A WAYNE GREEN PUBLICATION
July 1983 USA $2.95

HOT CoCo

THE MAGAZINE FOR TRS-80 COLOR COMPUTER AND TDP-100 USERS T.M.

Etch Your Own PC Boards—It's Easy

PAGE 124 FIND S.E.X. ON DISK PROG.

Telewriter-64: Is It for You?

Use a Real Monitor with Your CoCo

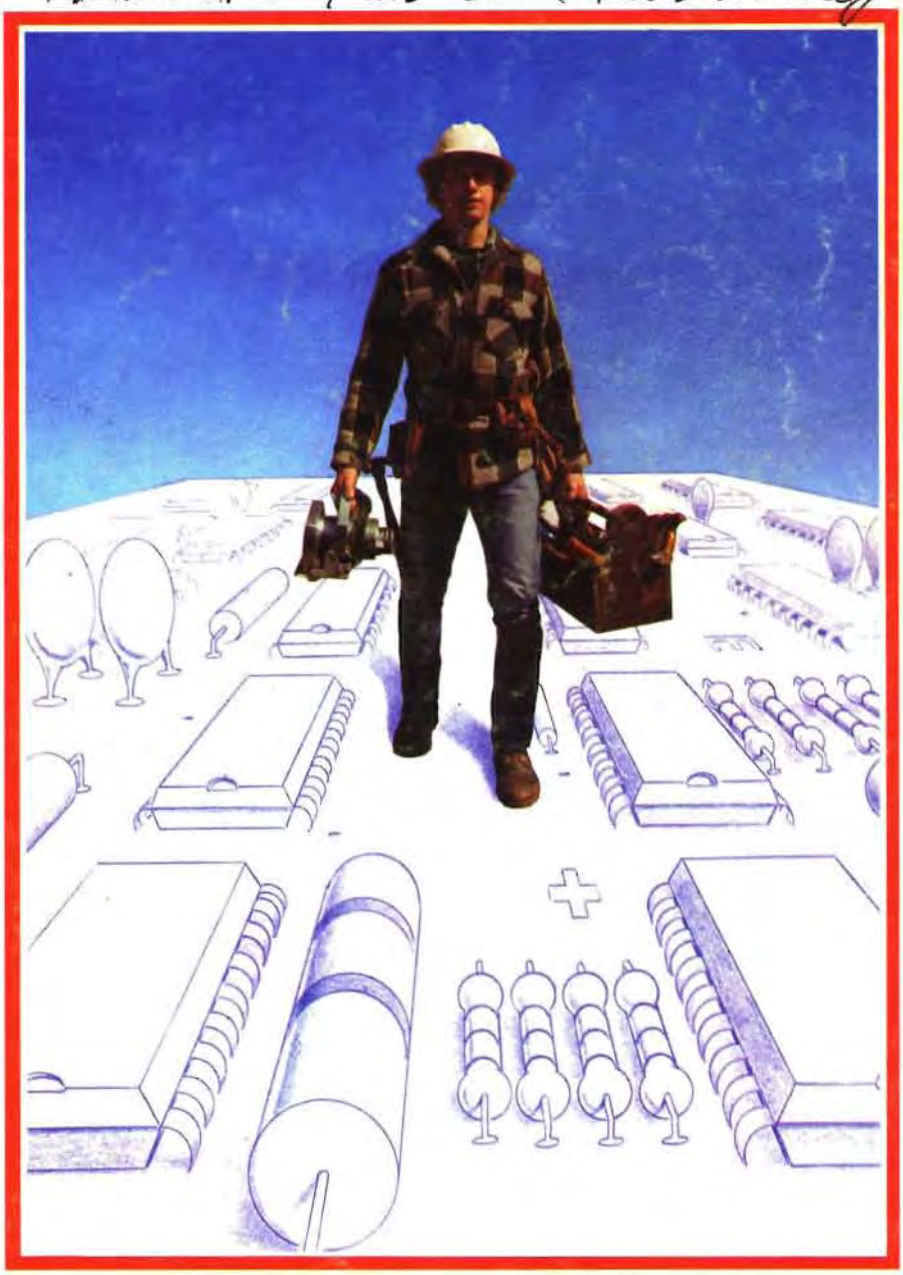
Clean Up Your Video RFI

You Can Use Color Artifacts In PMODE 4

Give Your CoCo A Bigger Brain: 64K Upgrade

Fireworks for the Fourth of July

Plus: Jake Commander's Spiral Driver—p. 140



Columns on Games, FLEX, Basic, and Graphics

0 74470 12067 07

Don't Get Burned

Most of the companies whose advertising you see in magazines like this brag that their programs for the Radio Shack Color Computer are 'just like the arcade games' they're patterned after.

We don't.

Most of the computer programs available for the Color Computer are clones. Clones of video games like every fourteen-year-old in country plays. Clones of games every fourteen-year-old in the country is bored with.

At **ScreenPlay,** we think the Color Computer is a pretty special machine. We think it deserves better than hundreds of "Chomp-Boy" arcade imitations and "Cavernous Cave" adventures. After all, the 6809 is as powerful as most 16-bit chips, and quicker than all of them. It has nearly unlimited potential.

You know all this. After all, you were smart enough to buy the machine. And people like you aren't going to want to play "Chomp-Boy" forever.

Ken Kalish and Jyym Pearson know the power of the 6809, too. And their programs for **ScreenPlay** will deliver that power to your Color Computer. Arcade programs with bright colors and snappy graphics. Adventure programs with elaborate scenarios and challenging problems. Programs that aren't just like everybody else's games — they're better. More complex. More demanding. More fun.

Jyym Pearson's machine language adventure games have been driving folks to distraction for years. Now you can challenge his worlds on your Color Computer. Worlds that demand every ounce of skill, ingenuity and intelligence you can muster.

The Institute, for example contains scenarios derived from your most horrifying nightmares, but this is a nightmare which you can escape through cunning and strategy.

Lucifer's Realm goes beyond nightmare. It takes you into Satan's Kingdom for a dramatic confrontation with the most evil mortals of all time.

And if you tire of matching wits with the likes of Hitler and Lucifer, you can try Kenneth Kalish's arcade games.

Phantom Slayer is like no other game you've ever seen for the Color Computer, featuring 3-D graphics in which you move about in **real-time.** No delays for anything — even though you may want one so you can catch your breath.

And then there's **Danger Ranger.** It's the kind of game people would fight over at an arcade — if any arcade **had** a game like this. **Danger Ranger** blasts from the screen with speedy, exciting action and colorful graphics that quicken their pace as you increase your skill.

And finally, there's **Invader's Revenge,** a game that offers an interesting reversal to a common gaming concept. Fast-paced and fun. Don't try this one unless you think you're pretty adroit — and uncommonly sharp.

ScreenPlay's new software. Special games for a special computer.

And for special people.

ScreenPlay™

The Institute cassette	$24.95
Lucifer's Realm cassette	$24.95
Danger Ranger cassette	$24.95
Phantom Slayer cassette	$19.95
Invader's Revenge cassette	$19.95

All games require 16K. They don't require Extended BASIC.

Please add $2.00 for First Class postage and handling. Add $4.00 for overseas orders.

ScreenPlay™

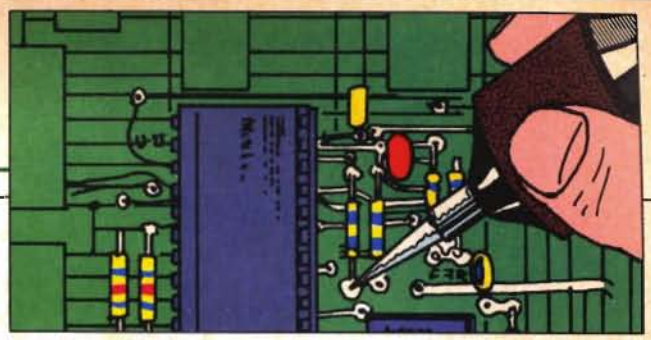
P.O. Box 3558
Chapel Hill, NC 27514 '83

© HAPPE BZ

To order, call 1-800-334-5470, or see your dealer.

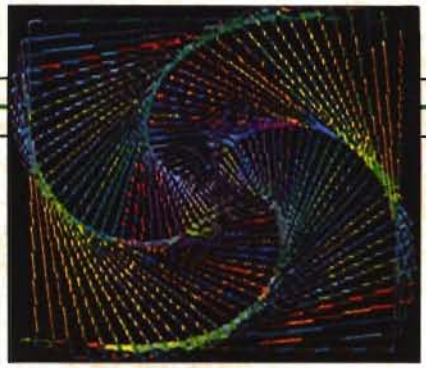
ScreenPlay™

HOT CoCo



Build It Yourself—p. 60

ARTICLES



Spiromania Returns—p. 140

Cover Montage by Jonathan Graves; Photo by Ozzie Sweet

DEPARTMENTS

Vol. 1. No. 2 July 1983

HOT CoCo (ISSN pending) is published 12 times a year by Wayne Green Inc., 80 Pine St., Peterborough, NH 03458. Phone: 603-924-9471. Second-class postage pending at Peterborough, NH, and additional mailing offices. Subscription rates in U.S. are $25 for one year, $38 for two years, and $53 for three years. In Canada and Mexico, $27.97—one year only, U.S. funds. Canadian distributor: Micron Distributing, 409 Queen St. West, Toronto, Ontario, Canada M5V 2A5. Foreign subscriptions (surface mail), $44.97—one year only, U.S. funds drawn on a U.S. bank. Foreign subscriptions (air mail), please inquire. In South Africa contact *HOT CoCo*, P.O. Box 782815, Sandton, South Africa 2146. **All subscription correspondence should be addressed to *HOT CoCo*, Subscription Department, P.O. Box 975, Farmingdale, NY 11737. Please include your address label with any correspondence.** Postmaster: Send address changes to *HOT CoCo*, Subscription Services, P.O. Box 975, Farmingdale, NY 11737.

624 KBYTE SYSTEM!

ONLY $599.00
(Including 2 Diskettes)

COLOR AMDISK-III COMPATIBLE.

The AMDISK-III micro-floppy disk system is an engineering breakthrough in disk size, storage capacity, media protection and user convenience. It's fully compatible with your Radio Shack*® Color Computer. Enjoy a full 624 KByte† (formatted) storage capability and the extra convenience of the new 3" hard plastic encased diskettes. They fit into a shirt pocket and are easy to mail, too.

The AMDISK-III drive system is ruggedly constructed for years of trouble-free operation, and is backed with our 90 day warranty on parts and labor.

Just circle the reader service number to receive complete specifications.

*Radio Shack is a registered trademark of Tandy Corporation.
†Requires recording on both sides.

DEALER INQUIRIES INVITED

2201 Lively Blvd. • Elk Grove Village, IL 60007
(312) 364-1180 TLX: 25-4786

AMDEK CORP.

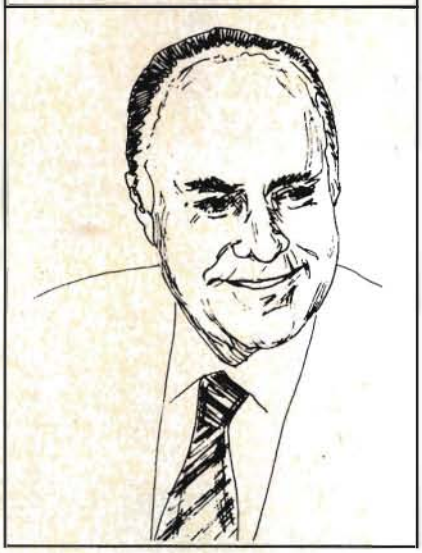
REGIONAL OFFICES: Calif. (714) 662-3949 • Texas (817) 498-2334

Amdek . . . your guide to innovative computing!

Off Color

WHAT THE COCO HAS THAT THE OTHERS DON'T

by Wayne Green



Someone asked me at a recent computer show why I hated the Color Computer. Hmmm . . . I wasn't aware that I did, so I got to mulling that surprise over. Even when there was some question about Radio Shack continuing its support of the system a year or so ago, I made it clear that I felt that the CoCo was probably one of the least appreciated microcomputers. It has tremendous potential.

You know, it is a big deal to get a magazine started, so my investing the time, people, space, and money in getting *HOT CoCo* going is a reflection of my conviction that the CoCo can be one of the winners if it is supported by a strong magazine. I like to make money as well as you, but the decision on starting a new magazine is a far-reaching and serious one, and concerns more what a magazine might be able to do for the microcomputer industry than whether it will just make money.

Each magazine that we put out helps some aspect of the industry to grow. With *80 Micro* we made it possible for hundreds of small firms to get started and sell accessories, programs and information on the TRS-80 computers. We generated a whole $300 million-a-year industry just with that one magazine. The decision on *HOT CoCo* was made because we see a similar opportunity, which this magazine should make possible.

Radio Shack has done a nice job in getting the CoCo designed and out on the market. Now I may be a bit overcritical of them for not putting out more software and other support for the system, but I also recognize that they have had their hands more than full trying desperately to keep up with the growth of the market for their other systems, their printers, and so on.

The chances are that you, as an owner of a CoCo, have lucked into something far beyond what you anticipated. As I've written before, I suspect that even the people at Radio Shack haven't fully appreciated the power of this computer—much less most of the customers. Many people have bought it because it looks nice, plays some computer games, isn't terribly expensive, has good service available. And, well, they wanted a computer.

HOT CoCo will take you from owning a confusing little computer with a couple of game programs into computing as far as you'd like to go. The magazine, because it forms a bridge between you, the user of the CoCo, and the people who are writing programs for it (who are designing accessories and writing information on how to use it) will make your CoCo almost infinitely more valuable.

You'll see how others are using the CoCo for interesting business applications. And the fact is that there are an incredible number of uses for a computer of this power in business. You'll find out how to use the CoCo to get used to computers in general and thus be less threatened by computer changes at work. You'll enter a whole new world of educational applications for the system, and this is a field which is just now really getting started.

Your CoCo investment is just the start. This is a powerful enough system so it can be expanded almost indefinitely—even to use with larger disk drives, different types of printers, networking in offices, and so on.

CoCo Survival?

If your investment in your CoCo and a growing number of expansions, peripherals, and so on are going to continue to hold their value, Radio Shack will have to continue to manufacture and sell the system. I got worried about this a year or so ago and made a big deal about it. As I said at the time, the CoCo is a computer which *should* be supported. Today, with the increasing competition from Timex, Commodore, Texas Instruments, Atari, Panasonic, Sanyo, BBC, and so on, there has been a good deal of discussion in the newspapers about Radio Shack and the CoCo. Would Tandy continue the CoCo?

The Tandy folks play their cards close to the chest, which fuels the fires of imagination for many newspaper writers. But I think we'll be seeing a new CoCo model coming out soon—in all probability before this is able to get into print. I suspect that this new CoCo will run the CoCo software and work with CoCo accessories. I also am darned sure that it will use some custom chips and thus require far fewer parts—and come down in price.

The people with whom I've talked who have seen the new CoCo (all sworn to secrecy of course) assure me that the new CoCo is going to blow everything else out of the water. Even discounting some of the enthusiasm as hyperbole, I think we're going to see

From Computer Plus to YOU . . .

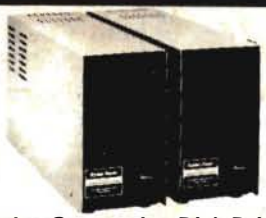
PLUS after PLUS after PLUS

Model 12
1 Drive $2699
2 Drive $3375

Color Computer 16K $175
w/16K Ext. Basic $255
w/ 32K Ext. Basic $345

Model IV 16K $849
Model IV 64K
2 Disk & RS232c $1699

Okidata 80 $320
Okidata 82A $399
Okidata 92 $510



Color Computer Disk Drive
Drive 0 $470 Drive 1 $299

Smith Corona TPI
Daisy Wheel $495

BUY DIRECT

Here are just a few of our fine offers . . . call TOLL FREE for full information.

COMPUTERS	
Model IV 16K	$849
Model IV 64K	
2 Disk & RS232 c	1699
Color Computer 16K	175
Color Computer 16K	
w/extended basic	255
‡Color Computer 32K-64K	
w/extended basic	345
Pocket Computer 2	165
Pocket Computer 4	59
Model 100 8K	679
Model 100 24K	835
Model 12 1 Drive	2699
Model 16 1 Drive	4199
MODEMS	
Hayes Smart Modem II	235
R.S. AC-3	129
R.S. Modem I	129
R.S. Modem II	199
PRINTERS	
Smith Corona TPI	495
Epson	Call
CGP-115	199
DMP-100	315
DMP-120	410
DMP-200	599
Okidata 82A	399
Okidata 92	510
Okidata 83A	655
Okidata 93	859
Gemini 10	319
Prowriter	375
DISK DRIVES	
Tandon 40 Track	289
Color DR0	470
Color DR1	299
ETC.	
CCR-81	52
R.S. Joysticks (pair)	22
16K RAM Chips	25
64K RAM Chips	75
32K Microbuffer Inline	229
Video Plus	24.95
Kraft Joystick (each)	49.95
Disk Controller	199
Serial to Parallel Conv.	69
Superpro Keyboard	69.95

SOFTWARE	(Tape Version)
Zaxxon	39.95
The King	26.95
Colorpede	29.95
Trapfall	27.95
Pac Attack	24.95
Ghost Gobbler	19.95
Planet Invasion	21.95
Color Zap	9.95
Railrunner	21.95
Space Shuttle	28.95
Typing Tutor	19.95
Color Come	49.95
Telewriter 64	49.95
FHL Flex (Disk)	69.95

Order any two above, take 10% off list.

R.S. Software 10% off list.

Send for complete list.

‡Color Computer 64K requires Disk 0 and D.O.S.

We have the lowest possible Fully Warranteed Prices AND a full complement of Radio Shack Software.

TOLL FREE
1-800-343-8124

computer plus

P.O. Box 926
480 King Street
Littleton, MA 01460
617-486-3193

Write for your free catalog

Prices subject to change without notice.
Not responsible for typographical errors.
TRS-80 is a registered trademark of Tandy Corp.

VISA MasterCard AMERICAN EXPRESS

18

Off Color

PUBLISHER/EDITOR
Wayne Green
EXECUTIVE VICE PRESIDENT
Sherry Smythe-Green
ASSISTANT TO PRESIDENT
Matt Smith
GENERAL MANAGER
Debra Wetherbee
ASSISTANT PUBLISHER
Jeff DeTray
CORPORATE CONTROLLER
Roger Murphy
ASSISTANT TO CONTROLLER
Dominique Smith
CIRCULATION MANAGER
603-924-9471
Patricia Ferrante
BULK & NEWSSTAND
SALES MANAGER
Ginnie Boudrieau
ADVERTISING, 603-924-7138
Advertising Manager: David Schissler
Sales: Penny Brooks, Mary Hartwell
Ad Coordinator: Kim Labbe
New England
Advertising Representatives:
John A. Garland, Frank Surace,
Garland Associates, Inc., Box 314 SHS,
Duxbury, MA 02332 617-934-6464

PRODUCTION
Manager: Nancy Salmon
Assistant: Michael Murphy
Frances Benton, Michael Ford,
Phil Geraci, Donna Hartwell,
Kimberly Nadeau, Lynn Parsons,
Anne Rocchio, Deborah Stone,
Theresa Verville,
Robert M. Villeneuve,
Karen Wozmak;
Ad Coordinators: David Wozmak,
Mary Seaver;
Assistant: Paula Ramsey;
Advertising Production: Fiona Davies,
Bruce Hedin, Scott Philbrick,
Jane Preston
PHOTOGRAPHY
Supervisor: Thomas Villeneuve;
Sandra Dukette, Laurie Jennison,
Sturdy Thomas, Irene Vail
TYPESETTING
Supervisor: Sara Bedell;
Darlene Bailey, Melody Bedell
Michele DesRochers, Prem Gongaju
Lynn Haines, Debbie Nutting,
Lindy Palmisano, Heidi Thomas
DESIGN
Supervisor: Joyce Pillarella;
Susan Donohoe, Denzel Dyer,
Howard Happ, Laurie MacMillan,
Dion Owens, Dianne Ritson,
Susan Stevens, Donna Wohlfarth
CREATIVE DIRECTOR
Jonathan Graves
DESIGN DIRECTOR
Christine Destrempes

the CoCo moving right along, generating more software, more accessories, and a growing number of things it can do.

