

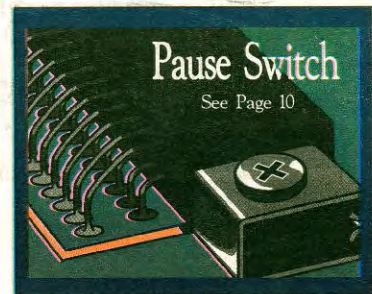
The RAINBOW

11 YEARS

THE COLOR COMPUTER MONTHLY MAGAZINE

June 1992 Vol. XI No. 11

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Feature Program

New Clear-screen Routines: ML and the CoCo 3

Machine language (ML) has many advantages over BASIC. Most users know machine-language programs run considerably faster than those written in BASIC. It is also possible to write ML programs so that they run in the "background," leaving the computer free to perform other tasks (simple multitasking). Yet another interesting difference is that machine language on the CoCo 3 gives us the power to *alter* the BASIC language.

The three machine-language programs presented here are examples of how I modified the CoCo 3 system to change the way the CLS command works. The programs are quite simple and most lines are commented, making them easy to follow.

Trapping The CLS Command

Every time a valid command is encountered, the CoCo executes a machine-language

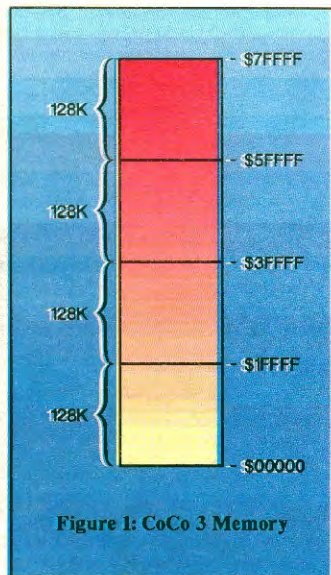


Figure 1: CoCo 3 Memory

subroutine in the BASIC ROM to perform the desired function. For example, when you enter CLS, the computer goes to a "command table" stored in the ROM and searches for the CLS command. Once it finds the entry for CLS, the CoCo deter-

mines where the routine starts and jumps to the appropriate address to execute the command.

The CLS command used for the CoCo 3's 32-column screen begins at Memory Location \$A928 (decimal 43304). We can "trap" the CLS command by placing a machine-language branch instruction at this address, pointing the CoCo in the direction of a different routine we want it to execute.

To get an idea of how this works, look at Line 160 of Listing 1. The ORG statement directs the assembler to locate the succeeding code at Address \$A928, the "hook" for CLS. What the assembler stores there is a long-branch instruction telling the computer to jump to Address \$01DA, which is where we'll put the

rest of our new CLS routine.

The second ORG (Line 190) tells the assembler to store the new routine starting at Address \$01DA. This is where the cassette huffer ordinarily resides in the CoCo. As written, the programs presented here *cannot* be used with a tape-based system. If a cassette command (CLOAD, CSAVE, etc.) is entered, any information stored in this area of memory will be destroyed — the new routine will be erased. (You can move the routines to another location if this presents a problem.)

Using the Hi-Res Screens

The two programs shown in listings 2 and 3 are intended for the CoCo 3's 40- and 80-column screens. They are a bit more complicated since we must use other tricks to gain access to these areas through machine language.

As most CoCo users know (or will soon find out), the 6809 microprocessor can address only 64K of memory. The CoCo 3's GIME chip, however, includes a memory-management unit (MMU) that allows the CoCo to address up to 512K of memory. The MMU does this by splitting the entire CoCo memory into 8K blocks, then mapping eight of these blocks into the 6809's address space as requested.

A CoCo 3 with 512K provides 64 distinct 8K blocks of memory. A 128K machine supports only 16 blocks, but ghosts these into the remaining areas as if the machine had 512K. Figure 1 shows how memory is apportioned in the CoCo 3. In a CoCo 3 with a full complement of 512K, the addresses from \$00000 through \$7FFFF are all ac-

tive and distinct. With 128K, only the top See Clear-screen Routines on Page 17

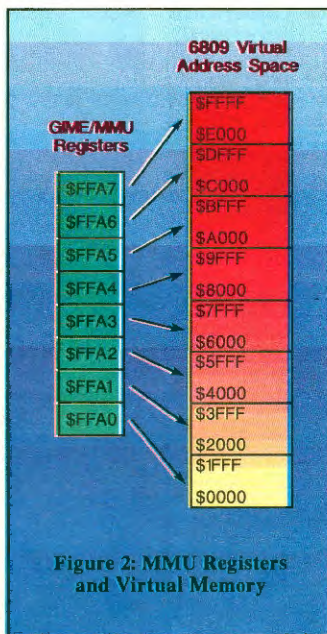


Figure 2: MMU Registers and Virtual Memory

Feature Program

CoCo Writes Purchase Orders

CoCoPO is a very handy little program, especially if you like to take advantage of the wonderful offers you see advertised in THE RAINBOW and other magazines. Over the past several years I have purchased a considerable amount of Color Computer software and hardware through third-party vendors, as well as from my local Radio Shack. Until I bought my CoCo 3, I used William Boston's Mail Order program (THE RAINBOW, August 1982) to handle purchase orders and found it to be a great help. However, I felt certain features could make the program a bit more functional, so I've added them. Still, Mr. Boston's program provided an excellent model from which to work.

CoCoPO is designed for the Color Computer 3 and uses the 80-column screen — you'll need an RGB or monochrome monitor to use it effectively. The program is menu-driven and quite easy to use. After running CoCoPO, start by selecting Option 1 (Enter Data). From this point, simply respond to the prompts.

After you fill in the address of the company from which you are ordering, the screen "form" appears. At the bottom of the screen is a prompt asking for the number of entries; if you are ordering more than one type of item, indicate here how many lines you will need. Enter just the numerical values at all prompts for prices — the pro-

See Purchase Orders on Page 30

In this issue:

Back Issue Information	14
◆ Bar Graph Printer	
Charles Kiedaisch	24
◆ Beat the Bomb Word Game	
John Sava	22
◆ Card-Player's Sort	
George R. Mabry	6
◆ Clean the CoCo 3 Screen	
Jason Dessel	1
◆ CoCo 3 Screen Expander	
Ron Dahlke	24
CoCo Consultations	
by Marty Goodman	4
◆ CoCo Writes POs	
Roger F. Krueger	1
◆ Convert PRINT@ Statements	
Mike Woolridge	14
Delphi Bureau	
by Eddie Kuns	18
Letters to Rainbow	2
◆ Matchmaker, Matchmaker	
Kevin Speight	16

Pause Switch	
Jeff Steidl	10
◆ Pretty Print With OS-9	
Stephen Goldberg	8
Print#-2	
by Lonnie Falk	2
◆ Print to the Screen and Printer	
James Provost	6
Received and Certified	22
Serial Communications	
Gary Kessler	27
◆ Star Grabber Game	
Jim McDowell	11
◆ Turn the World	
Barry Mitchel	12

Product Reviews:	
CoCo Family Recorder	
Farna Systems	15
Desk Accessory Pack	
from Cer-Comp, Ltd.	13
Unbelievable Offer #3	
Rick's Computer Enterprise	26

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Print#-2

Programming: Getting There From Here

In his new book *Accidental Empires* (a history of the last decade of the computer era — with special emphasis on the PC and Apple environments), Robert Cringley points out that what got people into computers in the beginning was programming. I believe Cringley is correct and that, to a great degree, this is why the Color Computer has always been so successful.

Certainly there are plenty of people who just want to huy applications, load them into their computers, and run them. Heck, by and large, I am one of these people. But what happens when there is no program? Or what if what you want the computer to do is something simple? The answer is programming.

This is why there have always been program listings in THE RAINBOW. Of course many of you buy the magazine, at least in

part, to get the "free" programs. But the truth of the matter is that "giving" you programs is only one of our goals.

Another goal we have is to teach a little "light" programming here and there. And it is a worthy thing to do. Let me explain.

I cannot add two numbers together particularly effectively. Despite the fact that my father promised me \$5 for every multiplication table I memorized, the 7's and 8's are still pretty much a mystery to me. So what I needed early on was a simple little program to add, subtract, multiply and divide numbers. Sure, it would have been easy enough to load a spreadsheet or one of those multifunction utilities, but that was overkill when all I wanted to do was add a few numbers together.

Programming was (and is) the solution. It is easy to write a program in BASIC to perform the four basic calculator functions.

Nowadays we load lots of programs at one time (using subroutines or OS-9), and we can do all sorts of fancy things. Yet I still use my own variation of the "adding machine" much of the time. I am sure many of you do similar things as well.

The point Cringley makes is that early on in the computer era, if you wanted a program that performed a particular task, generally you wrote it yourself. My point is that, even with the huge body of CoCo software available, there will always be some things you will want to do yourself. I also believe it is worth your time to learn

something about programming. This is why we put some emphasis on the subject in THE RAINBOW.

We will continue to emphasize this learning process monthly, if in no other way than by printing programs and showing you how they work. Sure, type in the listings (or get RAINBOW ON TAPE/DISK); but take the time to see how the program is constructed, too — what tricks the programmer uses, and how you can apply the techniques to the things you want to do.

Even with the huge body of CoCo software available, there will always be some things you will want to do yourself.

No, you do not have to be a programmer to use a computer. But I think it will increase your enjoyment of your CoCo if you delve into it a bit.

— Lonnie Falk

Letters to the RAINBOW



About Your New Look . . .

Editor:

My hat's off to you for the new format of THE RAINBOW. Although it is a bit bulkier, it sure is easier to read without the annoying glare found with the old slick pages. I am hopeful the changes will not be cosmetic only. Please return to the fat information-packed issues of yesteryear — perhaps a systematic reprinting of selected articles from early issues.

Many thanks and keep on serving us that good CoCo information.

Donnie Pardue
133 Lochmere Drive
Sanford, NC 27330

Editor:

The new tabloid format for THE RAINBOW is, well, functional. The important thing is it arrived — and that you're still supporting the CoCo. I must say that I long for the cheerful, funky, happy format and cover art of the middle 1980s, but then such is life. Again, thanks; Tandy is no longer with us.

Dale Hawley
3223 NE 89th St.
Seattle, WA 98115

Editor:

I have enjoyed THE RAINBOW for several years. I want you to know that I am not satisfied with your recent change. It is easier to store and look up back issues in book form.

If your magazine continues to come in a newspaper form, I will let my subscription lapse.

Lloyd Bledsoe
P.O. Box 169
Oxford, WI 53952

Editor:

A number of years ago I used a program called *Master Control III* on my CoCo I, but

I have since lost this utility. It was written by Alan Schwartz and put out by Soft Sector Marketing. The program generated BASIC commands with a keystroke — a great time saver when writing programs. Does anyone know where I can find it or another program like it for my CoCo 3?

Though I am sad to see the magazine style dropped, I hope the new format is more affordable to publish and better for the environment. Most of all, I hope it will yield more space for letters and articles on the CoCo's workings. We learn so much from other people's questions.

Alan Doherty
169 White Moss Drive
Marstons Mills, MA 02648

Editor:

With my 512K CoCo 3 and programs such as *Teletwriter 128*, *CHH PagesE*, *CoCo Max III*, *High Finance*, *Data Windows*, *Dynacalc* and many others (along with all the power and convenience of multitasking) I can do virtually anything that is accomplished with personal computers today.

I admit VGA would be nice, but not enough for me to go out and spend \$1000 or more and start over with a different system. No, I'm sticking with my CoCo 3. It has all the capability I need in a computer.

So keep THE RAINBOW coming, even if you have to go back to using that drugstore copier!

Thomas Fann
534 Moreley Avenue
Akron, OH 44320

Editor:

My gut feeling is that you should keep THE RAINBOW alive and in print, even if it must be on pulp newsprint. I know nothing about the publishing business. However, I do observe all the standard-sized magazines in my bookstore that obviously have a small audience (various hobbies and home crafts); though they have little advertising, they still survive.

I have all THE RAINBOWS (from the beginning) carefully saved and frequently use them. My main concern is whether the new format and the paper used will stand the test

of time or, like yesterday's newspaper, oxidize to brittle dust in a short time.

Besides my CoCo, I own a Tandy 1000 TL/2 with all the bells and whistles. It's a nice machine. But where do I go when I want to get something done smoothly and easily? To my CoCo. Sure, it's slower than bigger expensive machines, but I'm not a corporation, and I'm not especially in a micro-second hurry.

Magazines directed toward MS-DOS machines (PCM included) use most of their space describing what you can buy to do wonderful things for expensive prices. They provide very few programs you can type in yourself. A big joy of getting THE RAINBOW is to read, understand and type in a new way to do something. Even if you buy RAINBOW ON TAPE or DISK, the discussion of what, why, and how the program worked is there in THE RAINBOW. It is an education, not just a set of directions.

Somewhere in the thousand programs I've collected for CoCo, there's a BASIC or OS-9 program that will do almost everything that programs for MS-DOS accomplish. Long live the CoCo, and long live THE RAINBOW.

Page Edmondson
111 Windsor Lane
New Brighton, MN 55112

Editor:

I want to comment on your change from your magazine to a newspaper-type magazine. It is my opinion that the publishers of THE RAINBOW have made a mistake! How do we store or stack (or handle for that matter) this beast you have laid on us? I know expenses and profits play a big part in the decision-making process. Personally I would rather pay \$1 a year extra for my subscription than to suffer with the new format, which in my opinion is a step (or maybe two) backwards. Please reconsider going back to being a legitimate magazine.

E.J. Oelschlaeger
1242 Morrow Rd.
Pittsburgh, PA 15241

Editor:

Congratulations on your innovative new

format. You have given us larger print, larger ads, and more and better editorial content without raising the cost of the subscription. If it took slick paper to make a great publication, the *New York Times* and *Washington Post* would have slipped into obscurity long ago.

Your advertisers need to be reminded that Tandy has just about dumped all the CoCo hardware and software they had on the market. Other vendors surely suffered while people like me were picking up deals (such as *DeskMate 3* for \$2.95). But now there are thousands of us CoCo users who are relying solely on these vendors for our continuing hardware and software needs, and we're reading THE RAINBOW to find out about the products they sell.

Charles Radatz
KTNC Radio
P.O. Box 589
Falls City, NE 68355

Editor:

I was sorely disappointed when I received the latest issue of THE RAINBOW. I knew it was dwindling in size, but I was still able to file it in my library. I don't know how I can keep this format in good enough shape that I can refer to it—it is too big and has to be folded, and that tends over a time to ruin the magazine. I have two CoCo 3's and all the attachments. I also have hundreds of programs I have bought over the years. I still like the material you put in the magazine; but, I hope you can reproduce it in a size that can be filed in my yearly boxes.

I can afford to buy a PC-compatible, but the CoCo does all I want to do (even without having to learn OS-9 and C, though I appreciate the abilities of others who can use them and allow me to profit from their work). I will stay with the CoCo as long as I need it.

A.E. Robinson
Route 2, Box 2546-A
Boerne, TX 78006

Needs a Disk Drive

Editor:

I am looking for a Radio Shack (or compatible) disk-drive system for a Color Computer 2. Can someone help me locate one? I know I may also need an operating system.

Robert Simpson
5720 Rossmore Drive
Bethesda, MD 20814

Several RAINBOW advertisers offer disk-drive systems for the Color Computer. Check the ads from CoCo PRO!, Computer Plus and Owl-Ware in this issue. Drive0 systems usually include Disk BASIC, a general operating system for the CoCo.

Skipping the Perforations

Editor:

I have a CoCo 3, an FD-501 disk drive, a DMP-430 printer and an MPI PrintMate 99 Printer. I use the CoCo primarily for word processing, and I'm having some real problems with both printers. They print over the perforations, then skip spaces for the perforations a few lines down from the top of the page. It doesn't matter how I set the DIP switches. Can you tell me how the switches need to be set on either printer (or both)?

Kent Johnson
Route #1, Box 322
Provo, UT 84601

Perhaps others can give you specific information on DIP-switch settings, but if the misalignment is the same on all pages, we suggest you start the paper a little lower in the printer. With many "pull-feed" print-

ers, this is impossible—you must waste a whole piece of paper to start near the top of the next sheet.

Teach My CoCo to Talk

Editor:

I'm am in desperate need of an inexpensive speech system for my CoCo 3. Do you know where I can get one? Also, where can I find software to transfer files between a CoCo and an MS-DOS computer? Can I transfer files without using a modem? I would appreciate any help you could give me.

John Sava
618 N. Townsend Street
Syracuse, NY 13203

Elite Software and Granite Computer Systems offer utilities that can be used to transfer files between Disk BASIC and MS-DOS. Granite's system also supports OS-9 transfers. Also refer to the following two RAINBOW articles by Marty Goodman: "The Great Transformation" (June 1986, Page 182) and "CoCo to MS-DOS" (July 1986, Page 176).

Not Just Whistlin' Dixie

Editor:

I recently joined a Civil-War reenactment group and am now looking for any Civil War programs for the CoCo. I am looking for programs of any type (e.g., games, education, Civil War stats). Can anyone help? I have a CoCo and a CoCo 3, a disk drive, a printer and a modem.

E. Jeff Chandler
184 Mudtown Road
Sussex, NJ 07461-3616

CCTools: An Open Letter

Editor:

Micro 80 Users Group of Winnipeg, Manitoba, submitted CCTools to several BBSs last year. We have had a number of requests for the CCTools package. Unfortunately some of our subscribers sent personal checks instead of money orders. This causes quite a delay since the check has to clear before we can send out the CCTools package; an extra delay is involved if the check is from outside Canada. To make matters worse, a mail strike occurred just as we were starting to ship CCTools. One subscriber didn't get his package. When he wrote to inquire about it, we sent another package to him. We are sorry that this user was inconvenienced and disappointed in the shareware concept.

We will certainly do our best to make CCTools available to anyone as soon as they send for it. As stated in the distributed application and in the documentation, send no checks please—money orders only. For serious more-capable OS-9 users, CCTools is an environment that makes file, disk and utility management, as well as application launching, simple and fast.

Micro 80 Users Group
598 Riverton Avenue
Winnipeg, Manitoba
Canada R2L 0P1

OS-9 in Germany

Editor:

In have read in THE RAINBOW about the OS-9 programs Multi-View and Multi-View. What is the difference between them, and where can I get them? I have asked several Tandy stores in the U.S., but nobody seems to know. There are no Radio Shack stores in Germany.

I have problems trying to contact Tandy. I have written some letters but gotten no answers. Do you know a phone number I can use to ask about Tandy products?

I did manage to get OS-9 Level II and the

Development System. I received the disks and the documentation, but I didn't get a three-ring binder. Every time I use the manual, I end up with quite a mess on my writing desk. Where can I get an appropriate binder? (In Germany we have binders that have four rings.)

Eberhard Pflug
Alienberger Gasse 181
D-5303 Bornheim 4
West Germany

Prior to its introduction, Multi-View was often erroneously referred to as Multi-View. They are the same product. To the best of our knowledge, they are available only through Tandy's Express Order Service. You can contact Tandy by calling (817) 390-3011. Three-ring binders are available from most office-supply companies in the U.S.

Lending a Helping Hand

Editor:

One of the many ways I use the Color Computer is by providing computer activities for the children in my wife's daycare center. My old CoCo 2 has become the official daycare computer. The challenge has been to write programs that are appropriate for children from ages 2 through 5. I use CoCo Max II and Music+ to create graphics and music. Also, I bought the "Electronic Book" back when it was available from Radio Shack. I have found this is the only interface that children at these ages can use with ease.

The only problem we have is that many of the programs we use require synthesized speech, and the children frequently cannot understand the speech produced by the Radio Shack Speech/Sound Cartridge. I believe the Super Voice synthesizer, which was advertised a while back in THE RAIN-

BOW, would be the solution to our problem. However, I have been unsuccessful in locating even a used one. I am appealing to RAINBOW readers for help. I am interested in hearing from anyone who has Super Voice and would be willing to sell it to me for a reasonable price. It would be put to an extremely good use. Thank you.

Jim Bennett
118 Corlies Avenue
Poughkeepsie, NY 12601

Kudos

Editor:

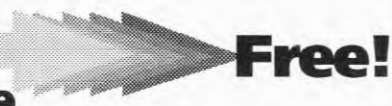
You are doing a great job! Continue this, and I'll read THE RAINBOW for a very long time. Thanks to you, I have learned more about computers in the past 10 years than I had learned before I discovered THE RAINBOW. I have also met new friends, and you have helped me decide what career I will choose in college. Once again, thank you very much.

Luis Tanon
Calle #2, M-12
Dos Rios, Bayamon
PR 00957

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, 9509 U.S. Hwy 42, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for 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, enter RAI to get to the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, enter LET to reach the LETTERS> prompt, then select Letters for Publication. Be sure to include your complete name and address.

Over
\$600 in
software



Free!

NO CATCH GIVEAWAY. We at CoCoPRO! are eager to meet new friends who use CoCos, and can think of no better way to make them than by **giving away** this fabulous collection of software to one lucky person...and that lucky person **could be you!**

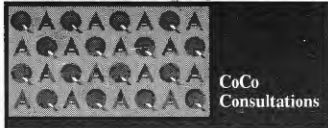
EASY TO ENTER. Simply send a postcard or letter with your name, complete address, telephone number, a brief description of your hardware setup, and indicate whether you use RSDOS, OS9, or both. **Entries must be received by July 15, 1992.** One entry per household. On or about July 15, a representative of accounting firm Baker & Assoc. will draw one lucky winner from all entries meeting the above criteria...and **that winner could be you.**

THE PRIZE PACKAGE. OS-9 Lv. 2 Development System, Simply Better, Newspaper09, NewsART09, NewsFONTS, V-Term, Disk Manager Tree, Tools II, Lv. II Tools, Presto Partner, Multi-Menu, Zapper, Carmen SanDiego, OS9 Lv 2 BBS, FlightSim II, CoCoPRO! Solitaire. All require a CC-3, some require OS-9 lv 2.

