, radio buttons, and joystick or mouse control.



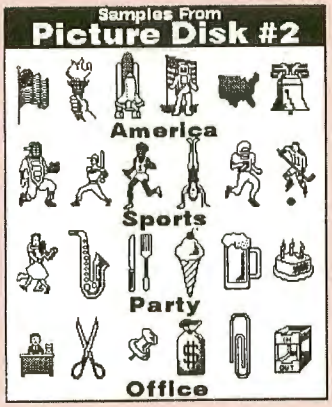
The CoCo Graphics Designer Plus (CGDP) is CoCo 2 and 3 Compatible. It allows pictures, and text in up to 4 sizes and 16 fonts, per page or banner. The cards & signs feature hi-resolution borders and complete on-screen previews. The CGDP comes with 16 borders, 5 fonts, and 32 pictures. It's 100% machine language for fast execution.

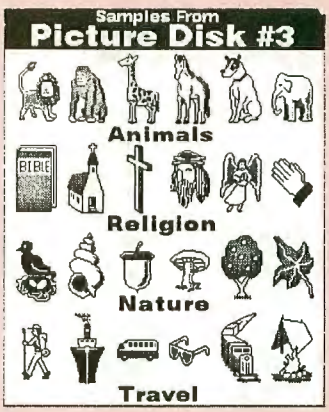
Printer Support Radio Shack DMP105, 106, 110,120, 130, 132, 200, 400, 420, 430, 440, 500, Epson FX/RX/LX/EX, LQ, Star 10X, SG10, NX10, NX1000, Panasonic KXP1080, 1090, 1091, 1092, Prowriter, C. Itoh 8510 & more.. Call for complete list.

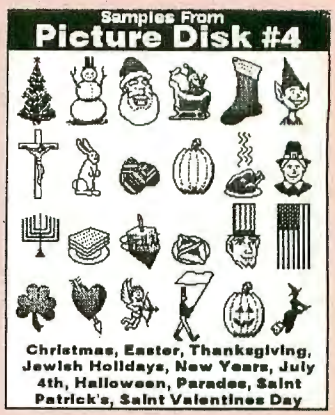
Requirements: 64K CoCo II or III, disk drive with RSDOS, mouse or joystick.

Picture Disks Now CoCo MAX & MAX-10 Compatible

In response to the many requests we received, our picture disks now include a simple format conversion utility making them easy to use with Colorware's MAX-10 and CoCo MAX II and III.



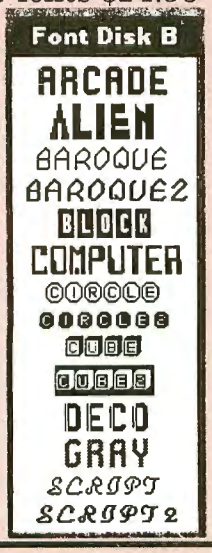




GREAT COCO CLIP-ART! Picture disks 2, 3, and 4, supplement the pictures that come with the CGDP. Each disk has 120 pictures arranged by subject. A few samples are shown above. Besides being compatible with Zebra's CGD and CGDP, each disk contains a utility to easily transform our pictures into CoCo Max pages, CoCo Max II clip book pages, CoCo Max III scrap books, and Max-10 clip art files. Order your picture disks today and use our great clip art with your favorite graphics programs!

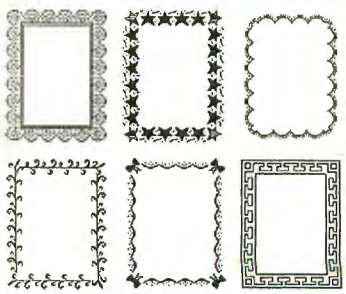
Zebra's Picture disks 2, 3, and 4 are priced at $14.95 each.

These two optional font collections supplement the fonts built into the CGDP.
Font Disk A 10 fonts $14.95
Font Disk B 10 fonts $14.95



New Product!
Border Disk #1

Over 100 high-resolution borders for the CoCo Graphics Designer Plus. Includes geometric patterns and artistic graphics for making great signs and greeting cards. A few samples are shown here at the right. Order CGDP Borber Disk#1 **$14.95**



Call, or mail us your address for a copy of our **FREE CoCo Catalog!**

Name_____

Address_____

City_____ State_____ ZIP_____

Ordering Instructions: All orders add $3.00 Shipping & Handling. UPS COD add $3.00. VISA/MC Accepted. NY residents add sales tax.

Zebra Systems, Inc., 78-06 Jamaica Ave., Woodhaven, NY 11421 (718) 296-2385

One-Liner Contest Winner . . .

This CoCo 3 one-liner illustrates the use of the PALETTE command to create animation — experience the "Sound Stretcher."

The listing:

```
Ø RGB:A=16Ø:B=A:M=96:HSCREEN2:FO
RZ=1TO8:C=C+Z:PALETTEØ,Ø:FORL=1T
O15:D=L:A=A-1:HCIRCLE(A,M-L),C,D
:B=B+1:HCIRCLE(B,M+L),C,D:NEXTL:
NEXTZ:FORT=8TO63:FORL=1TO15:PALE
TTEL,T:SOUND154+T,1:NEXTL:FORD=1
5TO1 STEP-1:PALETTED,Ø:NEXTD:NEX
TT
```

Paul Olmstead
Toledo, OH

(For this winning one-liner contest entry, the author has been sent copies of both *The Third Rainbow Book of Adventures* and its companion *The Third Rainbow Adventures Tape*.)

Two-Liner Contest Winner . . .

This two-liner repeatedly prints a column number line index, which can be used to format printer output.

The listing:

```
1 CLS:P=PEEK(65314)AND1:IF P>Ø T
HENPRINT@2Ø1,"printer offline":G
OTO1 ELSEPRINT@2Ø1,"PRINTING LIN
ES":PRINT"    HOLD <SPACE BAR> T
O STOP":FORX=1TO8:FORY=1TO9:L$=L
$+RIGHT$(STR$(Y),1):NEXTY:L$=L$+
"Ø":NEXTX
2 PRINT#-2,STRING$(2,13):FORX=1T
O8:PRINT#-2,STRING$(8," ");STR$(
X);:NEXTX:PRINT#-2,L$:IF PEEK(34
5)=247 THENEND ELSE2
```