For the entrepreneurally minded, the CoCo, mainly because of *HOT CoCo*, will present a great opportunity. With an estimated 417,000 CoCos already out there and again that many in prospect, this is a great market for a small firm to tackle. With that number of customers, even programs for the most esoteric applications will find happy homes and bring in money. I predict that we will see hundreds of new firms starting up and making fortunes providing support for the CoCo.

The Big Difference

The debates between CoCo and VIC-20 owners over the CompuServe network resemble more religious and political arguments than reasoned attempts at truth. There *are* some plusses for the CoCo in comparison to other lower-cost computer systems from the hardware viewpoint, but the main difference lies in the massive support of the CoCo in comparison to the other systems, and this comes down to the third-party publishing support given the CoCo first through *80 Micro* and now through *HOT CoCo*.

If you look over the situation, you see that none of the lower-cost computer systems are supported by a major independent magazine. Thus there is no real link between the users and a supporting industry, so the industry never really gets going. Most of these computers are being sold primarily through mass-merchandising outfits, which means that entrepreneurs have no way to get a program or accessory started up for these systems. It's just too big a job to try and get something distributed through 25,000 outlets. It takes a billion-dollar firm to do this successfully.

But your billion-dollar firms can only make and sell products that sell in the hundreds of thousands. Programs that will sell only a few thousand copies just can't be bothered with. And the same goes for peripherals. So if there is going to be any comprehensive support for a system, it really has to come from a myriad of small firms, and this means that there has to be a good, solid magazine to get them together with the customers.

The Radio Shack Color Computer is the *only* low-cost computer system supported by a strong independent magazine and a whole subset of the industry, so Radio Shack has an extremely powerful sales tool to use against Commodore and the others. . . if they'll do it.

If Radio Shack recognizes the power of this support and takes advantage of it, they could raise hell with Texas Instruments, Commodore, Atari and so on. There is no indication as yet that any of these other firms have tumbled to the importance of a strong support magazine. Indeed, being the only major publisher in the field starting up such magazines, I've sort of expected to get a call from at least one of the firms. Remember that they have millions, maybe billions of dollars riding on their sales, so one would think that they would want to do everything possible to nurture them. Not so.

Commodore has a couple of in-house magazines. I'll be kind and not comment on them. In-house publications are self-serving. They have to be because the editors want to keep employed and they find out all too soon that the parent company has an almost unbelievably thin skin. Indeed, the few modest nudges and jibes I've thrown at Radio Shack have created enormous reactions. It's easy to see why captive in-house publications have less than total credibility, and why they are not very helpful in developing a strong third-party support for the systems.

Would the editor of an in-house magazine be able to run an article on a third-party printer that is in direct competition to his host's printer? Not bloody likely. No, firms generally hate to see anything printed in their magazines that are even remotely in competition with their own products, and that includes software. The bottom line on that is the need for an independent publisher, preferably one with enough money so he doesn't have to kow tow to the manufacturer.

If T.I. or Commodore do decide to encourage a magazine to support their systems, they *could* give Radio Shack a lot harder battle. They do have some advantages over Radio Shack in having about five times as many stores selling their systems. But even so, with a lower-priced CoCo and the power of independent magazine support, I think Radio Shack can give 'em hell. ■

✓ See List of Advertisers on page 138

MANAGING EDITOR
Michael E. Nadeau
REVIEW EDITOR
Barbara Jatkola
NEW PRODUCTS EDITOR
Mark E. Reynolds
PRODUCTION EDITOR
Susan Gross
LAYOUT EDITORS
Joan Ahern, Bob Dukette,
Sue Hays, Laura Landy,
Judy Oliver,
Anne Vadeboncoeur
PROOFREADERS
Peter Bjornsen,
Harold Bjornsen,
Robin Florence,
Ellen Hardsog, Louis Marini
EDITORIAL
ADMINISTRATION
Celeste Wrenn

Subscriptions:
Problems with Subscriptions: Send a description of the problem and your current and/or most recent address to: *HOT CoCo*, Subscription Department, P.O. Box 975, Farmingdale, NY 11737.
Change of Address: Send old label or copy of old address and new address to: *HOT CoCo*, P.O. Box 975, Farmingdale, NY 11737. Please give eight weeks advance notice.
Dealers: Contact Ginnie Boudrieau, Bulk Sales Manager, *HOT CoCo*, Pine St., Peterborough, NH 03458. (800) 343-0728.

The left bracket, [, replaces the up arrow used by Radio Shack to indicate exponentiation on our printouts. When entering programs published in *HOT CoCo*, you should make this change.

HOT CoCo formats its program listings to run 64 characters wide. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: *HOT CoCo* Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include an SASE for a copy of our writer's guidelines. Payment for accepted articles is made at a rate of approximately $50 per printed page; all rights are purchased. Authors of reviews should contact the *HOT CoCo* Review Editor, 80 Pine Street, Peterborough, NH 03458.

DIGRESSIONS

We just returned from Rainbowfest, the first all-Color Computer show, sponsored by *the Rainbow* magazine and held in Chicago. The attendence and vendor turn-out was nothing short of amazing. We met CoCo users from Canada, Great Britain, New Zealand, and both U.S. coasts.

Everyone obviously had a great time. Many families attended, too, and they were all hardcore CoCo fans right down to "little sis'." It was surprising to see how many spent all three days at the show; a lot of people saw it as a good excuse for a vacation.

This kind of enthusiasm for the Color Computer illustrates the dedication its users have for this machine. More Ataris or VIC 20s are sold than CoCos, but we have not seen the kind of user loyalty and vendor support for these machines that we see for the Color Computer. Why?

The obvious reasons are the CoCo's 6809 CPU, a programmer's delight, and its expansion capabilities, which impress the hardware tinkerers. There is also a large amount of literature available in the form of magazines and newsletters. Many clubs, some with over 1,000 members, support the CoCo as well. And the cottage industry that has arisen for the Color Computer is huge and still growing.

What the Color Computer doesn't have in numbers over its competitors it makes up for in power and support. When you add all this up, it's easy to see why so many serious computerists choose the Color Computer.

What are your reasons for using a Color Computer over another brand? We are anxious to hear you, our readers, answer this question, as it will help us better cater to your needs. So, please write to us with your comments.

Coming Next Month

Next month is our graphics issue, and we've put together an impressive line-up of articles on this topic. Delmar Searls, our Graphically Speaking columnist, explains histograms and provides programs to generate them.

Frustrated artists will enjoy William Roney's piece on computer art. If you like your creations from Roney's article, perhaps you'd like a photo of it for posterity. Richard Ramella will present an easy-to-understand tutorial that will demonstrate how to photograph a video screen.

We'll also begin a three-part series on overlapping PMODEs by Ken Anderson (not the quarterback). This technique gives you an impressive arsenal of color hues to incorporate into your programs.

Drew Auth has a good Assembly utility that lets you print out color screen graphics in multiple black-and-white densities. This is the next best thing to multiple-color printers, which are too expensive for many CoCo users.

Our coup de maitre is David Meredith's article on displaying three-dimensional objects. This program lets you input your own coordinates to draw an infinite variety of shapes. But the good part of this piece is that you can shrink or enlarge it, rotate it in six directions, or move it on the screen in four directions. This program reminded us of the techniques used in computer-aided design and manufacturing (CAD-CAM) on machines much more sophisticated and expensive than the Color Computer.

August's nongraphic material is just as impressive. Marty Goodman follows up his monochrome monitor driver with a color monitor driver. J.J. Barbarello finishes his series on etching your own PC boards with a construction of an intrusion-detection/sound-actuated-typewriter device.

Mike Rigsby will show you how to turn your CoCo into a talking calculator that has sound quality much better than some commercial packages we've heard. Joysticks are not just for games; John Nicolettos will have a nice utility that lets you control the speed of listing your programs with this peripheral.

We hope you are as excited about August as we are.—*M.N.* ■

HOT CoCo BOOKS

COMPUTERS FOR EVERYONE 2nd EDITION—by Jerry Willis and Merl Miller This new, updated edition shows you how computers can be used in your home, office or school. It explains what computers can do and features a consumer's guide of the more popular computers to help you decide which one to buy and who to buy it from. There's even a chapter devoted to software that describes over 100 programs currently available. Also included are chapters on peripherals, telecommunications and computers in education. Abound with colorful photographs. BK1260 $5.95

THE BEGINNERS GUIDE TO BUYING A PERSONAL COMPUTER—by the Editors of *COMPUTE!* magazine. This easy-to-understand handbook is aimed at novices potentially interested in buying a first computer. It helps the consumer weigh the variables between different types of computer systems and includes comprehensive charts which clearly compare the standard and optional features of all the current mass market personal computers. Also contains a glossary of terms. BK1267 $3.95

MICROPROCESSOR INTERFACING TECHNIQUES—by Austin Lesea & Rodnay Zaks Will teach you how to interconnect a complete system and interface it to all the usual peripherals. It covers hardware and software skills and techniques, including the use and design of model buses such as the IEEE 488 or S-100. BK1037 $17.95

YOUR FIRST COMPUTER—By Rodnay Zaks Whether you are using a computer, thinking about using one or considering purchasing one, this book is indispensable. It explains what a computer system is, what it can do, how it works and how to select various components and peripheral units. It is written in everyday language and contains invaluable information for the novice and the experienced programmer. (The first edition of this book was published under the title "An Introduction to Personal and Business Computing".) BK1191 $8.95

New for the CoCo

TRS-80 COLOR COMPUTER GRAPHICS—by Don Inman with DYMAX This exciting book will enable you to explore all the graphics capabilities of Extended Color BASIC. You'll learn how to create interesting graphics to enhance your own computer programs. Also included are application programs and subroutines that will be invaluable when you begin writing your own graphics programs. Each chapter ends with a summary and practice exercise. BK1266 $14.95

ASSEMBLY LANGUAGE GRAPHICS FOR THE TRS-80 COLOR COMPUTER—by Don Inman and Kurt Inman with DYMAX. This dynamic new book uses sound and graphics to show you how 6809 assembly language can be used to perform tasks that would be difficult or impossible with BASIC. All of the techniques are explained in a hands-on approach. Learn how to tailor you own programming style, from editing, assembling, executing and even debugging, to making your own programs run quickly and efficiently. It is also packed with video screen diagrams which explain each step of the process of creating your own graphics. BK1277 $??.??

PROGRAMMING THE 6809—by Rodnay Zaks and William Labiak This book explains how to program the 6809 in assembly language, covering all aspects progressively and systematically: basic programming techniques and devices, application examples, data structures, and program development. No prior programming knowledge is required. BK1264 $14.95

TRS-80 Color BASIC—Bob Albrect Learn how to use the unique color, sound, and graphics of the TRS-80 Color Computer. This self-teaching guide uses a learn-as-you-play format to teach Color BASIC. Packed with games, experiments, programming problems, and solutions, it is an ideal introduction for children, teachers, and adults. It starts with simple concepts and takes you on to more complicated games, graphics, and activities, including many chances for you to try out your newly learned programming skills. Included is an entire chapter on programming problems, which offers tips on adapting to Microsoft BASIC on other personal computers. BK1280 $10.95

THE BASIC HANDBOOK—SECOND EDITION—By David Lien. This book is unique. It is a virtual ENCYCLOPEDIA of BASIC. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the HANDBOOK comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. BK1174 $19.95

DON'T (or How to Care for Your Computer)—by Rodnay Zaks. In plain language, with numerous illustrations, this book tells all the do's and don't's of the care, preservation and correct operation of the small computer system. Specific chapters cover each piece of hardware and software, as well as safety and security precautions and help for problem situations. Have your computer work right the first time and keep it working. No technical background required. For all computer users. BK1237 $11.95.

WAYNE GREEN BOOKS

COMPUTER CARNIVAL—by Richard Ramella. Your child can become a crackerjack computerist with the sixty TRS-80 Level II programs in COMPUTER CARNIVAL. This large-type, spiral bound book for beginners is a veritable funhouse of games, graphics, quizzes and puzzles. Written by *80 Micro* columnist Richard Ramella, the programs are challenging enough to ensure continued learning, yet short enough to provide your child with the immediate delight and reward of mastering basic computing skills. And for even greater enjoyment, get the CARNIVAL COMPANION, a 30-minute cassette containing all the programs in the book. Eliminates tiresome typing and lets your child spend more time enjoying the programs. BK7389 $16.97 CC7389 Book and Cassette $24.97

ANNOTATED BASIC A New Technique for Neophytes—Put your BASIC knowledge to work for you with this 2-volume set of TRS-80 Level II BASIC programs. Gain a better understanding of the elements and techniques involved in programming. *Annotated BASIC's* uniquely designed format breaks each program down for you to include: initial documentation and instruction, definitions of New BASIC Concepts, flowchart, annotations of sections, showing how each part fits into the whole, and explaining why certain BASIC commands are chosen over similar ones. Using the programs as they are or modifying them to sharpen your programming skills, *Annotated BASIC* is a helpful tool for any BASIC programmer.
BK7384 (Vol. 1, 152 pages) $10.95
BK7385 (Vol. 2, 136 pages) $10.95

THE SELECTRIC INTERFACE—by George Young. You need the quality print that a daisy wheel printer provides but the thought of buying one makes your wallet wilt. SELECTRIC™ INTERFACE, a step-by-step guide to interfacing an IBM Selectric I/O Writer to your microcomputer, will give you that quality at a fraction of the price. George Young, co-author of *Kilobaud Microcomputing* magazine's popular "Kilobaud Klassroom" series, offers a low-cost alternative to buying a daisy wheel printer. SELECTRIC INTERFACE includes: step-by-step instructions, tips on purchasing a used Selectric, information on various Selectric models, including the 2740, 2980, and Dura 1041, driver software for Z80, 8080, and 6502 chips, tips on interfacing techniques. With SELECTRIC INTERFACE and some background in electronics, you can have a high-quality, low-cost, letter-quality printer. Petals not included. BK7388 (125 pages) $12.97

NEW!

INSIDE YOUR COMPUTER—by I. R. Sinclair. Take the mystery out of microcomputer hardware with Inside Your Computer. This introduction to hardware describes what is inside the computer and what goes on inside its circuits. I.R. Sinclair's clear explanations apply to any microcomputer system. If you know BASIC, this book can give you the hardware and electronics fundamentals you lack. The author discusses aspects of the microprocessor chip, hardware circuits, the action of the interpreter, and the use of machine language. There is a section on binary numbers and binary arithmetic that includes a discussion of algorithms, floating-point numbers, and ASCII code. The author uses numerous photographs and schematics to illustrate the text. Readers will also get advice on software. Inside Your Computer contains a glossary of computer terms and an appendix explaining binary, decimal, and hexadecimal conversion. BK7390 $12.97

KILOBAUD KLASSROOM—By George Young and Peter Stark. Learning electronics theory without practice isn't easy. And it's no fun to build an electronics project that you can't use. *Kilobaud Klassroom* the popular series first published in *Kilobaud Microcomputing*, combines theory with practice. This is a *practical* course in digital electronics. It starts out with very simple electronics projects, and by the end of the course you'll construct your own working microcomputer! BK7386 $14.95

For Toll Free Ordering Call 1-800-258-5473

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to Hot CoCo Book Department Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. All orders add $1.50 for the first book, $1.00 each additional book for U.S. and foreign surface. $10.00 per book foreign airmail. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to Customer Service at the above address.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Feedback

New CoCo BBSes Announced

Edited by Mark E. Reynolds

Saturn Electronics of Bayside, NY, is launching a new electronic bulletin-board system for the New York/East Coast area.

This service is dedicated primarily to the Color Computer and is available on a 24-hour basis for users to leave, retrieve, and access information.

Saturn Electronics
57-61 Cloverdale Blvd.
Bayside, NY 11364
212-423-4623

I am pleased to announce the Mid-America Color Computer Bulletin Board System, known as MACC-NET.

Located in Kansas City, Missouri, the system is run on a 64K Color Computer, using three Shugart disk drives and an auto-answer modem. The system is available 24 hours a day, except during times of system maintenance and upgrades.

The purpose of this BBS is to provide a forum for Color Computer users to exchange ideas, hints and tricks, problem reports, and notes concerning available software and hardware. It is also a general sounding board for any aspect of the TRS-80 CoCo and the TDP-100.

A program up-load and down-load feature is available. The program down-load currently has a varied selection of programs, and plans are to include machine-language routines and text files of additional system documentation, such as ROM addresses, lower memory data areas, and so on.

Users of the system can leave messages for each other and notices of equipment for sale or wanted to buy. Useful information, and requests for information, are always welcome.

The up-load feature can be used to send any kind of ASCII data to the system. This can include Basic programs, Assembly source-code, text files of ROM addresses, and so on. All data sent to the system will be reviewed before being included on the down-load directory to eliminate duplications. Similar types of informational text may be combined into existing files where appropriate.

The MACC-NET is just beginning operation and we hope it will grow into a system of immediate use to beginners and experienced users. Any comments on system operation and features are welcome.

Steve Odneal
8609 East 73 Terrace
Kansas City, MO 64133
MACC-NET: 816-358-MACC (6222)
Voice: 816-356-2345 (evenings and weekends, usually until 10 p.m.)

There's a new kid in town. Strictly Communications Inc., based in Queens, NY, has just started a new bulletin-board system (BBS) for our town—and any town—U.S.A. We'd like to tell everyone about us.

It's for the fun and use of CoCo owners and it's free to all—no service charge. We want to share our fun with others, as a means of seeing what's out there for the CoCo.

Our BBS, CoCo's Nest, is operated by two 64K Color Computers, two double-sided MPI (B52) disk drives, an auto-answer modem, and a lot of patience.

Lee F. Blitch wrote the program we're using, and it's a super system. We also promote selling, buying, and new-item ads for callers. Anyone and everyone is invited to use our BBS by calling in on CoCo's Nest. Phone: 212-423-4623 data line, or 212-423-4626 voice line.

Arnold Schiffman, Pres.
Strictly Communications Inc.
P.O. Box 272
Glen Oaks, NY 11004

Ed. note: There is an error in June's "Serial-to-Parallel Interface" article by Don Le Roi. The first sentence of the second paragraph under the subhead The Serial Interface on page 32 should read, "... the computer monitors the serial *input line (pin 2)...." Also, after the paragraph that begins, "Mount the completed circuit board..." under the Construction and Calibration subhead on page 34, the reference to pin 1 should be to pin 2. We apologize for any problems this error may have caused.*

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

Setting The Standards

WHAT THEY ARE SAYING ABOUT COLORPEDE

". . . forefront of the pack . . ." **The Rainbow, Dec. '82** ". . . an outstanding offering." **N. Vernon, IN** ". . . the best graphics I have seen to date." **Erie, PA** "It is great!" **Dayton OH** ". . . the best graphics and playability of any color computer game . . ." **McKeesport, PA**

COLORPEDE

This truly outstanding engineer designed, 100% machine language game with multi-colored high resolution characters and fast action will challenge the most avid arcade buff. Can be played by 1 or 2 players controlled with joy sticks or key board. Joy stick control is fast, smooth and accurate. As COLORPEDE slithers through the toad stools, you attempt to destroy the COLORPEDE, knock out the menacing Bouncing Bug and eliminate toad stools while accumulating higher and higher scores. Demonstration mode with top 5 scores. Pause feature. For 16K Color Computer and TDP-100.

Cassette-$29.95 **Disk-$34.95**

INTRODUCING

ROBOTTACK

Ultra fast arcade action with colorful high resolution graphics. You are the super human who must fight off the attacking robots and save the remaining humans from destruction. You have super powers, can shoot in any direction and move anywhere on the screen to accomplish your vital mission.

Engineer designed, 100% machine language. Can be played by 1 or 2 players with joy stick control. Top 5 scores displayed. Pause feature. For 16K Color Computer and TDP-100 with joy sticks.