Send entries to:

COCO PRO!
PO Box 763 Ypsilanti, MI 48197

Entries not containing all requested information, or not received on or before July 15, 1992, may be disqualified.



Interfacing With the System Bus
 How do I interface hardware projects to the Color Computer system bus? Are prototyping cards available to assist me with making custom interface cards?

Dustin Mollo (DOCMOLLO)
 Forestville, California

Interfacing to the CoCo system bus is relatively straight-forward. The 6809 uses memory mapping for I/O. The I/O space for the CoCo 3 is \$FF00 through \$FF7E, but much of this area is taken up by various parts of the CoCo system itself. If you are using a Multi-Pak Interface or Slot Pak III, you can simplify address decoding by using the *SCS line. This line is active low for addresses \$FF40 through \$FF5F. If you use the *SCS line, however, make sure you switch (via software) to the slot that holds the device before attempting to address it.

You can use a GAL chip or small-scale logic chips (the 74LS30, 74LS133, and 74LS688 come in handy) with the address lines to decode for other parts of the I/O space. Addresses \$FF60 through \$FF7E are available, though you should stay away from \$FF68 through \$FF6F, which is used by one of two UART devices on most systems. I am told that addresses \$FF10-\$FF1F and \$FF30-\$FF3F in the CoCo 3 are also available — in a CoCo 1 or 2, these addresses conflict with the PIA chips, which “ghost” into that address space. You’ll want to gate any memory or I/O with the E-clock line, too, making sure that accesses occur only when the E clock is High. The 6809 uses a single R/*W line to control the direction of its 8-bit data bus.

CRC/Disto at one time offered an excellent Color Computer system-bus prototyping card — I used them for several projects and recommend them highly. CoCo PRO! may still be able to sell you some of these. If they are no longer available, you can make your own by scrapping other kinds of cards.

Transferring Big Files

I need to copy over half a megabyte of data (in the form of a random access file, for which I know the data-table format) from a CoCo running OS-9 to MS-DOS. What software and/or hardware do you suggest I use?

James W. Kerr
 Ft. Myers, Florida

Since this is a one-time transfer, I recommend you use terminal programs — one on the CoCo and the other on the MS-DOS computer. Any terminal programs that support Xmodem or Ymodem should be adequate, and there are a great many to choose from for both OS-9 and MS-DOS systems.

Link the two computers by using a null-modem cable between their serial ports. Since you are running OS-9, I assume you are using a Multi-Pak Interface (or Y cable) and an RS-232 pack of some kind. Given this, it is fairly easy to make a null-modem cable to go between a PC-compatible with a DB-25 connector for its RS-232 port and the DB-25 on the CoCo serial pack. Pins 2, 3 and 7 on the CoCo end should go to pins 3, 2 and 7, respectively, on the PC DB-25. Connect Pin 4 to Pin 5 on the CoCo end,

then connect Pin 4 to Pin 5 on the PC end — but don’t connect the CoCo end to the PC end. Similarly connect Pins 6, 8 and 20 together on each end. (See Figure 1)

If your PC compatible uses a DB-9 connector for its serial port, connect pins 2, 3 and 7 on the CoCo’s DB-25 to pins 2, 3 and 5, respectively, on the DB-9 (as opposed to the way we wired the DB-25 above). On the CoCo side connect pins 4 and 5 together and pins 6, 8 and 20 together, as described above. On the PC side, wire together pins 7 and 8. Also wire together pins 1, 4 and 6 on the DB-9 connector. (See Figure 2)

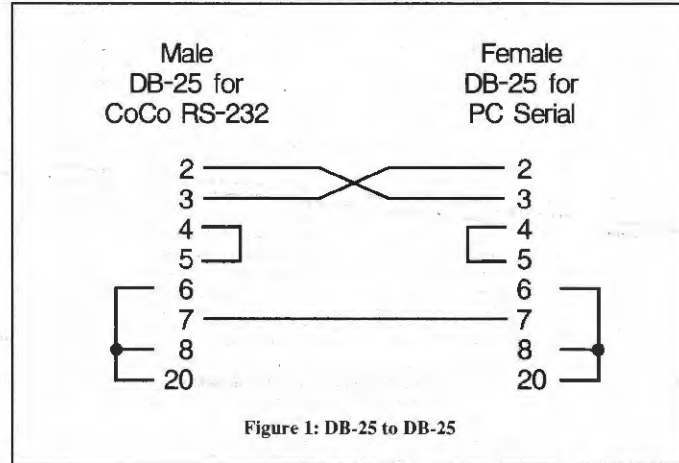


Figure 1: DB-25 to DB-25

Use the new cable to link the serial ports on the two computers and run a terminal program on each machine. Be sure you use the same communications speed on both machines. (I recommend using the fastest rate you can — probably 2400 bps.) Try typing a few letters on each keyboard, to make sure the same letters appear on the screen of the other machine. Once this is working, tell the PC to start an Xmodem receive and tell the CoCo to initiate an Xmodem send of the file you want to transfer. This should bring the file over.

Several OS-9 utilities are available for reading and writing MS-DOS disks. But for a single transfer, it may not be practical to buy such software.

Printout Slowpoke

When I send data from Max-10 to my DMP-130 printer at 2400 bps (the fastest speed the 130’s internal serial port accepts), it takes 30 minutes to print a page. This is just too long for me. Would a parallel interface help me achieve faster results?

Arthur R. Hinman
 Hummelstown, Pennsylvania

Unless you use a sizeable printer buffer along with a serial/parallel converter, you won’t get much better performance using the parallel port. Note that a serial/parallel converter is essential for hooking a Color Computer to a parallel printer port (unless you have a special hardware parallel port adapter of the sort that comes with certain Disto mini-expansion boards and some J&M disk controllers, along with appropriate software). Max-10 is slow to print because it prints a “bit image” of the page in the printer’s graphics mode. This requires far more data be sent to the printer than would be the case if the program used the available fonts in the printer and sent only ASCII text to the printer. Unless you need the desktop publishing capabilities of Max-10, you might consider using another word processor. Max-10 exacts a heavy price in printing speed for its great flexibility in the printing of fonts.

Swapping Printer Boards

Is there a board that can be swapped or installed in a Star Micronics NX-1000 with a Commodore interface to convert it for RS-232 input?

I found that cutting slots over the power transformer and power regulator in my CoCo 3 significantly reduced the heat level inside the case. This may be a quick and simple alternative to redesigning the power supply in CoCos that suffer overheating problems.

Doug Pirkey
 New Cumberland, Pennsylvania

DOS computer with a 5/4-inch 360K drive. This PC-based hardware from Central Point Software can copy any copy-protected disk produced for the Color Computer (with one exception, a case in which the media was intentionally damaged in a particular spot).

Connecting to Ma Bell

How do I hook my converted DC Modem Pak to a standard telephone line?

Jason Reighard
 Toronto, Ohio

The conversion of a DC Modem Pak for use as an RS-232 pack involves removing the 300-bps modem that is part of the DC Modem Pak. After the modification, you must use an external modem (preferably one that operates at higher speeds), connecting it to the converted pack with a standard serial cable (one that sends lines 2 through 8 and Line 20 straight from the DB-25 connector on the pack to the DB-25 connector on the modem). External 1200-bps modems are considered obsolete by many and can be purchased for around \$10 (used) at computer swap meets and flea markets. External 2400-bps modems are quite inexpensive — about \$70 to \$100 new — and can be had for \$30 to \$50 at swap meets and flea markets.

Error-Correcting Modems

I have a Disto Mini RS-232 pack. I want to know whether or not it can be used with an MNP 5 or V.42bis modem to support hardware flow control.

Bernie Ruddock (BFRSYS)
 Montville, New Jersey

What is usually needed to support hardware flow control with MNP 5 and V.42bis error detection and compression systems is support for the RTS and CTS lines of the RS-232 port by the hardware of the RS-232 port and, in some cases, by the software that talks to it. The Tandy RS-232 Pak does have hardware support for RTS and CTS. Some of the early Disto Mini RS-232 packs supported RTS and CTS, too. The RS-232 port on Disto’s mini-expansion bus, however, does not support RTS and CTS, nor does the CoCoPRO! RS-232 pack (though I did

There is no practical way to convert a printer that has a dedicated Commodore interface. While no doubt a new mother board for the printer would fix the problem, this would cost more than buying a new printer.

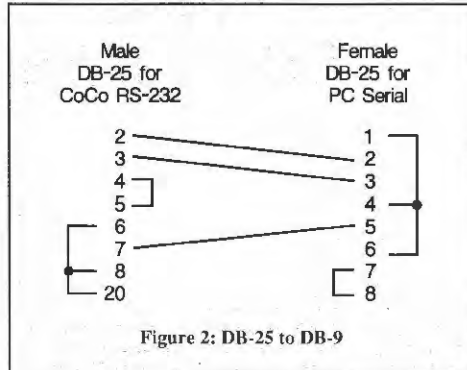


Figure 2: DB-25 to DB-9

You are quite right that better ventilation noticeably improves the heat dissipation of the CoCo, and that most of the heat generated by the CoCo 3 is produced directly below a part of the case that has its ventilation slots “cosmetically” sealed. Opening these slots sounds like an excellent idea, and most certainly is a lot less work than installing a remote power transistor and heat sink.

Copying the Uncopyable

Is there a utility for the CoCo that will allow me to back up copy-protected disks for archival purposes?

Howard Bacon
 South Pittsburgh, Pennsylvania

Long ago, Computize offered a utility called Spit ‘N Image that could copy most (though not all) copy-protected CoCo disks. Computize has left the market, however, and I don’t know if Spit ‘N Image is available elsewhere. Alternatively, you can use the Copy 2 PC Option Board on an MS-

provide space on the circuit board to add extra level converters and thus support for RTS and CTS). Check to see if pins 4 and 5 of the DB-25 connector go to a level-converter chip (a MAX232, 1488 or 1489 chip). If those pins are connected to level converters, RTS/CTS hardware flow control can be supported. If those pins are not connected anywhere, RTS and CTS cannot be used for flow control. Note that MNP modems offer an optional use of software flow control, although this may cause problems with binary data.

Null-Modem Connections

About six weeks ago, you gave me information on how to make a null-modem cable to connect my CoCo and 80286-based system. I followed your instructions, but the cable did not work. I got back to you and asked if somehow the problem might be related to the fact that COM 1 and COM 3 share an interrupt (as do COM 2 and COM 4), combined with the

See CoCo Consultations on Page 26

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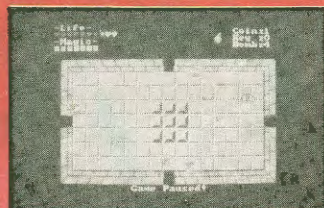
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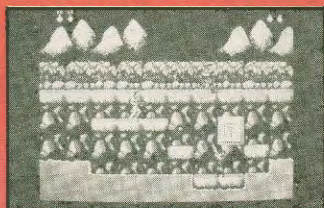
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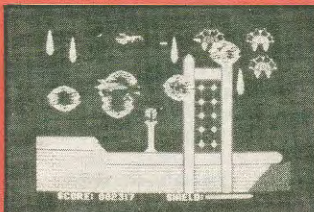
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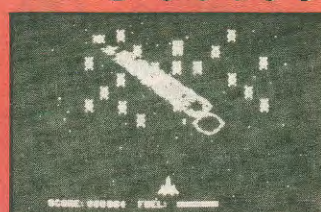
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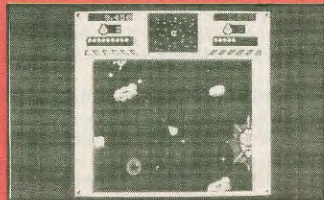
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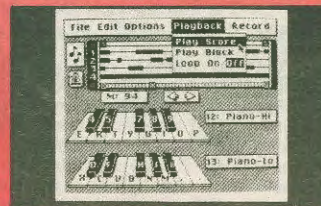
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The Card-player's Sort

Sorting a playing hand of cards after they are dealt can be accomplished in several different ways. One method many card players use is as follows: The player starts to form his playing hand by taking the first card from the pile and placing it in one hand. He then picks up the second card, holding it in the empty hand while deciding whether to place the new card on the left side or the right side of the first card. When he picks up the third card, he again holds it in his free hand until he has decided where it should go in relation to the other two. The player continues this process until all the cards in the hand have been sorted to his liking.

This method of sorting cards is equally applicable to sorting data with a computer. The sorting subroutine shown in the listing functions in a manner that is completely analogous to the card player's method for sorting cards. This routine, which is designed to sort 10 numbers stored in an array

under the labels X(1) through X(10), operates entirely within the FOR/NEXT loop between lines 2010 and 2050. The loop variable (A) starts with a value of 2 since there is no need to make a sorting decision until the second number is retrieved (or, for the card player, until the second card is picked up).

In Line 2020, the value of Array Element X(A) is temporarily stored in X(0), which is analogous to the card player's holding the new card in his free hand. In Line 2030, a loop is formed in which the value of X(0) is sequentially compared to each of the elements that have been processed so far. This loop continues as long as X(0) has a value that is equal to or greater than the value of the element to which it is being compared. If the value in X(0) is less than that of the comparison element, the value of that element is passed to the next higher location in the array. This process, which starts with the array element holding the largest value

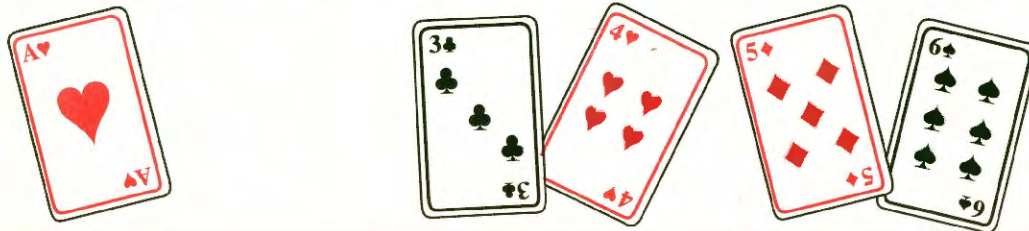
and progresses toward the one with the smallest value, locates the proper element in the array for storing the new value. This is equivalent to the card player's action of separating his cards one at a time until an opening has been created where the new card should be inserted.

In Line 2040, the value of X(0) (whose value is equal to the original value of X(A)) is stored in the array in its proper location. (This is equivalent to sliding the new card into the opening that has been created for it.) In Line 2050, the program loops back to Line 2020 to process the next element in the array (picking up the next card).

The primary advantage of this sorting technique comes from Line 2030. Note that any array element that is out of place is simply moved to the next highest position in the array. This is accomplished using a single assignment statement, X(A+S)=X(A+S-1), and does not require a complete swap of values between two elements in the

array. As a result, the "card-player's sort" uses fewer machine cycles and less processing time than sort routines that perform multiple value swaps between array elements. The average time required to sort 1000 sets of 10 random numbers using a CoCo 3 is about .9 milliseconds. In contrast, the average time to sort 1000 sets of 10 random numbers using an iterative bubble sort is about 1.45 seconds — an increase of more than 60 percent when compared to the time required for the card-player's sort.

In the DEMO program, the FOR/NEXT loop listed between lines 70 and 100 creates a set of 10 random numbers and displays them onscreen. In Line 110, the program branches to the subroutine where the sorting operation is performed. The FOR/NEXT loop, between lines 120 and 140, displays the sorted array in a separate column on the screen, allowing for comparison with the original set of numbers. Because the process of creating and displaying the array values uses a number of additional machine cycles, the total time required to run DEMO ranges from about 1.5 seconds up to as much as 2.0 seconds.



George R. Mabry is a retired aerospace engineer. He uses his Color Computer primarily for word processing, though on occasion he uses it to develop BASIC programs for use in his consulting work. George can be contacted at 18275 Hercules Street, Hesperia, CA 92345. Please include an SASE when requesting a reply.

Feature Program

Print to the Screen and Printer

Do you ever run BASIC programs that print information onscreen that you really need on paper? Or perhaps you want to keep a paper log of a computing session so you'll know just what you did. In either case, the solution is usually to grab a pencil and paper and start copying. Bah, humbug!

	POKE 360,x	POKE 361,y
Color BASIC	162	130
Extended BASIC	130	115
Disk BASIC 1.0/2.0	203	74
Disk BASIC 1.1/2.1	204	28

Figure 1: Sync Turn-off Pokes

Sync is a simple BASIC program that patches the software in the CoCo so that characters printed on the screen, whether entered from the keyboard or printed by a program, are also sent to the printer. This provides an easy way to keep a log, track moves in an adventure game, or keep a hardcopy of the output from that hot financial program.

The program shown in the listing pokes a short machine-language routine into low memory. This routine traps characters going to the screen and sends a copy to the printer. Two pokes are used (Line 40) to set the CoCo's Console-Out vector to the starting location of the machine-language routine, effectively turning it on.

After you enter the program, double check the data statements and poke values for errors, then save the program to tape or disk. Before running the program, make sure your printer is online; otherwise the computer may "hang." And make sure you use the appropriate baud poke in Line 50 so your printer doesn't print garbage.

(If your printer is set to 600 baud, you can eliminate Line 50 altogether.)

After you run Sync, any characters that appear on the screen are also printed. As written, the program works with any CoCo 1, 2 or 3. It should work with any BASIC program and may work with some commercial products (use the try-and-see method). To stop the synchronous output, cold start the CoCo; if this isn't acceptable, read on.

Sync is excellent for use as a stand-alone program that allows you to create a printed record of a computing session. Sync can be even more effective when used within your own BASIC creations — you can turn it on when you need it and off when you don't. To add Sync to your BASIC creation, put the lines in the program listing near the beginning of your program. Then you can turn Sync on (using

the pokes shown in Line 40) and off as needed. To turn synchronous output off under software control, use the appropriate pokes from Figure 1. For example, if you have Disk BASIC 1.1, use

```
POKE 360,3:POKE 361,232
```

to turn Sync on and

```
POKE 360,204:POKE 361,28
```

to turn it off. The turn-on pokes are the same for all versions of BASIC and Disk BASIC.

```

4K
The Listing: SYNC
1 *SYNC
2 *BY JAMES PROVOST
3 *REPRINTED FROM THE MAY 1984
4 *ISSUE OF THE RAINBOW
10 FOR X=1000 TO 1007
20 READ A:POKE X,A
30 NEXT X
40 POKE360,3:POKE361,232
50 POKE150,1 *PRINTER BAUD POKE
60 DATA 52, 84, 189, 162, 191
70 DATA 53, 84, 57
    
```

```

4K
The Listing: CARDSORT
1 'CARD-PLAYER'S SORT DEMO
2 'BY GEORGE R. MABRY
3 'COPYRIGHT (C) 1992
4 'BY FALSOFT, INC.
5 'RAINBOW
40 CLS
50 PRINT "CARD PLAYER'S SORT PRO
GRAM"
60 PRINT
70 FOR A=1 TO 10
80 X(A)=RND(1000)
90 PRINT X(A)
100 NEXT A
110 GOSUB 2000
120 FOR A=1 TO 10
130 PRINT @(32*A+48),X(A)
140 NEXT A
150 PRINT
160 PRINT "RUN THE PROGRAM AGAIN"
170 PRINT "(Y OR N)?"
180 Z$=INKEY$:IF Z$="" THEN 180
190 IF Z$="Y" THEN 40
200 IF Z$>"N" THEN 180
210 END
2000 REM* CARD PLAYER'S SORT *
2010 FOR A=2 TO 10
2020 S=0:X(0)=X(A)
2030 IF X(0)<X(A+S-1) THEN X(A+S
)-X(A+S-1):S=S-1:IF (A+S)>1 THEN
2030
2040 X(A+S)=X(0)
2050 NEXT A
2060 RETURN
    
```




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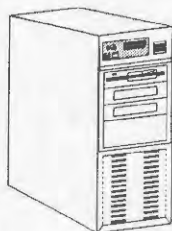
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Feature Program

Pretty-print OS-9 Source Code

Programmers are notorious for taking the easiest path to finish a task. For example, the OS-9 assembler allows you to put several spaces between fields (label, mnemonic, operand and comment) to align the columns, making the assembly-language listing very easy to read. (Notice how neat the listings look in THE RAINBOW.) However, if you're like me, you take the shortcut and put only one space between the fields. The problem with this is that when you print the listing for debugging or to show to someone, all the fields run together and it is downright difficult to read.

Pretty is a machine-language program I wrote to solve this problem. *Pretty* formats the source code and makes it look like it came straight from the pages of THE RAINBOW — and you can continue to put only one space between fields.

To use the program, just enter *pretty* followed by the name or pathlist of the desired file. If you omit the source filename, the program accepts lines from the standard input path through a pipeline or by input redirection. Two examples of this are

```
list sourcefile ! pretty
```

and

```
pretty <sourcefile
```

Pretty sends the newly formatted source

code to the standard output path, so it can be viewed on the screen or redirected to the printer or to a file. For example,

```
pretty uglisource >prettysource
```

formats the source code in *ugl* source and saves it in a new file called *prettysource*.