Sam Mony
Kalamazoo, MI

(For this winning two-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape*.)


```
Ø95C      DIM I,J,K:INTEGER
Ø96B      DIM DD:REAL
Ø972      DIM AA$:STRING[1]
Ø97E      DIM DD$:STRING[4Ø]
Ø98A      DIM SATFILE$:STRING[13]
Ø996      SATFILE$:="satellite_dat"
Ø9AA      OPEN #INPATH,SATFILE$:READ
Ø9B6      PRINT #SCRN,TAB(26); "Satellite Selection Directory"
Ø9EØ      PRINT #SCRN,TAB(26); " --------------------------"
Ø1Ø9      I:=Ø
Ø11Ø      READ #INPATH,S$
Ø11A      WHILE S$<>"DATEND" DO
Ø12C        FOR K:=1 TO 5
Ø13C          READ #INPATH,DD
Ø146        NEXT K
Ø151        READ #INPATH,I$
Ø15B        I:=I+1
Ø166        PRINT #SCRN USING "T24,I3>,'. ',S12<,' ',S13<",I,S$,I$
Ø195        FOR K:=1 TO 1Ø
Ø1A5          READ #INPATH,DD
Ø1AF        NEXT K
Ø1BA        READ #INPATH,S$
Ø1C4      ENDWHILE
Ø1C8      REPEAT
Ø1CA        INPUT #SCRN,"Enter number desired ",J
Ø1EC      UNTIL J>Ø AND J<=I
Ø1FF      CLOSE #INPATH
Ø2Ø5      OPEN #INPATH,SATFILE$:READ
Ø211      READ #INPATH,S$
Ø21B      FOR I:=1 TO J-1
Ø22F        FOR K:=1 TO 5
Ø23F          READ #INPATH,DD
Ø249        NEXT K
Ø254        READ #INPATH,DD$
Ø25E        FOR K:=1 TO 1Ø
Ø26E          READ #INPATH,DD
Ø278        NEXT K
Ø283        READ #INPATH,S$
Ø28D      NEXT I
Ø298      PRINT #SCRN,"Obtaining data for "; S$
Ø2B8      READ #INPATH,Y3
Ø2C2      READ #INPATH,D3
Ø2CC      READ #INPATH,H3
Ø2D6      READ #INPATH,M3
Ø2EØ      READ #INPATH,S3
Ø2EA      READ #INPATH,I$
Ø2F4      READ #INPATH,IØ
Ø2FE      READ #INPATH,OØ
Ø3Ø8      READ #INPATH,EØ
Ø312      READ #INPATH,WØ
Ø31C      READ #INPATH,MØ
Ø326      READ #INPATH,NØ
Ø33Ø      READ #INPATH,N1
Ø33A      READ #INPATH,KØ
Ø344      READ #INPATH,AØ
Ø34E      READ #INPATH,F1
Ø358      CLOSE #INPATH
Ø35E      PRINT #SCRN USING "'Frequency for doppler calculations: ',R8.3>,'MHz'"
            ,F1
Ø39D      INPUT #SCRN,"Any change (Y/N)? ",AA$
Ø3BC      IF AA$="Y" OR AA$="y" THEN
Ø3D1        REPEAT
Ø3D3          INPUT #SCRN,"Enter new frequency: ",F1
Ø3F5        UNTIL F1>.Ø
Ø4Ø4      ENDIF
Ø4Ø6      END
Ø4Ø8    PROCEDURE meananom
ØØØØ
ØØØ1      PARAM K,M,M9,NØ,N1,Q,QØ,T,TØ:REAL
ØØ28      Q:=QØ+NØ*(T-TØ)+N1*(T-TØ)^2.
Ø04F      K:=INT(Q+.ØØØØØ1)
Ø05F      M9:=INT((Q-K+.ØØØØØ1)*256.)
Ø07A      M:=(Q-K)*2.*PI
Ø08F      END
ØØ91
    PROCEDURE elemupdt
ØØØØ
ØØØ1      PARAM A,AØ,C(3,2),EØ,E1,GØ,IØ,KØ,MØ,N,NØ,N1,O,OØ,PØ,QØ,RØ,T
            ,TØ,W,WØ:REAL
ØØ61      DIM CØ,C1,C2,E2,K2,SØ,S1,S2:REAL
ØØ84      IF NØ>.1 THEN
ØØ94        AØ:=(GØ/(NØ*NØ))^(1./3.)
ØØB2      ELSE
ØØB6        NØ:=SQRT(GØ/AØ^3)
ØØC7      ENDIF
ØØC9      N:=NØ+2.*(T-TØ)*N1
ØØE4      A:=(GØ/(N*N))^(1./3.)
Ø1Ø2      E2:=1-EØ^2.
Ø115      E1:=SQRT(E2)
Ø11E      QØ:=MØ/36Ø.+KØ
Ø131      K2:=9.95*(RØ/AØ)^3.5/E2^2.
Ø156      S1:=SIN(IØ*PØ)
Ø163      C1:=COS(IØ*PØ)
```

```
 Ø17Ø       O:=OØ-(T-TØ)*K2*C1
 Ø188       SØ:=SIN(O*PØ)
 Ø195       CØ:=COS(O*PØ)
 Ø1A2       W:=WØ+(T-TØ)*K2*(2.5*C1^2.-.5)
 Ø1CF       S2:=SIN(W*PØ)
 Ø1DC       C2:=COS(W*PØ)
 Ø1E9       C(1,1):=C2*CØ-S2*SØ*C1
 Ø2Ø6       C(1,2):=-(S2*CØ)-C2*SØ*C1
 Ø224       C(2,1):=C2*SØ+S2*CØ*C1
 Ø241       C(2,2):=-(S2*SØ)+C2*CØ*C1
 Ø25F       C(3,1):=S2*S1
 Ø27Ø       C(3,2):=C2*S1
 Ø281       END
 Ø283
PROCEDURE trueanom
 ØØØØ
 ØØØ1       PARAM AØ,C(3,2),EØ,E1,G1,G2,M,R,T,X,Y,Z:REAL
 ØØ3D       DIM C3,C7,E,G7,M1,M5,R3,S3,S7,XØ,X1,YØ,Y1,Z1:REAL
 ØØ78       E:=M+EØ+SIN(M)+.5*EØ^2.*SIN(2.*M)
 ØØA7       REPEAT
 ØØA9         S3:=SIN(E)
 ØØB2         C3:=COS(E)
 ØØBB         R3:=1-EØ*C3
 ØØCB         M1:=E-EØ*S3
 ØØDB         M5:=M1-M
 ØØE7         IF ABS(M5)>=.ØØØØØ1 THEN
 ØØF8           E:=E-M5/R3
 Ø1Ø8         ENDIF
 Ø19A       UNTIL ABS(M5)<.ØØØØØ1
 Ø11A       XØ:=AØ*(C3-EØ)
 Ø12A       YØ:=AØ*E1*S3
 Ø13A       R:=AØ*R3
 Ø146       X1:=XØ*C(1,1)+YØ*C(1,2)
 Ø162       Y1:=XØ*C(2,1)+YØ*C(2,2)
 Ø17E       Z1:=XØ*C(3,1)+YØ*C(3,2)
 Ø19A       G7:=T*G1+G2
 Ø1AA       G7:=(G7-INT(G7))*2.*PI
 Ø1CØ       S7:=-(SIN(G7))
 Ø1CA       C7:=COS(G7)
 Ø1D3       X:=X1*C7-Y1*S7
 Ø1E7       Y:=X1*S7+Y1*C7
 Ø1FB       Z:=Z1
 Ø2Ø3       END
 Ø2Ø5
PROCEDURE geocentr
 ØØØØ
 ØØØ1       PARAM C8,C9,F,H9,L9,PØ,RØ,S8,S9,W9,X9,Y9,Z9:REAL
 ØØ38       DIM L8,R9:REAL
 ØØ43       L8:=L9*PØ
 ØØ4F       S9:=SIN(L8)
 ØØ58       C9:=COS(L8)
 ØØ61       S8:=SIN(-(W9)*PØ)
 ØØ6F       C8:=COS(W9*PØ)
 ØØ7C       R9:=RØ*(1-F/2.+F/2.*COS(2.*L8))+H9/1ØØØ.
 ØØB5       L8:=ATN((1-F)^2.*S9/C9)
 ØØD1       Z9:=R9*SIN(L8)
 ØØDE       X9:=R9*COS(L8)*C8
 ØØEF       Y9:=R9*COS(L8)*S8
 Ø1ØØ       END
 Ø1Ø2
PROCEDURE azelrnge
 ØØØØ
 ØØØ1       PARAM A9,C8,C9,E9,L5,PØ,R,R5,R6,R8,S8,S9,T,T6,W5,X,X9,Y,Y9,
             Z,Z9:REAL
 ØØ58       DIM B5,C5,D,S5,X5,X8,Y5,Y8,Z5,Z8:REAL
 ØØ83       X5:=X-X9
 ØØ8F       Y5:=Y-Y9
 ØØ9B       Z5:=Z-Z9
 ØØA7       R5:=SQRT(X5*X5+Y5*Y5+Z5*Z5)
 ØØC4       IF T6<>T THEN
 ØØD1         R8:=(R6-R5)/(T6-T)/864ØØ.
 ØØEC       ELSE
 ØØFØ         R8:=-9.ØE+Ø9
 ØØFB       ENDIF
 ØØFD       R6:=R5
 Ø1Ø5       T6:=T
 Ø1ØD       Z8:=X5*C8*C9+Y5*S8*C9+Z5*S9
 Ø131       X8:=-(X5*C8*S9)-Y5*S8*S9+Z5*C9
 Ø156       Y8:=Y5*C8-X5*S8
 Ø16A       S5:=Z8/R5
 Ø176       C5:=SQRT(1.-S5*S5)
 Ø18A       E9:=ATN(S5/C5)/PØ
 Ø19B       RUN QUADRANT(X8,Y8,D)
 Ø1AF       A9:=D/PØ
 Ø1BB       RUN QUADRANT(X,Y,D)
 Ø1CF       W5:=36Ø.-D/PØ
 Ø1E2       B5:=Z/R
 Ø1EE       L5:=ATN(B5/SQRT(1.-B5*B5))/PØ
 Ø2ØB       END
 Ø2ØD
PROCEDURE quadrant
 ØØØØ
 ØØØ1       PARAM DX,DY,D:REAL
 ØØ1Ø       IF DX>.Ø THEN
 ØØ2Ø         IF DY>.Ø THEN
```