Cassette-$24.95

TO ORDER:
VISA, MASTERCARD, Money Order. Please allow 2 weeks for checks. Add $1.50 for shipping. $3.00 outside U.S. 4% tax in Mich.

intracolor COMMUNICATIONS

P.O. Box 1035, East Lansing, MI 48823
(517) 351-8537

DEALER INQUIRIES INVITED. **FOR THE COLOR COMPUTER & TDP-100**

REVIEWS

Review Contents

Edited by Barbara Jatkola

Telewriter-64
Cognitec
704 Nob St.
Del Mar, CA 92014
16K
$49.95, cassette
$59.95, disk

by James Perotti

The latest version of Telewriter-64 deserves rave reviews. Combined with the Color Computer (64K for less than $450), a disk drive ($450), a black-and-white television ($88), and an Okidata 82A printer ($400), Telewriter-64 provides a full-featured, word-processing system for less than $1,500.

Telewriter-64 comes with four menus—the main menu, the format menu for the printer, the disk input/output (I/O) menu, and a new ASCII disk I/O menu. The menus make Telewriter easy to learn and use.

Each menu uses English phrases to describe the functions. You call up the menu functions by entering the first letter of the command, which is inverted (i.e., white on black) on the screen.

Telewriter also suits my fast and sloppy typing styles. Additions, deletions, and alterations to the text are a piece of cake. The four arrow keys let you move in any direction, and they repeat when you press the shift key simultaneously. The combination of the clear key and the arrow keys moves the cursor to the top or bottom of the text or to the far left or right margin.

This is what word processing is really about. You should not have to stop and think about how to perform each function. Good packages give writers a fast and comfortable means of producing text. Telewriter-64 does this and more.

New Features

Because many of you may already be familiar with older versions of Telewriter, I will devote most of this article to its new features.

Telewriter comes with a highly readable 51-by-24 character set, which is especially clear on a black-and-white TV. Obviously, an 80-by-24 screen is the preferred setup because what you see on the screen is what you get on the printer. A smaller screen is also acceptable, though, because Telewriter will align the printed text according to the margins you have set.

Telewriter-64 now has three optional display screens of 51-by-24, 64-by-24 and 84-by-24. It also offers two distinct character sets. The normal character set is four pixels, or dots, wide, and the other is three pixels wide. Press clear semicolon to switch from one to the other. The smaller set was necessary because the dots appeared to be touching on the 84-by-24 display screen. The three-dot width makes that screen much clearer.

In the past, users had trouble aligning tables of numbers. The realignment of text for the printer used to ruin the alignment of carefully prepared rows and columns of numbers. That is no longer a problem. Now you can set the same number of characters per line for the screen and the printer.

Allowing 10-character left and right margins leaves 60 characters per line. Set the screen display to 64-by-24 (clear *), set the width of the line to 60 characters, and enter your table. What you see is what will print.

An imbedded code prevents a block of text from being aligned or justified. The code, which does not print, is the up caret and the semicolon. The code must appear before and after the table to protect it.

Using right- and left-justification often results in lines that have huge blank spaces between the words. The way around that problem is to hyphenate long words. With Telewriter-64, you can set the characters per line to 60 and use the 64-by-24 display to check for spacy lines. You can then hyphenate long words that jumped to the next line and check the fit by realigning the text with clear A.

Telewriter-64 also provides a way to prevent phrases from being broken up by justification and alignment. This adjustment to the program forces the entire phrase to appear on one line.

Tabs and Print Options

The old Telewriter limited tabs to every eight spaces. The new version, however, lets you set tab stops wherever you want. You set the tabs by starting each file with an up caret T, followed by double-number line locations—e.g., up caret T 05 10 20. You can use the tabs anywhere in the text by hitting clear enter.

Telewriter was designed to run with the Epson MX-80 printers. If you have an MX-80, the commands in the format menu work. If you have another, however, you must include imbedded commands to send instructions to the printer.

Different printers also handle carriage returns differently. Telewriter-64 now provides four settings to deal with different printers.

Screen Editor for Basic

The Telewriter-64 upgrade has a new menu to facilitate working with

ASCII files. Normally, Basic programs are not written in ASCII, but you can save these programs in ASCII by adding an A to the end of a SAVE command—e.g., SAVE "GAME",A or CSAVE "GAME",A.

To use the ASCII menu in Telewriter-64, you must go to the normal binary disk I/O menu and get into Basic (hit B). Then substitute the ASCII disk menu by entering RUN"S/ASC". The menu quickly appears with all the commands for disk I/O. The jump in and out of Basic does not affect the text in Telewriter. It is still there when you get back to the ASCII menu. Like the other menu, you save text with S and read it in with R.

The Telewriter upgrade manual section entitled "ASCII Utilities—Imperfections" is recommended reading for those of you without disks.

Reading in Basic files requires a little care. Telewriter will align—i.e., make hash out of—your Basic listing as it is being read in unless you tell it not to. Setting the characters per line to zero prevents it from moving lines around.

You can also use Telewriter to write or change Basic programs. For instance, if you want to change some (or all) of your PRINT statements to PRINT #-2, you can use Telewriter's global-find-and-replace command.

Go to the top of the file and hit clear G. The screen clears, and the cursor blinks in the upper left corner waiting for you to enter what you want to find. In this case, you enter PRINT. The cursor drops down a line awaiting a replacement word or phrase. You enter PRINT #-2. Telewriter jumps back to the text and finds the first PRINT. Hitting clear R replaces it with PRINT #-2. A clear N moves you to the next PRINT. You can either replace it or move to the next one. It is easy to fly through a long program this way.

The rapid cursor movements also enable you to alter the program with great ease. Inserting and deleting are much easier with Telewriter.

Telewriter as FLEX Editor

The ASCII menu opens up a number of other uses for Telewriter-64. I use Colorcom/E to access an IBM mainframe computer, but it does not have an editor that I can use to prepare files to send. With Telewriter's ASCII menu, I can prepare files or programs for the mainframe and send them with Colorcom/E.

What I like best about this ASCII feature is that I can use it to write things for FLEX, as the FLEX editor has rather primitive editing features. Although Telewriter does not create FLEX-compatible files it does create ASCII files, which I can make compatible with FLEX.

Data Comp's version of FLEX includes the RSREAD utility, which permits FLEX to read Radio Shack files and convert them to the FLEX files. For example, if you have a Basic program that you want to try on TSC's (Technical System Consultants, the creators of FLEX) XBasic to see which is faster, just follow these steps:

1. LOAD "PROGRAM"
2. SAVE "PROGRAM",A
3. RUN"U **RUN TELEWRITER-64
4. Enter D(isk I/O), then B(asic)
5. RUN "S/ASC" **ASCII DISK I/O
6. *** Alter Basic commands exclusive to Radio Shack, such as PRINT #-2, POKEs, and PEEKs
7. RUN "FLEX
8. RSREAD 1.PROGRAM.DAT,0.PROGRAM. TXT ***convert to FLEX file format, using two disks.
9. Edit the program, delete the first line, then save it.
10. XBASIC PROGRAM ***runs the program.

You will find that there is almost no discernible difference in speed. Data Comp and Frank Hogg also provide a utility to convert FLEX files to Radio Shack files. The resulting Radio Shack files are written in ASCII.

With Telewriter-64, it is possible to go through a file page by page to see where the new paragraphs, long quotations, and headers fall on the page. The first step is to go to the format menu and set the margins, characters per line, and lines per page.

Then go back into the Edit mode, jump to the top of the file with clear up arrow, and hit clear V. Telewriter displays the cursor at the bottom of the first page. Every time you hit clear V, you move ahead another page. Remember that any change on one page will change the page breaks on all the other pages, so go back and try the clear V routine until everything lines up.

Other Considerations

I bought an early version of Telewriter on tape for my 16K Color Computer, but I quickly became unhappy with the limited memory for text storage. My new 64K CoCo with disks let me upgrade to the disk Telewriter revision. The program does run on the 16K machine, but I would recommend using a 32K or 64K computer to realize the program's potential.

One function that I have found particularly useful is the global search, which now has a "wild-card" feature. When doing a search, you can substitute the up caret for any letter in a phrase. For example, "state-of-the-art" might sometimes appear in your text with hyphens and sometimes without. The wild-card feature allows you to enter the phrase with the carets in place of the hyphens, then use clear N to change the hyphens or eliminate the phrase throughout.

In addition, the author has improved the imbedded commands considerably. All imbedded commands begin with an up arrow, which is set with clear period. For instance, you can insert comment lines with up arrow T space. The program will not print anything following the space. Comments are useful for noting page breaks or explaining what other imbedded commands do.

Another addition permits you to print control codes or other weird symbols or graphics. You enable the ASCII codes by using the imbedded command DP followed by the ASCII code for your printer's extended character set. Real underlining is now possible using this approach.

Finally, there is a vast improvement in preparing headers. Telewriter now makes it possible to print the page number as part of the header, rather than at the bottom of the page.

Telewriter-64 is a major improvement over what was already an excellent word-processing package. I like its unobtrusive operation and its "what you see is what you get" features, which make including tabular or columnar text a snap. The "finishing touches" help you avoid uneven lines or unfortunate page breaks, and the right-justification adds class to the finished product.

Telewriter-64 offers a great combination of easy use and perfectly printed pages. ■

Phantom Slayer
Invader's Revenge
Med Systems Software
P.O. Box 3558
Chapel Hill, NC 27514
16K
$19.95 each, cassette

by Larry Parker

Phantom Slayer is a three-dimensional maze game that offers smooth graphics and makes you feel as though you are actually wandering through a maze.

Your weapons include a laser pistol, which you can fire only at two-second intervals, and a phantom detector, which is an audio tone. The space bar acts in two steps. Pressing it loads the pistol, while releasing it actually fires the pistol. Once you have loaded the pistol, however, you cannot move until you complete the sequence. Because you can move faster than the phantoms and it takes more than one hit to score a kill, it is best to fire and run.

You receive two points for a hit and 10 points for a kill. If you manage to stay alive long enough, you can end the game by pressing R.

While you wander through the maze, you might see a green square on the floor. This can be a valuable escape route. Standing on the square and pressing enter transports you back to the start of the maze.

To help plan your strategy, you have the opportunity to view the maze from above—once at the start of the game and again each time you destroy a phantom, provided you press the D key.

Also included in the game is a training mode that allows you to get used to moving in the maze. Even though there are no phantoms to slay, it is worth your time to practice moving with the arrow keys. I practiced for several hours to get the "feel" of the keyboard-display interaction.

The keyboard control is a major weakness. Another shortcoming is that the phantoms do not locate you in a dead-end hall, even though they normally seek you out. Also, you cannot fire your laser pistol if you are making a turn. More often than not, the phantom is waiting around the corner to kill you.

Invader's Revenge

In the second game, Invader's Revenge, you are the last surviving Earth invader. The object is to avoid being blown up by the laser base or by inadvertently running into "human" ships.

You can fire your laser pistol (using the space bar) to blast the laser base or the human ships that are out to destroy you. The program produces different sound effects when you hit a human ship (blue) and the laser base (white). You receive 100 points for hitting a human ship and 1,000 points for hitting the flagship (red). You do not receive any points for hitting the laser base. If you are skillful enough to reach 10,000 points, you are rewarded with another ship.

The graphic motion is smooth, and the action on the screen responds quickly to your commands. The absence of joysticks, however, detracts

from the game because it takes time to get used to using the arrow keys to control direction and the space bar to fire the laser.

On the other hand, it does not take long to learn where to position your ship to avoid the onslaught of human ships. You can rest your fingers on the arrow keys and your thumb on the space bar to increase mobility and fire on the humans. If you need to catch your breath, just press P for a pause in the game. Pressing any other key starts the action again.

Invader's Revenge and Phantom Slayer are good examples of the graphics animation available on the CoCo. If you enjoy a challenge, I recommend that you add these games to your collection. ■

SP-1 Serial Interface Card
for the Epson MX-80
CNR Engineering
Distributed by Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
$49.95

by Dale L. Puckett

A computer without a printer is like an airplane without wings. The CoCo is no exception.

Perhaps you bought your Color Computer because it offered tremendous power at a price that didn't threaten bankruptcy. Despite this wisdom, you have another purchasing decision just ahead—you need a printer soon.

When you are shopping for a printer, the Epson MX-80 will no doubt be a strong contender, since it offers speed, exceptional graphics, and a starting price just over $400. There's one catch, though. The starting price buys you an MX-80 with a Centronics parallel interface. Unfortunately, the CoCo has an RS-232 serial interface, and the Epson serial interface adapter costs nearly $100 by mail order—$130 if you want one with a 2K buffer.

The SP-1 Plug-in Serial Interface for the Epson MX-80 is an inexpensive alternative.

Features

The SP-1 plugs directly into the Epson MX-80 and lets you access all typefaces and graphics modes in this printer.

To understand why you need a serial interface adapter, you must understand how computers talk to the outside world.

Some computers transmit and receive parallel data. This means they send data over a cable containing nearly a dozen wires. Eight wires carry the individual data bits in a character, and several more carry handshaking signals that let the printer tell the computer when it is ready for another character. Signal and chassis ground wires are also needed. The advantage of this method is speed. The computer sends a complete character each time it transmits to the printer.

Other computers, including the CoCo, transmit serial data. Instead of sending a complete character each

time, they divide the character into its individual parts and send them one at a time over a single wire.

CoCo's serial interface uses only three wires to carry the signal to the printer. One wire carries the data, while another carries the printer busy signal that lets CoCo know when it is ready to accept another character. The third wire is a ground return.

The SP-1 serial interface receives data from the CoCo 1 bit at a time and changes it back to the 8-bit character that the MX-80 expects. It uses a UART (universal asynchronous receiver/transmitter) to do the job.

Getting Started

This interface is easy to install. The first step is to run a test with the CoCo to see which Basic ROM is installed. To do this, type EXEC 41175 and enter. You should see:

```
COLOR BASIC 1.1
(C) TANDY
```

If you see the above message, then your interface board is ready to run. If, however, the test reports that you have Color Basic 1.0, you must set switch 2 on your new serial interface to the on position. This makes it compatible with the 7-bit code that Basic ROM 1.0 transmits.

The next step is to run a self-test with the Epson printer. To do this, you hold down the LF button on the MX-80 while you turn it on. Save the printout you receive for future reference. After you have installed the board, you should run this test again to make sure everything works properly.

After running the self-test, turn the printer off, unplug the line cord, and remove the cover. You should then set the switches according to the table shipped with the SP-1.

Actual installation is next. You simply locate the four mounting posts between the Epson's two circuit boards, noting the position of the 26-pin connector. Line up the connector on the SP-1 with its mate on the MX-80 and push gently. Then, secure the SP-1 to the Epson with the four screws provided. It's as easy as that.

Testing

You can test the SP-1 with the following two-line program:

```
10 PRINT #-2,"HELLO ";
20 GOTO 10
```

Just plug the SP-1's cable into the CoCo's serial port, enter the program and type run. The CoCo should print line after line of HELLO until you press the break key. Notice that the printer pauses about a second between each line. This is the time it takes to send the line from the CoCo to the printer.

Performance

This serial interface lets the CoCo send data at five different rates—300, 600, 1,200, 2,400, and 4,800 baud. To change the baud rate, you turn on one of five switches on the serial interface and POKE the proper data into location 150 in the CoCo's memory.

I find it best to leave the interface set at 600 baud because the CoCo expects the printer to be running at this

✓ See List of Advertisers on page 138

speed when you turn it on. If you want to use any other rate, you must first POKE the appropriate value into the CoCo each time you turn it on.

I tested the SP-I at the five baud rates. It ran flawlessly on the first four, but would not work at 4,800 baud. Fortunately, though, I had been forewarned. The SP-1 manual states, "Note that POKE 150,6 for 4,800 baud will work only on some lucky Color Computers." Table 1 gives you information on the baud rates.

Two additional switches let you turn word parity on or off, and a third lets you pick a 7- or 8-bit word. If you turn parity on, you can select either even or odd parity.

Documentation

The six pages of information you receive with your serial interface include everything you need. It is professionally written and is free of spelling errors and grammatical problems. It is also easy to understand.

An index is not provided, nor is it needed with such a short document. It is logically organized and takes you through the installation process one step at a time. I couldn't find any misleading statements that would get a novice in trouble.

Spectrum Projects gives you a 90-day warranty on the SP-1. If there is any evidence of abuse or modification, however, Spectrum voids your warranty.

Summary

The SP-1 serial interface for Epson's MX-80 will make an excellent addition to your Color Computer system. It is easy to install, works perfectly, and shouldn't require any maintenance. Best of all, the price is right. ■

Desired Baud Rate	SP-1 Switch On	CoCo Statement
4,800	#4	POKE 150,6
2,400	#5	POKE 150,18
1,200	#6	POKE 150,41
600	#7	POKE 150,87
300	#8	POKE 150,180

Table 1. Information on Baud Rates

64K Disk Utility Package
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
64K
$23.95, disk
(40K only, $11.96, cassette)

by David L. Wasler

The 64K Disk Utility Package contains three utility programs for the Color Computer—40K, the Software Print Spooler, and the ROMpak-to-Disk Converter.

The first of these, 40K, is one of the

more valuable programs available for the Color Computer. It is a must for all serious 64K Color Computer users. it frees 8K of memory by moving Extended Basic, which normally resides from hex 8000 to hex 9FFF, out of ROM and into RAM, starting at hex D800.

You must load 40K into the system before you load any other program.

I decided to try this new memory on Super Color Writer and a couple of games, and it worked fine.

Software Print Spooler

The Software Print Spooler is a utility program that provides a 32K buffer that outputs data to the printer. It is an ideal program for someone who uses the printer a great deal and wants to speed up the system.

The Print Spooler accomplishes this task by using the Color Computer page-mode method. The Color Computer has two 32K pages of memory for a total of 64K. The Print Spooler uses the unused 32K, or page two, to store the data that will go to the printer. It lets the system fill the buffer with this data and then alternates between outputting the data to the printer and running the program.

ROMpak-to-Disk Converter

This is a simple program for copying a ROMpak to disk via a cassette. Before you insert the ROMpak into the cartridge slot, cover pin 7 of the ROMpak with a piece of tape to prevent autostart.

Then, insert the ROMpak and use the CSAVEM command to copy the ROM to tape. (Warning: Do not remove the ROMpak with the power on.) This saves the ROMpak to tape.

Next, load ROM from disk and type RUN. Pressing enter saves the program to disk. All three programs would fit nicely into your utility library for the Color Computer. 40K is especially useful because it allows you to develop larger, more sophisticated programs for the CoCo. ■

The Stinger
Eigen Systems
P.O. Box 180006
Austin, TX 78718
16K
$24.95, cassette
$29.95, disk
$34.95, ROMpak

by R.W. Odlin

The Stinger, a machine-language game from Eigen Systems, is an original concept in arcade games. It offers a remarkable challenge as well as a number of surprises.

The object of the game is to accumulate points by capturing honeybees (little X shapes) in a hive of concentric circles, each with its entrance independently rotating counterclockwise around the central cell where the queen lies. Guard bees (distinctively colored little diamond shapes) sting you if they catch you. Early in the game the guard bees die when they sting you, but you always lose one of your six bee catchers (little white H shapes) when they do, and you must start again outside the hive.

You advance to the next level by clearing all the honeybees from the hive. Clearing each bee or guard speeds up the action, so toward the end everything revolves at a dizzying pace. You receive bonus points based on how long you took to clear the hive.

At the higher levels the guards can dodge through the hive walls without waiting for an opening. At level 3, the queen introduces a nasty surprise by hatching out a guard that rotates in the opposite direction, clockwise. Since I have not advanced past level 4, I cannot predict what further surprises may be in store.

Getting used to handling the joystick is difficult. Moving it to the left moves your bee toward the center of the hive, whereas moving it to the right moves your bee toward the outside.

Program Design

When you load the cassette to make a back-up, you learn that an auto-run module prevents you from finding the addresses you need to do so. I think a program with this kind of copy protection should provide more than two copies on one side of a 10-minute tape.