The *-p* option tells the program to paginate the output. If used, *Pretty* prints 65 lines then a blank line to ensure the print-head skips over the fanfold perforations. To have *Pretty* do this, just enter *-p* directly after *pretty* on the command line. To alter the line and page lengths, change the equate (equ) statements in the listing before assembling the program.

The assembly-language source code for *Pretty* is shown in Listing 1. If you do not have an OS-9 assembler, enter and run the BASIC09 program shown in Listing 2. This program generates the executable *pretty* module and stores it in the CMDS directory on the default drive. Level I users need to change all references to */dd* in Listing 2 to */60* (or another appropriate drive).

Stephen Goldberg is a dentist and the author of the Utilipak series of OS-9 utilities. He can be contacted at 695 Plainview Road, Bethpage, NY 11714. Please include an SASE when requesting a reply.

Listing 1: *Pretty.asm*

```
*****
*
* PRETTY - (c) 1988 by STEPHEN B. GOLDBERG
*
* Use: pretty [-p] [file]
* Formats and optionally paginates assembly language
* source code to standard output path. The standard
* input path is used if file name is omitted.
*
        ifpl
        use      /dd/defs/os9defs
        endc
*
        mod     len,name.prgm+objct.reent+1.entry,dsiz
*
linelen equ 80      printer line length
pagelen equ 66     page length
*
path     rmb 1      input path number
string  rmb 1      string flag
delim   rmb 1      string delimiter
paginate rmb 1     pagination flag
pgcount rmb 1      text line counter
inbuff  rmb 255    input buffer
outbuff rmb 255    output buffer
        rmb 200    stack
        rmb 200    parameters
dsiz     equ .
*
name     fcs /Pretty/
        fcb 2      edition number
        fcc /(c)1988 S.B.Goldberg/
*****
* INITIALIZE AND OPEN FILE
*****
entry   clr path      stancard input path
        clr string   clear string flag
        clr paginate clear pagination flag
        decb parameter?
        beq newpage  no, use standard input
        ldd ,x       parameter characters
        cmpa #'      option?
```

```

        bne open      no, open file
        orb  #20      make lower case
        cmpb #'p     paginate?
        bne open      no, open file with error
        inc paginate yes, set page flag
        leax 1,x     bump pointer
findfile ldd ,x+     parameter characters
        cmpb #20     filename?
        beq findfile no, look some more
        blo newpage  no filename, use standard input
open     lda #read.  read mode
        os9 i$open  open input file
        bcs pass    exit with error
        sta path    save path number
*****
* GET LINE FROM INPUT
*****
newpage lda #pagelen-1 lines/page
        sta pgcount to line counter
getline lda path     input path number
        leax inbuff,u input buffer
        ldy #255     maximum line length
        os9 i$readln get line
pass     l bcs error  branch on error
        lda ,x       first character
        cmpa #20d    blank line?
        beq printit  yes, print it
        cmpa #'*     comment?
printit l beq print2  yes, print it
*****
* FORMAT FIELD COLUMNS
*****
        leay outbuff,u output buffer
        ldb #8       length of label field
        bsr movetext move label to output buffer
        pshs y       save register
        ldb #3       opcode length
        leay fcc.pcr string pseudo-op
        bsr compare expect string operand?
        bcc setflag yes, set string flag
        bsr compare expect string?
        bcc setflag yes, set string flag
        bsr compare inherent mode opcode?
chkmode  bcs chknext  no, check next opcode
        puls y       yes, retrieve register
        ldb #20     opcode + blank operand
        bra operand move both
chknext  tst ,y           check next opcode character
        beq opcode done, move opcode
        bpl chkmode good opcode, check it
        incl no good, check 4 character opcodes
        leay 1,y   bump pointer
        bra chkmode check opcode
*
compare  os9 f$cmpnam compare opcodes
        leay b,y  next opcode
        rts      return
*
setflag  inc string  set string flag
opcode   puls y     retrieve register
        ldb #5      opcode field length
        bsr movetext opcode to output buffer
        ldb #14     operand field length
        tst string  string field?
        beq operand no, move operand to output buffer
        bsr dostring yes, ignore spaces in string
        bra document add comment
operand  bsr movetext operand to output buffer
document clra      no delimiter
        bsr comment add comment to output buffer
*****
* MOVE FIELD TO OUTPUT BUFFER
*****
movetext lda ,x+     line character
        cmpa #20d   space?
        beq skip    yes, add spaces to buffer
        sta ,y+     no, to output buffer
        cmpa #20d   end of line?
        beq print   yes, print line
        decb no, count character
        bra movetext move another character
skip     lda ,x+     line character
        cmpa #20d   another column?
        beq skip    no, check again
        blo moveit  end of line, save and print
        leax -1,x   reset pointer for next column
        lda #20d   space
spacer   sta ,y+     to buffer
        decb end of column?
```



```

bp1 spacer no, add another space
rts return
dostring lda ,x+ first string character
sta ,y+ to buffer
comment sta delim save as delimiter
decb count character
bra checkend check for end of line
mvstring lda ,x+ string character
sta ,y+ to buffer
decb count character
cmpa delim end of string?
beq skip yes, space to next column
checkend cmpa #50d end of line?
beq print yes, print line
bra mvstring no, move another character

```

* PRINT AND CHECK FOR PAGE END

```

print leas 2,s reset stack
clr string clear string flag
leax outbuff,u output buffer
print2 ldy #linelen maximum line length
lda #1 standard output
os9 !$writln line to output
bcs out exit with error
tst paginate pages?
lbeq getline no, get next line
dec pgcount end of page?
lbne getline no, get next line
leax <cr.pcr yes, carriage return
ldy #1 one character
os9 !$writln carriage return to output
lbra newpage start new page

```

* ERROR CHECK AND EXIT

```

error cmpb #e$eof end of file?
bne out quit with other error
noerr clrb clear error flag
out os9 f$exit quit
*
cr fcb $0d carriage return
fcc fcs /fcc/ string pseudo-op
fcs /fcs/ string pseudo-op

```

* INHERENT MODE OPCODES

```

fcs /abx/
fcs /daa/
fcs /mul/
fcs /nop/
fcs /rti/
fcs /rts/
fcs /sex/
fcs /swi/
fcs /asla/
fcs /aslb/
fcs /asra/
fcs /asrb/
fcs /clra/
fcs /clrb/
fcs /coma/
fcs /comb/
fcs /cwai/
fcs /deca/
fcs /decb/
fcs /inca/
fcs /incb/
fcs /lsla/
fcs /lslb/
fcs /lsra/
fcs /lsrb/
fcs /nega/
fcs /negb/
fcs /rola/
fcs /rolb/
fcs /rorb/
fcs /swi2/
fcs /swi3/
fcs /sync/
fcs /tsta/
fcs /tstb/
fcb 0
*
len emod
equ *
end

```

Listing 2: Makepretty.b09

```

PROCEDURE Makepretty
0000 (* Generates the binary module pretty *)
0028 (* Level 1 - change all /dd to /d0 *)
004D DIM path,byt:BYTE
0058 DIM count:INTEGER
005F PRINT "Creating pretty . . .";
0079 CREATE #path,"/dd/cmds/pretty":WRITE
0093 FOR count=1 TO 443
00A4 READ byt
00A9 PUT #path,byt
00B3 NEXT count
00BE CLOSE #path
00C4 PRINT
00C6 SHELL "attr /dd/cmds/pretty e pe"
00E3 END
00E5 DATA 135,205,1,187,0,13,17,129,146,0,40,3,147,80,114,101
0119 DATA 116,116,249,2,40,99,41,49,57,56,56,32,83,46,66,46,71
0150 DATA 111,100,100,98,101,114,103,15,0,15,1,15,3,90,39,33
0184 DATA 236,132,129,45,38,18,202,32,193,112,38,12,12,3,48,1

```



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0188	DATA 236,128,193,32,39,250,37,9,134,1,16,63,132,37,17,151	04A2	DATA 6,13,102,99,227,102,99,243,97,98,248,100,97,225,109
01EC	DATA 0,134,65,151,4,150,0,48,69,16,142,0,255,16,63,139,16	04D3	DATA 117,236,110,111,240,114,116,233,114,116,243,115,101
0223	DATA 37,0,187,166,132,129,13,39,2,129,42,16,39,0,139,49	04FE	DATA 248,115,119,233,97,115,108,225,97,115,108,226,97,115
0257	DATA 201,1,4,198,8,141,66,52,32,198,3,49,141,0,168,141,27	052C	DATA 114,225,97,115,114,226,99,108,114,225,99,108,114,226
028E	DATA 36,31,141,23,36,27,141,19,37,6,53,32,198,20,32,35,109	055A	DATA 99,111,109,225,99,111,109,226,99,119,97,233,100,101
02C5	DATA 164,39,15,42,240,92,49,33,32,235,16,63,17,49,165,57	0588	DATA 99,225,100,101,99,226,105,110,99,225,105,110,99,226
02F9	DATA 12,1,53,32,198,5,141,15,198,14,13,1,39,4,141,40,32	058E	DATA 108,115,108,225,108,115,108,226,108,115,114,225,108
0330	DATA 2,141,3,79,141,37,166,128,129,32,39,9,167,160,129,13	05E1	DATA 115,114,226,110,101,103,225,110,101,103,226,114,111
0364	DATA 39,45,90,32,241,166,128,129,32,39,250,37,239,40,31	060C	DATA 108,225,114,111,108,226,114,111,114,225,114,111,114
0395	DATA 134,32,167,160,90,42,251,57,166,128,167,160,151,2,90	0637	DATA 226,115,119,105,178,115,119,105,179,115,121,110,227
03C6	DATA 32,9,166,128,167,160,90,145,2,39,220,129,13,39,2,32	0662	DATA 116,115,116,225,116,115,116,226,0,31,1,214
03FA	DATA 241,50,98,15,1,48,201,1,4,16,142,0,80,134,1,16,63,140		
0434	DATA 37,30,13,3,16,39,255,73,10,4,16,38,255,67,48,140,18		
046B	DATA 16,142,0,1,16,63,140,22,255,50,193,211,38,1,95,16,63		



Quickie Hardware Project

Pause Switch Adds Freedom to CoCo Habits

Ring... Ring...
 "Could you get that, Tom? I'm playing *Reactoids*."
 "It's for you Jeff."
 "But I've almost beat my high score, and I have three reflectors left."
 "He says it's important."
 "Coming, &!@%\$!!!"

A common scenario in your home? I wish all games had a built-in pause feature, but some don't. Fortunately I came up with a solution.

You can use the switch to pause any program or to keep other people from messing up any program currently in your computer.

While reading through the service manual for my CoCo, I came across a reference to a *HALT line, a special control line on the 6809 CPU (central processing unit) chip. This line is available at Pin 40 on the 6809 and goes directly to Pin 3 on the Color

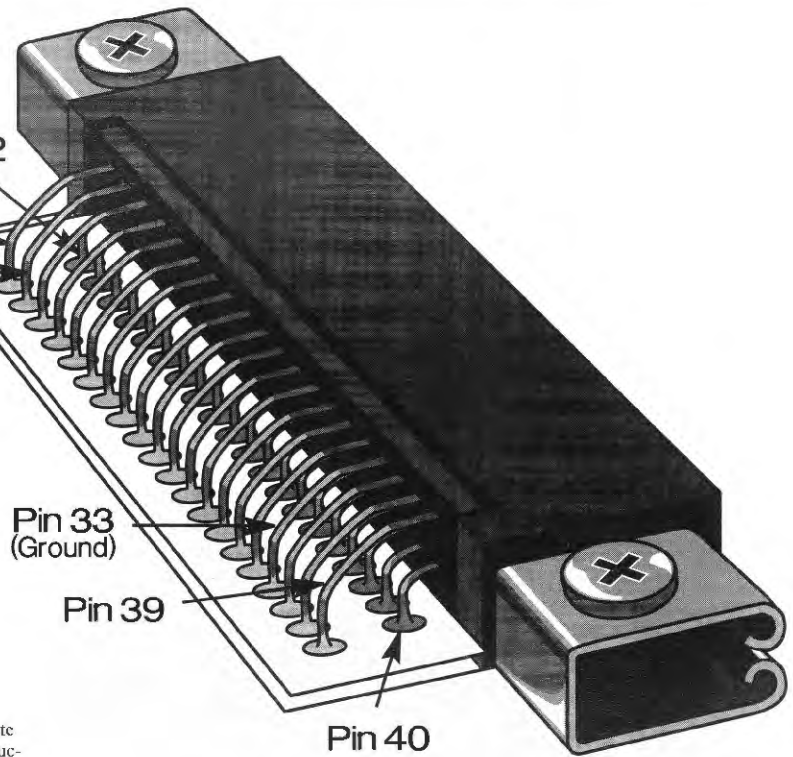
Computer's cartridge port. The *HALT line is active-Low (hence the asterisk), which means it is normally tied High through a resistor and is activated by "pulling" the line Low. This is done by connecting it to ground.

As soon as the 6809 detects a Low state on the *HALT line, it finishes the instruction currently being executed and waits for the *HALT line to go High again. We can use this feature to our advantage. If we connect a switch between the *HALT line and ground, we have created a hardware "pause" switch. And it works with any program: BASIC, machine language or ROM cartridge. However, it is important to remember you should *not* use the new pause switch when input/output equipment (disk drives, tape recorders, printers or modems) is in operation.

To add a pause switch to your CoCo, you'll need an SPST (single-pole, single-throw) switch, two 1-foot lengths of insulated wire, a soldering iron and solder, and a phillips screwdriver. You can find the switch at any Radio Shack or local electronics outlet. If you have no experience using a soldering iron, find a friend who does.

Now make sure the CoCo is *not* plugged in, then turn it on to drain any remaining charge in the main capacitor. This helps to protect you as well as the computer. You should also eliminate any static charge in your body by touching a grounded metal object (the cold-water pipe in your home should do the trick).

Now turn the CoCo on its back and remove the six screws holding the case bottom to the case top. (Note that doing this voids any existing warranty on the computer.) Turn the CoCo back over and remove the top of the case.



Look at the right side of the computer and you will see two rows of 20 metal pins connecting the cartridge slot to the main circuit board (see Figure 1). The pins in the left row are numbered 1, 3, 5, 7 and so on, from top to bottom (from the back of the computer to the front). Similarly, the pins in the right row are labeled 2, 4, 6, 8 and so on, from top to bottom.

As I stated before, the *HALT line is connected to Pin 3, the second Pin from the back in the left row. Signal ground is available on pins 33 and 34 of the cartridge connector. We are going to connect the switch between these two signals. Since Pin 33 is the easiest ground pin to reach with a soldering iron, we'll use that one.

Now you need to decide where and how you want to mount the switch. I cut a small square hole just above the cartridge port. The case is pretty tough so I had to use a hammer and a very sharp chisel. If the switch you purchase is designed to fit a round hole, use a power drill to make the opening. If you don't want to risk hurting the CoCo (or yourself), you may want to simply have the wires come up through the vents on top of the CoCo, making sure to knot the wires inside the case so they won't be yanked out. However, make sure you

insulate the switch connections with electrical tape.

Once the switch is mounted, use the soldering iron to solder a piece of wire to each of the two connectors on the SPST switch. Then solder one of these wires to Pin 3 of the cartridge connector and the other to Pin 33. Be careful not to drip any solder on the circuit board. If you do, wait a few seconds for it to cool, then *carefully* push it off the board with a small screwdriver or a pencil.

After you finish soldering and make sure the connections are secure, put the top back on the CoCo and replace the six screws. Now you can use the switch to pause any program or to keep other people from messing up any program currently in your computer. Happy pausing!

Jeff Steidl majored in computer science and minored in math, music and French. He plans to pursue a doctorate in computer engineering. Jeff enjoys pushing the CoCo 3 to new limits and is the author of the Sundog Systems' products GrafExpress and Photon.

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Quickie Program

Turn the World On End

Bring together Bill Bernico's *World* (THE RAINBOW, September 1988, Page 70), Fred Crawford's cover for the November 1987 telecommunications issue and an opening scene from Stanley Kubrick's *2001*, and you are *In Orbit*. *In Orbit* is a short BASIC program that is really out of this world (or off the planet, anyway).

Enter the program and save it to tape or disk before running it. Some of the lines in the listing are "packed" — these lines contain a few more characters than the CoCo normally allows you to enter. To enter these lines, type all the characters you can until the cursor won't move any farther. Press ENTER, then enter EDIT line, where line is the line number you are entering. Press X (for extend) and the cursor moves to the end of the line, at which point you can enter the remaining characters. Then just press ENTER to save the edited line in the CoCo's memory.

In Orbit draws a world map, then rotates it around the screen while playing a little something written by Strauss. Of course, you could substitute one of your own favorite screens for the image drawn in lines 110 through 160, and put a different 32-bar waltz in the PLAY values in Line 100 — but the effect would not be the same.

The high scroll rate is a result of my unique use of PCOPY in Line 190. (The GET and PUT commands reposition only 1/2 of the screen.) It should be easy to extend this

technique for use with graphics modes other than PMODE 1.

I hope you enjoy this little graphics/sound diversion. And I hope you will take the time to learn new animation tricks and techniques.

After careers in aerospace, mechanical and structural engineering, Barry Mitchel is exploring the computer-aided varieties. His outlets are tennis, biking, swimming and climbing with his family, and pushing the limits of his CoCo 3. He can be contacted at 70 Longview Road, Reading, MA 01867-2818. Please include an SASE when requesting a reply.



CoCo 3

The Listing: INORBIT

```

1 'IN ORBIT
2 'BY BARRY J. MITCHEL
3 'COPYRIGHT (C) 1992
4 'BY FALSOFT, INC.
5 'RAINBOW
100 DATA C,C,E,G,G,P4,G,G,P4,E,E,E,
P4,C,C,E,G,G,P4,G,G,P4,F,F,P4,0-
B,B,0+D,A,A,P4,A,A,P4,F,F,P4,0-B
,B,0+D,A,A,P4,A,A,P4,E,E,P4,C,C,
E,G,0+C,P4,C,C,P4,0-G,G,P4,C,C,E,
G,0+C,P4,C,C,P4,0-A,A,P4,D,D,F,
A,A,P2,P4,F#,G,0+E,P2,P4,0-G,E,E
,P4,D,A,P4,G,C,P8L8C,L4C,CP1
110 PMODE1,1:PCLS2:SCREEN1,0:DRA
W"BM0,30C45803BD5D32EU30BU63F03
8D7D2BBD4DF3BU3U28BU2UBU3U3F0D3
5BD3D3EU8U4U35F034BD7DRU2BU7U3F
D2BD2D28BD8BR8BU3UBU6U26RD25BD6D
3B4D4FDU6BU6BU10U21RD20BD6D4BD
7D6EU6BU6U5BU5U20D3RD15B05BD0D2D4
BD6D6RU6BU13U2BU4U1ED15BD04D
120 DRAW"BD14D6RU6BU17UBU5U13BU4
U2RD3BD3D12BD6D2BD16D6RU5BU17U2B
U7U11BU4U2BD8RD9BD27D5FU6BU27U8R
D9BD25D8BU4BU8U0BU16U12RND13RD1
2BD18D0BU3BRND8RD7BD24RBU25U6RND
6FD5BD27D0BU32RD5RU4FD3EU2FBD11L
2E2D2BD8FU9U2RU4U0BU7FD2BD5D2BD
2D3UEU12RD118D14DFU2BU14U12R
130 DRAW"ND10RD9BD19DBU29DRU9F
D9RU10BU7ED2BD4D14FU15BU4U2RD3BD
2D17FD3U26RD27FU29EU0D32FU33CD34F
U37RD38NLRU39EU0D36BD3D2FU3BU4U35
ED36BD4D3BD2D2FDU6BU7U20BU6U10D9
BD0D22BD4D7FU9BU3U20BU9U10RD12BD
10D3BD2D10BD5D10BD9D9F2HU14BU3U1
2BU6UBU4U2BU9U13FD13BD7D3
140 DRAW"BD4D7BD7D27U2EU24BU8U3B
U2UBU12U12FD12BD11D0D3D2BD9D2E
U20BU10U3BU13U14EU0D27D3D0D12D19
EU17BU17U26FD28BD17D15U2EU11BU20
U28RD25BD24D8EU6BU26U25RD24BD27D
4EU2BU29U23FD21BD3D2BRBU27U2BU1
4U5FD3BD14D4RU3BU16U2BR9BD39D4FU
6E7RU8BU2U2BU6U2EU4D0D6D2
150 DRAW"BD208RU8BU2U2BU2UBU3NU4
FD6D3D8FU10BU3U5RU23D3BD13D2BD
4D6D3D11FD6U18BU3U6BU3U5BU10U5R
D5BD9D6BD3D6BD3D19FD4U24BU3U7BU2
U7BU8U6RD4BD9D6BD3D8BD3D24FU25BU
3U9BU3U5BU10U3FD2BD9D6BD1D10BD3D
24EU22BU3U19RD20BD2D12EU20RU1LUE
U17DFD15BD5D13EU11BU6U14RD16
160 DRAW"BDRD3BD12D2BU17U6BU3U12
8U4U2BU10U2E04BD9D2BD4D10BD4D8BD
11D5RU5BU11U8BU3U12BU4U3BU8U4RD4
D0D64BD5D2FU22BU6U2BU6U3RD2BD7D
2BD5D24FD3U3H3GFRD3RU33RD32EU3
2ED32RU33BU4HU2EUN0D5RU5BD4D33FU3
4BU3U6FD5D3D38FU39BU3U3RD3D3D4
0EU38BU3U3RD3D3D3
170 PLAY"05C":EXEC44539
180 DIMM(57):PMODE1,1:PLAY"TA03
190 GET(0,0)-(23,191),W:POKE25,1
30:PCOPY129T01:PCOPY130T02:POKE2
5,PEEK(51):PUT(232,0)-(255,191),
W
200 READN$:PLAYN$:IFN$="CP1"THEN
RESTORE
210 GOTO190
    
```


Product Review

Window Master Desk Accessory Pak

The *Desk Accessory Pak* offers additional features to the *Window Master 3.0* program in the form of desk accessories. These accessories can be easily loaded in one of two ways: You can either run the *DAINSTALL* program from within the *FINDER* program — this installs the accessories when you need them — or you can use the new version of the *W.BAS* program, provided on disk. The latter approach installs the accessories upon each boot of *Window Master 3.0*. This approach also requires a two-drive system.