CBASIC III EDITOR/COMPILER

The ULTIMATE Color Computer III BASIC COMPILER!!!

If you want to write fast efficient machine language programs and you don't want to spend the next few years trying to learn how to write them in Assembly language or with a cheap compiler, then CBASIC III is the answer!!!

CBASIC III is the only fully integrated Basic Compiler and Program Editing System available for the Color Computer 3. It will allow you to take full advantage of all the capabilities available in your CoCo-3 including 512K RAM, without having to spend years trying to learn assembly language programming. CBASIC III allows you to create, edit and convert programs from a language you are already familiar with Enhanced Disk Color Basic, into fast efficient machine language programs easily and quickly. CBASIC III supports all the enhanced hardware available in the CoCo-3, including Hi-Res Graphics, & Screen displays, Extended Memory and Interrupts (Keyboard, Timer, Serial & Clock). We even added advanced commands not available in Basic to give you a level of control only avialable to very advanced Machine Language Programmers. Plus we made it exceptionally easy to use, not like some other compilers. CBASIC III is the friendliest and easiest compiler available for the Color Computer III.

CBASIC III is a powerful tool for the Beginner as well as the Advanced Basic or Machine Language programmer. You can write programs without having to worry about the Stack, DP Register, memory allocations and so on, because CBASIC III will handle it for you automatically. For Advanced users, CBASIC III will let you control every aspect of your program, even generating machine code directly in a program easily.

CBASIC III features well over 150 Compiled Basic Commands and Functions that fully support Disk Sequential and Direct access files, Tape, Printer and Screen I/O. It supports ALL the High and Low Resolution Graphics, Sound, Play and String Operations available in Enhanced Color Basic, including Graphics H/GET, H/Put, H/Play and H/DRAW, all with 99.9% syntax compatibility. CBASIC III also supports the built in Serial I/O port with separate programmable printer & serial I/O baud rates. You can send and receive data with easy to use PRINT, INPUT, INKEY, GETCHAR and PUTCHAR commands.

CBASIC makes full use of the powerful and flexible GIMI chip in the Color Computer 3. It will fully utilize the 128K of RAM available and install 2 Ultra Fast Ramdisks if 512K is available, for program Creation, Editing and Compilation. You can easily access all 512K of memory in a Compiled program thru several extended memory commands that can access it in 32K or 8K blocks and single or double bytes.

CBASIC has its own completely integrated Basic Program Editor which allows you to load, edit or create programs for the compiler. It is a full featured editor designed specifically for writing Basic programs. It has block move and copy, program renumbering, automatic line number generation, screen editing, printer control and much more.

The documentation provided with CBASIC III is an 8 1/2 by 11 Spiral Bound book which contains approximatly 120 pages of real information. We went to great lengths to provide a manual that is not only easy to use and understand, but complete and comprehensive enough for even the most sophisticated user.

CBASIC III is the most expensive Color Basic Compiler on the market, and well worth the investment. You can buy a less expensive compiler for your CoCo-3, and then find out how difficult it is to use, or how limited its features are. Then you'll wish you had bought CBASIC III in the first place. Dollar for dollar, CBASIC III gives you more than any other compiler available. If you can find a better CoCo-3 Basic Compiler then buy it!!!

Requires 128K & Disk $149.00

DATAPACK III PLUS V1.1

SUPER SMART TERMINAL PROGRAM

AUTOPILOT & AUTO-LOG PROCESSORS
X-MODEM DIRECT DISK FILE TRANSFER
VT-100 & VT-52 TERMINAL EMULATION

- No lost data even at 2400 Baud on the COCO-3 Serial I/O port.
- 8 Display Formats, 32/40/64/80 columns at 192 or 225 Res.
- 50K Text Buffer when using the Hi-Res Text Display & Disk.
- ASCII & BINARY disk file transfer support via XMODEM.
- Directly record receive data to a disk file (Data Logging).
- VT-100 terminal emulation for VAX, UNIX and other systems.
- VT-100/52 cursor keys, position, insert/delete, PF & Alt. keys.
- Programmable Word Length, Parity, Stop Bits and baud rates.
- Complete Full and Half Duplex operation, with no garbled data.
- 9 Variable length, Programmable Macro Key buffers.
- Programmable Printer rates from 110 to 9600 baud.
- Send Files directly from the Buffer, Macro Keys or Disk.
- Display on Screen or Print the contents of the Buffer.
- Freeze Display & Review information On Line with no data loss.
- Built in Command Menu (Help) Display.
- Built in 2 Drive Ramdisk for 512K RAM support and much more.

Supports: R.S. Modem-Pak & Deluxe RS-232 Pak, even with Disk.

Requires 128K & Disk, $59.95

EDT/ASM III

128/512K DISK EDITOR ASSEMBLER

EDT/ASM III is a Disk based co-resident Text Editor & Assembler. It is designed to take advantage of the new features available in the CoCo-3 with either 128K or 512K of memory. It has 8 display formats from 32/40/64/80 columns by 24 lines in 192 or 225 Resolution, so you use the best display mode whether you are using an RGB or Composite monitor or even a TV for your display. Plus you can select any foreground or background colors or even monochrome display modes. It will even support 512K by adding an automatic 2 drive Ultra Fast Ramdisk for lightning fast assembly of program source code larger than memory. There is also a free standing ML Debug Monitor, to help you debug your assembled programs. EDT/ASM III has the most powerful, easy to use Text Editor available in any Editor/Assembler package for the Color Computer.

- Supports Local and Global string search and/or replace.
- Full Screen line editing with immediate line update.
- Easy to use Single keystroke editing commands.
- Load & Save standard ASCII formatted file formats.
- Block Move & Copy, Insert, Delete, Overtype.
- Create and Edit files larger than memory.