The graphics are also disappointing. The Extended Color Basic CIRCLE algorithm draws the circles that make up the hive. Several better methods are available. At times it is difficult to see the openings in the hive walls because the lines are so thin.

Because of a quirk in PMODE 4, the hive is sometimes red and sometimes blue. This matters only because the guards are harder to see when the hive is red and they are blue. If this bothers you, hit reset until the colors reverse.

The Stinger has the makings of a fine game, but its graphics limitations detract from the basic design. ■

Planet Raiders
Aardvark Technical Services
2352 S. Commerce
Walled Lake, MI 48088
16K Color Basic or 32K disk
$19.95, cassette or disk

by Mark J. Welch

Planet Raiders is a Defender-type game in which the goal is to rescue stranded "Nazbiets" (people) from the surface of a planet infested with enemies.

You pilot a rescue ship along the surface of a mountainous planet, picking up the Nazbiets and shooting enemy fuel depots, dwellings, and radar towers, while avoiding cannon fire and occasional attack ships that chase you.

The game offers only one planetary surface, which wraps around, so if you fly long enough in one direction, you end up where you started. The mountains are always arranged the same way, but the Nazbiets and enemies are arranged differently in each attack wave. In later waves, the cannons and attack ships are more common, more deadly, and harder to shoot.

Each wave of the game involves rescuing 20 Nazbiets from the planet's surface. If you shoot a Nazbiet, you

get no points, and you cannot collect as big a bonus at the end of the wave for the Nazbiets you rescued. The size of the bonus increases with each wave.

For long games, there is a "pause" feature that allows you to get a drink or answer the phone without losing ships.

Planet Raiders has three difficulty levels. At the first level, your ship and shots can pass through mountains to hit the enemy, while at the second your ship can pass through mountains, but your shots cannot. At the third and most difficult level—accurately called impossible by the designer—your ships and shots cannot pass through the ground, but the cannon fire and enemy attack ships can.

After six or seven hours of play, the first level becomes routine, and you lose ships only through carelessness. This is because you can avoid cannon fire by flying below the surface, as the cannons shoot only at their own level or above.

As the game progresses, the cannons fill the sky with shots, and the attack ships move more rapidly. The attack ships follow you anywhere and pass through other enemies, but you cannot.

Some Bugs

The game has a few bugs, some of which may be part of the design to add to the game's difficulty. One irksome problem is that enemies or Nazbiets occasionally "drift" on the planet's surface or even underground, which is an obvious programmer error.

In later waves, the joystick seems to be more sensitive when you try to speed up or reverse the action. This might be my imagination due to the faster pace of the game, but other players have noticed it, too.

An interesting twist to the game is that although the planet is at least a dozen screens wide, the cannons can shoot off one end of the screen and have the shots immediately appear on the other side. Thus, it is possible for them to shoot you from behind when the nearest enemy is a full screen width ahead.

Planet Raiders manages to work around the natural limitations of the Radio Shack joysticks and combines the full graphics capability of the Color Computer with the speed of machine language. Although not as packed with features as the Defender arcade game, Planet Raiders is entertaining and highly addictive. ■

Planet Invasion
Spectral Associates
141 Harvard Ave.
Tacoma, WA 98466
206-565-8483
16K Color Basic, Disk-Compatible
$21.95, cassette

by John Steiner

Color Computer users have waited a long time for quality software, but Planet Invasion is one example of Spectral Associates' ability to satisfy this need.

The game, written by Steve Geiseking, is modeled after the Defender arcade game. It looks a lot like Defender, from the shape of your spacecraft and the enemy ships to the dotted landscape and long-range view window. If you have played Defender, you will have no trouble understanding this game.

The basic objective is to defend the planet from swarms of Praetorian invaders as they arrive to steal your precious caloxin crystals. The most common enemy craft you must face are "grabbers." These vehicles descend to the planet surface and lift the crystals, carrying them toward the top of the screen. They defend themselves by firing small projectiles. If the invader reaches the top of the screen, you find yourself faced with a "killer."

To keep this from happening, you must shoot the grabber, destroying him and causing the crystal to fall back to the planet surface. A short fall will not destroy the crystal. If the fall is long, however, you might try to save the crystal by catching it before it hits the ground and carrying it safely to the surface. If you lose all your crystals to the invaders, you will be forced to fight in deep space, far from the planet's surface.

Additional enemies include chasers, miners, and beamers. A collision with any invader is fatal to your ship. Chasers give you the most trouble. They move quickly and search you out. Miners leave small mines that can destroy you if you cross their path. Beamers split into three berserkers when you hit them. Beamers and berserkers can fire upon an unsuspecting defender.

You have only three basic weapons to defend yourself. The weapon you use most is the ship's laser gun, which you fire by pressing the right joystick fire button. Holding the button down causes automatic firing, but prevents you from using your arsenal of smart bombs simultaneously.

You have three smart bombs, which you fire by pressing the space bar. A bomb destroys all the invaders on the screen. I usually save these to defend myself from the chasers, which move so fast that I can never seem to shoot them.

Your last weapon is maneuverability. Pressing H sends your ship into hyperspace, which can save you from final destruction.

You start with three ships, but receive a new ship and smart bomb after each 10,000 points.

The game moves quickly and has adequate sound effects. The joystick provides vertical and horizontal thrust. It is easy to control horizontal action, but more difficult to modulate vertical action properly. Small vertical changes do not seem to register, which tends to make you overcompensate and end up far from the desired vertical position.

As with many arcade games, the action slows down slightly when the screen fills with Praetorians, but the speed increases rapidly when you eliminate a couple of enemies. You cannot change the difficulty level, but there are increasingly difficult screens, or "waves" of invaders. With each four waves, you receive a new set of crystals to defend. The screen number appears to the right of the long-range scanner.

The game remembers the high score for a series of games, but does not offer a true two-player option. The instruction sheet suggests two players oppose the invaders by having one control the joystick, while the other operates the keyboard.

I wish the program included a pause key. It is frustrating to see a high score terminated by a phone call or other interruption.

The single sheet of documentation is sufficient for you to understand the game and its variations. Spectral Associates also provides instructions to transfer the program to disk. The company will replace any tape that has been accidentally damaged for $1.50.

If you are a fan of the Defender-style game, Planet Invasion would be a welcome addition to your collection. ■

Stars
Ilume Design
4653 Jeanne Mance St.
Montreal, Quebec
Canada H2V 4J5
16K
$15, cassette
$20, disk

by James W. Wood

Although Stars has the potential to be an extremely entertaining and educational program, it falls short of the mark for several reasons.

The frustration begins almost immediately. The instructions tell you to CLOAD the program, then type RUN and press enter. I followed these directions, assuming that the computer would read the data from within the program. After waiting for 10 minutes with no results, I listed the program and found an INPUT#-1 statement, which showed that the computer was supposed to read data stored on the tape. Nowhere did the instructions explain that you must load the data from the tape, while depressing the play key on the recorder.

On my second try, the program loaded in one minute. Dumping the data from the cassette into the computer took another two and one-half minutes. Looking at an almost-empty screen for that long can be boring, and I wonder why the program does not display something else, such as a set of instructions, which would keep the player occupied during the delay.

When the data was finally loaded in my 32K computer, I received an IE error in 19. By typing GOTO20, I solved

the problem. I did not have any trouble with my 16K machine.

After putting me through all that, the program asked if I would like stars or planets. I chose planets, and the computer displayed four diagrams of planets as they appear about one hour after sunset during winter, spring, summer, and fall. Pushing X displays a number identifying each planet, while Z removes the number. The program also displays nearby visible stars. As I recall, it is also important to observe the planets during the hour before sunrise, so I was surprised that the program did not offer this option, too.

Because the planets' positions vary from year to year, the company offers an updated list of planet positions at the end of each year. The list is free with a self-addressed stamped envelope, but it is not clear whether the list is a computer program that generates a new data tape or just a written list.

The other option, stars, gives you a choice of the four seasons and a choice of early or late in the evening. The program displays a list of visible galaxies and constellations for that season and time of night. You then choose the one you want, and the program displays the night sky with your choice blinking on and off.

The sky is shown as a round region, but there are difficulties in drawing it on a flat surface. Unless you have a spherical video monitor or can program in 3-D, these problems will always exist. For example, the ecliptic is the path of the planets around the sun. Looking at it in the sky, you imagine a flat plane, but it is represented in the program sky by "+" signs in a curved line.

Another problem is the representation of several constellations at once. The Pleiades, or Seven Sisters, are represented as one dot. The constellation Andromeda, which is shown as four stars, does not match the picture in my astronomy book. Orion's belt does not point to the Pleiades, and the only individual star listed is the North Star. In addition, the low resolution limits display of individual stars that are close together.

I guess my main question is why you need a computer program for this purpose. You could buy a star chart and planet locator to use outside or study a chart inside without waiting for the

program to load into the computer. The computer should create displays and perform functions that people cannot see on paper. Perhaps the program could show a planet's movement through the stars for one year or could take a closer look at the gas nebulas, galaxies, double stars, and planets. After viewing a constellation, the program might display a full-screen enlargement, with information about its outstanding features. An instructional package might include a computerized quiz on the heavens.

The cassette version of Stars does come with two pages of instructions and a four-page glossary of constellations, planets, and galaxies. A listing of monthly data on meteor showers for January through December does not, however, state which year it covers.

As I said in the beginning, Stars has a lot of potential, but for the price of the program as it now stands, you could buy a book on astronomy with many color illustrations and much more information. ■

TRS-80 Programmer's Sourcebook
J. Bradley Flippin, Editor
Ocean
P.O. Box 2331
Springfield, VA 22152
Softcover, 40 pp.
$4.95

by Edward F. Sayle

Impulse buying to acquire computer knowledge can prove a reckless alternative to acquiring the same information free or at low cost. A good example of this is the *TRS-80 Programmer's Sourcebook*.

At $4.95 for 40 pages, it compares poorly with the 200-plus pages of Radio Shack's *TRS-80 Applications Sourcebook* priced at $2.95, which it mimics.

A colorful cover and ample cartoons mask the shortage of program listings, which the publisher promises to expand in future editions of the twice-yearly booklet. There are no offerings at all for the Pocket Computer and the Model 16, and only 14 for the Model II. Users of the Model III fare a bit better with 55 listings. The book offers 35 programs for the Color Computer, but they are limited to only five vendors.

The editor admits to some start-off weakness: "This project has been a Catch-22. To do the job efficiently requires a computer to process and print the listings, but that costs too much for a first-time effort. So, we crunch along on a rented typewriter until we can justify doing it right." Anyone who pays the asking price will wish the editor had waited.

There is one significant improvement over the Radio Shack sourcebook. The editor has included the competitive system software that Radio Shack consciously omits from its volume. Thus, you can turn to Ocean's sourcebook for sometimes-valuable debuggers, utilities, and reformatting tools.

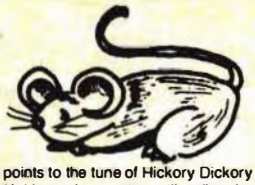
The booklet also includes two pages of computer club listings. The publisher promises more listings and user comments, along with an information exchange in future issues. The critical indices offered in the Radio Shack book (by software name and by vendor) are missing in Ocean's premiere edition, although the publisher also promises them sometime in the future.

In a comparison of the two sourcebooks, Radio Shack's wins hands down. Yet, in a sense, you might consider purchasers of either one to be losers because they are actually paying for a listing of classified ads. Whether a program appears or not depends on the vendor's willingness to fork over $10 for each listing. In addition, neither includes any evaluation of quality or debugging. In fact, Ocean seems to have exceeded fair use in emulating Radio Shack's advertisement-solicitation and listing form, which explains why some listings are identical.

The sourcebooks are also a costly and inexact way of learning what software is available. Often a vendor's dis-

Extra Color Enjoyment NOW

THE PROGRAM STORE™



CLOCK

From B5 Software

A small mouse keeps points to the tune of Hickory Dickory Dock! Helps children K-4th grade practice telling time by using a large graphic clock with synchronized moving hands. Four skill levels: hour, quarter hour, five minute and one minute intervals. Options include reading hours and minutes separately. It's time to learn!

26727 16K Extended Basic Tape $24.95

MONEY

From B5 Software

Pay your fare and ride to the moon! Five skill levels from counting dimes, nickels and pennies to combinations of more than a dollar using graphic coins. If correct answer is given for a series of three, the rocket ship ascends to the moon. Don't miss one oryou'll crash!

36548 16K Extended Basic Tape $19.95

SPELLING

From B5 Software

Flexible program allows you to input and store words or use graded data tapes. Words flash on screen from .1 to 10 seconds, then player types the word. Complete a lesson, then watch the attractive graphic display of superlative words and sing along!

36605 16K Extended Basic Tape $16.95

Data Tapes—CANNOT BE USED ALONE $6.95 EACH
35334 Dolch Words
29876 Grade 2
39260 Grade 3
39226 Grade 4
37617 Grade 5
35356 Grade 6
35312 Adult

TOWER OF FEAR

from Programmer's Guild

Awesome text adventure for novice or experienced. The Wizard's Tower, last of the surviving fortresses, is a catacomb to the omnipresent undead spirit of Blackheart Flamethrower. Enter if you dare, but don't expect to emerge alive!

35031 16K Extended Basic Tape $19.95

ZAXXON

from DataSoft

The official Zaxxon, now for home use, combines 3 dimensional effects, unique color graphics and realistic sound effects. Arcade action while you maneuver your ship through a battlefield of enemy missiles, tanks and planes to meet your match in the deadly Zaxxon Robotarmed with a lethal homing device.

35963 32K Tape or Disk $39.95

VOYAGER I

from Avalon Hill

You're on board a spaceship infested with killer robots in this graphic science fiction game. You must clear the 4-level 144-location ship of robots and arm it to self-destruct. Can you do it and escape before you, too, are blown up? High-speed graphics are represented in 3-D perspective representing your eye's view; with instant switching to floor plan maps. Extended BASIC required.

29012 16K Tape $19.95

GHOST GOBBLER

from Spectral Associates

In this new and exciting version of the popular arcade game, use your joysticks to move your Ghost Gobbler through the maze, eating dots and power pills to score points. 8 bonus shapes, super sound, and 16 skill levels. Extended BASIC required; joysticks.

22611 16K Tape $21.95

SCEPTER OF KZIRGLA

from Rainbow Connection Software

Real-time graphics adventure game with arcadesound for the color compuler. 13 floors of dungeon with monsters, treasure chests, hidden trap doors... even a flying magic carpet! All in your quest to find the Scepter of Kzirgla. Whatever you do, don't get caught in the poisonous gas cloud! Extended BASIC required.

26514 16K Tape $19.95
26525 16K Disk $21.95
Also, Conquest of Kzirgla
27199 16K Tape $21.95
36537 32K Disk $26.95

Programmer's Corner

COLOR COMPUTER DISASSEMBLER

by Jake Commander from Interpro

Learn machine and assembly language while disassembling any portion of your Color Computer's memory. Features easy-to-read 6809 mnemonics and a BASIC program for you to learn how memory is organized and disassembled.

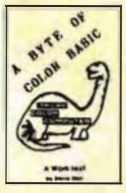
26390 16K Extended Basic Tape $19.95

SUPER "COLOR" DISK-ZAP

by Tim Nelson from Nelson Software

Now, the dream of repair of I/O errors is a reality! Lets you retrieve bashed files including BASIC and Machine Code programs. Special dual cursor screen display shows Hexidecimal and ASC II. Full prompting to help you every step of the way plus manual that teaches disk structure and repair.

23421 Disk $69.95

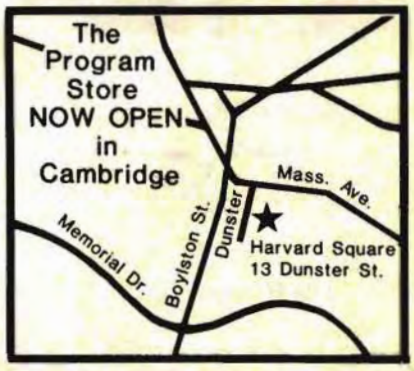


A BYTE OF BASIC

by Steve Blyn from Computer Island

A work-text that teaches, gives examples and practice exercises about COLOR BASIC. Learn to read, write and understand simple programs, as well as low resolution pictures, songs and music.

41117 Softcover Book $4.95



Over 2500 Programs for TRS-80, ATARI 400/800, APPLE, IBM & VIC 20.

For Information Call 202-363-9797

Visit our other stores:
829 Bethel Rd., Columbus, OH
Seven Corners Center, Fall Church, VA
W. Bell Plaza, 6600 Security Blvd., Baltimore, MD
White Flint Mall, Rockville Pike, Rockville, MD
Harvard Square, 13 Dunster St., Cambridge, MA
Westmoreland Mall, Rte. 30 East, Greensburg, PA

THE PROGRAM STORE™ T.M.

Franchise Openings Available in selected cities.

Coming soon to Philadelphia

To Order Call Toll-Free 800-424-2738

MAIL ORDERS: Send check or M.O. for total purchase price, plus $2.00 postage & handling. D.C., MD & VA: add sales tax. Charge cards. Include all embossed information.

THE PROGRAM STORE · Dept. 03-07-3 · Box 9582 · 4200 Wisconsin Avenue, N.W. · Washington, D.C. 20016

Item #	Title	Tape/Disk/Rom/Book	Price

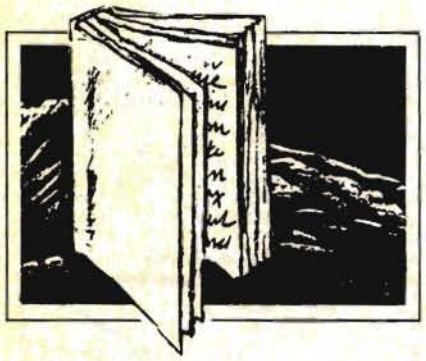
Postage $2.00
Total
☐ CHECK ☐ VISA
☐ MASTERCARD
Computer _For TRS-80 Color Computer unless otherwise specified.

Name
Address
City State Zip
Card # Exp.

play advertisement in another publication gives a more complete description of the product and identifies all available formats. A computer magazine costs less than the Ocean sourcebook and offers a much wider range of software in its advertisements. More important, such magazines offer critical reviews of programs, which the sourcebooks do not.

In addition, note the many free software catalogs offered in monthly magazines. For less than a dollar in postage, you can tap an almost unlimited reservoir of software catalogs. Reader inquiry cards cut the cost of building a catalog library even more.

If you can afford the luxury of a sourcebook, buy it. But, if you want to know what software is available, purchase a computer magazine that focuses on your computer model, read the ads, and send for the free catalogs. ■



The Computer Glossary
by Alan Freedman
Prentice-Hall
Softcover, 298 pp.
$14.95

by Stephen G. Stone III

Everyone needs a dictionary on occasion, especially when learning a foreign language. This is true whether the foreign language is German or "computerese." With this in mind, *The Computer Glossary* might be just the dictionary you need.

Actually, *The Computer Glossary* is designed to be used first as a textbook on data processing and later as a handy glossary. The first part of the book is composed of three sections addressed, respectively, to the business manager, the student, and the personal computer buyer.

Each section consists of a one-page statement describing the data-processing environment as it pertains to each group. A simple flowchart lists the words that you should look up in sequence to provide a basic understanding of general data-processing concepts.

The remainder of the book constitutes the glossary. Each word appears in bold-faced type, with the definition following. Any word in the definition that is defined elsewhere in the glossary appears in all caps. This cross-reference is quite extensive. Most definitions contain five or six cross-references.

The scope of the glossary is fairly comprehensive. Table 1 contains a list of terms I composed to test the coverage. I tried to include simple and more advanced words. Of the 63 terms in the list, six were not included in the book. The six words that I couldn't find in *The Computer Glossary* are zone punch, traffic, shannon, null, chaining, and delimiter.

Shannon, a somewhat esoteric term having to do with the measurement of data quality, is the only word for which exclusion is understandable. The remaining five are common data-processing terms that should have been included. To be fair, though, no glossary on any subject covers all the possible terms.