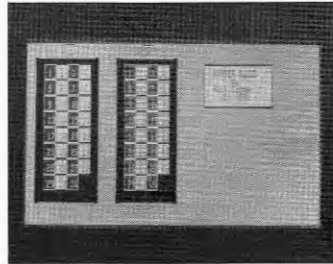
The accessories package contains a font editor, an icon editor, a calendar program, a terminal package, disk utilities, function-key utilities, a graphics editor, and a version of *Othello* called *Flip-It*.

The font editor allows you to create original fonts for use with *Window Master*. The system has 10 resident fonts or character sets. To create new sets you must edit one character at a time. For experimentation, I edited a few characters from an existing character set. If you make a mistake prior to saving a character, it is possible to reload the original character. While editing, the resulting character is displayed in a character box. After each character in the set has been edited and saved, you must update the character set to prevent loss of your efforts.

The icon editor is part of the font editor program. If you select *GFX Font* or *GFX Small* from the character-set menu, you're actually choosing to edit icons. The process

of editing icons is handled in a similar fashion to that of font editing.

If you have a need for marking a calendar though don't require a program with all the bells and whistles, the calendar program should suit your needs. The calendar program prompts you to enter the month and year to display. Next, the month is shown and you're able to mark special dates and enter reminders and notes of up to 120 characters per date. Created notes can be saved by month to data files for later recall. Options exist for changing the calendar to a new month and year, redoing a month's notes, opening a previously saved data file, saving a data file, renaming a data file, and exiting the program.



The terminal package provided is simple though workable and handy for light communication needs. It can operate at 300, 1200 and 2400 bps; supports 5 through 8 bits; handles mark, space, none, odd or even parity; supports half- or full-duplex mode; and can communicate through the serial port or use a *Deluxe RS-232 Pak*. There are three pull-down menus: a File menu for viewing a directory and killing files, a transfer menu for selecting between sending or receiving using ASCII or Xmodem, and a

screen menu for using a normal or split screen. The split screen provides a conference mode text box for entering text that will not be overwritten by information received on the screen. Users can switch between a graphics screen or an 80-column text screen. The text screen is the faster of the two and is recommended for displaying text at 1200- or 2400-bps.

The disk utilities are similar to those already provided with the *Window Master* package with the exception of a new backup routine. The *Window Master* utilities menu offers an initialization option but no backup option. The range of disk functions now includes formatting, labeling and backing up disks as well as copying, killing and renaming multiple files. When a function is selected, you're prompted for the destination disk drive.

A powerful feature of *Window Master* is its use of function keys. Function keys can execute programmed routines of up to 250 characters in length. The programming process offered by the accessory program is similar to that offered by the *Fkeys* menu options in the *FINDER* program of *Window Master*. You can program or delete a key, display all keys for quick reference, and save or load a key set. The process of programming is simplicity at its best. You select the key to use (upper- or lowercase), click on the text area and enter the corresponding routine, then save the key set.

If you are a graphics artist or a game player, you too can have some fun using the *Desk Accessory Pak*. The graphics editor provides three graphics modes: a 4-color by 640 resolution, a 16-color by 320, and a 16-color by 640 resolution. The editor supports many text styles and sizes for inclusion with graphics images, graphics tools and editing functions, and the ability to save

and load images. The fat-bits (zoom) mode is great for creating pictures with fine detailing.

How about a game of *Flip-It*? You deserve a break from programming at evenings end. *Flip-It* is a version of *Othello*, played on a 10-by-10 grid, for two players or one versus the computer. It provides for quite a challenge.

Window Master is required to use the *Desk Accessory Pak*. *Cer-Comp Ltd.*, 5566 *Ricochet Avenue*, *Las Vegas, NV 89110*, 720-452-0632; \$39.95.

— Tony Olive



To determine from within a program which text screen (32-, 40- or 80-column) is being used on the CoCo 3, use peeks to Location \$E7 (decimal 231). If the value returned from this peek is 0 (zero), the current screen is 32 columns wide. A returned value of 1 indicates the 40-column screen is in use, and a value of 2 means 80 columns are active. Use these peeks to determine the text-screen size, then have your program proceed accordingly.

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Feature Program

Move Print@ to a New Location

Have you ever tried to run a CoCo 1 (or 2) program on the CoCo 3's Hi-Res text screens and had PRINT@ statements get in your way? If so (and if you persevered in the attempt), you know how tedious and time-consuming it can be to convert those PRINT@s into appropriate LOCATE statements for the CoCo 3. I've owned a Color Com-

puter since 1981, and I have a lot of older programs. I wrote *Convert* to make an easier job of converting my software for the CoCo 3. *Convert* reads a BASIC program and changes all occurrences of PRINT@ to LOCATE, adding appropriate screen coordinates.

Before proceeding, enter the listing and

save it to disk as CONVERT.BAS. When you first run the program, you are prompted for the name of program you want to convert. The file must be a BASIC program that has been saved on disk in ASCII format. (To save a BASIC program in ASCII, use the .A option described with the SAVE command in your disk-drive manual.) After this, you are

prompted for an output filename. This is the new name (it must be different than the input filename) under which you want the converted program saved. *Convert* uses LINEINPUT statements for both prompts, so you can add filename extensions and drive numbers. Finally, you are prompted for whether you want the PRINT@ statements converted for 40 or 80 columns.

Convert reads line-by-line through the ASCII file searching for PRINT@ (the target string set up in Line 300). If it finds this string, it searches for more occurrences within the same line. If the target string is not found in the current line, the program dumps the line into the output buffer.

After *Convert* has found all occurrences of the target string in a specific line, the program branches to the conversion subroutine. There it converts the PRINT@ number into column and row values for a 32-column screen and multiplies these values by a conversion factor. The program then rebuilds the line character-by-character, replacing PRINT@abc with LOCATE xx,yy:PRINT. The converted program is saved to disk in ASCII format.

Caveats

I've tried to make *Convert* as crash-proof as possible, and so far it has worked with all the programs I've converted. However, there are a few things to keep in mind when using *Convert*. First, the Color Computer can handle only 255 characters in a program line. If you have a line "pushing the envelope" (say, above 220 characters), you should break it into two or more lines. The reason for this is simple: The LOCATE statement is much longer than the PRINT@ statement, and the converted line may be longer than 255 characters.

The string variable that holds the converted line as it is built is CDS (Line 520). If the length of the contents of this variable goes over 255 characters, the operating system will return an LS error (string too long). The error-trap subroutine in *Convert* informs you of the error, closes all files, and deletes the partial destination file.

Another thing to remember is that *Convert* can handle up to 11 PRINT@ commands in a given line, though a more practical limit is eight PRINT@s. You'll probably get an LS error long before 11 conversions. I've run the program and have converted up to seven PRINT@ statements in one line.

Finally, there is a loss of proportion when converting locations for a 32-column screen to an 80-column screen. Although data is placed correctly on the screen, the characters, words and screen structure change proportions. The effect is less noticeable on the 40-column screen. To regain the proper sense of proportion, you may need to fine tune some of the LOCATE values.

Mike Woolridge is a weather forecaster with the National Weather Service. He may be contacted at 1006 Solon Court, Dunbar, WV 25064, (304) 768-1052. Please include an SASE when requesting a reply.

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CoCo 3 Disk

The Listing: CONVERT

```

1 *PRINT@ CONVERTER
2 *BY MIKE WOOLRIDGE
3 *COPYRIGHT (C) 1992
4 *BY FALSOFT, INC.
5 *RAINBOW MAGAZINE
10 CLEAR 5000
20 ON ERR GOTO 820
30 AA=40
40 DIM PS(11)
50 DIM PE(11)
60 DIM PN(11)
70 DIM RP$(11)
80 CLS
90 LINE INPUT "FILE TO BE CONVER
TED...";A$
100 PRINT
110 LINE INPUT "NAME OF CONVERTE
D FILE...";B$
120 PRINT
130 PRINT"CONVERT PRINT@ STATEM
ENTS TO:"
140 PRINT"      1. 40 COLUMN S
CREEN"
150 PRINT"      2. 80 COLUMN S
CREEN"
160 INPUT A:IF A<1 OR A>2 THEN C
LS:GOTO 130
170 IF A=1 THEN AA=40 ELSE AA=80
180 WIDTH AA
190 PRINT "CONVERTING FILE ";A$
200 PRINT
210 PRINT "TO FILE ";B$
220 PRINT
230 PRINT "FOR SCREEN SIZE OF";A
A
240 PRINT
250 PRINT "PLEASE WAIT..."
260 OPEN "I",#1,A$
270 OPEN "O",#2,B$
280 LINE INPUT#1,IP$
290 IF EOF(1)--1 THEN CLOSE#1:QP
--1
300 TG$="PRINT@"
310 PS(1)=INSTR(1,IP$,TG$)
320 IF PS(1)=0 THEN PRINT#2,IP$
ELSE GOTO 340
330 IF QP=-1 THEN 590 ELSE GOTO
280
340 FOR X=2 TO 10
350 PS(X)=INSTR(PS(X-1)+1,IP$,TG
$)
360 IF PS(X)=0 THEN GOTO 380
370 NEXT X
380 FOR Z=1 TO X-1
390 FOR V=PS(Z)+5 TO PS(Z)+10
400 CC$=MID$(IP$,V,1)
410 IF CC$="@" THEN C=V
420 IF CC$="," THEN PE(Z)=V:PN(Z
)=VAL(MID$(IP$,C+1,V-1)):C=0
430 NEXT V
440 NEXT Z
450 MM=X-1
460 GOSUB 610
470 C=1
480 FOR VV=-1 TO LEN(IP$)
490 IF C>MM THEN GOTO 510
500 IF VV=PS(C) THEN CD$=CD$+RP$
(C):VV=VV+PE(C)-PS(C):C=C+1:GOTO
530
510 CC$=MID$(IP$,VV,1)
520 CD$=CD$+CC$
530 NEXT VV
540 IP$=CD$
550 PRINT#2,IP$
560 CC$="":CD$=""
570 IF QP=-1 THEN GOTO 590
580 GOTO 280
590 CLS:PRINT "PROGRAM HAS BEEN
CONVERTED."
600 END
610 'SBR FOR NUMBER CONVERSION
620 FOR K=1 TO MM
630 J=PN(K)
640 IF J<0 THEN J=0
650 IF J>511 THEN J=511
660 Y=INT(J/32)
670 X=J/32
680 Z=X-Y
690 Y=Y+1
700 Z=(Z*32)+1
710 IF AA<80 THEN Z=Z ELSE Z=Z*2
720 YY=(Y-1)*1.5
730 ZZ=(Z-1)+1.25
740 IF YY-(INT(YY))<0.5 THEN YY=
INT(YY) ELSE YY=INT(YY)+1
750 IF ZZ-(INT(ZZ))<0.5 THEN ZZ=
INT(ZZ) ELSE ZZ=INT(ZZ)+1
760 XX$=STR$(ZZ):XX$=RIGHT$(XX$,
LEN(XX$)-1)
770 YY$=STR$(YY):YY$=RIGHT$(YY$,
LEN(YY$)-1)
780 RP$(K)="LOCATE "+XX$+" "+YY$
790 RP$(K)=RP$(K)+":PRINT "
800 NEXT K
810 RETURN
820 'ERROR TRAP SUBROUTINE
830 IF ERNO=14 THEN PRINT"STRING
TOO LONG!":PRINT "SHORTEN THIS
LINE...":PRINT CD$:CLOSE#1:CLOSE
#2:KILL B$:END
840 IF ERNO=68 THEN PRINT "CAN N
OT FIND THAT FILE!...TRY AGAIN!":
FOR K=1 TO 100:NEXT K:RUN
850 CLS:PRINT "ERROR NUMBER...":
ERNO;" IN LINE NUMBER...":ERLIN:
END
    
```

Product Review

The CoCo Family Recorder

OK, you've been asking for it, now here it is. *The CoCo Family Recorder* is a unique program designed to keep track of family members in a genealogy environment. The resultant database of information is designed to show relationships between ancestors and relatives. The database is limited to a maximum of 500 individuals and 200 marriages. There are a number of files on the 5 1/4-inch disk that comes with the package:

- CREATPER — Formats and creates the data file PERSFILE which contains personal information.
- CREATMAR — Formats and creates the data file MARRFILE which contains marriage information.
- UPDATPER — Allows entering information into the PERSFILE as well as making changes at a later date.
- UPDATMAR — Allows entering information into the MARRFILE as well as making changes at a later date.
- INDEXPC — Creates an index file called PCINDEX which relates children to their respective parents.
- INDEXMAR — Creates an index file called MINDEX which relates husbands and wives

together.

- LISTPER — Prints a list of all the names in the PERSFILE in order of record number.
- LISTMAR — Prints a list of all the marriages in the MARRFILE.
- LISTPCI — Prints a list of all parents and their children.
- PRINTPER — Prints individual person records as requested.
- PRINTMAR — Prints individual marriage records as requested.
- WORKSHT — Prints an information worksheet that can be used as an aid in gathering the necessary information for the database.

Because of the relationships carried within the personal files, pedigree information may be associated backwards for any number of generations. There is no specific limit to the number of generations the program will handle. Because of the parent/child index, which relates parents to their children and the marriage index, it is possible to relate any number of persons together in family groups. Expanded family groups can be shown by combining the pedigree chart with the family group printouts. A very helpful booklet can be produced by displaying pedigree charts followed by the listed family groups.

The personal information files contain such things as a person's name, date and

location of birth, and parents. If appropriate, it also contains the date of death and burial information. Pedigree information is that information which shows parents, grandparents, etc., and direct ancestry. Family group information is that information about a marriage, the children of that marriage, and the date and location of the marriage, as well as person file numbers.

The CoCo Family Recorder is entirely menu-driven and thus very easy to use. It requires a CoCo 3 with at least two disk drives and a monitor capable of 80-column text. All Tandy DMP and Epson/IBM-compatible printers are supported. A well-written and -documented 14-page instruction booklet is provided and needed in order to fully understand the various functions and capabilities of the program.

This is a long-awaited program that will be welcomed by many in the CoCo community. The various screens are well-designed and the layout is simple, yet practical. *The CoCo Family Recorder* is priced fairly and does what it's advertised to do. If you are interested in genealogy and use a CoCo 3, this program will be a welcome addition to your library. (*Farna Systems, 904 2nd Ave., Robins AFB, GA 31098; \$29.95. A demo version is available for \$5, which is refunded when you purchase the regular version.*)

—Robert Gray



TIP

If you find that a line in a listing you are entering is too long, the reason might be that it is packed. When you enter a BASIC program line, the computer watches the length of that line; when it reaches 240 characters, the computer refuses to accept more.

If you need to get a few more characters into the line, press ENTER to place what you've already typed into memory, then type EDIT and the line number followed by ENTER. Press X (for extend) to move the cursor to the end of the line. Now you can enter more characters. The Edit mode has its own length limit, though, so the computer will take a few more characters and stop again.

This trick does let you stretch your lines (saving memory and slightly increasing speed), but it often causes confusion when someone who doesn't know about it enters a line from a program listing. Also, if you cram too many additional characters into a line, you may find they won't print correctly even though they are actually present. Finally, packed listings will not save properly in ASCII format. Because of these problems, we don't recommend using the technique in programs intended for publication. Still, some get through, and we want you to know how to deal with them when they do.

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Feature Program

Matchmaker, Matchmaker

Have you ever wanted to run a computerized dating service or pen-pal club? What about pairing up people as roommates for camp or at school? Or running a tournament where people are matched based on their abilities and what times they're available to play? Using the Color Computer, *Matchmaker* makes these tasks far easier than if they were done by hand.

Matchmaker is designed to pair people based on similar criteria. Before running the program, get the people you want to pair to answer the questions you want to use for matching them. When deciding how to set up the questionnaire, keep in mind *Matchmaker* expects numeric input -- use questions that lead to a numerically scaled ranking of ability, desire, etc. (more on this in a moment). Then run *Matchmaker* and use the Enter New Data option to enter the criteria you are using to match compatible people. You can use a sentence, or just a word to remind yourself. You can also weight each criterion. For example, if two players aren't available at the same time, it doesn't much matter whether they are of the same ability. So you would enter a relatively large weighting number for the time criterion, and use a small weight for ability.

Once you have entered the criteria, enter the names of the people you want to pair. As written, *Matchmaker* supports up to 50 people and 20 criteria. If your computer has enough memory, you can easily change these numbers in Line 10: Variable MN represents the maximum number of people and

MC represents the maximum number of criteria. As you enter people's names, you must also enter a number score for each criterion. Once you've entered the data, *Matchmaker* matches the most compatible pairs (those "couples" having the most similar scores in each question) for you.

You must decide for yourself when setting up the criteria what numbering system to use. For example, you might have all questions ranked on a scale from 1 to 5. A person with high ability might get a 5 and a person with moderate ability, a 3. A Yes response to a question might be a 5, and a No might be a 1. *Matchmaker* accepts numbers from 1 to 100; the important thing is that you use a consistent scale for each person on any given question.

Matchmaker is designed to work on any CoCo with at least 16K. Extended BASIC is not required, and the program automatically knows whether you are using a tape recorder or a disk drive (Line 300). *Matchmaker* allows you to save, load, add to, or print the data. These options are fairly self-explanatory, and their use should not present any problems.