The Assembler portion of EDT/ASM III features include:

- Supports the full 6809 instruction set & cross assembles 6800 code.
- Supports Conditional IF/THEN/ELSE assembly.
- Supports Disk Library file (include) up to 9 levels deep.
- Supports standard Motorola assembler directives.
- Allows multiple values for FCB & FDB directives (unlike R.S. EDT/ASM)
- Allows assembly from the Editor Buffer, Disk or both.

Requires 128K & Disk $59.95

TEXTPRO IV

"The ADVANCED COCO-3 Word Processing System"

- 9 Hi-Res Displays from 58 to 212 columns by 24 lines in 225 Res.
- On Screen Display of Bold, Italic, Underline & Double Width print.
- Up to 8 Proportional Character Sets Supported with Justification.
- Up to 80 Programmable Function Keys & Loadable Function key sets.
- Fully Buffered keyboard accepts data even duiring disk access.
- Autoexecute Startup files for easy printer & system configuration.
- 8 Pre-Defined Printer function commands & 10 Programmable ones.
- Supports Library files for unlimited printing & configurations.
- Disk file record access for Mail Merge & Boiler Plate printing.
- Completely Automatic Justification, Centering, Flush left & right.
- Change indents, margins, line length, etc. anytime in the text.
- Create and Edit files larger than memory, up to a full disk.
- Easily imbed any number of printer format and control codes.
- Built in Ultra Fast 2 drive RAMDISK for 512K support.

TEXTPRO IV is the most advanced word processing system available for the COCO-3, designed for speed, flexability and extensive document processing. It is not like most of the other word processing programs available for the Color Computer. If you are looking for a simple word processor to write letters or other short documents, and never expect to use multiple fonts or proportional spacing, then most likely you'll be better off with one of the other simpler word processors. But, if you want a powerful word processor with extensive document formatting features to handle large documents, term papers, manuals, complex formatting problems and letter writing, then TEXTPRO IV is what your looking for. It works in a totally different way than most word processing programs. It uses simple 2 character abbreviations of words or phrases for commands and formatting information that you imbed directly in your text. There are over 70 different formatting commands you can use without ever leaving the text your working on. There are no time comsuming, and often frustrating menu chases, you are in total control at all times. You can see what the formatted document will look like before a single word is ever printed on your printer. Including margins, headers, footers, page numbers, page breaks, column formatting, justification, and Bold, Italic, Underline, Double Width, Superscript and Subscript characters right on the screen.

TEXTPRO IV can even support LASER PRINTERS with proportional fonts, take a good look at this AD? It was done with TEXTPRO IV on an OKIDATA LASERLINE-6 laser printer!!! All the character sets used on this AD are proportional spaced characters, all centering, justification, and text printing was performed automatically by TEXTPRO IV.

Requires 128K & Disk $89.95

HI-RES III Screen Commander

The DISPLAY you wanted but didn't get on your CoCo-3

- 54 Different Character Sizes available from 14 to 212 cpl.
- Bold, Italic, Underline, Subscript, Superscript and Plain character styles.
- Double Width, Double Height and Quad width characters.
- Scroll Protect form 1 to 23 lines on the screen.
- Mixed Text & Graphics in HSCREEN 3 mode.
- PRINT @ is available in all character sizes & styles.
- Programmable Automatic Key repeat for fast editing.
- Full Control Code Keyboard supported.
- Selectable Character & Background color.
- Uses only 4K of Extended (2nd 64K) or Basic RAM.
- Written in Ultra Fast Machine Language.

HI-RES III will improve the standard display capabilities of the Color Computer 3, even the 40 and 80 column displays have several features missing. For example, you can't use PRINT @ or have different character sizes on the same screen, even when mixing text and graphics with the HPRINT command. Hi-RES III can give you the kind of display you always dreamed about having on your CoCo-3, with a wide variety of display options that you can easily use with your Basic or ML programs.

HI-RES III is totally compatible with Enhanced Color Basic and its operation is invisible to Basic. It simply replaces the normal screen display with an extremely versatile display package. With the full control code keyboard, you can control many of HI-RES III extended functions with just a couple of simple keystrokes.

Requires 128K Tape or Disk $34.95

512K RAMDISK & MEMORY TESTER

RAMDISK is an ALL Machine Language program that will give you 2 ULTRA High Speed Ram Disks in you CoCo-3. It does not need or require the OS-9 operating system. It works with R.S. DOS V1.0 or V1.1 and it is completely compatible with Enhanced Color Disk Basic! Plus it allows your CoCo-3 to run at double speed all the time even for floppy disk access!!! It will not disappear when you press reset like some other ramdisk programs. The MEMORY tester is a fast ML program to test the 512K ram. It performs several bit tests as well as an address test so you know that your 512K of memory is working perfectly.

Requires 512K & Disk $19.95

"The SOURCE III"

DISASSEMBLER & SOURCE CODE GENERATOR

The SOURCE III will allow you to easily Disassemble Color Computer machine language programs Directly from Disk and generate beautiful, Assembler compatible Source code.

- Automatic label generation and allows specifying FCB, FDB and FCC areas.
- Disassemble programs Directly from disk, unlike other disassemblers.
- Automatically locates Begin, End and Execution address.
- Output Disassembled listing with labels to the Printer, Screen or both.
- Generates Assembler source files directly to disk or printer.
- Built in Hex/Ascii dump/display to locate FCB, FCC & FDB areas.
- 8 Selectable Display formats 32/40/64/80 columns in 192 or 225 Res.
- Selectable Foreground & Background colors & Printer Baud rates.
- Built in Disk Directory an Kill file commands.
- Menu display with single key commands for smooth, Easy operation.
- Written in Ultra Fast Machine Language.

Requires 128K & Disk $49.95

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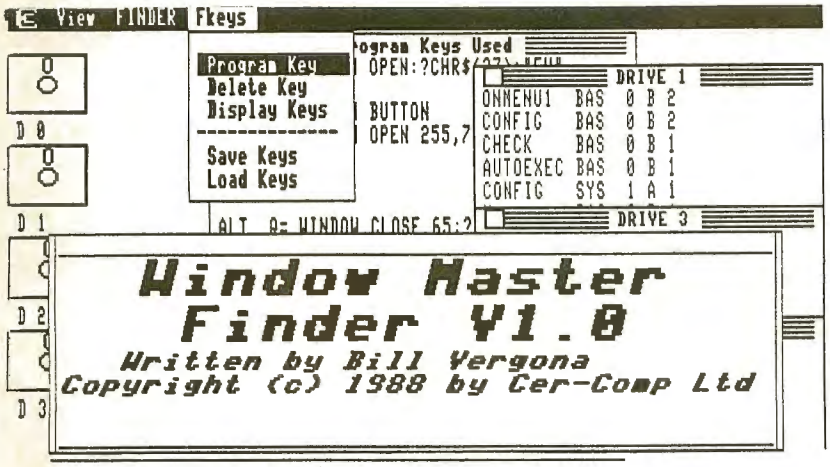
"Window Master"



Screen Display Fonts

Window Master supports up to 54 different character sizes on the screen with 5 different character styles. You can have Bold, Italic, Underlined, Super-Script, Sub-script or Plain character styles or any combination of them in any character size. You can also change the text color and background at any time to get really colorful displays.

Fully Basic Compatible

Window Master is fully compatible with Enhanced Color Disk basic with over 50 Commands & functions added to fully support the Point & Click Window System. Window Master does not take any memory away from Basic, so you still have all the Basic Program memory available.