For the sake of comparison, I looked up the words on my list in the *Encyclopedia of Computer Science*, which is 1,532 pages long. I couldn't find 19 words. The encyclopedia is about seven years old, however, which might account for the absence of microcomputer terms. Even allowing for this, the list of omitted words numbers 11.

Although the coverage is broad, in most cases the definitions do not go into any great depth, although a couple run as long as four pages. The brevity is not a problem, however, because the book does bill itself as just a glossary.

The fact that *The Computer Glossary* can serve as a textbook and a glossary makes it quite versatile. I would recommend it to novice and experienced computer users because it will not, like most introductory volumes, just sit on the shelf after you have gone through it once. You will refer to *The Computer Glossary* again and again. ■

ASCII
Basic
baud
BCD
binary search
bit
Boolean
bubble memory
buffer
bug
byte
cache memory
carrier
chaining
checkpoint
Cobol
compiler
CRT
cursor
delimiter
DOS
EOF
EPROM
firmware
flag
floppy
half duplex
hardware
hex
hollerith
I/O
index
interface
JCL
K
LAN
macro
mask
modem
module
nanosecond
null
off line
parity
program
queue
RAM
real time
register
relocate
ROM
shannon
software
source program
syntax
terminal
TPI
traffic
trap
virtual storage
Winchester
word
zone punch

Table 1. Test List of Words

READ THE FINE PRINT.
It's worth your time. This is good stuff.

SYSTEMS SOFTWARE

MACRO-80C

This is a **disk-based editor, macro assembler and monitor,** written for Color Computer by Andy Phelps. THIS IS IT — The ultimate programming tool!

The powerful 2-pass macro assembler features conditional assembly, local labels, include files and cross referenced symbol tables. MACRO-80C supports the complete Motorola 6809 instruction set in standard source format. There are no changes, constraints or shortcuts in the source language definition. Incorporating all of the features of our Rompack-based assembler (SDS80C), MACRO-80C contains many more useful instructions and pseudo-ops which aid the programmer and add power and flexibility.

The screen-oriented text editor is designed for efficient and easy editing of assembly language programs. The "Help Key" feature makes it simple and fun to learn to use the editor. As the editor requires no line numbers, you can use the arrow keys to position the cursor anywhere in the file. MACRO-80C allows global changes and moving/copying blocks of text. You can edit lines of assembly source which are longer than 32 characters.

DCBUG is a machine language monitor which allows examining and altering of memory, setting break points, etc.

The editor, assembler and monitor — as well as sample programs — come on one Radio Shack compatible disk. Extensive documentation included. **MACRO-80C Price: $99.95**

SOFTWARE DEVELOPMENT SYSTEM

The Micro Works Software Development System (SDS80C) is a complete 6809 editor, assembler and monitor package contained in one Color Computer program pack! Vastly superior to RAM-based assemblers/editors, the SDS80C is non-volatile, meaning that if your application program bombs, it can't destroy your editor/assembler. Plus it leaves almost all of 16K or 32K RAM free for **your** program. Since all three programs, editor, assembler and monitor are co-resident, we eliminate tedious program loading when going back and forth from editing to assembly and debugging!

The powerful screen-oriented Editor features finds, changes, moves, copys and much more. All keys have convenient auto repeat (typamatic), and since no line numbers are required, the full width of the screen may be used to generate well commented code.

The Assembler features **all** of the following: complete 6809 instruction set; conditional assembly; local labels; assembly to cassette tape or to memory; listing to screen or printer; and mnemonic error codes instead of numbers.

The versatile monitor is tailored for debugging programs generated by the Assembler and Editor. It features examine/change of memory or registers, cassette load and save, breakpoints and more. **SDS80C Price: $89.95**

MICRO WORKS COLOR FORTH

- Forth is faster to program in than Basic
- Forth is easier to learn than Assembly Language
- Forth executes in less time than Basic

Forth is a highly interactive language like Basic, with structure like Pascal and execution speed close to that of Assembly Language. The Micro Works Color Forth is a Rompack containing everything you need to run Forth on your Color Computer.

Color Forth consists of the standard FORTH Interest Group (FIG) implementation of the language plus most of FORTH-79. It has a super screen editor with split screen display. Mass storage is on cassette. Color Forth also contains a decompiler and other aids for learning the inner workings of this fascinating language. It will run on 4K, 16K, and 32K computers. Color Forth contains 10K of ROM, leaving *your* RAM for *your* programs! There are simple words to effectively use the Hi-Res Color Computer graphics, joysticks, and sound. The 112-page manual includes a glossary of the system-specific words, a full standard FIG glossary and complete source listing. COLOR FORTH ... THE BEST! From the leader in Forth, Talbot Microsystems. **Price: $109.95**

MICROTEXT: COMMUNICATIONS VIA YOUR MODEM!

Make your Color Computer an intelligent printing terminal with off-line storage! The Microtext module is just what you'll need for:

- Talking to a timeshare system or information service
- Printing out what is received as it is received
- Saving received text to cassette tape
- Re-displaying the received text even while on-line
- Communications with other computers
- Using your computer as a general-purpose 300-baud terminal
- Downloading programs from other computers

The Microtext module is a program pack containing not only firmware but a second serial port so that both your printer and modem can be connected at the same time. Microtext can be configured for any serial printer that will work with the Color Computer, even if it requires line feeds! But even if you don't have a printer, you can keep a permanent copy of your data by storing to cassette tape. Also, any Radio Shack/Centronics-compatible parallel printer may be used by adding the Micro Works' PI80C parallel interface.

For those of you with special terminal applications, Microtext has selectable parity; it sends odd, even, mark or space. With mark parity (which is default) you can send to computers requiring either seven or eight bits. All 128 ASCII codes can be sent. Exchange programs with other Color Computer users! Basic programs may be downloaded from other computers or timesharing systems.

You'll find many uses for this versatile module! Available in ROMPACK, ready-to-use, for **$59.95.**

MACHINE LANGUAGE

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

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

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

BOOKS

6809 Assembly Language Programming, by Lance Leventhal, **$16.95**

TRS-80 Color Computer Graphics, by Don Inman, **$14.95**

Assembly Language Graphics for the TRS-80 Color Computer, by Don Inman, **$14.95**

Starting Forth, by L. Brodie, **$19.95**

GAMES

Star Blaster — Blast your way through an asteroid field in this action-packed Hi-Res graphics game. Available in ROMPACK; requires 16K. **Price: $39.95**

Pac Attack — Try your hand at this challenging game by Computerware, with fantastic graphics, sound and action! Cassette requires 16K. **Price: $24.95**

Haywire — Have fun zapping robots with this HI-Res game by Mark Data Products. Cassette requires 16K. **$24.95**

Dunkey Munkey — Arcade excitement awaits those who dare to conquer the Munkey! Joystick and 32K required, by Intellectronics. Cassette: **$24.95**

Colorpede — Great graphics, two-player option, and pause control in this exciting game by Intracolor Communication. Cassette requires 16K: **$29.95**

Adventure — *Black Sanctum* and *Calixto Island* by Mark Data Products. Each cassette requires 16K: **$19.95** each.

Cave Hunter — Experience vivid colors, bizarre sounds and eerie creatures in hot pursuit as you wind your way through a cave maze in search of gold treasures. This exciting HI-Res game by Mark Data Products requires 16K for cassette version. **$24.95**

Starfire — Fly around the planet defending Earthlings from being snatched up by aliens in this challenging game from Intellectronics. Cassette requires 16K: **$21.95**

Doodle Bug — Joystick-controlled Doodle Bugs must move quickly through mazes while being chased by enemy bugs in Hi-Res game by Computerware. Cassette requires 16K: **$24.95**

Astro Blast — You'll need to act fast as you protect Earth from wave after wave of alien invaders in this HI-Res game by Mark Data. Cassette requires 16K: **$24.95**

HARDWARE

PARALLEL PRINTER INTERFACE — Serial to parallel converter allows use of all standard parallel printers. PI80C plugs into the serial output port, leaving your Rompack slot free. You supply the printer cable. **PI80C Price: $89.95**

MEMORY UPGRADE KITS: Consisting of 4116 200ns., integrated circuits, with instructions for installation. **4K-16K Kit Price: $39.95. 16K-32K Kit** (requires soldering experience) **Price: $39.95.** For Rev. level E, ET, NC and TDP-100s, we carry 64K chips; upgrading is easy! Eight prime **64K chips** and instructions: **$64.95**

Romless Packs for your custom EPROMs — call or write for information.

THE MICRO WORKS

MasterCharge/Visa Accepted
California residents add 6% tax.

P.O. BOX 1110, DEL MAR, CA 92014 (619) 942-2400

The Basic Beat

First Steps To Basic Programming

Lesson 2

by James W. Wood

Okay class, put away your notes, get out a pencil and turn to Quiz 1. The answers are at the end of the column.

Most students don't like short answers. In the next quiz, maybe I'll try multiple choice.

Last month I stated that variable names can be one letter, a letter followed by a single-digit number, or two letters. A variable can be longer than two letters. Often programmers will use words as variables. One could have BASE = 50.

Using words helps the programmer remember what the variable represents. However, if one line contains BASE = 50 and another line has BALLAST = 70, there will be trouble. The computer only recognizes the first two letters of the variable name.

Run Program Listing 1. The computer responds with BASE = 70 and BALLAST = 70. Since the first two letters are the same, the computer cannot distinguish between the two words. This is an error that the computer will not tell you about. The computer is only so smart.

Always place the variable on the left side of the equal sign. For example, do not put 5 = A into a program. Why? It doesn't work! A syntax error will be your only reward for anything other than a variable to the left of an equal sign.

All math operations must be on the right side of an equal sign. A statement such as R + E = 3 will not compute—it is another syntax error.

That reminds me—you need to learn some more math operations. Type Program Listing 2, run it, and figure out if the computer is correct. The asterisk (*) is a multiplication symbol. The slash (/) located on the same key as the question mark means to divide. The minus sign (−) is located on the same key as the equal sign (=).

In Listing 2, why did I use a semicolon at the end of each PRINT statement? Correct—it causes the printout to be spaced closely so that all the answers are on the same horizontal line.

Most of the answers seem reasonable. A + B is 7 + 4, which equals 11. 7 − 10 = −3, and 6*10 = 60. Ten divided by 4 is printed as 2.5 (sorry—the computer won't print fractional answers unless a fairly fancy program has been written).

Does 7 + 4*6 = 31?| Let's see—

```
10  BASE = 50
20  BALLAST = 70
30  PRINT"BASE = ";BASE
40  PRINT"BALLAST = ";BALLAST
```

Program Listing 1

1.) What are two ways to remove printing from the screen?
2.) What command, used in a program, is ignored by the computer? It is used to make notes to someone reading the program.
3.) After clearing the screen, how can you put the program back on the screen easily?
4.) What command erases your program from the computer's memory?
5.) Which keys will cause program execution to pause?
6.) How would you cause your computer to print green letters on a black screen? (Inverse video—Radio Shack's choice for lowercase).
7.) What command starts a program to execute?
8.) How do you determine the number of bytes of memory remaining?
9.) Which of the following may be used as variables: A, A4, A+, A(, AD, 3A, ZZ ?
10.) What is used at the very beginning of each line of a computer program?
11.) Which command prints a question mark?
12.) What punctuation is used with the PRINT command to make the printout two columns, each 16 characters wide?

Quiz 1

```
10  A = 7
20  B = 4
30  C = 6
40  D = 10
50  PRINT A + B;
60  PRINT A − D;
70  PRINT C*D;
80  PRINT D/B;
90  PRINT A + B*C;
100 PRINT K + A;
```

Program Listing 2

The NEW Color Accountant: much more than a great balancing act.

This is a class act, the headliner. Our NEW Color Accountant is a star performer. In fact, this is the second edition of the **most complete financial package available** for TRS-80 COLOR users... more flexibility, greater accuracy and even more ease of operation than before. Here's how it performs:

1. CHECKBOOK MAINTENANCE—automatically balances your checkbook with each entry; manages checks, charges, deposits and interest quickly and accurately.
2. CHART OF ACCOUNTS—maximum of user flexibilty with up to 99 accounts plus 9 subcategories may be defined.
3. CHECK SEARCH—multi-reference; tracks items on every field including tax deductibles.
4. NET WORTH/INCOME/EXPENSE STATEMENT—know-exactly-where-you-stand program generates statements with the touch of a key.
5. TIMELY BUDGET ANALYSIS—detailed evaluation of **all** expenditures and income.
6. CHECK WRITER—prints personalized checks.*
7. PAYMENTS/APPOINTMENTS CALENDAR—monthly displays of up to 250 bills and 200 appointments.
8. COLOR GRAPH DESIGN PACKAGE—graphs all monthly files.
9. MAILING LIST—maintains all records, sorts by name or zip, allows add/change/delete.
10. FRIENDLY USER MANUAL—complete with system flow charts and indexing; over 130 pages of the most thorough documentation on the market.

This menu-driven star provides printouts of all files and statements plus sound assisted data entry. Less than one hour of data input per month provides all the financial wizardry you'll ever need.

If this class act costs more than others, it's because this is the star of the show and you want only the best to handle your finances.

TRS-80 COLOR is available on cassette with 16K and 32K Ext. Basic, 32K only for diskette.

Just $74.95 cassette and $79.95 diskette and the best you can buy will start performing for you.

To order call

1-800-334-SOFT

DEALER INQUIRIES INVITED

programmer'sinstitute

a division of **FUTURE HOUSE**

p.o.box 3470, chapel hill, north carolina 27514, 919-967-0861

245

See List of Advertisers on page 138

7+4=11, and 11*6=66. The computer must have goofed. No, it didn't. According to the rules of math, multiplication or division is to be performed before addition or subtraction. So, 4*6=24 and 7+24=31—the computer's answer is okay.

Line 100 added K to 7 and got 7. The value of all variables is set equal to zero as soon as RUN is entered. K was not assigned any value; therefore, it remained equal to zero.

Try Program Listing 3. The run tells you that C=6.70625338E+09. There's the E in a number, as promised last month. The number is expressed in scientific notation. A high-school algebra, chemistry, or physics book should include many interesting facts about scientific notation.

Briefly, E refers to a power of 10 by which the number is to be multiplied. C=6.70625338 times 10 to the ninth power or C=6.70625338 times 1,000,000,000, which is 6,706,253,380. The decimal point is moved nine places to the right.

A negative number after the E means to move the decimal point to the left by a number of spaces equal to the last two digits. For example, 2.617E−06 would be expressed as .000002617.

Many calculators include an E or an EE key as a means of scientific notation. A calculator's display of 2.34E+12 would probably show 2.34 12. The E is not displayed, but a blank number area indicates its presence.

How accurate was the result for C? The real value is (drum roll) 6,706,253,376. The CoCo was off by four in almost seven billion—not bad, but not exact. For most applications, however, it is accurate enough.

If you want exact answers you will need to write or buy a program that can fulfill your needs. It is possible to multiply and obtain correct results to several hundred decimal places, but it does require a sophisticated program.

The computer can also take numbers in scientific notation. Try Program Listing 4. The screen shows the number 600,000, which is 2,000 times 300.

Scientific notation pops up only rarely, but it's a good thing to know.

Did you notice that Listing 2 got a little long? There is a way to combine several statements into one line. A colon (:) separates commands on one line. Let's rewrite Listing 4 to see how it's used.

Program Listing 5 runs exactly the same as does Listing 4, although it uses less memory. I will use colons to separate commands where it helps to keep a program short enough to list on the screen. Excessive use of colons can render a listing unreadable.

"If you break the program and then type CONT and hit enter, the program will continue . . . from where it was when you hit break"

```
10  A=54321
20  B=123456
30  C=A*B
40  PRINT"C=";C
```

Program Listing 3

```
10  A=2E3
20  B=3E2
30  C=A*B
40  PRINT C
```

Program Listing 4

```
10  A=2E3:B=3E2:C=A*B:PRINT C
```

Program Listing 5

```
10  A=0
20  A=A+1
30  PRINT A;:GOTO20
```

Program Listing 6

```
10  A=1:B=4:JW=3
20  PRINT B*JW;A+B;JW-A
30  STOP
40  PRINT B+JW;A+A
```

Program Listing 7

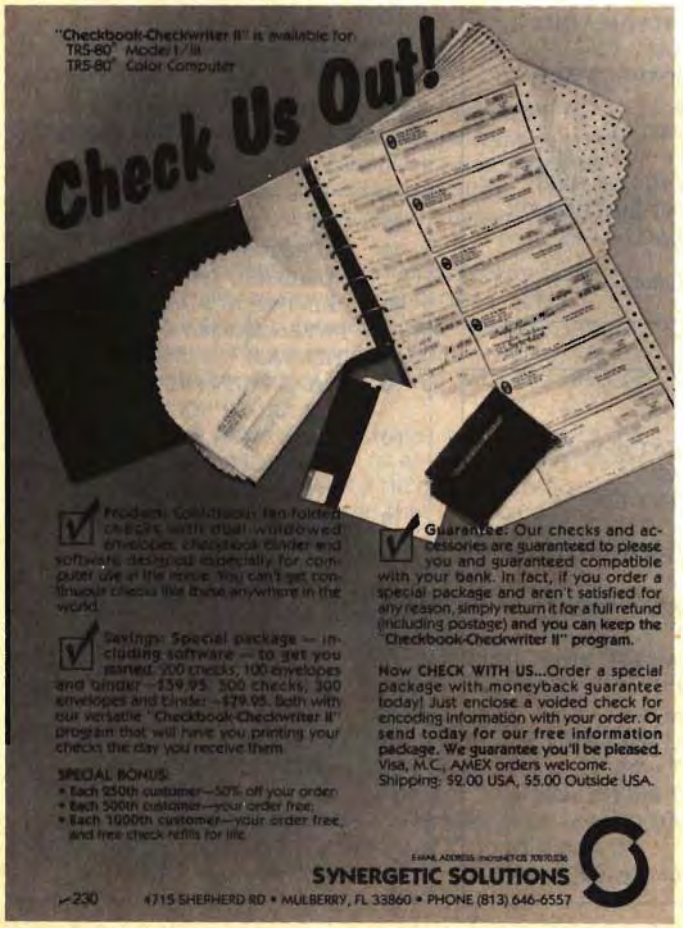
How is CONT used? While Program Listing 6 is running, hit the break key. If you then type RUN and hit enter, the program will start with the number 1 (at the beginning). If you break the program and then type CONT and hit enter, the program will continue counting from where it was when you hit break. Now you know how to continue a game in case someone accidentally hits break while you are playing (this will work only if the game is written in Basic).

What's the difference between END and STOP? Not much—try Program Listing 7. Running it results in the message BREAK IN 30. If line 30 is changed to 30 END, instead of 30 STOP, the program still quits at the same place, but doesn't tell where it quit.

Some students get confused after reading Listings 6 and 7. Often they try something like Program Listing 8A. It doesn't work. Line 20 gives an answer of zero instead of the expected 10, because the program failed to assign a value to C; therefore, C equals zero. Program Listings 8B or 8C will run with no errors. If you want to use the value of A+B later, then Listing 8B would be better, since C has been equated to A+B.

The CoCo can add numbers, but can it add words? Sure it can. Try Program Listing 9 for an ego trip. The variables NA$, B$, and M$ all end with a dollar sign ($). They are string variables. Strings can be added, but not subtracted, multiplied, or divided. The result of adding strings is to have them attached end to end. For example, adding "Radio" to "Shack" results in "RadioShack." You have to remember to allow for spaces to separate words.

The computer is programmed to handle 200 characters in strings, each character being a number, letter, or symbol. If your program contains more than 200 string characters an OS (out of string space) error may result. No problem, just type CLEAR (the letters, not the clear key), followed by a number (the number being at least as large as the amount of string space needed). CLEAR 2000 is possible but



↙ See List of Advertisers on page 138

only leaves about 300 bytes of programming space on a 4K computer.

Try Program Listing 10A for a further demonstration of adding strings. Notice that string variables cannot be added to numerical variables. The name can be added to WILL BE. The age is printed as a number between the two strings, M$ and N$ + P$.