Kevin Speight is a student who enjoys using his CoCo for programming and word processing. He can be contacted at Box 266, Howe Hall, Dalhousie University, Halifax, Nova Scotia B3H 4J5. Please include an SASE when requesting a reply.

```
*"+S$(CO,1):A=A+1:IF A<N THEN 90
150 FORK=1TON:IF LEFT$(S$(X,1),1)
)="*" THEN S$(X,1)=RIGHT$(S$(X,1)
),LEN(S$(X,1))-1)
160 NEXTX
170 PRINT:INPUT"<ENTER>":P$
180 CLS:PRINT:PRINTSTRING$(32,15
6):TAB(11):"MATCHMAKER":PRINTSTR
ING$(32,147):TAB(8):"BY KEVIN SP
EIGHT"
190 PRINT:PRINT"CHOOSE":PRINTTAB
B(10)"1 LOAD DATA":PRINTTAB(10)
"2) SAVE DATA":PRINTTAB(10)"3) E
NTER NEW DATA":PRINTTAB(10)"4) A
DD TO DATA":PRINTTAB(10)"5) PROD
UCE PAIRINGS":PRINTTAB(10)"6) QU
IT"
200 IS=INKEY$:IF IS=""THEN200 EL
SE I=VAL(I$):IF I<1 OR I>6 THEN
200 ELSE ON I GOTO 210,240,250,2
70,60,280
210 CLS:PRINT"ARE YOU SURE YOU
WANT TO LOAD DATA (ANY DATA IN
MEMORY WILL BEERASED)? YES OR NO
?"
220 IS=INKEY$:IF IS=""THEN220 EL
SE IF IS="Y" THEN 230 ELSE 180
230 GOSUB300:OPEN "I",#DN,F$:INP
UT#DN,VF:IFVF<>33THENCLOSE#DN:GO
TO180 ELSEINPUT#DN,N:INPUT#DN,C:
FORX=1 TO N:FOR Y=1 TO C+1:LINE
INPUT#DN,S$(X,Y):NEXTY,X:FORY=1
TO C:LINE INPUT#DN,Q$(Y):INPUT#DN
,O(Y):NEXTY:CLOSE#DN:GOTO180
240 IFN<1 THEN180 ELSEGOSUB300:0
```

```
250 CLS:PRINT"ARE YOU SURE YOU W
ANT TO ENTER NEW DATA? (ANY OLD
DATA IN MEMORY WILL BE LOS
T) YES OR NO?"
260 IS=INKEY$:IF IS=""THEN 260 E
LSE IF IS="Y" THEN 20 ELSE180
270 IFN>MN-2 OR N=0 THEN180 ELSE
CLS:INPUT"HOW MANY PEOPLE TO ADD
":NN:IFNN/2<>INT(NN/2) THEN INPU
T"PLEASE LEAVE SOMEONE OUT. AN
EVEN NUMBER NEEDED <ENTER>":P$
:GOTO270 ELSE IFNN<1 OR NN>MN
THEN 270 ELSEST=N+1:N=N+NN:GOTO5
0
280 CLS:PRINT"ARE YOU SURE YOU W
ANT TO QUIT? (DATA WILL BE LOST
) YES OR NO?"
290 IS=INKEY$:IF IS=""THEN 290 EL
SE IF IS="Y" THEN END ELSE 180
300 CLS:INPUT"FILENAME":F$:IFLEN
(F$)>8 THEN 300 ELSE IF PEEK(&HC
000)=68 THEN DN=1 ELSE DN=-1
310 RETURN
```

16K

The Listing: MATCHMAK

```
1 *MATCH MAKER
2 *BY KEVIN SPEIGHT
3 *COPYRIGHT (C) 1992
4 *FALSOFT, INC.
5 *RAINBOW MAGAZINE
10 MN=50:MC=20:DIMS$(MN,MC),Q$(M
C),Q(MC):GOTO180
20 CLS:INPUT"HOW MANY CRITERIA":
C:IF C<1OR C>MC THEN20 ELSE FOR
Y=1TO C:PRINT:PRINT"CRITERION #"  
Y:;LINEINPUTQ$(Y):INPUT"RELATIVE
WEIGHT (ENTER=1)":Q(Y):IFQ(Y)=0
THEN Q(Y)=1
30 NEXTY
40 CLS:INPUT"NUMBER OF PEOPLE":N
:IFN/2<>INT(N/2)THEN INPUT"PLEAS
E LEAVE SOMEONE OUT--AN EVEN
NUMBER IS NEEDED <ENTER>":P$:GOT
040 ELSEIFN<1OR N>MN THEN40 ELSE
PRINT:ST=1
50 FORK=ST TON:CLS:PRINT"PERSON
#"  
X:;NAME:;:LINEINPUTS$(X,1):
PRINT:PRINT"ENTER DATA":FORY=1T
O C:PRINTQ$(Y):;INPUTXX:S$(X,Y+1)
)=STR$(XX):NEXTY:PRINT:NEXTX:GOT
0180
60 IFN>1 THENCLS:PRINT"OUTPUT TO
SCREEN OR PRINTER?" ELSE180
70 IS=INKEY$:IFIS="P" THEN DV=-2
ELSE IF IS="S" THEN DV=0 ELSE 7
0
80 CLS:PRINT#DV,"PAIRINGS":PRIN
T#DV:A=1
90 IF LEFT$(S$(A,1),1)="*" THEN
IF A<N THEN A=A+1:GOTO90 ELSE 15
0 ELSE B=A+1:FL=0:PRINT#DV,S$(A,
1):;":
100 IF B>N THEN 140 ELSE IF LEF
T$(S$(B,1),1)="*" THEN B=B+1:GOT
0180
110 FORY=2TO C+1:D=0:D=ABS((VAL(
```

```
S$(A,Y))*Q(Y-1)-(VAL(S$(B,Y))*Q
(Y-1))+D:NEXT Y
120 IF FL=0 THEN BD=D:CO=B ELSE
IF D<BD THEN BD=D:CO=B
130 FL=1:B=B+1:IF B<N THEN 100
140 PRINT#DV,S$(CO,1):S$(CO,1)-"
```



New Clear-screen continued from Page 1

portion (from \$5FFFF through \$7FFFF) is used. The three 128K portions below this in the memory map are *duplicates* of the top portion. In addition, the top 64K of the upper 128K portion is the default memory area assigned to the 6809 at powerup (in both 128K and 512K systems). Therefore if you turn on a 128K CoCo 3 and enter POKE

&H0E00,23, LPEEKs to \$70E00, \$50E00, \$30E00 and \$10E00 would all return a value of 23.

GIME registers \$FFA0 through \$FFA7 tell the computer which of the available 8K blocks are needed and in what order they appear in the 6809's 64K address space. The register locations correspond to the 6809's 64K virtual address space as shown in Figure 2.

In each of the registers shown in Figure 2 there can be a six-bit value (\$00 to \$3F) that tells the computer to which of the sixty-four 8K blocks that register should point. For instance, to map Block \$1C (physical memory) into the virtual space from \$6000 through \$7FFF, you would store \$1C into Address \$FFA3. Some of the more important memory areas, along with their associated block numbers, are shown in Figure 3.

The programs in listings 2 and 3 map the Hi-Res text screen into the addressable 64K space in lines 270-280 and 240-250, respectively. The code to do this is as follows:

```
LDA  #36  Hi-Res Text Block
STA  $FFA1 GIME Reg.-Block 2
After this code is executed, both programs use addresses in the range $2000 through $3FFF when "talking" to the Hi-Res screen. As stated earlier, this is the range pointed to by the GIME register at Address $FFA1.
The ANDCC instruction (lines 210 and 180, respectively) is used to turn on the CoCo 3's interrupts — the programs use interrupts as a timer.
Like the program in Listing 1, the programs in listings 2 and 3 use two ORG instructions. However, rather than trapping the CLS command, the latter programs hook the WIDTH command (which traps the CLS) located at Address $F68F in Super Extended BASIC.
```

Running the Programs


Enter each listing and assemble it to disk with *EDTASM*, using /AO and whatever other switches you want. Before loading any of the assembled programs, make sure

There are many other uses for the little tricks presented here and for the extended RAM-addressing capabilities of the CoCo 3. The Hi-Res text screen is easy to work with, and you can modify other commands

Block	Function	Physical Address
\$34	HGET/HPUT buffer	\$68000 - \$69FFF
\$36	Hi-Res text-screen RAM	\$6C000 - \$6DFFF
\$3C	Extended BASIC interpreter	\$78000 - \$79FFF
\$3D	Color BASIC interpreter	\$7A000 - \$7BFFF
\$3E	Disk BASIC interpreter	\$7C000 - \$7DFFF
\$3F	Super BASIC, GIME, I/O interrupts	\$7E000 - \$7FFFF

Figure 3: Some Important CoCo 3 Memory Blocks

TIP



When programming with a computer, it is often necessary to convert between the decimal numbering system and hexadecimal. And the CoCo provides an easy way to perform these conversions. To convert a Hex value to decimal, enter ?&Hxxxx, replacing the four X's with the Hex digits. (The ? symbol is shorthand for PRINT.) To convert from decimal to Hex, enter ?HEX\$(yyyy), where yyyy is the decimal number you want to convert.

you are in the proper screen mode. SNAKE works only on the 32-column screen, while STACKER is intended for the 80-column screen. The program in Listing 3, FADER, is designed to work with both the 40- and 80-column screens. Enter the appropriate WIDTH command before loading any of the programs listed here.

Also, *do not* enter EXEC after loading any of the programs. The patch is already in place after loading, and you need only enter CLS to see the new routines in action. You can enter CLS from the command line or call it from within a BASIC program. If you really want to use EXEC, you can remove the CLS traps before assembling the programs.

Finally, if you enter WIDTH40 or WIDTH80 on the 32-column screen after one of the programs is installed, you may find the CoCo 3 appears to lock up. In fact the computer is faithfully executing the routine — you just can't see it. Similarly, if you are on a Hi-Res screen and you change the screen width, the new routine is executed before the width is changed.

to suit special needs. With a little imagination, you can write some really interesting and amazing programs. For more information about the Hi-Res screens and the CoCo 3's GIME/MMU, refer to the CoCo 3 Service Manual and the manual that comes with the computer itself. Also check out Rick Adams' "GIME Power" (THE RAINBOW, March 1989, Page 14).

I want to thank Mike Pepe for the help he gave me on these programs and extended RAM addressing. Without him, this article would not have been possible. Thanks, Mike.

Jason Dessel is an engineering student who has written several programs for the CoCo (including a warehouse-inventory and -billing program for a large distributing company). In his spare time, Jason enjoys philosophical conversation, exercise and music.

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CoCo 3 Disk

Editor's Note: The programs shown in listings 1, 2 and 3 are "segmented." This means that, when assembled, the programs are stored in various locations in the CoCo 3's address space. Since the CoCo cannot handle segmented programs on tape, the following three programs are not included on this month's RAINBOW ON TAPE. They are, however, included (along with source code) on this month's RAINBOW ON DISK.

Listing 1: SNAKE

```
00100 *****
00110 * 32 column text snake! *
00120 *   By: Jason Dessel *
00130 *   June 1988 *
00140 *****
00150
00160      ORG   $A928  ORG at "CLS" location
00170      LBRA  $1DA   Branch to prg.
00180
00190      ORG   $1DA   Org. our program
00200
00210      LDB   #96    Space character
00220      LDY   #$200  Distance from start to end
00230
00240 RSTART LDX   #$600 End of screen
00250      LEAY  -1,Y   Decrement Y 1
00260      BEQ   ENDEX
00270
00280 DOWN  LDA    ,X    Load A w/ char. before
00290      CMPX  #$400  First character?
00300      BLO  RSTART  If so, restart
00310      LEAX  1,X    Add one to scrn location
00320      CMPX  #$5FF  End of screen?
00330      BHI  CUT     If so. End!
00340
00350 * **Main Loop** *
00360 STORE STA    ,X    Store char. one space over
00370      LEAX  -1,X    Move back one
00380      STB   ,X    Store space right before
00390      BRA  DOWN   Move next char down one
00400 CUT   LDX    #$5FF  Load X with end of scrn
00410
00420      BRA  STORE  Restart LOOP
00430
00440 ENDEX LDY   #$400  Return to top
00450      STY   $88
00460      RTS
00470      END   $E00
```

Listing 2: STACKER

```
00100 *****
00110 ** STACKER - CLS patch **
00120 **   By: Jason Dessel **
00130 **   June 1988 **
00140 *****
00150 ** Special THANKS to **
00160 **   Mike Pepe **
00170 *****
00180
00190      ORG   $F68F  WIDTH 80 command
00200      PSHS  A,B,X,Y,U
00210      ANDCC #5AF
00220      JSR  $01DA  Jump to our clear subr.
00230      PULS A,B,X,Y,U
00240      BRA  $F6A2  To end of CLS command
00250
00260      ORG   $01DA  Page memory [HI-RES text scrn]
00270      LDA  #36
00280      STA  $FFA1
00290
00300      LDB  #25    24 lines on scn. + one extra
00310      STB  LINE  (to clear chars.)
00320
00330 LOOP1 LDB   LINE  Each line is 2 bytes [80*2=160]
00340      LDA  #160
00350      MUL
00360      TFR  D,X
00370      LEAX $2000,X Go to next line to be moved
00380
00390      BSR  MOVE  Go to MOVE subr.
00400
00410      LDB  LINE  Load B with # lines left
00420      DECB Decrement # lines left
00430      STB  LINE  Store new amt lines
00440      TSTB Are there any more lines?
00450      BNE  LOOP1  If so, branch back to loop
00460      LDX  #$2000
00470      BSR  MOVE  Branch to move
00480
00490
00500      LDX  #$2000  Top of HI-RES screen
00510      STX  $FE00
00520
00530      RTS
00540
00550 MOVE  LDB   #80
00560      LDY  #$2000
00570 NOV100 LDU   ,X    Load U with X
00580      STU  160,X  Store char. on next line
```

```
00590      STY  ,X++
00600      DECB Decrease line counter 1
00610      BNE  MOV100
00620
00630      SYNC
00640
00650      CMPX #2000+(30*160)
00660      BNE  MOVE   Go if not end
00670
00680      RTS
00690      LINE FCB  0
00700      END   $0E00
```

Listing 3: FADER

```
00100 *****
00110 ** FADER - CLS patch **
00120 **   By: Jason Dessel **
00130 **   June 1988 **
00140 *****
00150
00160      ORG   $F68F  WIDTH 80 command
00170      PSHS  A,B,X,Y,U
00180      ANDCC #5AF
00190      JSR  $01DA  Jump to our clear subr.
00200      PULS A,B,X,Y,U
00210      BRA  $F6A2  To end of CLS command
00220
00230      ORG   $01DA
00240      LDA  #36    Page memory [HI-RES text scrn]
00250      STA  $FFA1
00260      GETDAT LDX  #COLORS Get color table in X
00270      INCR  LDA  ,X+    Get color, increment
00280      CMPA  #99
00290      BEQ  ENDEX  End of cycle?
00300      STA  $FFB8  Change to current palette
00310      PAU010 LDY  #35000 Set pause value
00320      PAU020 LEAY -1,Y Decrement Y
00330      BEQ  INCR
00340      BRA  PAU020
00390      ENDEX LDX  #$2000 Clear Screen subr.
00400      LDY  #$2000
00410      CLR020 STY  ,X++  Store color & attr (2 bytes)
00420      CMPX #2000+(2*80*24)
00430      BNE  CLR020
00440      BRA  DONE
00450 ** COLOR TABLE **
00460 ** RGB colors! **
00470 COLORS FCB  1    Dark Blue
00480      FCB  5    Dark Purple
00490      FCB  8    Dark Medium Blue
00500      FCB  9    Brilliant Blue
00510      FCB  15   Bright Blue
00520      FCB  25   Light Med. Blue
00530      FCB  28   Light Grey/Green
00540      FCB  58   Pale Green
00550      FCB  26   Light Blue/Green
00560      FCB  18   Brilliant Green [default]
00580      FCB  99
00590 DONE  CLRA
00600      STA  $FFB8  Change to black FG
00610      LDA  #39
00620      STA  $FFA1  Return to normal
00630      RTS
00640      END   $E00
```



New Features

Many new features have appeared over the past several months. I'll describe some of the more useful additions as well as some of the older features people have recently discovered.

If you receive a high volume of mail, you may find yourself unable to keep up. An easy way to keep track of important messages, beyond using folders, is to use Mail's MARK command. All marked messages appear in the directory listing prefixed with an asterisk. You can also use the new SELECT command to see only selected messages.

When you type DIR, you see a directory of the current Mail folder. The name of the listed folder is printed at the right margin of the screen on the first line of the directory listing. The listing shown in Figure 1 is a directory of my MAIL folder.

The current folder always defaults to MAIL if you do not have new mail when you enter Mail. If you do have new mail, the folder defaults to NEWMAIL. Notice above that I have three marked messages in MAIL: 6, 7, and 10.

If you want to read only marked messages — which is useful when you have quite a lot of messages in one folder — you can do the following:

MAIL> select /marked

3 messages selected

MAIL> dir

```
MAIL
# From          Date
      Subject
* 1 BOS1B::EMTWO 9-NOV
-1991 ELM v2.3 PL11 can't reply
to me.
* 2 BOS1B::EMTWO 9-NOV
-1991 My specifics
* 3 BOS1C::GREGL 13-JAN
-1992 Some interesting results
```

Now we see only those messages in which we are most interested. The SELECT

command is useful for far more than just selecting folders and marked messages, however. Let's say you remember receiving a message from Jason Bucata, but you don't remember when or what the subject was. You just remember that the message arrived during December 1991. You could enter

```
MAIL> select /before=1-jan-1992 /since=1-dec-1991 /from=jbucata
```

and a directory would show all messages you received from Jason during December 1991. You can also search by subject:

```
MAIL> sel /sub=re
```

4 messages selected

```
MAIL> dir
```

```
MAIL
# From      Date
  Subject
1 BOS2A::DODGECOLT  8-JAN
-1991 RE: ar
2 BOS1C::GREGL      11-APR
-1991 RE: Delphi bureau delayed
* 3 BOS1B::EMTWO     9-NOV
-1991 ELM v2.3 PL11 can't reply to me.
```

```
* 4 BOS1C::GREGL      13-JAN
-1992 Some interesting results
```

The /SUBJECT qualifier selects all messages containing the given substring anywhere in the subject of the message, in any combination of uppercase and lowercase characters. If there are any blanks in the string for which you want to search, you must surround the string with quotation marks. You can also select just those messages to which you have replied, or those to which you haven't replied. Yes, just as you would expect, if you enter

```
MAIL> select /replied
```

you will select only those messages in the current folder to which you have replied. If you want to see those messages to which you have not yet replied and received since January 15, 1992, you can specify:

```
MAIL> select /noreplied /since=15-jan-1992
```

So, as you see, you can combine these qualifiers to be as specific as you desire. Once you have selected the messages you want to see, you can use all of the normal Mail commands. Your selection lasts until you use the SELECT command again, or

#	From	Date	Subject	MAIL
1	BOS2A::DODGECOLT	8-JAN-1991	RE: ar	
2	BOS1C::GREGL	11-APR-1991	RE: Delphi bureau delayed...	
3	BOS1B::07ESRTIMOTHY	6-MAY-1991	kermit (dial)	
4	BOS1A::BILLBEISSERT	12-OCT-1991	KBCOM for the MM/1	
5	BOS1B::TIMKIENTZLE	4-NOV-1991	Term program ravings...	
* 6	BOS1B::EMTWO	9-NOV-1991	ELM v2.3 PL11 can't reply to me.	
* 7	BOS1B::EMTWO	9-NOV-1991	My specifics	
8	BOS1C::GREGL	18-NOV-1991	VT100 Emulations	
9	BOS1A::MIWRIGHT	7-DEC-1991	KBCOM and gshell	
* 10	BOS1C::GREGL	13-JAN-1992	Some interesting results	

Figure 1: Output of Online DIR Command

until you leave Mail. For full information on the SELECT command, enter HELP SELECT in Mail.

Editing Files

Many people who have used a VAX before are used to the command-line and full-screen editing available. If you call Delphi directly (you don't use SprintNet or Tymnet), you can use these features; however, if you use a packet-switching network like Sprintnet or Tymnet, you normally cannot. The reason is that characters such as backspace, delete, and escape sequences are interpreted at the local network node, not at Delphi. (This is called "local echo" because characters you type are echoed

from the local network node, not from Delphi.)

To set up host echo, where each character you type travels all the way to Delphi before it is echoed back to you, enter

```
OS9> /echo host
OS9> /save
```

These commands change your settings permanently to host echo. You will notice a much slower response to your keypresses with host echo, so you may want to try it (or turn it on and off within an online session). To turn host echo on for the current login only, you can type /ECHO HOST without using /SAVE. To return to local echo, enter

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/ECHO ECHO. You can enter either command from anywhere on Delphi that accepts slash commands—that is, anywhere but in Mail.

You may now be sitting there asking, "Yeah, but what does hostecho do for me?" If you use host echo, you can use EDT in full-screen mode. EDT? Yes, EDT is one of the two editors you can select as your online editor. If you are editing a forum message, you can type /EDIT to enter your chosen editor. If you now type C (for Change mode), you will enter full-screen mode where the arrow keys move the cursor around the screen. When you are finished editing, exit by pressing ^Z (CTRL-Z) and then enter EXIT at the prompt.

Next month I'll explain EDT and Change mode in more detail. I'll also cover some useful tricks you can perform with the online editors.

New Conference Features

Jason Bucata (JBUCATA) brought to my attention new features of the /WHO command that work in Conference. The new options are:

```

/WHO A Available list only
/WHO G Your group only
/WHO I Idle list only
/WHO N Nonprivate groups only
/WHO P Private groups only

```

People are listed as idle if they are sitting at the CONFERENCE> prompt and have not yet entered a conference group. A private group is a conference group that you must be invited to join before you can enter. Generally, any conference group with "Private" in the title is a private group. These options cause /WHO to list only people who meet the selection.

New Uploads

In the OS-9 SIG General Information database, several people contributed news bulletins describing *G-Windows*—a window driver used in some OS-9/68000 machines. Steve Adams (STADAMS), the author of *G-Windows*, released a description of the *G-Windows* library functions. Robert Kemper (BOBKEMPER) uploaded several useful files: a full listing (including descriptions) of the contents of each OS-9 database. Because of the ongoing database reconstruction, these files may not be totally accurate. But these files will at least help you find what is online. Erich Schulman (ESCHULMAN) contributed a list of 10 humorous commandments for C programmers to follow.

In the Applications (6809) database, Homer Meyer (MEYER001) posted a C rewrite of Kevin Darling's gmap utility. Robert Coulter (RDCOULTER) uploaded a utility that sets the right mouse as a Hi-Res mouse, allowing flexibility in your startup file. Chris Serino (CSERINO) released the first version of his phone handler. This application allows phone messages to be stored for many users.

In the Telecom (6809) database, Philip Brown (THEFERRET) uploaded Brian Marcotte's VT100 terminal emulator. Alan Sheltra (ANIMAJIK) released a demo version of the STG BBS package. Mark Steiner (MODEL299) uploaded into Device Drivers a Disk BASIC program that patches your OS-9 boot (not the OS9Boot file), allowing you to modify the boot screen's colors. Brian Steward (STEWARTD) contributed Bob Santy's patch for RBF that adds a new status call as well as the ability to undelete files.

The Programmers Den found many OS-9/68000 versions of popular GNU programs such as lex (Lexical Analyzer), gawk (GNU's awk), and bison (a version of yacc

—Yet Another Compiler Compiler). In the 68K-OS9 Database, Brian Wright (POLTERGEIST) uploaded a compilation of EFFO (the European Foundation For OS-9) utilities. The archived files in this group are huge, so you may want to check the index to these archives, which is also located in this database.

In the CoCo SIG General Information database, Carl Boll (CBJ) uploaded information about the Glenside Color Computer Club, a Chicago club supporting our favorite computers. Joe Sannucci (SANNUCCI) released the latest version of Roger Taylor's *The Projector* into the CoCo 3 Graphics database. This program displays many different graphics formats.