Hi-Resolution Displays

Window Master uses the full potential of the Color Computer 3 display by using the 225 vertical resolution display modes instead of the 192 or 200 resolution modes like most other programs. It uses either the 320/16 color mode or the 640/4 color display to give you the best display resolution possible, and can be switched to either mode at any time.

Mixed Text & Graphics

Window Master fully supports both Text & Graphics displays and even has a Graphics Pen that can be used with HLINE, HCIRCLE, HSET and more. You can change the Pen width & depth and turn it on or off with simple commands. We also added Enhanced Graphics Attributes that allow graphics statements to use And, Or, Xor and Copy modes to display graphic information. With the Graphics enhancements added by Window Master, you could write a "COCOMAX" type program in Basic! In fact we provide a small graphics demo program written in Basic.

Event Processing

Window Master adds a powerful new programming feature to Basic that enables you to do "Real Time" Programming in Basic. It's called Event Trapping, and it allows a program to detect and respond to certain "events" as they occur. You can trap Dialog activity, Time passage, Menu Selections, Keyboard activity and Mouse Activity with simple On Gosub statements, and when the specified event occurs, program control is automatically routed to the event handling routine, just like a Basic Gosub. After servicing the event, the sub-routine executes a Return statement and the program resumes execution at the statement where the event occured.

Enhanced Editing Features

Window Master adds an enhanced editor to Basic that allows you to see what you edit. It allows you to insert & delete by character or word, move left or right a word or character at a time, move to begin or end of line, toggle automatic insert on/off or just type over to replace characters. The editor can also recall the last line entered or edited with a single key stroke. You can even change the line number in line to copy it to a new location in the program.

Disk contains 128K & 512K version of program.

Window Master Features

Multiple Windows

Window Master supports multiple window displays with up to a maximum of 31 windows on the screen. Overlapping windows are supported, and any window can be made active or brought to the top of the screen. Windows can be picked up and moved anywhere on the screen with the mouse. There are 6 different Window styles to choose from and the window text, border and background color is selectable.

Pull Down Menus

Menus are completely programmable with up to 16 menus available. They can be added or deleted at any time in a program. Menu items can be enabled, disabled, checked or cleared easily under program control. Menu selection is automatically handled by Window Master & all you have to do is read a function variable to find out which menu was selected.

Buttons, Icons & Edit Fields

Each Window can have up to 128 buttons, Icons or Edit fields active, if you can fit that many. Buttons, Icons and Edit field selection is handled automatically by Window Master when the mouse is clicked on one. All you have to do is read a Dialog function to find out which Button, Icon, or Edit field was selected, its very simple.

Mouse & Keyboard Functions

Window Master automatically handles the Mouse pointer movement, display and button clicks. It will tell you the current screen coordinate, the local window coordinate, window number the mouse is in, the number of times the button was pressed, which window number it was clicked in and more. The Keyboard is completely buffered, and supports up to 80 programmable Function keys that can contain any kind of information or command sequences you can imagine. You can load and save function key sets at any time. So, you can have special sets of function keys for different tasks. The "Ctrl" key is supported so that you have a full control code keyboard available.

Window Master Applications

Window Master pushs the Color Computer 3 far beyond its normal capabilities, into the world of a "User Friendly" operating enviornment. We are already planning several new programs for use with Window Master. So you don't have to worry about having to write all your own programs. And don't forget that many existing Basic and M.L. programs will run under Window Master with little or no changes. The Possibilities for Application programs are endless: Spread Sheets, Word Processing, Communications, Education, Games, Graphic Design, Desk Top Publishing and on and on.

Hardware Requirements

Window Master requires 512K of memory, at least 1 Disk Drive, a Hi-Res Joystick Interface and a Mouse or Joystick.

Technical Assistance

If you run into difficulty trying to use some of Window Master's features, we will be happy to assist you in any way possible. You can write to us at the address below or call us between 10am and 2pm Pacific Standard Time for a more timely response. Sorry, no collect calls will be accepted.

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Two-Liner Contest Winner . . .

The object of this two-player game is to blockade your opponent. Use the joysticks to force your opponent to run into the wall or the blue or yellow "trails."

The listing:

```
Ø POKE65495,Ø:CLS:PRINT@12,"BLOC
KADE":PMODE1:PCLS:LINE(Ø,Ø)-(255
,191),PSET,B:C(Ø)=178:C(1)=96:C(
2)=76:C(3)=96:FORI=1TO1ØØØ:NEXT:
SCREEN1,Ø:FOROL=1TO11395:PSET(C(
Ø),C(1),2):PSET(C(2),C(3),3):FOR
I=ØTO3:J(I)=JOYSTK(I)-32:NEXT'
(C) 1988 M. TOEPKE
1 FORI=ØTO2STEP2:H=-(ABS(J(I))<A
BS(J(I+1))):C(H+I)=C(H+I)+2*SGN(
J(H+I))-2*(J(H+I)=Ø):NEXT:H=PPOI
NT(C(Ø),C(1)):I=PPOINT(C(2),C(3)
):IFH>1ANDI>1THENPRINT"BOTH LOSE
"ELSEIFH>1THENPRINT"RIGHT LOST"E
LSEIFI>1THENPRINT"LEFT LOST"ELSE
NEXT
```

Michael Toepke
Oak Harbor, WA

(For this winning two-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

Two-Liner Contest Winner . . .

Time is difficult to add and keep track of because it's in "base" 60 instead of 100. It is even more difficult to average. This one-liner provides a running total and running average of input hours, minutes and seconds.

The listing:

```
1Ø CLS:PRINT"TIME BY CHARLES L.
GIBSON":PRINT"TOT.-";D;"HRS.*";E
;"MIN.*";F;"SEC.":PRINT"AVE.-";L
;"HRS.*";M;"MIN.*";N;"SEC.":INPU
T"HRS..";A:D=D+A:INPUT"MIN..";B:
E=E+B:INPUT"SEC..";C:F=F+C:H=F+(
E*6Ø)+(D*36ØØ):J=J+1:K=H/J:L=Ø:M
=Ø:N=Ø
2Ø IFE=>6ØTHENE=E-6Ø:D=D+1:GOTO2
ØELSEIFF=>6ØTHENF=F-6Ø:E=E+1:GOT
O2ØELSEIFK=>36ØØTHENK=K-36ØØ:L=L
+1:GOTO2ØELSEIFK=>6ØTHENK=K-6Ø:M
=M+1:GOTO2ØELSEIFM=>6ØTHENM=M-6Ø
:K=K+36ØØ:GOTO2ØELSEIFK<6ØTHENN=
K:GOTO1Ø
```