There are just a couple of commands left this month, but they have many uses. I'm not completely happy with line 60 of Listing 10A. Let's ask the person if he or she is male or female, and then the computer can reply with the correct term (his or hers).

Without typing NEW, change Listing 10A to Program Listing 10B. This means only type in lines 35, 37, 38, 60, and 80. In line 37, if the IF is true, the line continues to the THEN statement and sets W$ = "HIS". If the response is FEMALE, then line 38 sets W$ = "HER". The string variable is added onto "ON" in line 60 and printed by line 80.

IF . . . THEN has an optional extention, ELSE, which is executed in cases where IF is false. IF . . . THEN . . . ELSE can be used in several ways. You can compare strings as was illustrated in Listing 10B. You can also compare numbers.

Before trying any more program listings, let's learn the Basic equivalent for several algebraic equality/inequality statements. Table 1 summarizes their meanings. Program Listing 11 illustrates their usage. Try several pairs of numbers. The program may not be much to brag about, but make sure you understand why it works. Remember, I'm training you to program, not just to type.

On the Color Computer I have had IF . . . THEN statements with syntax errors for no apparent reason. I discovered that spaces can make a difference. Try Program Listing 12 with no spaces in line 40. It gives a syntax error. Retype line 40 with a space between R = E + W and THEN. Now it works.

Unless your program is so long that you don't have enough memory, it is best to put spaces before and after all IFs and THENs. Some computer models will sometimes allow you to leave out the THEN, i.e., IF R = 4 PRINT "YES". On the CoCo it would be wise to always use a THEN with every IF.

Some programmers will use a line like IF K = 3 THEN 30. This line will send the program to line 30 if K equals 3. Another way to write the line would be IF K = 3 THEN GOTO 30. The second method is easier for a beginner to follow.

The use of CLOAD and CSAVE to record and reenter programs is covered well enough in the owner's manual. I do offer two additional hints.

A = B	A equals B
A<B	A is less than B
A< = B or A = <B	A is less than or equal to B
A>B	A is greater than B
A> = B or A = >B	A is greater than or equal to B
A<>B or A> <B	A does not equal B

Table 1

```
10  A=6:B=4
20  PRINT C=A+B
```

Program Listing 8A (Wrong)

```
10  A=6:B=4
20  C=A+B
30  PRINT C
```

Program Listing 8B (Right)

```
10  A=6:B=4
20  PRINT A+B
```

Program Listing 8C (Right)

```
10  CLS
20  INPUT"WHAT IS YOUR
    NAME";NA$
30  CLS
40  B$="IS A VERY SMART
    HUMAN"
50  M$=NA$+B$
60  PRINT M$
```

Program Listing 9

```
10  CLS
20  INPUT"WHAT IS YOUR
    NAME";NA$
30  INPUT"HOW OLD ARE
    YOU";AG
40  CLS:AG=AG+1
50  M$=NA$+" WILL BE"
60  N$=" ON HIS OR HER"
70  P$=" NEXT BIRTHDAY"
80  PRINTM$;AG;N$+P$
```

Program Listing 10A

```
10  CLS
20  INPUT"WHAT IS YOUR
    NAME";NA$
30  INPUT"HOW OLD ARE
    YOU";AG
35  INPUT"ARE YOU MALE OR
    FEMALE";S$
37  IF S$="MALE" THEN
    W$="HIS"
38  IF S$="FEMALE" THEN
    W$="HER"
40  CLS:AG=AG+1
50  M$=NA$+"WILL BE"
60  O$=" ON "+W$
70  P$="NEXT BIRTHDAY"
80  PRINTM$;AG;O$+P$
```

Program Listing 10B

```
10  CLS
20  PRINT:PRINT"GIVE ME TWO
    NUMBERS."
30  PRINT"PLACE A COMMA BE-
    TWEEN THEM."
40  INPUTA,B
50  IF A>B THEN PRINT A;
    "IS LARGER":GOTO20
60  IF B>A THEN PRINT B;
    "IS LARGER" ELSE PRINT
    "THEY ARE EQUAL"
70  GOTO 20
```

Program Listing 11

```
10  R=4
20  E=1
30  W=3
40  IF R=E+WTHENPRINT"IT
    WORKED"
```

Program Listing 12

"Recording a program is not like recording a song. If part of a song is recorded on the leader, you only lose a few seconds of the song. But if part of a program is recorded on the leader, you lose all of the program."

Some tapes have leaders. This is plastic that attaches between the brown magnetic tape and the cassette hub. Your program cannot be recorded on the leader. Make sure the tape is advanced to the magnetic tape before CLOADing a program.

Recording a program is not like recording a song. If part of a song is recorded on the leader, you only lose a few seconds of the song. But if part of a program is recorded on the leader, you lose all of the program.

Second hint—more than one program can be recorded on a tape. When recording programs, the first step is to rewind the tape to the beginning. Then set the recorder's counter to zero. If this is the first program to be recorded on the cassette tape, then fast-forward to 5 on the counter.

Momentarily eject the cassette to be certain you are beyond the leader. Record the program. Make a written note of where the program began and ended. Let's say the recorder stopped at 12. The next program could be recorded starting at 16 on the counter. Always leave at least four blank spaces between programs.

To CLOAD the program that starts at 16, position the tape at 14. This will allow the tape to reach proper speed before the program starts to load information into the computer. Too slow a speed lowers the frequency and causes an I/O (input/output) error. Caution—different recorders' counters count off different lengths of tape; even the counters on Radio Shack's CTR-80 and CCR-81 cassette recorders will not agree with each other. It is good practice to make two recordings of any program you want to keep.

Next month I plan to start my game campaign. The commands will become more colorful and the programs more playable. After all, didn't your piano, football, skating, or whatever lessons become more enjoyable after you learned to play? ■

Answers to Quiz 1

1. CLS (ENTER) or (CLEAR)
2. REM or '
3. LIST (ENTER)
4. NEW (ENTER)
5. (SHIFT) @
6. (SHIFT) 0
7. RUN (ENTER)
8. PRINT MEM (ENTER)
9. A, A4, AD, ZZ
10. line number
11. INPUT
12. comma

See List of Advertisers on page 138

Elmer's Arcade

DUDLEY DO-RIGHT MEETS RADIO SHACK

by Richard Ramella

My friend Elmer owns a penny arcade in the seedier part of town. While others are raking in tons of quarters with their video game parlors, Elmer steadfastly resists the Electronic Age except for a few pre-1960 games with primitive transistors.

"Video games are a flash in the pan," he says. "They'll run their course and everybody will come back here, where you can still play Shooting Gallery for a penny or Mechanical Baseball for a nickel."

"I don't see them yet," I always reply.

And his answer to this is always, "Give them time," followed by a confident but grim pull on his cigar, which never seems to go out or get shorter.

That's how—as always—my latest visit to Elmer's Arcade began. I jingled the change in my pocket. "I've raided the piggy bank, Elmer. What's new around here?"

"Have I got a treat for you!" he grinned. I followed him past a row of pinball machines so old they were based on the Civil War. We trekked boldly onward through a forest of kinetoscopes with titles such as *Bathing Beauties of 1910*, *What the Butler Saw*, and *Bertie Serves the Salad Undressed*, all G-rated of course.

And more quickly than it takes a neophyte to lose a game of Donkey Kong, we found ourselves before an ancient mechanical game called Snowshoe Mountie. In this game, the player uses a lever to maneuver a small metal figure of a Royal Canadian Mounted Policeman. The terrain is a field of snow and trees that moves in an endless loop until the Mountie runs into a tree. Then the game ends.

Program Listing

```
100 REM * X-SKI / RICHARD RAMELLA / TRS-80 EXTENDED COLOR BASIC
110 REM * ELMER'S ARCADE # 1
120 CLS0
130 DATA LUMMOX,SNOWBUNNY,TYRO,NOVICE,AMATEUR,PROFESSIONAL,EXPE
RT,CHAMPION,WORLD CHAMP
140 FOR A=0 TO 8
150 READ V$(A)
160 NEXT
170 Q=28
180 H=1
190 Y$=STRING$(31,128)
200 P$=CHR$(239)
210 FOR A=1 TO 2
220 P$=P$+P$
230 NEXT A
240 L$=CHR$(8)
```

Listing continued

Fascinated, I started playing and couldn't stop until all my pennies were gone. "Kind of addictive?" Elmer grinned.

"I'm going to put this into the computer," I said.

"Computer-schmuter!" Elmer replied. "It'll never work."

"I'm going home to do it right now!" I said.

"So go!" Elmer said, throwing a disgusted hand at me. "And thanks for all your change."

Think Snow

Elmer was wrong. X-Ski, which stands for cross-country ski, is a terrific computer arcade game. If you like arcade games, this one will hook you for many hours. It requires Extended Color Basic.

Let me share with you the Ramella Theory of Computer Arcade Games, then tell you how to play X-Ski and explain a bit of the programming involved.

A good game requires luck and skill in countering random events that can cause you to lose. A good arcade game has movement, random events, and degrees of success. It also has two points of light, one of which the player controls and the other that the program controls and that the player either tries to elude or catch.

Here's how to play X-Ski. Type RUN and press enter. The player is an orange graphic at the top of the screen. Three kinds of graphics—green trees, blue ice patches, and yard markers—emerge from the bottom of the screen. Avoid running into the trees and yard markers or the game ends. Try to hit the ice patches because this scoots you ahead 50 yards.

You maneuver the orange ski graphic to the left by holding down the left-arrow key, to the right by holding down the right-arrow key, and straight ahead by lifting your hand off the keyboard.

Yard markers, which appear every 10 yards, mark the score. To start, the trees are bushes, but they widen at

100, 200, and 400 yards. The eight ratings follow: less than 100 yards, lummox; 100–199 yards, snowbunny; 200–299 yards, tyro; 300–399 yards, novice; 400–499 yards, amateur; 500–599 yards, professional; 600–699 yards, expert; 700–799 yards, champion; 800 yards and above, world champ.

Here are two clues for success: You can ski sideways through obstacles with no harm other than a few figurative pine needles down your electronic ski parka; also, try to hit the ice patches while skiing straight ahead or you might jump them without any effect.

Programming Notes

The POINT command is handy if you write arcade games. It tests whether a light is on or off at a specified screen location. Line 370 tests to see if the skier has hit a patch of ice. If so, it adds to the score, scoots the skier ahead, and skips to line 390. Line 380, the loser line, tests if the locations just below the skier graphic are off or on. If both are off, the game continues, but if one is on, the game ends.

In lines 240 and 250 I make L$ the value of the left-arrow key and R$ the value of the right-arrow key. Line 340 tests whether the player is holding down either of these arrow keys and if so, it moves the skier one PRINT@ space in the proper direction. In other words, the skier keeps moving sideways as long as the player depresses the arrow key and the graphic has not reached the defined edge of the field.

How does this simple Basic program achieve fairly fast graphic movement? The secret is scrolling up. Line 448, the next to last line available, prints the obstacle graphics. Then line 420 PRINT @ 480,Y$ prints 31 empty spaces on the last line available. This inserts an empty line plus one green space at the end. This shifts everything on the screen up one line, giving the illusion of movement. ■

Anyone who has trouble keying in this program may confide in me. Write to Richard Ramella at 1493 Mt. View Ave., Chico, CA 95926. Enclose a self-addressed stamped envelope (Canadians, send 40 cents coin and a self-addressed envelope) if you want a reply. Send a listing of the program as it is in your machine or indicate the error message, the line in which it occurs, and what the program seems to be doing wrong.

Listing continued

```
250 R$=CHR$(9)
260 J$(1)=CHR$(215)+CHR$(219)
270 J$(2)=CHR$(215)+CHR$(223)+CHR$(219)
280 J$(3)=CHR$(215)+CHR$(223)+CHR$(223)+CHR$(219)
290 J$(4)=CHR$(215)+CHR$(223)+CHR$(223)+CHR$(223)+CHR$(219)
300 A=15
310 B=30
320 M=1
330 C$=CHR$(128)
340 IF (PEEK(343)AND8)=0 THEN X$=L$ ELSE IF (PEEK(344)AND8)=0 T
HEN X$=R$ ELSE X$=CHR$(133)
350 IF X$=L$ AND A>0 THEN Z$=CHR$(246): A=A-1: B=B-2 ELSE IF X$
=R$ AND A<30 THEN Z$=CHR$(249): A=A+1: B=B+2 ELSE Z$=CHR$(245)
360 PRINT @ A,C$+Z$+C$;
370 IF POINT(B+2,2)=7 THEN N=N+40: FOR L=240 TO 1 STEP -20: PRI
NT @480,STRING$(32,128);: SOUND L,1: NEXT L: GOTO 390
380 IF POINT(B+2,2)<>0 OR POINT(B+3,2)<>0 THEN 500
390 PRINT @ 448+RND(Q+1),J$(H);
400 P=RND(30)
410 IF P=1 THEN PRINT @447+RND(26),P$;
420 PRINT @ 480,Y$
430 IF N/10=INT(N/10) THEN PRINT @ 448+RND(Q),N;: FOR T=1 TO 40
:NEXT: PRINT @ 480,Y$
440 N=N+1
450 IF N>199 THEN H=2
460 IF N>399 THEN H=3
470 IF N>699 THEN H=4
480 PRINT @ A,C$+Z$+C$;
490 GOTO 340
500 M=INT((N-13)/100)
510 IF M<0 THEN M=0 ELSE IF M>8 THEN M=8
520 PRINT @ 480,"YARDS:"N-13"- RATE: "V$(M);
530 SOUND RND(10)*15,1
540 SET(A+A+RND(3),RND(3),RND(8))
550 GOTO 530
560 END
```


See List of Advertisers on page 138

Super "Color" Library™

For the TRS-80 Color and TDP System 100 Personal Computers

No matter what kind of problem you are trying to solve with the Color Computer, there is a program in the ever-expanding integrated, **Super "Color" Library** that will give you the solution; Faster, Better, Smarter!

Every Library program features **MEMORY-SENSE** to determine your computer's memory, from 16 to 64K, and adjusts automatically to maximize work space. All programs, except the **Super "Color" Speller** and **Super "Color" Disk-ZAP**, feature a true lowercase display with below line descenders. Each program has been written specifically for the Color Computer in fast machine code to be totally compatible for optimum performance — Something a motley assortment of programs from diverse sources or a passel of overpriced, wallet-FLEXing software from a bygone era simply can not achieve.

The **Super "Color" Library** has all the power, speed, dependability and compatibility you will ever need so build your library a volume at a time or put the full power of the complete library of problem solvers to work right away.

— *NEW!* —

64K Compatible

Super "Color" Writer II™

32x16 & 51-64-85x21&24 WITH REAL LOWERCASE DISPLAY

VERSION 3.0 By Tim Nelson

THE INTELLIGENT WORD PROCESSOR

The **Super "Color" Writer II** is for those who desire the best. It is the most powerful, fastest, most dependable and versatile word processor available for the Color Computer, from 16 to 64K. The **Super "Color" Writer II** has features for the most demanding professional, yet it is easy enough for newcomers to master.

Of course the **Super "Color" Writer II** has all the features you would expect from the highest quality word processor, such as a clear, crisp and readable professional display with your choice of display colors, 9 display formats; standard 32x16 & 51-64-85x21 &24 with real lowercase descenders; full 4-way cursor control, sophisticated edit commands, the ability to edit any BASIC program or ASCII textfile, seven delete functions, locate and change, wild card locate, a real block move & copy, word wrap-around, programmable tabs, display memory used and left, non-breakable space, multiple headers and footers, dynamic text formatting, comprehensive format parameters, use with ANY printer at any baud rate from 110 to 9600 baud, automatic justification, automatic pagination, automatic centering, automatic flush right, underlining, superscripts, subscripts, pause print, single-sheet pause, optionally print comments, append text files, available in a ROMPAK cartridge for maximum work space, but that's only half of the story. No other program can even begin to compare in features with the **Super "Color" Writer II.**

Check These Exclusive Features

MEMORY-SENSE adjusts to computer's memory (16-64K) for maximum work space; TYPE-AHEAD, TYPAMATIC KEY REPEAT and KEY BEEP for the pros; 3 PROGRAMMABLE FUNCTIONS; AUTO PHRASE INSERT; COLUMN CREATION; TEXT FILE LINKING; HELP MENU; A TRUE EDITING WINDOW IN ALL 9 DISPLAY MODES; TRUE FORMAT WINDOW to display line lengths up to 255 characters, with horizontal and vertical scrolling to replicate the printed page including centered lines, headers, footers, page breaks, page numbers, margins, giving a perfect printed document every time. Also makes hyphenation a snap; **TRUE AUTOMATIC JUSTIFICATION** for neat, even left and right hand margins; Ability to use CHARACTER CODES for printing special characters available with your printer; freedom to embed as many PRINTER CONTROL CODES as desired anywhere in the text, **EVEN WITHIN JUSTIFIED TEXT;** 90-plus page tutorial manual.

ADDITIONAL DISK FEATURES: Read a directory, Display free granules, Save with Automatic Verification, Load and Append ASCII files, and BASIC programs, Kill files, and Link files from disk for continuous printing. 54K bytes of workspace available with a 64 K system. Only the best offers all of these features.

TAPE $69.95 **ROMPAK $89.95** **DISK $99.95**

Tutorial only $15.00 (Refundable with purchase)
Tape & Disk require 32K for lowercase display
Previous **Super "Color" Writer II** owners call for upgrade policy

Super "Color" Mailer™

By Tim Nelson

The **Super "Color" Mailer** is a powerful multi-purpose mailing list merging and sorting program including lowercase display that uses files created by the **Super "Color" Writer II.** Combine files, sort and print mailing lists, print "Boilerplate" documents, automatically insert text in standardized forms, address envelopes, the list is endless.

TAPE $39.95 **DISK $59.95**

Operators Manual only $10.00 (Refundable with purchase)

NEW

Super "Color" Speller™

By Peter A. Stark

The **Super "Color" Speller** is a fast machine-code proofreading program to correct **Super "Color" Writer** files. Automatically proofreads your documents against a 20,000 word stock dictionary, plus your own customized dictionary and corrects typos or marks them for special attention.

AVAILABLE ON DISK ONLY $69.95

Operators Manual only $10.00 (Refundable with purchase)

NELSON SOFTWARE SYSTEMS **9072 Lyndale Avenue So., Minneapolis, Minnesota 55420 612/881-2777**

32x16 & 51-64-85x21&24 Display With Lowercase Descenders And 16 Thru 64K Too!

NEW Super "Color" Calc™

ELECTRONIC SPREADSHEET By Kevin Herrboldt

Now you can answer those "What if?" financial projection, forecasting, budgeting, engineering and calculating questions with precision, speed and power using the **Super "Color" Calc**, truly the finest electronic worksheet and financial modeling program available for the Color Computer, from 16 to 64K. Now every Color Computer owner has access to a calculating and planning tool rivaling VisiCalc® containing all its features and commands and then some. You need only change one variable and you instantly see how that change affects your assumptions. You can even use VisiCalc templates freely with **Super "Color" Calc!** Combine spread sheet tables with **Super "Color" Writer II** documents to create ledgers, projections, statistical and financial reports and budgets.

Features include: 9 display formats: standard 32x16 & 51-64-85x21&24 with real lowercase descenders * MEMORY-SENSE to adjust to computer's memory (16-64K) for maximum work space. Full-size 63x256 worksheet * Easy to use * HELP Menus to make learning faster * Machine code speed and high precision * Total flexibility in calculating * Up to FOUR VIDEO DISPLAY WINDOWS to compare and contrast results of changes * Sine and Cosine functions, Averaging, Exponents, Algebraic functions, and base 10 or 16 entry * Multi-layered Column and Row Ascending and Descending sorts * Locate formulas or titles in fields * Easy entry, replication and block moving of frames * Global or Local column width control up to 81 characters each * Create titles of up to 255 characters * Typamatic Key Repeat * Key beep * Type-ahead * Print up to 132 column worksheet * Prints at any baud rate from 110 to 9600 * Print formats savable along with worksheet * Enter control codes for customized printing.

DISK FEATURES: Read a directory; Display free granules; Kill files; Save with Automatic Verification; Load files; Append disk files for complete worksheet printing. 54K bytes of worksheet space available with a 64K system.