In the Utilities & Applications database, Richard McNabb (RICKMAC) contributed a utility that displays two disk directories and allows copying files between them as well as many other disk maintenance features. Denver Page (DENPAG) also release a disk utility. Joe Sannucci (SANNUCCI) uploaded SSN.BAS, which explains how Social Security numbers are distributed; if you've ever wondered, the answers are now at hand. If you want to find where an unfamiliar long distance number is located, you'll be interested in John Lentz's (COCOJOHN) DIRASST.BAS program. John also uploaded Jeff Kilsdonk's GIFTAG.BAS, which creates simple labels suitable for gifts.

Danny Fye (DFYE) uploaded several CEBBS (a CoCo BBS) games and utilities. Joe Sannucci (SANNUCCI) released the latest version of Wayne Laird's list of BBS's supporting the CoCo and OS-9. This list now includes phone numbers of BBS's that carry Fidonet echos.

Eddie Kuns is pursuing a doctorate in physics at Rutgers University. He lives in Aurora, Illinois, and works as a programmer and researcher at Fermilab. Eddie is the OS9 Online database manager; his username is EDDIEKUNS.

OS-9 SIG ONLINE

General Information

```

TC70 KIT INFORMATION
FHOGG Frank Hogg
G-WINDOWS LIBRARY DESCRIPTION
STADAMS Steve Adams
MOTOROLA FREEMAN BBS
WALKERG Greg Walker
LOW-COST RAINBOW AD INFO
DSRTFOX Francis Swygert
NEW COMPANY FORMATION
NIMITZ David Graham
ALLFILES DESCRIPTIONS 18/12/91
BOBKEMPER Robert Kemper
THE COUPLER
JSUTEMEIER Jim Suteimeier
LOW-COST ADS FOR RAINBOW
DSRTFOX Francis Swygert
OS-9 PROGRAMMER'S JOURNAL #3
EARTHER Shawn Driscoll
C PROGRAMMER'S TEN COMMANDMENTS
ESCHULMAN Erich Schulman
TC70.FLP: V4 FLOPPY DRIVER INFO
FHOGG Frank Hogg
GWINDWS ANNOUNCEMENT FROM FHL
FHOGG Frank Hogg
GWINDWS ANN. FROM DELMAR CO.
EDELMAR Ed Grestek

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Applications (6809)

```

STDShell V1.0C: SHELL MENU ENV.
ILLUSIONIST Michael Graffam
DISKCOPY 2.1: DIS< COPYING UTIL.
DKINDBERG Darren Kindberg
UNLZ3: EXTRACT LZH ARCHIVES
COGITATR Norman Rheume
DFSKMATE3/ANY VDG + FIRES MOUSE
RICKMAC Richard McNabb
RUN DM3 APPS FROM MULTI-VUE
RICKMAC Richard McNabb
PICK6 LOTTO HELPER
BOBKEMPER Robert Kemper

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OS9STAT: OS9 STATISTICS PACKAGE
HERMAN Chris Strickland
GPMAP: SHOW GET/PUT BUFFER MAP
MEYER001 Homer Meyer
MENU: L2 MENUING SYSTEM
RICKULAND Rick Ulland
GSORT: DIR. SORT FOR MULTIVUE
WOAY Jim Martin
PRINTFORM 2.0: PRINTOUT FORMATER
WOAY Jim Martin
MOUSE: JOYSTICK TO HI-RES MOUSE
RDCOULTER Robert Coulter
DISCAN V3.1A - DETECT BAD SECTORS
OIGEN40 Eugene Anderson
VSHLL FOR MULTIVUE
DKINDBERG Darren Kindberg
DC-MESSAGE V2.0
CSERINO Chris Serino
BWUTIL: SET FILE TIME/DATE
RPIERCE Robert Pierce

```

Telecom (6809)

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VT100: SMALL TERMINAL PROGRAM
THEFERRET Philip Brown
STG NETWORK/BBS DEMO RELEASE
ANIMAJIK Alan Sheltra
ICGN AND AIF FOR SUPERCOMM 2.1A
ESCHULMAN Erich Schulman

```

System Modules (6809)

```

OS9 BOOT SCREEN COLOR PATCH
MODEL299 Mark Steiner
DISO (6551) MOD FOR DCO
TRIX John Farrar
RBF30.AR IPATCH FOR RBF
STEWARTD Brian Steward

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Games & Graphics

```

STAR TREK 4096 COLOR IMG PIX
DEANHOLDER Dean Holder
BEATLES "BUTCHER COVER" 4096 IMG
DEANHOLDER Dean Holder
WIPEOUT: DIGITIZED SOUND FILE
MODEL299 Mark Steiner
SGT. PEPPER'S ALBUM COVER (IMG)
DEANHOLDER Dean Holder
STAR TREK: RASCAN IMAGES (IMG)
DEANHOLDER Dean Holder
ROMAN PILLARS (VF3)
DONALDLF Leslie Donaldson
MARINE CORPS EMBLEM (VEF)
BRWOOLSTRUM Brian Woolstrum

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Music & Sound

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I WANT YOU: ELVIS SONG (UME)
HOWARDC Howard Rouse
NEW GOLDEN OLDIES (UME)
HOWARDC Howard Rouse
A MIXED BAG OF SCORES (UME)
MISHOO Mike Shook
MERRY XMAS FROM ZOG'S CAVERN BBS
ANIMAJIK Alan Sheltra
GEORGE HARRISON SOUND FILES
DEANHOLDER Dean Holder

```

Programmers Den

```

FLEX: GNU VERSION OF LEX
NIMITZ David Graham
GAWK: GNU AWK IMPLEMENTATION
NIMITZ David Graham
XRAY V1.0? DISASSEMBLERS HELPER
BOBKEMPER Robert Kemper
BISON: "YACC" CLONE FROM GNU
NIMITZ David Graham
XRAY V1.00 DISASSEMBLERS HELPER
BOBKEMPER Bob Kemper
GUIB V1.1: BASIC09 GUI ROUTINES
EARTHER Shawn Driscoll

```

68K-OS9

```

RAND.C: RANDOM NUMBER FUNCTION
JSUTEMEIER Jim Suteimeier
TTY/PTY IMPLEMENTATION(UNIXLIKE)
THEFERRET Philip Brown
WTPY: SET WINDOW TYPE ON MM/1
COMPER Glen Hathaway
STICKY - MAKE OSK MODULES STICK
JOELHEGBERG Joel Hegberg
TC70 TERMLIB ENTRY
BRYANC Bryan Clingman
NEW STANDARD FONTS FOR MP1
MARKGRIFFITH Mark Griffith
TEXT FILE CONVERSION FILTERS
VAXELF John Donaldson
PEARLS: RANDOM MESSAGE PRINTER
PAGAN Stephen Curville
BALLS: MULTI COLOR BALLS
COMPER Glen Hathaway
RANDOM NUMBER FUNCTION FOR C
VAXELF John Donaldson
HFO PD DISKS (OSK)
POLTERGEIST Brian Wright
PDEMO: PALETTE DEMO FOR MM1
COMPER Glen Hathaway
COLORS: COLOR DEMO FOR MM1
COMPER Glen Hathaway

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AUTODOC: AUTOMATIC C DOCUMENTER
NIMITZ David Graham
PARANOIA - OSK GAME
POLTERGEIST Brian Wright
VGIF2: GIF VIEWER FOR VGA OSK SYS
WRHAMBLEN William Hamblen
SETTERM 1.21: SET TERM ENV.
BRIANWHITE Brian White
OSK SYSTEM UTILITIES
VAXELF John Donaldson
BOOTS: KEEP TRACK OF # OF BOOTUPS
JOELHEGBERG Joel Hegberg

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Tutorials & Education

```

CUSTOM MULTI-VUE BOOT DISK
RICKMAC Richard McNabb
DESKMATE 3 HELP / ADD LINEFEEDS
RICKMAC Richard McNabb
FLOPPY DRIVE CONFIGURATIONS
BOBKEMPER Bob Kemper

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General Information

```

GLENDSIDE COCO CLUB
CBJ Carl Boll

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CoCo 3 Graphics

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PINK FLOYD IN CM3
RICKMAC Richard McNabb
STAR WARS IN CM3
RICKMAC Richard McNabb
JETS IN CM3
RICKMAC Richard McNabb
THE PROJECTOR V2.1
SANNUCCI Joe Sannucci
PEEK-A-BOO
SANNUCCI Joe Sannucci
OLD & NEW TREK CHARACTERS
SANNUCCI Joe Sannucci
SOME CM3 PICS
TIND John Tindall

```

Utilities & Applications

```

TWO DISK DIR/FTIF UTILITY
RICKMAC Richard McNabb
DISK FILE UTILITIES
DENPAG Denver Page
SSN
SANNUCCI Joe Sannucci
DIRASST.BAS
COCOJOHN John Lentz
GIFTAG.BAS
COCOJOHN John Lentz
BOWLING STATS VERSION 5.3
REDCOAT Don Joyce

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Hardware Hacking

```

MODEM/NUL MODEM COCO CABLES
TINIFF Madin Simmons
LS138 / E CLOCK FIX
MARTYGOODMAN Marty Goodman

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Games

```

SOLITAIRE-3
SANNUCCI Joe Sannucci
RICKMAC RICHARD ROLL FROM RAM
RICKMAC Richard McNabb
STOCK MARKET SIMULATION/GAME
SANNUCCI Joe Sannucci
COCOCLUE
SANNUCCI Joe Sannucci
DRAGN.ARC
CPELOSI Charlie Pelosi
B.OX.BIN
SANNUCCI Joe Sannucci

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Classic Graphics

```

MERRY CHRISTMAS FROM KCCOCO
DFYE Danny Fye

```

Music & Sound

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VAR. SONGS FOR THE CASIO MT-240
DFYE Danny Fye
TJUKEBOX
TMB Terry M. Blackwell
CHRISTMAS MUSIC
DFYE Danny Fye

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Product Reviews & Announcement

```

LOW-COST RAINBOW AD INFO
DSRTFOX Francis Swygert

```

Telecommunications

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DIALER FOR DELUXE RS232 PAK
EARL CASPER Earl Casper
STAR WRECK GAME FOR CFBBS
DFYE Danny Fye
HANGMAN GAME FOR USE WITH CEBBS
DFYL Danny Fye
SUPERCEBBS
DFYE Danny Fye
COCOS9ER #6
SANNUCCI Joe Sannucci

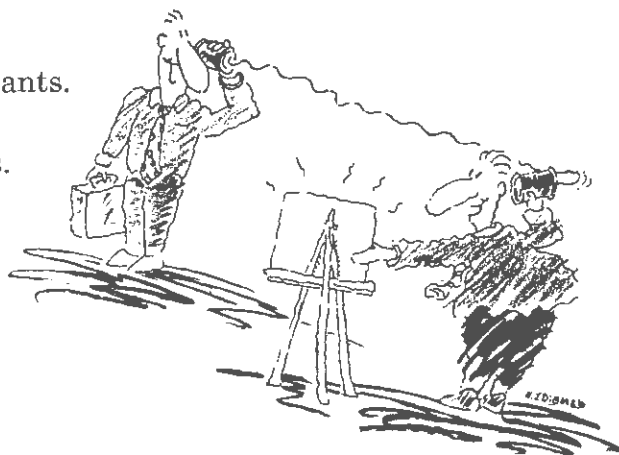
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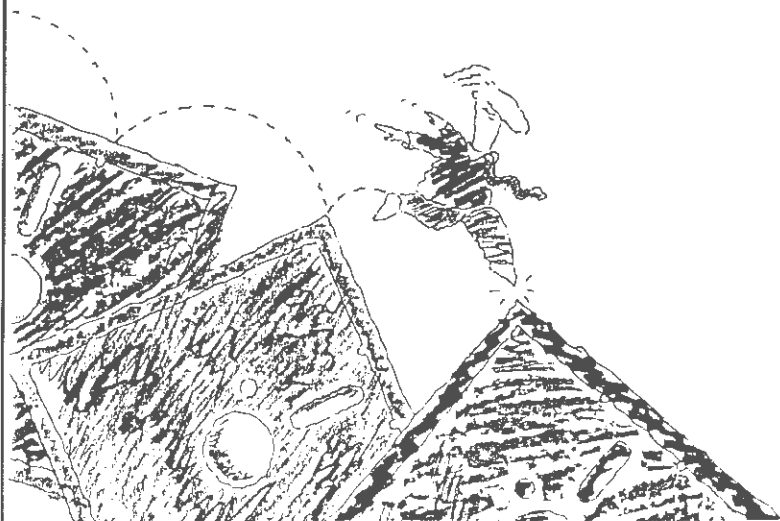
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Feature Program

Get a Bang out of Word Games

Beat the Bomb is an explosive word game (pun intended) for the CoCo 3. The program draws a bomb onscreen, lights the fuse, then challenges you to unscramble five words before the bomb goes off.

To play, enter the listing, save it to tape or disk, and enter RUN. When the game first starts, a prompt is displayed and you can choose one of three levels of play: easy, medium or hard. Press the first letter of the appropriate level — *Beat the Bomb* draws your nemesis and displays the first scrambled word.

When you think you have solved the scrambled word, type its letters in the correct order. (If you are a touch typist, you may need to slow your typing speed a bit to allow for the BASIC program loops.) The letters you type appear in the upper-right corner of the screen. If your solution is correct, you need not press ENTER — *Beat the Bomb* automatically displays the next word. Otherwise, press ENTER to delete the attempt and try again. Play continues in this fashion until you correctly solve five words or the fuse burns down.

After you've played a few rounds of *Beat the Bomb*, you'll find you know most of the scrambled words by sight. You can change the words used by entering new words into Array Z. Lines 140 through 380 store 50 words (two words per line) in Z(1) through Z(50). To reduce the "cheating" factor, have a friend enter new words for you.

Presented appropriately, *Beat the Bomb* is an excellent educational tool. It helps students quickly establish relationships between consonants and vowels. To target the game for a specific level, change the words used so they all have about the same number of letters.

If you like high-pressure situations, you'll like the way *Beat the Bomb* puts you under the gun!

John Sava is 14 years old and enjoys programming the Color Computer. He may be contacted at 618 N. Townsend Street, Syracuse, NY 13203.

```

150 Z$(3)="DINOSAUR":Z$(4)="BUIL
DING"
160 Z$(5)="NUMBERS":Z$(6)="OCTOP
US"
170 Z$(7)="EASTER":Z$(8)="CHRIST
MAS"
180 Z$(9)="THANKSGIVING":Z$(10)=
"SUMMER"
190 Z$(11)="WINTER":Z$(12)="SPRI
NG"
200 Z$(13)="PUMPKIN":Z$(14)="RAI
LROAD"
210 Z$(15)="VIBRATE":Z$(16)="CHE
MISTRY"
220 Z$(17)="SCIENCE":Z$(18)="HIS
TORY"
230 Z$(19)="ENGLISH":Z$(20)="HOU
SE"
240 Z$(21)="MULTIPLY":Z$(22)="SU
BTRACT"
250 Z$(23)="DEMAND":Z$(24)="VEGE
TABLE"
260 Z$(25)="ANIMALS":Z$(26)="MAR
ATHON"
270 Z$(27)="DOCTOR":Z$(28)="LIZA
RD"
280 Z$(29)="CROCODILE":Z$(30)="F
INGERS"
290 Z$(31)="PIRATE":Z$(32)="BREA
TH"
300 Z$(33)="EXAMINE":Z$(34)="HOR
SE"
310 Z$(35)="FLOATING":Z$(36)="LE
ARN"
320 Z$(37)="TELEPHONE":Z$(38)="P
ORCH"
330 Z$(39)="GLOWING":Z$(40)="TRA
IN"
340 Z$(41)="CRACKLE":Z$(42)="GRO
AN"
350 Z$(43)="DREAMING":Z$(44)="BI
RDS"
360 Z$(45)="ORANGE":Z$(46)="NAPK
IN"
370 Z$(47)="IMPORTANT":Z$(48)="W
RITE"
380 Z$(49)="JUNIOR":Z$(50)="MUSC
LE"
390 I=1:FORG=1TOS
400 O=RND(50)
410 FORH=1 TO 5:IF O=Q(H) THEN 4
00 ELSE NEXTH
420 P$(G)=Z$(O):Q(I)=O:I=I+1:NEX
TG:FORG=1TOS:O(I)=O:NEXTG:I=1
430 FORG=1TOS:FORH=1 TO LEN(P$(G
))
440 V=RND(LEN(P$(G)))
450 FORT=1 TO LEN(P$(G)):IF V=Q(
T) THEN 440 ELSE NEXTT
460 T$=T$+MID$(P$(G),V,1)
470 Q(I)=V:I=I+1:NEXTH:PP$(G)=T$
:T$="":I=1:FORU=1 TO LEN(P$(G)):
Q(U)=O:NEXTU:NEXTG
480 HSCREEN2:HCLS6:HCOLORB
490 HCIRCLE(155,115),75
500 HLINE(95,80)-(215,100),PSET,
B
510 HPAINT(97,83),11,8
520 HPAINT(155,115),8,8
530 HLINE(153,0)-(158,70),PSET,B
540 HPAINT(154,2),7,8
550 HLINE(190,5)-(310,30),PSET,B
:HPAINT(192,6),11,8
560 HGSET(0,0)-(30,8),1
570 HDRAM"BM10,0;C8U1R1U1R1U1R2D
1R1DIR1D1R2U1R1U1R1U1R2D1R1DIR1
R5D1L1D1L1D1L2D1L1D1L1D1L2U1L1U
1L1U1L2D1L1D1L1D1L2U1L1U1L1U1L5U
1R1U1R1U1R2U5"
580 HPAINT(11,2),1,8
590 HGSET(0,0)-(30,8),2
600 HPUT(0,0)-(30,8),1:HPUT(0,5)
-(30,13),1:X=0:Y=8:R=0:B=1:F=24:
HCOLOR3:HPRINT(16,15),"B E A T":
HPRINT(18,17),"THE":HPRINT(16,19
),B O M B"
610 HCOLORB:HLIN(0,0)-(90,25),P
SET,B:HPAINT(2,2),11,8:HCOLORB:H
PRINT(1,1),"SOLVED":HPRINT(7,1),B-1
,B-1
620 A$=INKEY$:IF A$="" THEN 630
ELSE GOSUB710
630 HPUT(138,X)-(168,Y),2
    
```

```

640 HCOLOR2:HPRINT(12,11),PP$(B)
650 PLAY"T25501AB"
660 HPUT(138,X)-(168,Y),1
670 R=R+1:IF R=ZX THEN R=0:X=X+1
:Y=Y+1
680 IF X=33 AND Y=41 THEN 700
690 GOT0620
700 HCOLOR1:HPRINT(24,2),Q$:FOR
N=1T010:HCOLOR2:HPRINT(24,2),P$(
B):PLAY"T20001CCCCCCCCCCCCC":H
COLOR1:HPRINT(24,2),P$(B):PLAY"
T20001CCCCCCCCCCCCC":NEXTN:HCO
LORS:HPRINT(26,5),"YOU LOSE 11":
PLAY"T5005FF04FF03FF02FF01FF
F":FORN=1T0500:NEXTN:GOT0700
710 HCOLOR2:HPRINT(F,2),A$:O$=O$
+A$
720 PLAY"T17503CDF"
730 IF A$=CHR$(13) THEN HCOLOR1:
HPRINT(24,2),Q$:HCOLOR2:O$="":F
=23
740 IF O$=P$(B) THEN FORN=1T010:
HCOLOR2:HPRINT(24,2),P$(B):PLAY"
T20001AA02AAA":HCOLOR1:HPRINT(
24,2),P$(B):PLAY"T20003AAA04AAA
5AAA":NEXTN:O$="":HPRINT(12,11),
PP$(B):B=B+1:F=23:GOT0770
750 IF B>5 THEN GOT0770
760 F=F+1:RETURN
770 HCOLOR1:HPRINT(1,1),"SOLVED
":HPRINT(7,1),B-2:HCOLORB:HPRIN
T(1,1),"SOLVED":HPRINT(7,1),B-1
:IF B>5 THEN 830 ELSE 750
780 T$=INKEY$:IFT$="" THEN 790 ELS
E820
790 HCOLOR6:HPRINT(1,20),"PLAY A
    
```

```

GAIN":PLAY"T1501ABAB"
800 HCOLOR1:HPRINT(1,20),"PLAY A
GAIN":PLAY"T1501ABAB"
810 GOT0780
820 IF T$="Y" THEN 50 ELSE POKE6
5496,0:CLS:END
830 HCOLOR5:HPRINT(25,5),"CONGRA
TULATIONS":PLAY"T2501DDDD02DDDD
3DDDD04DDDD05DDDD":FORN=1T0500:N
EXTN:GOT0780
    
```



Received and Certified



Forth program sold by BDS Software. To keep costs low, the three-page instruction manual is provided on floppy disk. It can be viewed and output to your printer using the reader program, which is also included on the disk. *BDS Software, P.O. Box 485, Glenview, IL 60025-0485; \$5.75.*

The following products have recently been received by THE RAINBOW, examined by our 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.