Charles Lee Gibson
Edwardsville, IL

(For this winning two-liner contest entry, the author has been sent copies of both *The Third Rainbow Book of Adventures* and its companion *The Third Rainbow Adventures Tape.*)

```
ØØ3Ø          D:=ATN(DY/DX)
ØØ3D        ENDIF
ØØ3F        IF DY<.Ø THEN
ØØ4F          D:=2.*PI+ATN(DY/DX)
ØØ65        ENDIF
ØØ67        IF DY=.Ø THEN
ØØ77          D:=.Ø
ØØ82        ENDIF
ØØ84      ENDIF
ØØ86      IF DX<Ø THEN
ØØ93        IF DY=.Ø THEN
ØØA3          D:=PI
ØØA9        ELSE
ØØAD          D:=PI+ATN(DY/DX)
ØØBC        ENDIF
ØØBE      ENDIF
ØØCØ      IF DX=.Ø THEN
ØØDØ        IF DY>.Ø THEN
ØØEØ          D:=PI*1.5
ØØED        ELSE
ØØF1          D:=PI*.5
ØØFE        ENDIF
Ø1ØØ      ENDIF
Ø1Ø2      END
Ø1Ø4
PROCEDURE scrnhdr
ØØØØ
ØØØ1      PARAM SCRN:INTEGER; C$:STRING[6]; DATEN$:STRING[8]; DATORB1$
           :STRING[52]; DATORB2$:STRING[11]; S$:STRING[4Ø]; GG,LN
           :INTEGER; K:REAL
Ø04F      PRINT #SCRN,CHR$(12);
Ø05A      GG:=Ø
Ø061      PRINT #SCRN,TAB(27); C$; " PREDICTIONS FOR "; S$
Ø087      GG:=GG+1
Ø092      PRINT #SCRN,TAB(8); "U.T.C.    AZ    EL   DOPPLER  RANGE HEIGHT  LAT   LONG"
           ;
ØØD6      PRINT #SCRN,"    PHASE"
ØØE8      PRINT #SCRN,TAB(8); "HHMM:SS   DEG   DEG    HZ       KM     KM   DEG    DEG"
           ;
Ø12C      PRINT #SCRN,"    (256)"
Ø13E      PRINT #SCRN USING DATORB1$,DATEN$,K;
Ø151      PRINT #SCRN,DATORB2$
Ø15B      GG:=GG+3
Ø166      END
Ø168
PROCEDURE scrncont
ØØØØ
ØØØ1      PARAM SCRN:INTEGER; PV:BOOLEAN
ØØØE      DIM AA$:STRING[1]
ØØ1A      IF PV THEN
Ø023        END
Ø025      ENDIF
Ø027      PRINT #SCRN,TAB(2Ø);
Ø032      PRINT #SCRN,"Press "; CHR$($1F); CHR$($24); "ENTER"; CHR$($1F
           ); CHR$($25);
Ø05E      INPUT #SCRN," to continue predictions ",AA$
Ø084      END
Ø086
PROCEDURE prntrhdr
ØØØØ
ØØØ1      PARAM PRN,LN,PG:INTEGER; E8,F1,H9,K,L9,W9:REAL; C$:STRING[6
           ]; DATEN$:STRING[8]; DATORB1$:STRING[52]; DATORB2$:STRING
           [11]; S$:STRING[4Ø]
Ø061      IF PG>1 THEN
Ø06D        PRINT #PRN,
Ø074        PRINT #PRN,
Ø07B        PRINT #PRN,
Ø082      ENDIF
Ø084      PRINT #PRN,
Ø08B      PRINT #PRN,
Ø092      PRINT #PRN,
Ø099      PRINT #PRN,TAB(16); C$; " PREDICTIONS FOR "; S$; ", BEACON: "
           ; F1; "MHZ"
ØØD6      PRINT #PRN,TAB(8); C$; TAB(15); "LAT= "; L9; TAB(27); "W. LONG= "
           ; W9;
Ø1Ø9      PRINT #PRN,TAB(44); "ALT= "; H9; "METERS"; TAB(62); "PAGE: "
           ; PG
Ø139      PRINT #PRN,TAB(25); "MINIMUM ELEVATION = "; E8; " DEGREES"
Ø169      PRINT #PRN,TAB(8); "----------------------------------------"
           ;
Ø19F      PRINT #PRN,"----------------------"
Ø1BF      PRINT #PRN,TAB(8); "U.T.C.    AZ    EL   DOPPLER  RANGE HEIGHT  LAT   LONG"
           ;
Ø2Ø3      PRINT #PRN,"    PHASE"
```

```
 Ø215      PRINT #PRN,TAB(8); "HHMM:SS   DEG   DEG    HZ       KM     KM   DEG    DEG"

           ;
 Ø259      PRINT #PRN,"    (256)"
 Ø26B      PRINT #PRN,TAB(8); "----------------------------------------"

           ;
 Ø2A1      PRINT #PRN,"-----------------------"
 Ø2C1      PRINT #PRN USING DATORB1$,DATEN$,K;
 Ø2D4      PRINT #PRN,DATORB2$
 Ø2DE      LN:=LN+8
 Ø2E9      END
 Ø2EB
PROCEDURE strngnum
 ØØØØ
 ØØØ1      PARAM STR:STRING[2]; NUM:REAL
 ØØ13      STR:=CHR$(48+FIX(INT(NUM/1Ø.)))+CHR$(48+FIX(NUM-1Ø.*INT(NUM

            /1Ø.)))
 ØØ44      END
 ØØ46
PROCEDURE sidereal
 ØØØØ
 ØØØ1      PARAM YEAR,G2:REAL
 ØØØC      DIM DAYS78:REAL
 ØØ13      DAYS78:=INT((YEAR-77.)*365.25)-366.
 ØØ31      IF YEAR<=77 THEN
 ØØ3E        DAYS78:=DAYS78+36525.
 ØØ4D      ENDIF
 ØØ4F      G2:=DAYS78*2.7379ØØ931E-Ø3+DAYS78*DAYS78*8.Ø5975E-16+.278586Ø56
 ØØ74      G2:=G2-INT(G2)
 ØØ81      END
```

Listing 2: echo.source

```
 ***************************************************
*
* ECHO  -  COPYRIGHT (c) 1988 by S.B.GOLDBERG
*
* Echo text to standard output path with some
* UNIX like enhancements.
*
* Use: Echo [text]
*      \c = terminate without new line
*      \f = clear screen (form-feed)
*      \n = go to new line
*      \\ = print backslash
*      \### = print decimal ### ASCII character
*
        ifpl
        use   /dØ/defs/os9defs
        endc
*
        mod   len,name,prgrm+objct,reent+1,entry,dsiz
*
hicount rmb   1   msb character count
locount rmb   1   lsb character count
        rmb   2ØØ   stack
        rmb   2ØØ   parameter
dsiz    equ   .
*
name    fcs   /Echo/
        fcb   1   edition number
        fcc   /(c)1988 S.B.Goldberg/
*******************************
* CONVERT AND DISPLAY
*******************************
entry   clr   hicount   zero character count
        clr   locount
        tfr   x,y   start of text
        pshs  x   save parameter pointer
loop    ldb   ,x+   get text character
        cmpb  #'\   backslash?
        bne   save   no, save character
        ldb   ,x+   get next character
        cmpb  #'\   backslash?
        beq   save   yes, save it
        orb   #32   make lower case
        cmpb  #'c   print without new line?
        beq   print   yes, print line
        cmpb  #'f   form feed (clear screen)?
        bne   newln   no, check for new line
        ldb   #$Øc   yes, clear screen character
        bra   save   save it
newln   cmpb  #'n   new line?
        bne   ascii   no, test for ascii number
        ldb   #$Øa   yes, line feed
        bra   save   save it
ascii   bsr   num   decimal number to binary
        tstb   zero?
        beq   loop   yes, continue looking
save    stb   ,y+   save output character
        inc   locount   count it
        cmpb  #$Ød   end of parameter?
        bne   loop   no, get next character
print   ldy   hicount   output length
        puls  x   output address
        lda   #1   standard output path
        os9   i$writln   print it
        bcs   out   exit with error
        clrb   clear error flag
out     os9   f$exit   quit
*******************************
* DECIMAL NUMBER TO BINARY
*******************************
num     leax  -1,x   reset pointer
        clrb   zero value
        bsr   bin   first digit
        bsr   bin   next 2 digits
bin     lda   ,x   get digit
        suba  #'Ø   make binary
        cmpa  #9   valid digit?
        bhi   back   no, return
        pshs  a   yes, save it
        lda   #1Ø   multiply old total
        mul   by ten
        addb  ,s+   add current digit
        leax  1,x   bump pointer
back    rts   return
*
        emod
len     equ   *
        end
```