Tutorial and sample templates are supplied with the program.

ROMPAK $89.95 **DISK $99.95**

Tutorial only $15.00 (Refundable with purchase)
Disk requires 32K for lowercase display

Super "Color" Disk-ZAP™

By Tim Nelson

Now the dreamed-of repair of I/O errors is a reality. The **Super "Color" Disk-ZAP™** is the ultimate repair utility for simple and quick repair of all repairable disk errors. Designed with the non-programmer in mind, the **Super "Color" Disk-ZAP™** will let you retrieve all types of bashed files, including BASIC and Machine Code programs.

This high-speed machine code disk utility has a special dual cursor screen display to show HEXIDECIMAL and ASCII displays simultaneously. You are able to: Verify or modify disk sectors at will * Type right onto the disk to change unwanted program names or prompts * Send sector contents to the printer or any other RS-232 device * Search the entire disk for any grouping of characters * Copy sectors * Backup tracks or entire disks * Repair directory tracks and smashed disks * Full prompting to help you every step of the way * 50-plus page Operators Manual which helps you simply and quickly fix the vast majority of disk errors, and teaches the rudiments of disk structure and repair.

AVAILABLE ON DISK ONLY $49.95

Operators Manual only $10.00 (Refundable with purchase)

Super "Color" Terminal™

THE FINEST TERMINAL PROGRAM ANYWHERE!
Version 3.0 By Dan Nelson

The best has become even better, with many new features including 9 display formats: 32x16 & 51-64-85x21&24 with real lowercase descenders, plus compatibility with the 64K Color Computer. This user-friendly program makes communicating with ANY computer a breeze even for a newcomer. Communicate using your modem with all the popular information services such as Dow Jones, Compuserve, The Source, and local BBS's, clubs, friends, or the main-frame at work. You can also communicate directly with other microcomputers, such as the TRS-80 I/III, II, other Color Computers, Apples, IBM PCs, etc., via RS-232 without using a modem. Save the information or PRINT IT!

FEATURES: MEMORY-SENSE to adjust to computer's memory (16-64K) for maximum work space. Selectively print data at baud rates from 110 to 9600 * 54K of data storage with 64K disk system. 128 character ASCII keyboard * Automatic graphics mode * Word mode (word wrap) for unbroken words * Send & receive **Super "Color" Writer II, Database & Calc** files. ASCII files. Machine Language & BASIC programs * Set communications baud rate from 110 to 9600. Duplex: Half-Full-Echo. Word length: 5 6 7 or 8. Parity: Odd/Even or None. Stop Bits: 1-9 * Local linefeeds to screen * Save and load ASCII files. Machine Code & BASIC programs * Unique CLONE feature for copying any tape * Lower case masking * 10 Keystroke Multiplier (MACRO) buffers to perform repetitive pre-entry log-on tasks and send short messages * Programmable prompt or delay for send next line * Selectable character trapping * Files compatible with other Library programs.

ADDITIONAL DISK FEATURES: Works with up to four Disk Drives. Call a directory. Print free space. Kill disk files. Save with Automatic Verication and Load textfiles or BASIC programs. Save and Load KSM'S to the disk.

TAPE $49.95 **ROMPAK $59.95** **DISK $69.95**

Operators Manual only $10.00 (Refundable with purchase)
Previous **Super "Color" Terminal** owners call for upgrade policy.

NEW Super "Color" Database™

This high speed machine language program including true lowercase displays fills all your information management needs, be they for your business or home. Inventory, accounts, mailing, lists, family histories, you name it, the **Super "Color" Database** will keep track of all your data.

The **Super "Color" Database** features MEMORY-SENSE to adjust to computer's memory (16-64K) for maximum work space. It is structured in a simple and easy to understand menu system with full prompting for easy operation. Your data is stored in records of your own design, each divided into as many fields as you need. All files are fully indexed for speed and efficiency. Full sort of records is provided for easy listing of names, figures, addresses, etc., in ascending or descending order. The math package performs arithmetic operations and updates other fields which is especially useful when used as an order entry and invoicing system. You can create reports, or lists for mailings, or whatever. Create files compatible with the **Super "Color" Writer II and Terminal.** Up to five different print formats are available, and control codes may be imbedded for customized printing.

AVAILABLE ON DISK ONLY $79.95

Operators Manual only $10.00 (Refundable with purchase)

For Orders ONLY Call Toll Free

master charge **1-800-328-2737** VISA

Customer service and product support call (612) 881-2777.
MAIL ORDERS: $3 U.S. Shipping ($4 CANADA, $10 OVERSEAS)
Personal checks allow 3 weeks. **ORDERS SHIPPED SAME DAY!**
Available at Dealers everywhere.
If your Dealer is out of stock ORDER DIRECT!

NELSON SOFTWARE SYSTEMS

9072 Lyndale Avenue So. 612/881-2777

A Division of Softlaw Corporation Minneapolis, Minnesota 55420 U.S.A.

TRS-80 is a trademark of Tandy Corp. Visicalc is a trademark of VisiCorp.

WE TAKE THE COLOR COMPUTER SERIOUSLY.
AUTHORS' SUBMISSIONS ARE ENCOURAGED.

126

BY MARTIN H. GOODMAN

MONOCHROME MONITOR DRIVER

If you use your CoCo for long hours of text processing (programming or word processing) or for black-and-white graphics (PMODE 4), you might want to construct the following circuit.

This circuit grabs the video output before the color information is mixed in and produces the sharpest, cleanest text and black-and-white graphics that the Color Computer is capable of generating. When viewed on a monochrome monitor (green, amber, or black and white), the image is better than the images available from the normal (RF) output viewed on color or black-and-white TVs. It is even superior to the text I have seen on a friend's RGB monitor driver, which he built for his CoCo. The improvement is most noticeable when viewing 51-column text pages such as those produced by Telewriter.

Keep in mind that this circuit will not show colors, even if the output is displayed on a color monitor, and that multicolor graphics may look disappointing because the circuit assigns only one of three gray levels to the eight colors available. Artifact colors—the so-called extra PMODE 4 colors—appear as areas of fine stripes or dots. There is a way to modify this circuit to let it produce eight gray levels corresponding to the eight colors in the CoCo repertoire. I will describe this circuit in Part 2 of this series.

To use this circuit, you must have a monochrome monitor handy. I am typing this article on my CoCo using this driver circuit and my $170 Amdek green-screen monitor. New green-screen monitors can be had for less than $100. Paying a premium for ultra high-resolution monitors is not necessary, as the CoCo's signal is of limited resolution. Any monochrome monitor should do just fine. I am told that amber is preferable because it is easier on the eyes. My circuit will *not* have any detrimental effect on the color RF output signal.

At last there is a way to produce a clear, sharp black-and-white image with your Color Computer.

Some folks have made or purchased color monitor driver circuits and are driving monochrome monitors with them. Although you do get a readable image, the image is smeared and contains annoying vertical stripes. This is the result of the color information messing up the black-and-white signal. The circuit described here provides a crystal-clear, sharp image on a monochrome screen.

Theory of Operation

The information for your video signal is created in the VDG chip (U7 MC6847). Pin 28 of this chip is the Y (synch + luminance) output, which carries the monochrome video signal in inverted form. Pins 10 and 11 (theta A and theta B) carry the color information. These three outputs are integrated into a color-composite video signal by U12, the video mixer IC.

This color-composite video signal is fed into that metal box with the RCA socket on it (U5, the ASTEC modulator). The ASTEC is actually a miniature TV station that produces a radio (RF) signal. This signal is then recognized by an ordinary color TV, which reverses the process to put an image on the screen. Thus, a black-and-white signal in a normal CoCo gets mixed with color data, modulated onto an RF carrier, demodulated in the TV set, separated into color and black-and-white data, and at long last put on your very low-resolution color TV screen.

It should not surprise you to learn that in this elaborate process a fair degree of clarity is lost. The system this article describes takes the signal directly out of the Y output of the VDG, buffers it (to preserve the integrity of the signal that contributes to the RF output), inverts and amplifies it, then buffers it again before sending it to your choice of socket for plugging into a 75-ohm impedance monochrome monitor.

The scheme I hinted at for achieving a gray scale output involves similarly (but not identically) buffering the theta A and theta B lines and bleeding part of those signals into the monochrome output through low-value resistors.

Construction and Mounting Hints

You can construct the entire circuit

COLOR COMPUTER/TDP-100*
SUPER-PRO
REPLACEMENT KEYBOARD KIT

- Affordable Price—**Only $69.95.**
- A ***must have*** for all serious computerists.
- Highest quality—U.S. made.
- Direct replacement—same key layout
- Professional appearance and operation.
- Fast, simple installation.
- Complete instructions included.
- In stock now.

*Computers produced after approximately October 1982 require an additional keyboard plug adapter. Please add $4.95.

AT YOUR FAVORITE DEALER OR DIRECT FROM

MD *Mark Data Products*

24001 ALICIA PKWY., NO. 226, MISSION VIEJO, CA 92691 • (714) 768-1551

We pay shipping on all orders in the continental U.S. and Canada. Overseas add $5.00 for shipping and handling. Foreign orders please remit U.S. funds. California residents, please add 6% sales tax. We accept MasterCard and VISA. We are always looking for quality machine language programs. Contact us for details.

241

See List of Advertisers on page 138

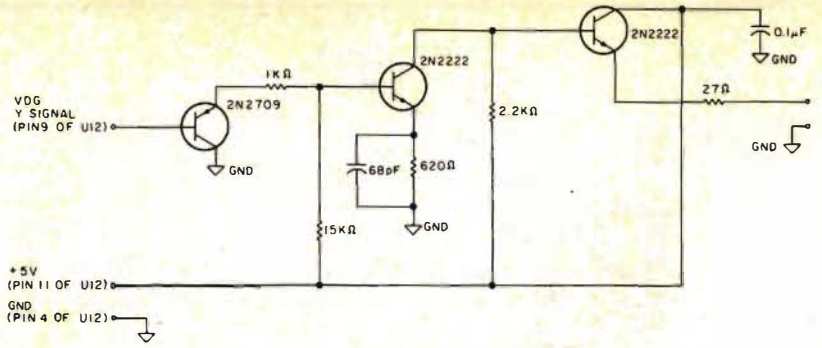


Fig. 1. Monochrome Monitor Driver Schematic

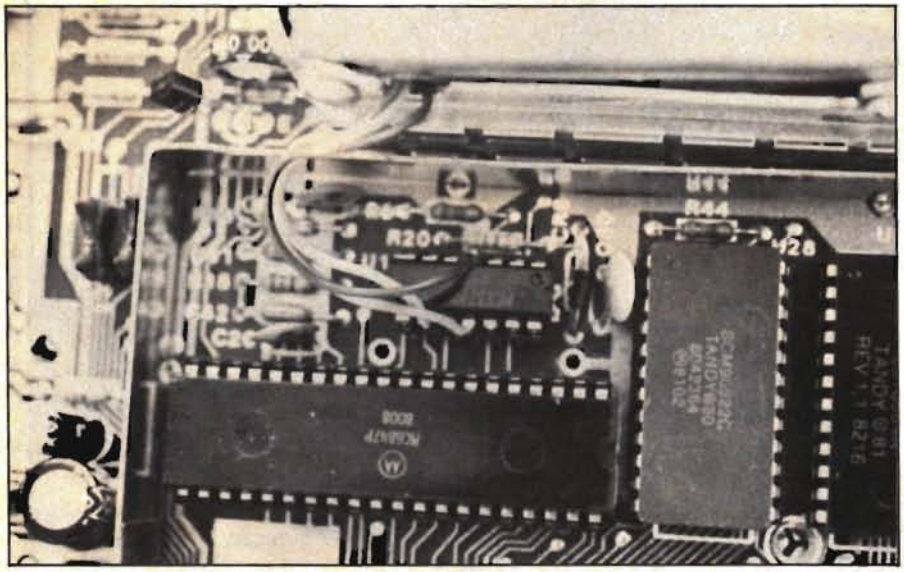


Photo 1. Wiring of Device to U12

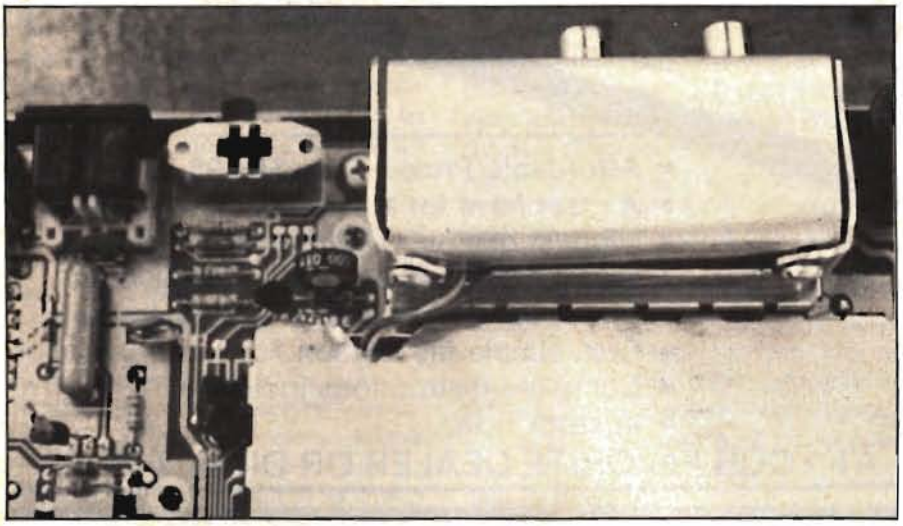


Photo 2. Device and RF shield in place. Note notch in shield for wiring.

(Fig.1) on a piece of perfboard 1 by 1½ inches in size. It is then mounted inside a small metal box the size and shape of the ASTEC using two small machine screws. The lid of the ASTEC lifts off easily to allow you to attach my box (be careful positioning the screw heads—it's dense in there) and thus allows for future adjustment of the ASTEC if necessary. More timid souls might want to use double-stick adhesive tape instead of screws.

The circuit needs a +5V, a ground, and a VDG Y output to run. Those three lines are obtained off the pins of the video mixer (U12) as follows (see Photo 1):

- Pin 4 = gnd
- Pin 11 = +5V
- Pin 9 = VDG Y

I ran short wires out of my box and soldered them to appropriate pins on the video-mixer chip. This chip is tough, and injuring it would take determined abuse in soldering or handling. Be aware, however, that it is hard to find a vendor who will sell you one of these chips. (Tandy National Parts sells them for about $4 each.) If you do short out some pins on the chip and turn on the power, you may blow that chip and other more expensive chips. Therefore, proceed with care.

Timid souls may want to solder a 14-pin socket to a 14-pin header, take the lines off the header, and plug U12 into the socket. I tried this arrangement myself. It is more reversible than the first procedure, but the chip sticks up too high to allow the RF shield to close. You would be obligated to make a minor modification in the RF shield to allow the chip to fit.

I completed my mod by drilling a hole in the back of my CoCo's top lid to allow access to the RCA jack I installed. The completed project is seen in Photo 2. I was unable to find a box the right size, so I made one by modifying the smallest Radio Shack chassis box I could find.

What About Sound?

Once you switch to some form of composite video, you lose the sound output. As yet, there is no standardized way to combine audio and video signals going into monitors. Some monitors have a jack for separate sound input, but this requires a separate audio signal.

To get a separate audio signal, tap into pin 3 on the ASTEC RF modulator box. Run a piece of audio coax, with the shield grounded and the center conductor connected to pin 3 of the ASTEC, into the audio input of your monitor. If you don't have a provision for audio input on your monitor, buy Radio Shack's item #277-1008. This is a little speaker and amplifier (9V battery powered) all in one box for $11.95. Run the audio signal from pin 3 of the ASTEC into the box input and . . . voila! . . . sound!

Take Note

As with all modifications of the

CoCo, opening the case will void your warranty. Some kind Radio Shack repair people will still repair modified computers (though not under warranty) as long as the modification clearly is not what is causing the problem. Others insist on ripping out the modification before they do anything. They do have the right to refuse to service anything they consider to be too messed up.

I am assuming that you know your way around the inside of the Color Computer. For information on questions such as how to open your case and where to find the chips in question, I urge you to refer to the technical reference manual Radio Shack sells for $15 (cat. #26-3193) or to articles in this and other computer magazines.

Seven screws hold the case together. Once the case is opened, you can find the chips discussed in this article under the removable metal shield (the RF shield). The tech reference manual and my schematic should be adequate to guide you in constructing and installing this circuit.

Photo 3. Back of Computer Showing RCA Sockets

New CoCos and TDP 100s

Since I wrote this article, Tandy has introduced a new board for the Color Computer and also uses this board in the TDP 100. Apart from changes in layout, made primarily in an attempt to comply with FCC regulations, Tandy made several changes in the video output circuitry. The part numbers of all components are different too.

Although the MC 1372 chip now lies in a new location on the new board, it is even easier to find than it was on the old board. Tandy's engineers had to solder on a 56K resistor to the chip at the last minute, so look for that silly resistor soldered right to the pins. It is now called U6, not U12, and the VDG is now called U9, not U7.

The resistor was added when Tandy found that the artifact colors wouldn't show up in the RF signal due to a too-weak colorburst signal. The resistor bleeds a little extra VDG clock signal (colorburst) into the output of the video mixer, curing this problem.

An advantage new-board owners will immediately see is that their video-mixer chip is not covered by an RF shield. Thus, you have more freedom to construct a fancy plug-in adapter. When you take out the MC 1372 chip, don't worry about that resistor soldered to it: just leave it there. This circuit will work on a new board. If you have trouble that you think is related to circuit board changes, I would like to hear about them.

I will supply either the bare printed circuit board or the board and the necessary components. The board alone costs $10, and the board with components costs $15. You can purchase an assembled and tested unit for $35. Please include $1 for shipping. Order from Cheshire Cat Software, c/o Marty Goodman, 1529 Addison St., Berkeley, CA 94703. ■

Marty Goodman is a physician and an active electronics hobbyist.

✓ See List of Advertisers on page 138

BY JOHN STEINER

FILECHECK

Confused about what files are on your disk? This subroutine lets the CoCo keep track of file names.

Most programs leave file-name processing to the programmer. He must ensure that a file is on the disk and that a file does not already exist when specifying a new one, which could wipe out the old file.

I decided to program the computer to do this. My first step was to create ON ERROR GOTO routines via a block of error-handling codes. But this method replaced files with other files without warning. The Color Computer disk system manual had the answer on p. 62, the command DSKI$.

You can set DSKI$ to read any track or sector on the disk, including the directory files on track 17, sector 3. The manual includes a simple program that reads the directory and prints any file name with the extension /DAT.

I modified that program to include a subroutine that will read the directory and set a flag when a given file is found. The flag notifies you if the file you wish to read is not on the disk, or it notifies you that the file you are writing already exists, giving you the option to change the file name before it's too late.