Icon-Basic09, a graphic user interface for BASIC09 under OS-9 Level II. *Icon-Basic09* allows the programmer to point and click on icons to enter keywords and statements into BASIC09 programs, making programs easier to write and understand. It is also useful for examining programs written by others. Users can list existing programs, and icons will replace the corresponding keywords. Requires a CoCo 3 with at least 256K, OS-9 Level II, and a mouse or joystick. *HAWKSoft, P.O. Box 7112, Elgin, IL 60121-7112, 708-742-3084; \$20.*

CF83 Patcher, this program patches the CF83 *Forth* disk to add an improvement to the *Forget* word. Requires the CF83 *Forth* program disk. *BDS Software, P.O. Box 485, Glenview, IL 60025-0485.*

CoCo Cassette #115, a variety of programs presented monthly for the CoCo 1, 2 and 3. This issue contains: *Flies*, a graphics game in which you must exterminate pesky flies; *Speech Hims*, software for the Speech/Sound Cartridge; *Mountain Wars*, a two-player graphics game; *Super Copy and Kill*, a disk-utility program; *Darn*, a highly addictive block-dropping game; *Maze*, another two-player graphics game; *Disk Directory*, a menu program; *Backup*, a machine-language program that formats and copies 35- or 40-track disks; *Roman Checkers*, an *Othello* clone for the CoCo; and *Gnome Quest 2*, a CoCo 3 disk-only graphics adventure game. *T & D Software, 2490 Miles Standish Drive, Holland, MI 49424, 616-399-9468; \$8.*

The Bible in CF83 Forth Blocks, the entire King James Version of the Bible in CF83 *Forth* blocks on 27 floppy disks. The text is continuous throughout the blocks, without paragraphing or other organization, and is thus suitable for those who want to experiment with developing their own concordance programs. Unless a user plans to write his own access programs, use of this product requires CF83 *Forth* and the CF83 *Forth* block editor. *BDS Software, P.O. Box 485, Glenview, IL 60025-0485; \$67.50.*

CF83-6: System Extension Words Set, Use of this program requires the CF83

The Rainbow Seal of Certification is open to all manufacturers of products applicable to the Tandy Color Computer, regardless of whether or not those companies advertise in THE RAINBOW. By awarding the Seal, we certify the product exists — we have a sample copy and have examined it. However, this does not constitute any guarantee of satisfaction. As soon as possible, these products will be forwarded to reviewers for evaluation.

CoCo 3

The Listing: BEATBOMB

```

1 *BEAT THE BOMB
2 *BY JOHN A. SAYA
3 *COPYRIGHT (C) 1992
4 *BY FALSOFT, INC.
5 *RAINBOW MAGAZINE
6 HBUFF1,150:HBUFF2,150
70 POKE65497,0:CLEAR1000:DIMZ$(5
0),P$(5),PP$(5),Q(20)
60 ON BRK GOTO 50
70 WIDTH32:CLS:FORN=0T0510:PRIN
TCHR$(166):NEXTN:PRINT00,"<e> A
S Y":PRINT@169,"<m> E D I U M"
:PRINT@342,"<h> A R D":
80 PLAY"T25502ABCDG01ABCDG"
90 A$=INKEY$:IFA$="" THEN 90
100 IF A$="E" THEN ZX=30
110 IF A$="M" THEN ZX=20
120 IF A$="H" THEN ZX=10
130 CLS3:PRINT00,"PLEASE WAIT..."
:PLAY"T25502ABCDG01ABCDG"
140 Z$(1)="SCHOOL":Z$(2)="COMPUT
ER"
        
```


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"The most complete Editor/Compiler I have seen for the CoCo..." -The RAINBOW March 1986

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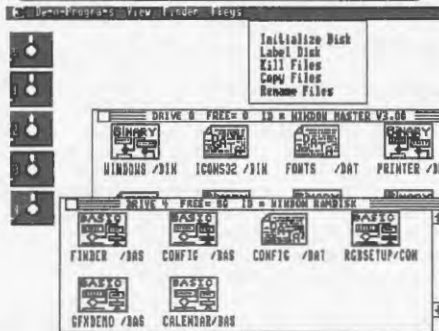
The Assembler features include:

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"...it offers so many features that it is probably underpriced. I recommend this software to all CoCo3 owners." -The Rainbow February 1989

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"Window Writer is a powerful word processor that is fun to use, very user friendly..... The Environment compares favorably to that of Microsoft Windows" - RAINBOW Dec. 1989

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Quickie Program

Bar Graph Printer

Bar Graph is a simple 16K Extended BASIC program that is designed to print bar graphs using a Radio Shack dot-matrix printer. You can select the types of data to be entered (the categories) and the data values. The printed result allows you to compare values in related categories and is great for tracking personal budgets.

When run, Bar Graph asks you for the title of the graph. The program then prints the title. After this, you are asked to enter a category (rent, groceries, year, etc.) and the value for that category. As written, the program accepts values from 0 to 1000. Enter an E to end the program. Bar Graph prints each category and its value as it is entered, so you can print as many different categories as you want in one printout.

The control codes in the program are designed to work with most Radio Shack dot-matrix printers. The

codes and the lines in which they appear are shown in Figure 1. The program does not alter the printer baud location (POKE 150, x) and prints at whatever rate for which the computer is set. (The default power-up rate is 600 baud.)

The printed bars are generated using the STRING\$ function and block-graphics characters illustrated in the Radio Shack printer

Line	Code	Function
100	CHR\$(27);CHR\$(14)	start elongation
110	CHR\$(27);CHR\$(15)	end elongation
110	CHR\$(27);CHR\$(20)	condensed print (17 cpi)

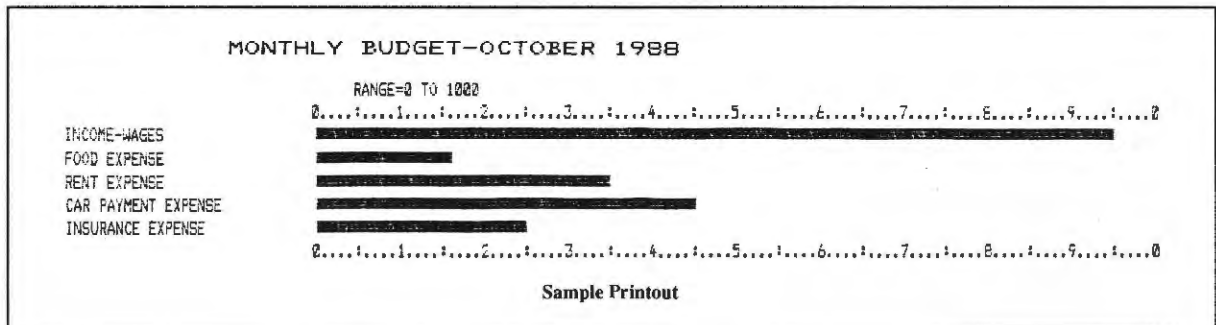
Figure 1: Bar Graph Printer Codes

program to accept values in the 0-10 range, change 1000 in lines 30 and 120 to 10. Also change Line 180 to T=N*10. To alter the program for a 0-100 range, change 1000 in lines 30 and 120 to 100. Then change Line 180 to T=N.

manuals. The graphics characters used are CHR\$(239) in Line 200, and CHR\$(233) and CHR\$(234) in Line 220.

As stated before, Bar Graph accepts data entries from 0 to 1000. To modify the

Charles Kiedaisch is a retired tool-and-die designer and builder. He still does some design at home, and he uses his CoCo 3 to create master drawings. One of his hobbies is writing programs for the CoCo.



```

16K Extended
The Listing: BARGRAPH
1 'BAR GRAPHER
2 'BY CHARLES A. KIEDAISCH
3 'COPYRIGHT (C) 1992
4 'FALSOFT, INC.
5 'RAINBOW
10 CLS:PRINT"IN THIS PROGRAM YOU
WILL BE ASKED TO:"
20 PRINT:PRINT"ENTER A CATEGORY(
I.E. FOOD,RENT, ETC.)"
30 PRINT:PRINT"ENTER AMOUNT(BETW
EEN 0 AND 1000)"
40 PRINT"TO END ENTER <E>"
50 PRINT
60 INPUT"PRESS <ENTER> TO START"
;S$
70 IF S$=CHR$(13)THEN 110
80 CLS:LINEINPUT"NAME/DATE OF GR
APH ";D$
90 PRINT@236,"PRINTING"
100 PRINT#-2,TAB(20);CHR$(27);CH
R$(14);D$
110 PRINT#-2,CHR$(27);CHR$(15);C
HR$(27);CHR$(20)
120 PRINT#-2,TAB(35);"RANGE=0 TO
1000"
130 PRINT#-2,TAB(30);"0.....
1.....2.....3.....4.....
.....5.....6.....7...
.....8.....9.....0"
220 PRINT#-2,C$;TAB(30);CHR$(234
);STRING$(L,X$);CHR$(233)
230 GOTO 140
240 PRINT@236,"PRINTING"
250 PRINT#-2,TAB(30);"0.....
1.....2.....3.....4.....
.....5.....6.....7...
.....8.....9.....0"
260 PRINT@234,"PROGRAM ENDED"
270 END
    
```

POKE

It is easy to tell the CoCo to switch between upper- and lowercase from within a BASIC program. To switch to lowercase characters, use POKE 282,0. (Remember, the CoCo 1 and 2, and the CoCo 3 32-column screen show lowercase as inverted characters.) To tell the computer to return to uppercase, use POKE 282,2. These pokes are real handy for working with the CoCo 3's Hi-Res text screens.

Feature Program

Expander Gives the Full CoCo 3 Picture

When adding Super Extended BASIC to the CoCo 3, Microware chose not to provide support for the full physical capabilities of the hardware. For example, while the CoCo 3 and CM-8 are capable of resolving 225 lines vertically, the built-in software can address only the first 192 lines. Expander is a short machine-language program that adds support for the extra lines on the CoCo 3's Hi-Res graphics screens, allowing you to draw bigger images and display more text on the HSCREENS.

Bits 5 and 6 of the video-resolution register (\$FF99) in the GIME chip determine the vertical resolution of HSCREENS 1 through 4. If both bits are clear (zero, or Low), the number of usable lines is 192. (This is the default setting.) However, if both bits are set (one, or High), the CoCo 3 resolves 225 lines vertically. To display

```

CoCo 3
Editor's Note: The following listing generates a segmented machine-language program when it is assembled. Since the tape software in the CoCo's ROM cannot handle segmented programs, Expander does not appear on this month's RAINBOW ON TAPE. The program is, however, available on this month's RAINBOW ON DISK.
The Listing: EXPANDER
00100 *****
00110 * HIRES GRAPHICS SCREEN EXPANDER *
00120 *
00130 * HSCREEN 3 & 4 HSCREEN 1 & 2 *
00140 * 640 BY 225 320 BY 225 *
00150 *****
00160 ORG $01DA
00170 START LDA #$34 MMU BLOCK #34 IS NOW USED FOR
    
```


200 lines. Bit 5 should be set and Bit 6 cleared.

Expander sets Bits 5 and 6 of \$FH99 and modifies BASIC to support the larger vertical resolution. Since the new screen is 5280 bytes larger, I had to relocate the memory reserved for BASIC's HGET/HPUT buffer space from Memory Block \$34 to Block \$37. The

latter is an 8K block of memory not ordinarily used by BASIC.

The program is written in two sections. The first (lines 160 through 340) in the assembly-language listing) loads into memory starting at Address \$01DA. This is where the cassette I/O buffer usually re-

sides. If you are using a cassette-based system, you'll need to change the address in the first ORG statement to an unused area of memory before assembling the program.

The second half of *Expander* overlays a routine in Super Extended BASIC that is used to switch to the graphics modes. For this reason it must be loaded into memory starting at Address \$E04D. This part of *Expander* also changes the border color to match the background color in all HSCREEN modes.

Once you have assembled *Expander*, put the larger graphics screens into effect by entering LOADM "EXPANDER": EXEC. After the program loads and executes, the OK prompt returns and you can immediately take advantage of the new screen size. All graphics commands work as they did prior to the modification—you do not have to alter existing BASIC programs. Just remember the new limits. For example,

```
HLINE(0,0)-(319,224),PSET,B
```

draws a box around the screen, and

```
HPRINT(0,27),"Message"
```

prints the word Message on Line 27.

Submitting Material To Rainbow

Contributions to the RAINBOW are welcome from everyone. We like to run a variety of programs that are useful, helpful and fun for other CoCo owners.

WHAT TO WRITE: We are interested in what you want 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 that 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 in ASCII format 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 wanting more detailed information on making submissions, please send a self-addressed, stamped envelope (SASE) to: Submission Guidelines, THE RAINBOW, The Falstaff Building, P.O. Box 385, Prospect, KY 40059. We will send you comprehensive guidelines.

Please do not submit material currently submitted to another publication.

Ron Dahlke is a certified auto technician who has worked in the auto-repair business since 1985. He purchased his Color Computer in 1986 to keep shop records and has been programming since that time. He can be contacted at W7585 Novak Lane, Waterloo, WI 53594, (414) 261-6989. Please include an SASE when requesting a reply.

```
00180 STA $E0EE EXTENDED HSCREEN MEMORY
00190 LDA #537 MMU BLOCK #537 IS NOW USED AS
00200 STA $E0D4 BASICS HBUFF GET/PUT STORAGE
00210 STA $E3A3 MEMORY
00220 STA $E508
00230 LDD #5ACA0 NEW HCLS END ADDRESS
00240 STD $E6E7
00250 LDA #225 ALLOW BASIC TO DRAW ON EXTENDED
00260 STA $E7BA PART OF SCREEN
00270 DECA
00280 STA $E7BE
00290 STA $E875
00300 STA $F526
00310 LDA #27 ALLOW HPRINT UP TO LINE 27
00320 STA $EF8F
00330 LDX #5E0E1
00340 JMP $E0F1
00350 *
00360 ORG $E04D
00370 PSHS Y,X,A NEW MODE SWITCH ROUTINE
00380 LBRN $0000
00390 IFAX MDATA,PCR
00400 LEAY MODES,PCR
00410 LDA $E6
00420 SUBA #1
00430 LDA A,Y
00440 STA 2,X
00450 LOY #5FFB0
00460 LDA $FE0B
00470 LDA A,Y
00480 STA 3+MDATA,PCR
00490 JMP $E082
00500 MODES FDB $757E
00510 FDB $747D
00520 MDATA FDB $4C80
00530 FDB $0000
00540 FDB $0000
00550 FDB $C000
00560 FCB 0
00570 END START
```

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CoCo Consultations continued from Page 4

fact that I had a mouse on COM 1 and was trying to do serial communications via the null-modem cable on COM 3. I just got around to testing this theory by unplugging the mouse and using the null-modem cable on COM 1. It now works perfectly.

Ted Jaeger (TEDJAEGER)
Fulton, Montana

A Great! Now try putting the mouse on either COM 2 or COM 4 while using either COM 1 or COM 3 for serial communications with the terminal program. I suspect you will find things will work fine.

Connecting Epson Printers

Q I recently acquired an Epson LX-800 printer that I want to use with my Color Computer 2. How do I connect the printer to the computer?

Robert Russel
Sorrento, Florida

A All Epson printers I have seen come with a parallel interface. You will need to use a serial/parallel converter to connect the CoCo 2's serial port to the parallel port on the Epson. Epson makes serial/parallel converters that plug inside many of its printers. With such a unit installed, you'd just need a CoCo printer cable (4-pin DIN to DB-25 with pins 4, 3 and 2 of the CoCo

DIN going to pins 3, 7 and 20, respectively, of the DB-25 connector).

I'm not specifically familiar with the LX-800 printer. Some Epson printers have, in addition to a 36-pin Centronics parallel connector, a 6-pin DIN serial connector. If your printer has such a serial port, you may be able to use the printer with your CoCo after making up a proper cable. You'll have to check the manual to get the pinout for that port in order to make a cable to connect it to the CoCo. (You'll also need to check the manual for the correct DIP switch settings for the printer to use the serial port.) Connect Pin 4 of the CoCo DIN to the "data in to printer" pin on the Epson. Connect Pin 3 of the CoCo DIN to the Ground pin on the Epson serial connector. Finally, connect Pin 2 of the CoCo DIN to the "busy handshake line" of the Epson. Note that the CoCo requires that the Busy signal be Low when the printer is busy.

Modem Won't Talk Back

Q I recently got a new 2400-bps Hayes-compatible modem, and it displays an odd idiosyncrasy when hooked to my Tandy RS-232 Pak. I can tell it to dial, and it does; and it connects properly and works fine once connected. However, while it is in its command state, I cannot see anything onscreen the modem is sending to my computer. That is, if I type AT, I do not see OK. If I type ATDT ####-####, the modem

dials the specified number, and once connected the modem works fine. But I see neither ATDT ####-#### nor any connect messages. Note that I have set the modem to ATE1 (turning on the echo), but to no avail. I use a straight-through cable between the modem and the RS-232 Pak for pins 2, 3, 4, 5, 7, 8 and 20, although I also route Pin 8 of the modem to Pin 6 of the RS-232 Pak to enable my BBS to properly detect carrier.

Lavern Schoonover (LVSCHOONOVER)
Idaho Falls, Idaho

A Your problem is that the 6551 ACIA chip in the RS-232 Pak will not receive any data unless it has a valid signal on its carrier-detect line. There are generally two possible solutions to this problem.

One solution is to make a cable that is like your current cable, except that it does not route Pin 8 of the modem to Pin 8 of the RS-232 Pak. Keep Pin 8 of the modem going to Pin 6 of the RS-232 Pak for the benefit of your BBS program, but also short Pin 8 and Pin 20 of the RS-232 Pak together. This will force Pin 8 of the RS-232 Pak high whenever Pin 20 of the RS-232 Pak is high. Since all terminal programs make Pin 20 (DTR) of the RS-232 Pak high when they are activated, you should now be able to see responses sent by the modem on your screen, even when the modem is in command state.

Alternatively, if you are using a straight-

through cable, send the command AT&C0&W to the modem. This first activates the &C0 option, where the modem makes its carrier-detect line high regardless of whether it has detected a carrier or not. The &W command writes this to the non-volatile RAM in the modem, so that it defaults at power on to that state of carrier detect forced high all the time. To return the modem to normal function with respect to its carrier-detect pin, type AT&C1&W. This is assuming, of course, your modem supports both the &C and &W commands that are part of the Hayes Smart-modem 2400 command set.

I recommend the hardware fix, for it is compatible with the special modification you have made for your bulletin board, whereas the software fix removes the ability to use hardware to determine whether the carrier is or is not active. But for those using the modem with terminal programs (those not running BBS programs on their CoCo), the software fix is by far the quickest, simplest and most effective approach.

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 THE RAINBOW's CoCo SIG. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

Product Review

Rick's Treasure Chest: Unbelievable Offer #3

Rick's Computer Enterprise has done it again by bundling a wide variety of quality programs at an extremely low price. Shrewd investment opportunities are always welcome in these hard economic times, and it's even better when they are of immediate benefit to your children. This package is a good learning tool for elementary or junior high school students.

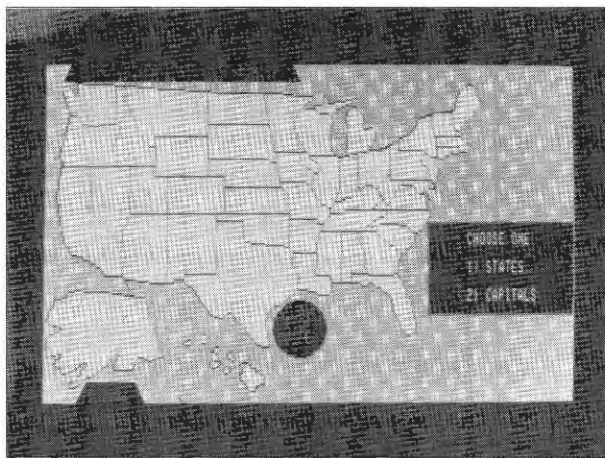
Unbelievable Offer #3 includes several educational programs. *Cirmath* helps children with simple addition problems. The student's score is based not only on correct answers but on reaction time. Another program, *Mymicro*, displays a microscope with its different parts labeled for review. After the student has memorized the parts, he takes a short quiz to test memory skills. *Spelling* is an eleven-word spelling tutor. The tutor flashes a word onscreen (at one of four speed settings) and prompts the user to re-type the word. Instructions are given for changing the words. Both *Mymicro* and *Spelling* display the percentage of correct answers.

Remember learning the states and capitals in geography class. (Is geography still taught in our elementary schools?) To help students learn geography, *Unbelievable Offer #3* includes some fine programs that cover this topic: *US Drill* and *Locate*. *US Drill* tests the student's ability to identify and locate states and capitals. *Locate* features drills for latitude, longitude, major cities of the world, the continents, countries

of the world and famous landforms. A tutorial is provided for brushing up on longitude and latitude skills.

How much does your child know about U.S. presidents? *Presidents* is designed to test knowledge of presidents in two ways. In the first approach, the program asks up to three general questions regarding a specific president. The second approach involves questions of a which-president-came-first nature.

After a hard day at school, what better way is there to unwind than to play some games. *Unbelievable Offer #3* includes nine games that should appeal to children of all ages. *Tictac* is a math version of tictactoe. This game requires players to correctly answer a two-digit addition or subtraction



problem before placing an X or O on the game board. Also included are a version of *Hangman* and a *Simon-type* simulation called *Stones*, which tests memorization skills. (Yes, I know these are educational programs, but they're games, too!)

I remember being given a slide puzzle of the United States to keep me amused on long car trips. (My brother would craftily mix the tiles, sometimes leaving an east-

coast state way over on the west coast.) *Pixslide* is a picture-slide puzzle that loads a NIB-format picture and scrambles it into 15 pieces — you've got to unscramble 14 of them. When (and if) you manage to do so, the computer places the final piece in the puzzle. *Numslide* is a number-slide puzzle in which you must rearrange 31 tiles in ascending order.