Listing 3: Make Echo

```
PROCEDURE MakeEcho
 ØØØØ      (* Generates the module "Echo" in the CMDS directory *)
 ØØ37      DIM path,byt:BYTE
 ØØ42      DIM count:INTEGER
 ØØ49      (* If echo already exists in your CMDS directory *)
 ØØ7C      (* include the following line *)
 ØØ9C      (* SHELL "rename /dd/cmds/echo echo.old" *)
 ØØC7      CREATE #path,"/dd/cmds/echo":WRITE
 ØØDF      FOR count=1 TO 137
 ØØEF        READ byt
 ØØF4        PUT #path,byt
 ØØFE      NEXT count
 Ø1Ø9      CLOSE #path
 Ø1ØF      SHELL "attr /dd/cmds/echo e pe"
 Ø12A      END
 Ø12C      DATA 135,2Ø5,Ø,137,Ø,13,17,129,161,Ø,38,1,146,69,99
 Ø15D      DATA 1Ø4,239,1,4Ø,99,41,49,57,56,56,32,83,46,66,46
 Ø18E      DATA 71,111,1Ø8,1ØØ,98,1Ø1,114,1Ø3,15,Ø,15,1,31,18,52
 Ø1BF      DATA 16,23Ø,128,193,92,38,33,23Ø,128,193,92,39,27,2Ø2,32
 Ø1FØ      DATA 193,99,39,29,193,1Ø2,38,4,198,12,32,13,193,11Ø,38
 Ø221      DATA 4,198,1Ø,32,5,141,27,93,39,217,231,16Ø,12,1,193
 Ø252      DATA 13,38,2Ø9,16,158,Ø,53,16,134,1,16,63,14Ø,37,1
 Ø283      DATA 95,16,63,6,48,31,95,141,2,141,Ø,166,132,128,48
 Ø2B4      DATA 129,9,34,9,52,2,134,1Ø,61,235,224,48,1,57,3Ø
 Ø2E5      DATA 168,89
```

Accessible Applications

The importance of standard formats in file and directory use

What's the Difference?

By Richard A. White
Rainbow Contributing Editor

I received a call from Bill Guthke of Greenville, South Carolina, and his problem was pertinent to this month's topic. Although fairly new to the CoCo and to OS-9, Bill did run a Model I and works as an industrial-controls specialist. Further, he had read the manuals and one of Dale Puckett's books. Unfortunately, he had little opportunity to practice what he had read, so OS-9's use of directories hadn't sunk in. Basically, Bill was unable to load `Config` or `BASIC09`. Let's work through the basics of directory use, so we can understand the basics of Bill's problem.

Let's start with the OS-9 distribution disk's directories. A directory is a table of filenames and the data pertinent to each. Some of those filenames can be the names of other directories (sub-directories) under the one we are reading. The first directory table on a disk is for the root directory, and it begins in Sector 3 of the disk. Since sector numbering begins with zero, this is the fourth sector. All OS-9 files, including directories, have file-header sectors, and the root directory's file header is in Sector 2.

Richard White lives in Fairfield, Ohio, has a long background with microcomputers and specializes in BASIC programming. With Don Dollberg, he is the co-author of the TIMS *database management program.*

The sector number identifying the beginning of the file or sub-directory offers information for each listing in a directory table. If we start with a freshly-formatted disk and make a new `CMDS` directory on it, we use the command `MakDir` in the following manner:

```
OS9:makdir /d0/CMDS
```

The word *CMDS* is displayed as the first file listing in Sector 3 and starts at Byte 64. After the four bytes representing the letters C, M, D and S, there are zeros until Byte 95, which is $0A (10 decimal). This means that the `CMDS` directory's header starts at Sector $0A. (Actually, OS-9 uses three bytes for sector location, but in this example the first two bytes are zero, so I won't write them out.)

Note that when you format a disk, the format process allocates sectors for the root directory. If you type `free /d0` to determine the space available for a 35-track, single-sided disk, the computer identifies that disk capacity is 640 sectors and that 630 are free. The format process allocates sectors $01 to $09 for the root directory.

On the OS-9 system disk, the first file in the root directory (Sector 3) is `OS-9boot`. Byte 95 now refers to the starting location for `OS9boot` and is also $0A, which is the first free sector after the sectors allocated for the root directory. The next root directory entry, `CMDS`, starts at Byte 96 of Sector 3. Its starting sector is shown at Byte 127 as $75. All the sectors between $0A and $75 have been used by `OS9boot`. Note: These are the locations used on the Level II system and `Config` distribution disks. The same pattern holds for the Level I versions, but the `CMDS` directory location on this system disk is different because the length of Level I's `OS9boot` is different.

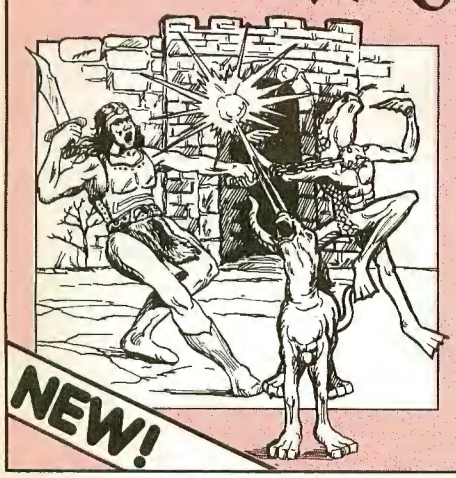
Now let's consider what happens when you boot using the system disk. OS-9 assigns its current execution and data directories in memory. A current execution directory is the drive and disk directory in which OS-9 will look for an executable (program) module when a module name has been entered at the OS-9 prompt. A current data directory is the drive and disk directory in which OS-9 looks for a data file if given a filename and no other path data.

These files will be on `/d0` or on your hard drive (`/h0`). The data directory will be the root directory whose header is on Sector 2, so an $00 00 02 location will be stored in memory. Whenever OS-9 needs to find a data file, it will determine the drive number for the current data file and then find the sector where the directory itself starts. It does the same thing when it is looking for an executable module, which it expects to find in the current `CMDS` directory.

Now we have enough information to consider the trap Bill has fallen into. First, he booted using a backup of his distribution disk. OS-9 carefully recorded the sectors where the root and `CMDS` directories started, so it could use them as its current data and execution directories. He then replaced his system disk with his disk containing `Config`

SUNDOG SYSTEMS

Warrior King



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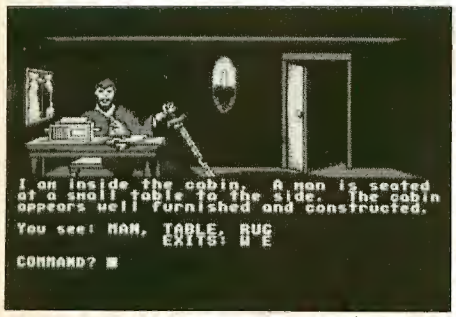
In Quest of the Star★Lord



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and typed Config. OS-9 went through the following reasoning process: It first looked at its in-memory module table and found no Config. It next looked up the starting sector of the current execution directory and read that sector. Because the CMDS directory on the Config disk was at a different location than on a system disk, OS-9 looked in what was now the wrong sector. It did not read what it expected to read and stopped trying to find a CMDS directory on the disk.