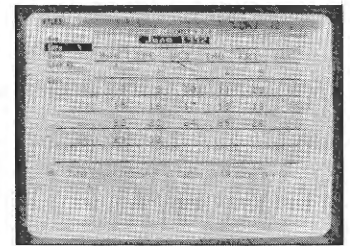
Perhaps the toughest game of the bunch is *Wheels*. The goal is to spin seven connecting wheels, aligning the colors inside each wheel with matching colors on adjacent wheels.

Give *Connect* a try if you like word-association games. You are shown a word underneath which are the first letters of six other words. The goal is to figure out the six

other words by word-association. Also in the word-game genre is *Discover*, a *Scrabble*-type game. The twist is that you must uncover words already hidden on the game board. Your turn lasts until you've uncovered a word or hit a blank spot on the board. You receive points for finding words — the player with the highest score wins. The last game included with *Unbelievable Offer #3* is called *Takesome* and is played against the computer. A random number of apples is placed on the screen. You can remove up to three apples per turn. The player left with the last apple loses.

Disk 2 of *Rick's Treasure Chest* contains three utilities and one home-help program. *Colprint* is a color-print driver for users of the Star NX-1000 color printer. This machine-language program automatically selects the palettes for printing color pictures. *Palsaver* is designed for use with *VUmaster*, a popular public-domain graphics viewer. Normally, if the Reset button is pressed while running *VUmaster*, the cor-

rect palette data is lost. *Palsaver* saves the correct palette data, allowing you to use the graphics — with correct colors — with other programs.



Many people who have a CoCo 1 or 2 also have a collection of PMODE graphics images. If you've upgraded to a CoCo 3, you can use *Transpix* to quickly and easily transfer PMODE images for display on HSCREEN2.

Most everyone who shops at a grocery store knows the importance of having a list of items to buy. *Shopper* is a database that takes the grocery selection process one step further. Not only does it allow for printing grocery lists, it stores information for price comparisons for up to four different stores. *Shopper* works best when used with an RGB monitor.

Though system requirements aren't listed in the manual that comes with *Unbelievable Offer #3*, an advertisement in THE RAINBOW did state that a CoCo 3 and an RGB monitor are required. However, I found using a monochrome monitor or T.V. to be adequate with most of the programs.

This bundle of 20 software programs is quite a steal. Considering the time and effort required to create these programs, and the price of \$20 (one dollar per program) you're getting a lot of bang for your buck. Frugal shoppers should seriously consider buying this package. It really is an unbelievable offer. (*Rick's Computer Enterprise*, P.O. Box 276, Liberty, KY 42539, 606-787-5783; \$20.)

— Jamie Hensen

Telecommunications

Serial Asynchronous Communication

This article describes concepts and applications for serial asynchronous communication. Most of the definitions and communications topics discussed here are generic and apply to any computer system, large or small. Introduced are basic data communications concepts and EIA-232-D (RS-232-C) issues.

Applications for Serial Communication

Perhaps it would be best to start by describing why anyone would want a communications interface. Communications interfaces allow data transfer between a computer and such external devices as another computer, a modem, a printer, a terminal, home security equipment, laboratory apparatus or robotics devices.

Many types of communications interfaces are available for computers: serial or parallel, synchronous or asynchronous, full-duplex or half-duplex. These terms will be defined later; let it suffice for now that serial asynchronous interfaces are the least expensive and simplest available.

My personal application was to build a small, simple network for file transfers between several small computers in my office. The computers I needed to connect were an Apple II+, a TRS-80 Model 100 portable computer and a Tandy 1000. Serial interface boards I purchased for the Tandy 1000 and the Apple, plus the built-in serial port on the Model 100, let me easily exchange text files between any pair of ma-

chines. The key is that all the serial ports use the Electronics Industries Association (EIA) RS-232-C standard hardware interface.

Serial interface hardware usually does not come with software to control it. Furthermore, RS-232-C (or EIA-232-D, as it is now known) specifies only the electrical interface and is therefore independent of the controlling software. This standard hardware interface allows any appropriate software to work together. In my case the Tandy 1000 serial port is controlled using either the Telecom software that is part of *DeskMate* or the *Crosstalk XVI* communications package. The Model 100 is controlled by its built-in Telecom program; the Apple, by software I wrote. The point is, I have never had any problem exchanging files using these different pieces of software.

Introducing Data Communications

To really understand what is meant by serial asynchronous communications, it is necessary to present some basic data communications terms and concepts. I recommend two books for any reader who wants to really delve into this topic. *Technical Aspects of Data Communication*, by John E. McNamara, is one of the best books

available on the technical nitty-gritty of communications hardware and interfaces. *Data and Computer Communications*, by William Stallings, is a good overview of

Serial vs. Parallel Communication

Let's start by differentiating between serial and parallel communication (Figure 1). In a parallel system all bits of a word (or character or byte) are transmitted at one time, each bit on a separate wire or circuit. An additional wire is required to carry a clock signal, necessary to keep the transmitter and receiver in synchronization with each other. In a serial system there is only one wire for bit transmission, where each bit in the word is sent one after the other. Assume that we have an eight-bit byte.

A parallel system, then, requires at least nine wires for the clock and data; only one bit time, however, is required to transmit the entire byte. Conversely, a serial system requires only a single transmit circuit and eight bit times to transmit a byte.

(As an aside, the term *byte* usually means a character but does not always refer to an eight-bit quantity. The standard term *octet* is used to unambiguously refer to an eight-bit entity. In this article I use byte as a synonym for octet.)

Figure 1 shows the American Standard Code for Information Interchange (ASCII) representation of the character E as 01000101.

Note that the leftmost bit is called the Most Significant Bit (MSB) and the rightmost bit is the Least Significant Bit (LSB). Most serial systems transmit the LSB first.

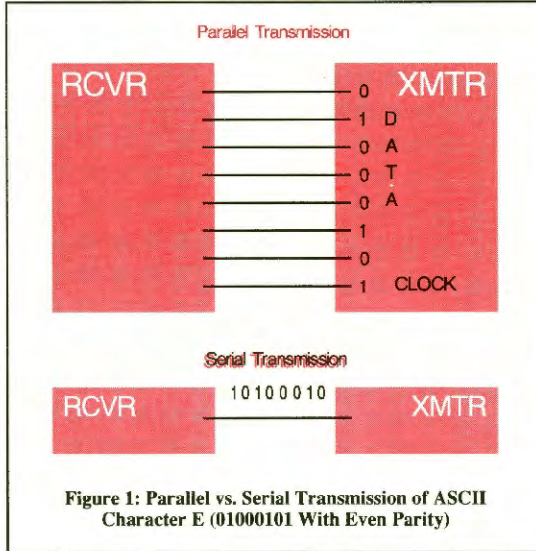


Figure 1: Parallel vs. Serial Transmission of ASCII Character E (01000101 With Even Parity)

data-communications topics and presents an introduction to computer networking as well. (For more information on these and other references, see the end of this article.)

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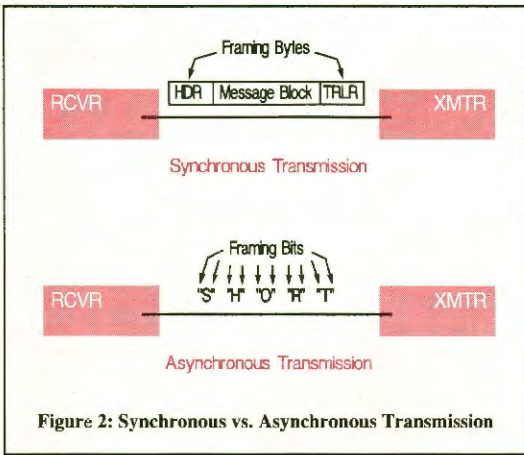


Figure 2: Synchronous vs. Asynchronous Transmission

Parallel communication interfaces are common in internal computer buses, such as those between the processor and a disk drive or between the chips on the motherboard. Computer buses are typically relatively short (less than a hundred feet or so), operate at high speed (several megabytes per second), and are vendor-specific. That is, if a third party wants to develop a device to plug into the Color Computer cartridge port, for example, the device must conform to a hardware specification written by Tandy for the CoCo.

Most computer owners are familiar with one commonly used parallel interface: the Centronics interface. The Centronics bus is usually used for computer-to-printer applications and has a limited distance; it is not designed for general computer-to-computer communication.

Communications between computers may be over long distances (upwards of thousands of miles), operate at relatively low speeds (usually limited to 19,200 bits per second over the dial-up telephone network), are typically serial, and usually use a vendor-independent interface. The goal is for machines built by different vendors to communicate easily with each other.

It is beyond the scope of this article to explain all the reasons computer-to-computer communication is usually serial. Consider, however, that parallel communication requires many more wires than does serial. The number of wires usually equals the word size; how, then, should machines with unequal word size communicate? What happens when I upgrade my eight-bit computer to a 16- or 32-bit computer? Indeed, cost is a major reason serial communication is preferred.

Consider also that a large amount of computer-to-computer communication uses the telephone network. On the order of one billion miles of wire is already in place in this country's telephone network; a single wire easily supports serial communication but cannot support parallel.

Finally, parallel communication systems require clocks and repeaters to ensure that all bits in a word stay in synchronization with each other. This adds to the cost of those systems.

McNamara's and Stallings' books provide more motivation on the serial/parallel issue; we will continue our discussion with serial communications only.

Synchronous vs. Asynchronous

Serial communication can be either *synchronous* or *asynchronous*. These terms refer to the timing relationship of characters in a message with respect to each other.

Serial transmission must have framing information immediately before and after the actual data bits to be transmitted. Fram-

ing information is used by the transmitter to let the receiver know that something important is about to happen — namely, that user data is coming down the line. Framing information at the end of transmission indicates that the data block is completed.

In synchronous communication (Figure 2), all bytes in a message are transmit-

Types of Transmission Channels

Finally we must distinguish among the different types of transmission channels. Channels can be simplex, half-duplex, or full-duplex.

A *simplex* link is one where information flow can be in only one direction. An example is the link between a stereo and its speakers, or the transmission from a TV or radio station. Simplex links are not of common interest for data communications.

Most useful data-communications applications require channels in which data can flow in both directions. In the *half-duplex* environment, information can flow in both directions but in only one direction at a time. An example is the communication between two people; the air carries words in both directions, but rules of reasonable conversation dictate that both people don't speak at the same time. The operation of CB and most other two-way radios is another example of half-duplex communication. It should be clear that some rules are necessary to indicate which end of the link should transmit next in these systems.

A *full-duplex* channel is one in which information can flow in both directions simultaneously. Computer-to-computer communication is typically full-duplex. Full-duplex is frequently referred to simply as duplex.

This article is oriented toward serial, full-duplex, asynchronous communication. This type of communication is very general and relatively simple, not requiring a complex protocol.

Asynchronous Transmission
Figure 3 shows the format of an asynchronous character. During periods of no transmission, power is applied to the line to keep it in the ON state. Since a line that is out will have no power on it, a bad line and an idle one are easily differentiated.

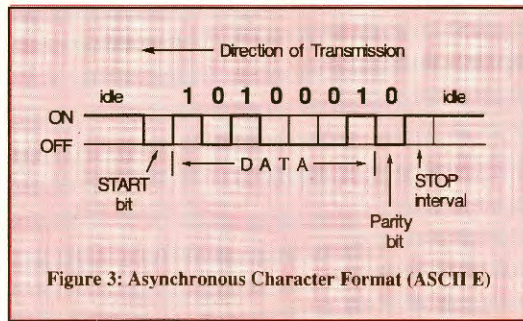


Figure 3: Asynchronous Character Format (ASCII E)

ted together as a block, one byte immediately after the other. The data message block is preceded by a header (HDR) and followed by a trailer (TRLR); these are the *framing characters*. In synchronous-communication protocols, framing characters can include such information as a message sequence number, message type, acknowledgement of a previous message, and error detection information. Usually the number of framing characters is very low compared to the amount of data. For example, the Digital Equipment Corporation DECnet protocol allows messages of up to 16,383 octets in length; the additional framing information is only 10 characters in length.

Asynchronous communication systems (Figure 2) transmit every character (or word) in a message individually, without regard to when previous characters were transmitted. Each character has at least two framing bits. A START bit precedes a character, letting the receiver know that data bits are about to come in. Then the bits comprising a single character are received. The transmission is terminated with a STOP period.

Asynchronous communication is typically used between a terminal and a computer. This is because users of terminals tend to be relatively slow compared to the computer. The human user is part of the error detection and correction cycle. Typographical errors, when seen, can be easily corrected with the Backspace key. Erroneous messages are typically indicated with a Syntax Error message and corrected when the user retypes the message correctly.

Computer-to-computer communication, on the other hand, is usually at high speeds and tends to be synchronous. A communications protocol must be used for error detection and correction, since a user cannot monitor the high-speed communication and certainly could not make necessary corrections.

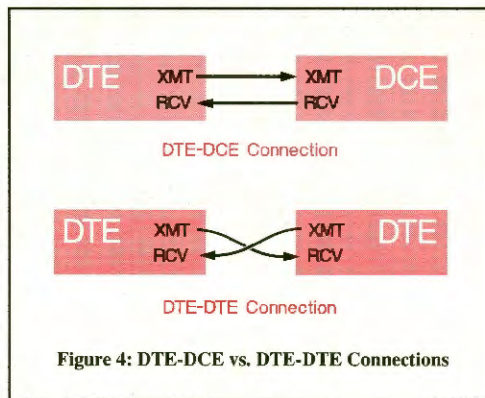


Figure 4: DTE-DCE vs. DTE-DTE Connections

When a character is sent, the receiver detects a transition from the ON (or MARK) state to the OFF (or SPACE) state. This OFF state lasts for a single bit time and is called the START bit. The appropriate number of data bits are then received, where the LSB is usually received first. The data bits are followed by a STOP interval, during which time the line is held in the idle (ON) state for 1, 1.5, or 2 bit times. The use of the STOP interval is based on printing terminals, which require a reset period between each character received.

The *baud* indicates how many signals per second are sent down the wire; baud means *signals per second*. The *bit rate* refers to how many bits are sent down the wire per unit time and is typically denoted *bits per second* (bps). The bit rate may be different from the baud, depending upon how many bits are sent with each signal; only if one bit of data is sent with each signal are the baud and bit rate the same.

An example helps clarify these concepts. If a signal lasts for 0.00333333 seconds (or 3.3333 milliseconds), the device is operating at 300 baud (one signal per 0.003333 seconds equals 300 signals/second). If each signal carries a single bit, the bit rate is 300 bps; if each signal carries four bits, the bit rate is 1200 bps.

The difference between bit rate and baud is very important. It can be easily shown that transmission over ordinary telephone lines cannot exceed 6000 baud or so. However, the bit rate can be on the order of 30,000 bits per second. These numbers are based on Nyquist's and Shannon's theorems, well beyond the scope of this article; interested readers are referred again to McNamara or Stallings.

Parity is an error-detection mechanism. In an even-parity system, all characters must have an even number of one bits turned ON; in an odd parity system, an odd number of one bits must be ON. Consider the seven-bit ASCII characters A (1000001) and E (1000101). When parity is used, these seven-bit characters are transmitted as eight-bit entities where the MSB, or leftmost bit, is the parity bit.

In an even-parity system, A, with an even number of one bits already ON, has the parity bit turned OFF; thus it is sent as 01000001. The E, on the other hand, has an odd number of one bits, so its parity bit is ON to make the number of one bits even; thus E is sent as 11000101. In an odd-parity system, characters A and E are represented as 11000001 and 01000101 respectively (see Figure 3).

Two other types of parity systems can also be used. In a MARK-parity scheme, the parity bit is always set to 1. In a SPACE-parity scheme, the parity bit is always zero.

The EIA-232-D (RS-232-C) Interface

The RS-232 standard is the most commonly used interface in the United States for serial, asynchronous communication between terminals, computers, and modems operating at speeds below 20,000 bps. (The International Telegraph and Telephone Consultative Committee (CCITT) Recommendation V.24, essentially identical to EIA-232-D, is commonly used outside North America.) The EIA first released Recommended Standard 232 (RS-232) in 1961. In 1969 RS-232-C was made available. RS-232-C remained virtually unchanged until 1988, when EIA-232-D was adopted. Since EIA-232-D is basically the same as RS-232-C, this article treats them as if they were the same (except where noted). The EIA was renamed the Telecommunications Industry Association (TIA) in 1989.

EIA-232-D can be used in either the synchronous or asynchronous-transmission environment. The standard defines the electrical characteristics of the interface and the circuits that must be present to effect communications. Pin numbers are provided for the typical D-shaped, 25-pin connector (DB-25) most often associated with RS-232-C. Although RS-232-C did not specify that the DB-25 connector be

used, the EIA-232-D version does. (This means you can purchase an "RS-232-C" device that uses a connector other than the DB-25.)

It is often said that RS-232-C/EIA-232-D limits devices to a maximum separation of 50 feet; this is in fact not the case. One electrical characteristic defined in the standard is the maximum allowable capacitance, which is limited to 2500 picoFarads (pF). Since normal cable has a capacitance of 50 pF/foot, a limitation is usually quoted. Significantly longer separations are possible using low-capacitance (or *low-cap*) cable.

A detailed description of the EIA-232-D standard, circuits, and their operation is also beyond the scope of this article, but Kessler and McNamara describe it in detail. A copy of the standard may also be obtained from the EIA (or TIA) at 2001 Eye St. NW, Washington, D.C. 20006. Finally, the book *RS-232 Made Easy*, by Martin Seyer, is full of excellent information for either the professional or hobbyist wanting to interconnect RS-232 devices or gain a better understanding of the standard.

EIA-232 Cabling

Many people build their own EIA-232 cables because they are expensive to buy but easy, cheap and fun to build. Two male (or female) solderless connectors and a 25-lead ribbon cable cost about \$15 and yield a fine 25-foot EIA-232 cable. These items are available from most Radio Shack or electronics supply stores. A caveat, however, must be provided regarding this practice.

Most people who build their own cables connect all 25 leads of the ribbon cable to the connectors. However, some of the pins are unassigned by the RS-232-C and EIA-232-D specifications, and most of the other

leads are unused for most common applications; in fact 10 or fewer of the pins are used for most applications. For this reason some manufacturers put test points at these "unused" pin positions. Using a cable with

the transmit (XMT) lead and receives from the DCE on the receive (RCV) lead. In other words, DCE devices receive data on the XMT line and transmit on the RCV line. However, DTE devices transmit on the

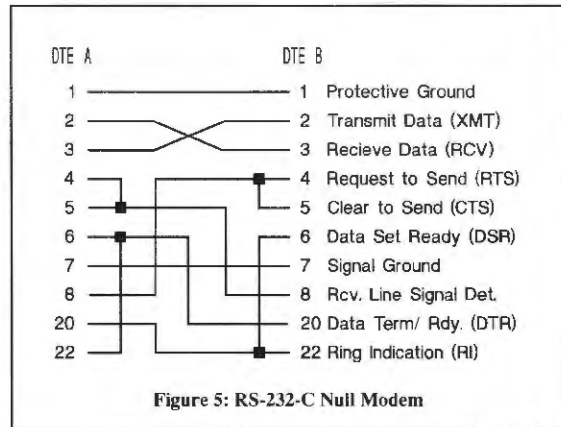


Figure 5: RS-232-C Null Modem

all 25 conductors connected could allow too much voltage to enter a device if you do not know exactly how a "foreign" device is internally wired. The way around this is to pull out the pins of all unused leads from at least one of the connectors (and preferably from both).

Another cabling issue regards a null-modem cable (Figure 4). EIA-232 recognizes two types of devices, *Data Terminal Equipment* (DTE) and *Data Communications* (or *Circuit-terminating Equipment*) (DCE). EIA-232 expects that a DTE be connected to a DCE; e.g., a terminal or PC (DTE) connected to a modem (DCE). If a DTE and DCE are connected with a normal EIA-232 cable, the communication works fine since the DTE transmits to the DCE on

the transmit pin at one end is connected to the receive pin on the other end and vice versa. This is a common application; if two computers are in the same room, do you want to connect them using two modems and two phone lines or using a single short cable?

Additional leads must also be crossed by the null-modem cable to allow the devices to communicate. A null-modem box allowing the direct interconnection of two DTEs can easily be built with the wiring diagram shown in Figure 5. Note that only 10 leads are shown in the diagram. This is a specified EIA-232 subset providing support for asynchronous, leased-line — dedicated — applications.

A way around using a null-modem cable exists in some applications. Some EIA-232 products allow the user to configure the device as either DTE or DCE. If one device is configured as a DTE and the other as a DCE, a null-modem cable is not needed. Before building or buying a null modem, check the specifications of the devices you are trying to connect.

If two devices set up as DTEs (e.g., two PCs) are connected, the two XMT circuits are connected to each other, as are the two RCV circuits. Obviously these two devices cannot communicate.

Summary

A great many topics have been declared "beyond the scope of this article." Parallel communications, synchronous communications protocols, EIA-232-D details, other interface standards besides EIA-232, information theory, error-detection techniques, and computer networks are among the many topics that can be greatly expanded upon. It is to be hoped this introduction encourages the reader to pursue more in the data communications area.

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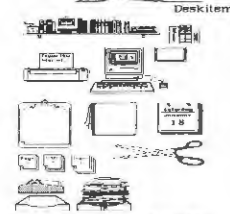


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