At this point, OS-9 looked for a data directory. Since the root directory started on the same sector on both disks, it found a directory, but there was no Config listed in that directory. OS-9 had no choice but to send the "Path Name Not Found" message.

I asked Bill to boot up his machine, put in his Config disk and enter the following:

```
OS9:chx /d0/cmds
OS9:config
```

He reported disk action, and then Config came up for him for the first time.

I have spent a lot of time explaining why you must use the command chx and/or chd when you change disks. Not doing so is one of the more frequent errors a new or occasional user makes, and it is difficult for inexperienced users to figure out their errors by themselves. Count on making this mistake in the future, but remember how to solve the problem it causes.

I had problems because the manual and distribution disk for OS-9 Level I did not agree in procedure. The manual instructs users to type basic09 to start the program. Anyone who did so got the infamous 216 Error. Ultimately, I (and many others) discovered that the distribution disk had no commands directory, and all files are saved in the root directory. The root directory worked for a data directory, but OS-9 would not load an executable module from a data directory. Users could load BASIC09 by typing the full path name: /d0/basic09. The best solution was to copy BASIC09 to a CMDS directory that could be used as a current execution directory. After all, you need a CMDS directory to store your packed modules.

Also, I expect others to set up OS-9 directories and files the same way I do when I "follow the book." Deviations waste my time and cause confusion when I discuss problems and possible solutions. There is a *wrong* way to correct the Level I distribution disk that works: Change your current execution directory to whatever directory the program module you want is in — regardless of the directory's name. It could be a root directory.

CALC	CMDS	COM	DOCS
DS	FORTH	GAMES	HPUB
MODULES	RAINBOW	RFEST1088	SCULPTOR
SPELL	SYS	TEMP	TESTING
UTIL	dynacalc.trm	startup	

Table 1: Directory of . . 15:27:44

Since this works, you may wonder why I consider it wrong. It's wrong because it is not organized, nor would this procedure be expected. This may not seem important to beginners, whose only programs are those that come on their OS-9 disks. However, it becomes vital as you collect more and more software. A hard disk can look like a library after a tornado if a careful directory discipline is not maintained.

The primary purpose of directories is to organize files so they can be found easily. They are just like file folders and file drawers. The number of directories you have on a disk is dependent on how you want to organize your files. If you are using 35-track, single-sided drives, you may not have any directories on a data disk. The disk itself is the directory. However, a double-sided, 40-track drive provides over twice as many file sectors for storage, and having a number of directories on these larger-capacity disks makes sense. Some of us use double-sided, 80-track, 3½-inch disks for storage and archiving. In this case we have 2880 sectors available, and directories are nearly always needed. With hard disks, which can hold thousands of files, there is no alternative to carefully planning directory structure.

Under OS-9, we follow conventions that govern how directory and filenames are written. Directory names are written in uppercase letters. Filenames always contain lowercase letters. Some may have a number of uppercase letters, like CC3Disk, but there are always some lowercase letters as well. This way, you can scan a directory listing and identify directories and files.

If you accidentally use all uppercase letters for filenames or put lowercase letters in a directory name, use Rename to correct it — whether it is a filename or a directory name. OS-9 doesn't care if you use upper- or lowercase. So when you are changing a directory or calling a module, you can use either. The upper- and lowercase conventions are meant to help you read directory listings, not to help OS-9.

Let me give you some examples. Table 1 shows a portion of the root directory on my hard drive:

Since my system boots in part from the hard drive (after OS9Boot is loaded from /d0), the expected CMDS and SYS directories are present. The StartUp file is in the root directory where OS-9 expects it. The only other file present in my root directory is dynacalc.trm, which is used by *DynaCalc* to initialize itself.

The CMDS directory contains all the commands and programs that I routinely use (currently, 92 files). These files have nothing in their names to indicate that they are executable, but I know they are since I only put executable modules in a CMDS directory.

Some programs, like *Home Publisher* and *Sculptor*, use files that are designed to go in a CMDS directory but are not executable files. On the hard drive, I make a directory for each application and put these files in a CMDS sub-directory under the application directory. (Those using only floppies have one or more application disks with a CMDS directory on each.)

All of us collect software we very seldom use. Unless you have limited space, the only reason to keep these modules in a separate directory is to make them easier to find for use or update. I keep two directories, UTIL and MODULES, with a CMDS sub-directory under each for unused modules.

Those of you who use only floppies work under a more severe capacity limit and need to move infrequently used modules to other disks for storage.

Again, include a CMDS directory on each disk and put your modules there, so you know they are programs and not data files. I sometimes make a backup of my current boot disk and then delete OS9Boot and everything in the CMDS directory. Then I copy a selection of program modules onto this disk. This disk can replace the boot disk without changing directories.

Finally, keep your directory names short. This saves typing and makes directories easier to use. If they are easy to use, you are more likely to use them. As far as OS-9 is concerned, all disk files are the same. They consist of a file header and sectors of bytes. The first byte in the file-header sector is the attribute that tells OS-9 whether it is a directory or a file — and if it is a file, whether it can be read, written to or executed. This is all OS-9 wants to know about the file contents. The remainder of the file header contains data OS-9 needs to read or write to the file. Included in this information is the length of the file because OS-9 files do not include an end-of-file marker. The file itself includes only information written by the application that saved it. OS-9 could have sent it anywhere — to a printer, through a serial port or to the display. This is what is meant by the term "Unified Input/Output System." The file data is not specific in any way to the device to which it is sent.

File content is specific to the application. A *DynaCalc* spreadsheet can be sent to a printer or to a display, but it won't make any sense to you. It needs *DynaCalc* to translate it to a readable form. On the other hand, you can redirect a program's screen output to the printer, where it is completely readable. Software hackers delight in writing file-handling utilities. You can get utilities to count files, lines, words and letters, sort files, and filter and search files. One of the more useful utilities is one that compresses a file, generally for archive-storage purposes. These utilities take advantage of each series of the same character that are found in many files. In other words, if you indent a paragraph in a letter, you might insert five spaces. A compression program finds this series of characters and replaces it with two or three bytes identifying the character and its number in the series.

A good archive program also stores multiple files in one sequence, which wastes little space. If a file uses only one byte of its last sector, OS-9 allocates that whole sector to the file. An archive program is set up to start the next archived file in the byte that follows the end of the preceding file. Savings of 10 to 60 percent are possible with text files. These columns normally can be compressed to save 40 percent of their original length.

AR and PAK are the two widely used OS-9 archiving programs. Both are available for downloading on the Delphi OS-9 SIG Database. They are also available from many other BBSs. I suggest you get both since you will find downloads archived both ways.

OS-9's use of directories makes file location and sorting much easier. This ease gives OS-9 users more freedom to use a variety of applications; however, it can also make learning to use the system effectively a little more difficult. If we standardize our methods of directory use and modification, we can make this system easier to use and more enjoyable.

See you next month.

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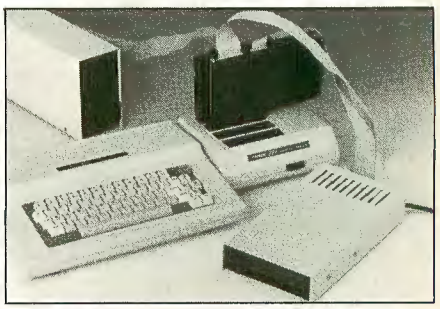

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