The syntax of the statement is as follows:

DSKI$ dn, t, s, str1, str2

The order of variables expressed are drive number, track, sector, string 1, and string 2. DSKI$ returns two 128-byte strings that are placed in the variables for strings 1 and 2. By stepping through track and sector numbers in FOR...NEXT loops, you can read anything on the disk. There is also a DSKO$ command that writes two

Program Listing 1

```
10 ' RANDOM ACCESS MAILING LIST
20 ' JOHN STEINER JUNE 28, 1982
30 CLEAR1000
40 KB$="T50;AB"
50 REM RANDOM ACCESS DISK FILE
60 REM INPUT MODULE
70 INPUT "FILE NAME";F$
80 IF LEN(F$)<1 OR LEN(F$)>8 THEN PRINT "IMPROPER FILE SPEC":GOT
O 70
90 GOSUB1000
100 IF FT>0 THEN PRINT"THIS FILESPEC IS ALREADY IN USE":PRINT"DO
 YOU WISH TO WRITE OVER THE FILE (Y/N)?":ELSE140
110 FW$=INKEY$:IFFW$=""THEN110
120 IFFW$="Y"ORFW$="y"THEN140
130 GOTO70
140 OPEN "D",#1,F$,67
150 FIELD #1,20 AS NF$,20 AS AF$, 15 AS CF$, 2 AS SF$, 10 AS ZF$
160 CLS
170 REM GET NAME
180 PRINT "ENTER "CHR$(34)"END"CHR$(34)" TO QUIT"
190 INPUT "ENTER NAME";N$
200 IF N$="END" OR N$="end" THEN 570
210 IF LEN(N$)>20 THEN PRINT "NAME TOO LONG":GOTO190
220 REM GET ADDRESS
230 INPUT "ENTER ADDRESS";A$
240 IF LEN(A$)>20 THEN PRINT "ADDRESS TOO LONG":GOTO 230
250 REM GET CITY
260 INPUT"ENTER CITY";C$
270 IF LEN(C$)>15 THEN PRINT "CITY NAME IS TOO LONG":GOTO 260
280 REM GET STATE
290 INPUT "ENTER STATE CODE";S$
300 IF LEN(S$)<>2 THEN PRINT "ENTER AS ONLY 2 DIGIT CODE":GOTO 2
90
310 REM GET ZIP CODE
```

Listing continued

System Requirements

16K RAM
Extended Color Basic
Radio Shack Disk Controller
1 Disk Drive

128-byte strings to the disk.

Experiment carefully with that command, however, since information written on the disk in this manner is not recorded in the directory. If you write incorrect information to track 17, you can destroy the allocation table or disk directory, making further access to the disk difficult or impossible.

The subroutine that reads the disk directory starts at line 1000 in both programs. The disk directory is located at track 17, sectors 3 to 11. I used a simple loop to increment the sector, while INSTR does a string-compare looking for your file name (lines 1050 and 1070).

INSTR is a powerful string function that compares the two strings specified in the argument. In the subroutine, F$ is the file name you are looking for, and X$ and Y$ contain directory information from DSKI$. INSTR returns a number to variable F in our routine. This number indicates the position of the target string within the string being searched. If it is not found, INSTR returns a zero.

Line 1080 checks through the loop and sets flag FT if a directory listing is found. After searching through the file, line 1100 tells you if FT is still zero. The routine is fast and accurate, but you

Listing continued

```
320 INPUT"ENTER ZIP CODE";Z$
330 IF LEN(Z$)<>5 AND LEN(Z$)<>10 THEN PRINT "ENTER 5 OR 10 DIGI
T CODE":GOTO 320
340 REM PRINT LABEL
350 CLS
360 PRINT@64,"YOU ENTERED:"
370 PRINT N$
380 PRINT A$
390 PRINT C$
400 PRINT S$
410 PRINT Z$
420 INPUT "ARE THERE ANY CORRECTIONS <Y/N>";CO$
430 IF CO$="Y" OR CO$= "y" THEN 160
440 IF CO$="N" OR CO$="n" GOSUB 470
450 GOTO 160
460 REM SAVE FILE
470 CLS
480 I=I+1
490 PRINT@224, "WRITING FILE"
500 LSET NF$=N$
510 LSET AF$=A$
520 LSET CF$=C$
530 LSET SF$=S$
540 LSET ZF$=Z$
550 PUT #1,I
560 RETURN
570 CLOSE #1
580 END
1000 REM  SUBROUTINE TO FIND FILE ON DIRECTORY
1010 FT=0
1020 PRINT:PRINT"ONE MOMENT PLEASE":PLAY KB$
1030 FORX=3TO11
1040 DSKI$ 0,17,X,Y$,Z$
1050 F=INSTR(Z$,F$)
1060 IF F>0 THEN FT=FT+1
1070 F=INSTR(Y$,F$)
1080 IF F>0THEN FT=FT+1
1090 NEXT
1100 IFFT=0THENPRINT F$;" IS NOT IN THE DIRECTORY"
1110 F=0:Y$="":Z$="":RETURN
```


See List of Advertisers on page 138

must specify the file name correctly.

As written, the program allows for no specified extensions. This was deliberate, as I usually let Basic use the standard extensions of BIN, BAS, and DAT. Using this method saves me the hassle of modifying my file name string to check for extensions, and keeps me from specifying a text file name that is the same as a program file name.

The two program listings comprise a simple random-access mailing-list utility. The routines work well, and need only a simple file-edit program to make them complete.

Program Listing 1 creates a list by prompting for the name, address, city, state, and zip code. The code that interfaces with the subroutine is located in lines 70–130. Line 70 gets the file name, and line 80 checks it for correct length. If the length is less than eight characters, it is padded to eight characters with spaces. This is done so that a string-compare will check all eight characters.

If no spaces were added, flag FT is set if a file called FILESPEC is found when you specify the file called FILE. A GOSUB 1000 executes the subroutine, and if the file name is found, upon return, line 110 is true. At that point, the program notifies you of the duplicate file name and gives you the chance to change your file name.

The file is opened and names can be entered into the records. Each record is written directly to the disk as soon as the data is verified. This means that the file is open at all times during program execution.

Typing END closes the file, and ends the program. Be sure to always exit the program in this manner; merely punching the break key will not close the file.

The file-print routine in Program Listing 2 prints your mailing list. A file name is specified at line 110. If you enter DIR at this time, you will get the directory, and be able to enter a file name again. Line 140 checks for proper file-name length, and 150 pads the file name with spaces. After returning from the subroutine, an FT check is done in line 170.

A message tells you if the subroutine did not find the file specified, and you can return to line 120 to reenter the file name. Since the file does exist, it is opened, fielded, and printed.

The print statements in lines 240–270 use the variable PR in a PRINT# statement. If PR is −2, the list prints out. If PR is 0, the list prints on the screen. Lines 70 and 80 set PR. This saves duplicating print statements for screen and printer.

You can search and specify file names using the extension. Some string manipulation is necessary. The directory sectors list files in the following manner:

```
FILE1 BASFILE2 BASTHIRDFILBIN
FILEFOURDAT
```

The file names are listed end to end with extensions added. Names with fewer than eight characters are padded with spaces before the extension is added. As a result, you cannot use the normal convention of FILENAME/DAT, or FILENAME.DAT because the string-compare would always be false since the period and slash are not included in the directory. Overcome this by using two input statements, such as:

```
INPUT "FILENAME";A$
INPUT "EXTENSION";B$
F$ = A$ + B$
```

After checking for the file name, you must reconstruct it with an extension limiter:

```
F$ = A$ + "/" + B$
```

Then you can open the file, and continue.

The subroutine is easy to use in any of your programs. Enter the routine at line 1000; renumber it so it is well above your highest line numbers, and CSAVE it in ASCII format. You can then easily merge it with any of your file programs using the Color Computer's MERGE command.

If you have any problems or questions, send me a self-addressed, stamped envelope. ■

```
10 ' RANDOM ACCESS LIST PRINTER
20 ' JOHN STEINER JUNE 28, 1982
30 CLEAR1000
40 KB$="T50;AB"
50 PRINT"THIS PROGRAM READS RANDOM ACCESS FILES AND PRINTS A MAI
LING LIST"
60 PRINT"YOU MAY PRINT THE LIST TO SCREEN OR PRINTER"
70 PRINT"ENTER P FOR PRINTER, OR PRESS ANY KEY"
80 P$=INKEY$:IFP$=""THEN80
90 IF P$="P" OR P$="p" THEN PR=-2 ELSE PR=0
100 IF PR THEN PRINT"BE SURE TO TURN PRINTER ON":PLAY KB$:FOR I=
1 TO 1000:NEXT
110 REM INPUT MODULE
120 INPUT "FILE NAME";F$
130 IF F$="DIR" THEN !:GOTO120
140 IF LEN(F$)<1 OR LEN(F$)>8 THEN PRINT "IMPROPER FILE SPEC":GO
TO 120
150 IF LEN(F$)<8 THEN F$=F$+" ":GOTO 150
160 GOSUB 1000
170 IF FT=0 THEN PRINT"FILESPEC DOES NOT EXIST":PRINT"ON THIS DI
SK":PRINT"PLEASE REENTER":GOTO 120
180 OPEN "D",#1,F$,67
190 FIELD #1,20 AS NF$,20 AS AF$, 15 AS CF$, 2 AS SF$, 10 AS ZF$
200 CLS
210 R=R+1
220 GET #1,R
230 PRINT @224,"RECORD"R":"
240 PRINT # PR, NF$
250 PRINT #PR, AF$
260 PRINT #PR, CF$;" ";SF$;" ";ZF$
270 PRINT#PR,"":PRINT#PR,""
280 IF PR=0 THEN GOSUB330
290 IF LOF(1) <> R THEN 210
300 CLOSE #1
310 PRINT "END OF FILE"
320 END
330 PRINT@448,"PRESS ANY KEY TO CONTINUE..."
340 A$=INKEY$ : IF A$="" THEN 340
350 RETURN
1000 REM  SUBROUTINE TO FIND FILE ON DIRECTORY
1010 FT=0
1020 PRINT:PRINT"ONE MOMENT PLEASE":PLAY KB$
1030 FORX=3TO11
1040 DSKI$ 0,17,X,Y$,Z$
1050 F=INSTR(Z$,F$)
1060 IF F>0 THEN FT=FT+1
1070 F=INSTR(Y$,F$)
1080 IF F>0THEN FT=FT+1
1090 NEXT
1100 IFFT=0THENPRINT F$;" IS NOT IN THE DIRECTORY"
1110 F=0:Y$="":Z$="":RETURN
```

Program Listing 2

John Steiner can be reached at 508 4th Ave. N.W., Riverside, ND 58078.

YOU CAN MAKE A FORTUNE IN MICROS!

THE MICRO COMPUTER BUSINESS WILL GROW FROM $10 TO $100 BILLION IN THE NEXT EIGHT YEARS! ARE YOU READY TO CASH IN?

The **micro computer business** is predicted to grow from its present $10 billion to **$100 billion** before 1990! Imagine the possibilities this opens for you! No matter where you live, if you're starting up or presently in business, **no other industry offers you more opportunities!**

Now, finally, all the inside information you need to secure a prosperous future in this dynamic industry is available in **one place - THE COMPUTER ENTREPRENEUR MANUAL!** – An **immense** information source, compiled by our **inquisitive** research team, aided by a panel of **experts** and **business people** from **all areas** of the **computer industry!**

We present the inside story of **more than 100 lucrative computer businesses you can enter,** where you'll find the **real opportunities** for the eighties: from one man operations like **Programming Author, Word Processing Center** or **Consulting,** to **Systems House, Service Bureau, Computer Store etc!** Many at little or no investment! All the invaluable facts and figures: **How to start, Capital needs, Profit estimates and Margins, How to Sell and Market, How missing** technical or business experience **need not stand in your way, Source of Suppliers, etc!** Details that could take **years** to find out on your own!

We'll show you **inside tricks,** like how to **never again pay retail** for computer products and consumer electronics, **even for one item - right now,** while you're starting your business! How to get **free merchandise** and trade show **invitations, etc. This alone** will **more than pay** for the **manual!** You'll read **actual case histories** of other computer entrepreneurs, so you can **learn** from **their mistakes,** and **profit** from their **success stories! Where** you'll be **one year** from now depends on **your actions today!** Let us **show you how** to take the **first crucial steps!**

Order now and take **advantage** of our **limited introduction special, THE COMPUTER ENTREPRENEUR MANUAL,** and a **six month subscription to THE COMPUTER ENTREPRENEUR REPORT/NEWSLETTER** (so you're **always up-to-date** with the industry), **both** for **only $29.95! You must** be **convinced** on **how easy** you can **strike it rich** in the micro computer business - or you may **return** the manual for **a full refund** within thirty days! **USE OUR TOLL FREE NUMBER TO ORDER!**

EVERYTHING YOU NEED TO KNOW TO SUCCEED IN THE COMPUTER BUSINESS IS ALL IN THIS MANUAL!

THE COMPUTER ENTREPRENEUR MANUAL has the **answers** to **all your questions** about **selecting, starting** and **succesfully running a computer business!** There has **never** been such a **comprehensive collection** of **know-how** and **information** about this business **in one place! All the facts you need** to **plan** and **acheive your goals** in **easy-to-follow, step-by-step instructions!**

These are some of the **100-plus businesses** covered in **PART ONE** of the manual, with the facts on **How to start and run, Start-up Cost (Even** how to operate **on a shoestring),** What **profits to expect, Wholesale prices, Mark-ups, Suppliers, future outlook, case histories** for **each, etc:**

Systems House, Software Author (who to sell to and who to avoid), **Service Bureau, Software Publisher** (How to find programs that sell. **Word Processing Service, Consulting** and **Consultant Broker** (use your skills or those of others, **make $150 - $1000 a day!), The incredible Games Business, Computer Store** (Franchises: Pro and Contra, or a low inventory store **in your home!), OEM, Hardware Mfg, Data base** and **Teletext Service (big prospects!), Used Computers, Repairs, Rent-A-Computer, Promote Fests** and **Trade Shows, Turnkey Systems, Bartering, Mail Order, Compile and rent mailing lists, Specialized Data Headhunting** and **Temp Help Service, Tech Writer Shop, Custom Engineering,** The **highly profitable Seminars** and **Training Business , and many more!**

Many **new ideas** and **ground floor opportunities! Interviews** and **success stories** on **companies** of **all sizes! Privy info on the profits made:** How some **computer store** operators **net** $100 - $250,000! Little known outfits that made their owners **millionaires,** one of these low-key companies, making simple boards, went from **nil** to $20,000,000 and **100 employees** in **four years!** Programmers that make $300,000. **Thousands** of **micro millionaires** in the making, etc!

Whatever your goal is - **Silicon Valley Tycoon,** or just a **business at home - we guarantee** you'll find a **business** to **suit you - or your money back!**

PART TWO of the manual is **loaded** with the **know-how** and **"streetfighting" savvy** you need, both as a **novice** or business **veteran,** to get started, to stay and to **prosper** in the micro computer business! **A goldmine of information** in clear and easy-to-use instructions: How to prepare your **Business Plan, Outside financing,** The **mistakes** you **must avoid,** How to **hire** and **manage employees, Incorporation** (when, and how to do it **cheaply**), **Surviving bad times, Record Keeping,** how to **estimate your market before you start,** Use **multiple locations** to **maximize profits,** how to **promote** and **stay** steps **ahead of the competition!** How to get **free advertising, free merchandise, free advice, Power negotiating** with suppliers to **double** your **profit margins, etc!** Even how to **keep a present job while starting a business part time!**

Don't miss this opportunity to be part of this **great industry - the next success story** could be **your own! Order the manual today!** Part one and two, bound in **a deluxe ring binder,** where you can also **collect our newsletter (free for six months with the manual - a $32.50 value!) - all for only $29.95!**

THE COMPUTER ENTREPRENEUR NEWSLETTER – ALL THE LATEST INSIDE BUSINESS NEWS! NOW! SIX MONTHS FREE WITH YOUR MANUAL!

You're **always attuned** to the industry, and **your manual kept up-to-date,** with our **newsletter!** Each issue has the **latest business news, ideas, new suppliers,** our **indispensible "watchdog" column** on **profits, discounts** (don't miss mfg's promos, like recently, when top video monitor sold at $80 - that's half wholesale, **one third of the retail price!), the competition, the big deals, etc! Feature stories** with start-up info and case histories **on new micro businesses!**

You'll get **invitations** to trade shows and conventions, the **usage** of our **advisory service** and our **discount buying service** for your purchases!

You'll find **many items** in our newsletter that will **save you the cost of your manual many times over!**

CALL TOLL FREE!
CHARGE IT!
Credit Card Orders
(MC, VISA only)
accepted 24 hours/day
1-800-227-3800
Ask for extension 1135
In California call
1-800-792-0990

MasterCard VISA

Order by phone (Credit cards only), or use the coupon:

✓549

Mail to **THE COMPUTER ENTREPRENEUR PUBLISHING CO. PO BOX 456, Grand Central Station, New York, N.Y. 10163**

Please send me **THE COMPUTER ENTREPRENEUR MANUAL,** and the **six month free subscription** to **THE COMPUTER ENTREPRENEUR REPORT/NEWSLETTER. All for only $29.95,** plus $3 for postage/handling (**NY residents:** add $2.64 for sales tax). If I decide not to keep the manual, I may **return** it **within 30 days** for **a full refund.**

NAME: _____

ADDRESS: _____

CITY, STATE, ZIP: _____

☐ **Check or M.O. enclosed** **Charge to** ☐ **VISA** ☐ **MC**

CARD# _____

Exp. Date: _____

SIGNATURE: _____

HC0783

BY RICHARD ESPOSITO
& RAYMOND W. ROWE

64K MODIFICATION

The 32K Color Computer has always compared favorably to the Apple II, at least in terms of price, its 6809 microprocessor, and its use of Extended Color Basic. In the past, however, the Apple II had the edge in RAM size and software availability.

Now all that has changed. With the 64K modification described in this article and the availability of the FLEX operating system, which allows a plethora of software to run on the CoCo, the Color Computer has outdistanced the Apple II.

When you add the larger high-resolution display options now available for the CoCo, you have an even more impressive machine.

You can bring your Color Computer up to its full potential by adding memory chips yourself.

Identifying Your Board

To find out which board your computer has, look at the lower right side of the board, where there is a series of numbers followed by a letter. This letter indicates which board you have.

If you have a D board, the list of parts needed for the 64K modification is surprisingly short. (See Table 1.) If you have experience working with printed circuit (PC) boards, this modification will cost less than $100—and even less if you already have the 1.1 ROM.

If you have an E board, all you need is some wire. If your board has no letter following the number, it is an F board. Computers that have F boards do not have a black border surrounding the keyboard. All TDP-100s use the F board.

If you have an F board, your job is easy. If you have a 32K F, all you need is the software to get 64K. If you have 16K F, remove capacitors C58, C60, C62, C64, C66, C68, C70, and C72. Replace your 16K chips with 4164s and set the jumpers to the 64K position. You must add one jumper to the board, but the position requiring the jumper is clearly marked 64K.

Converting D Boards

The first step in this 64K modification is to upgrade all older D boards to E status. Unplug the machine, turn it upside down, and loosen the five screws holding the case together. The fifth screw is under the black warranty label. Place a piece of masking tape over each hole with the screw still in it so it will not fall out.

With the computer rightside up, remove the top cover. Unplug the keyboard and put it aside. After clipping the two plastic cable ties, remove the metal shield covering the section of the board that contains the central processing unit (MC6809), synchronous address multiplexor (MC6883 SAM), two peripheral interface adapters (MC6821 PIAs), video display generator (MC6847 VDG), and memory.

Disconnect the power supply from the PC board. It has five plug-in leads. Remove the 10 #6 ½-inch Phillips-head screws that hold the PC board. After you remove the screws, pop the 16 metal fasteners that protrude through the board.

At this point, with the board removed from the base, perform the following steps:

1. Remove the eight dynamic RAM chips. They are labeled U20–U27 on the board. The RAM chips are 4027s if you have a 4K machine or 4116s if you have a 16K machine. If you performed my piggyback modification (*80 Micro*, March 1982, p. 126), also remove the wire from pin 35 of the SAM chip.
2. Remove the 6883 SAM chip U10 with care. This chip is highly susceptible to static discharge.
3. Turn the PC board over so that you are looking at the foil side. Refer to Fig. 1 and cut the following lands:
   - the −5 volt land at "A"
   - the +5 volt land at "B"
   - the +12 volt land at "C."

   Make these cuts cleanly and about 1/16-inch wide. Use a high-quality cutting tool, such as an Exacto knife with a #11 blade.
4. Remove a portion of the green film at point D to expose the lands for soldering.

- 1.1 Color Basic ROM (RS #AXX3052)—I paid $36.30 at my local Radio Shack store. To find out if your computer already has this part, type EXEC 41175. If your computer displays Color Basic 1.1, you have it. If it displays Color Basic 1.0, you do not.
- eight 64K dynamic RAMs (I used NEC 4164s)
- one 33-ohm, 1/4-watt, 10-percent resistor
- a 12-inch length of 30-gauge wire-wrap wire
- a 6-inch length of insulated AWG 26- or 28-gauge wire
- a small piece of spaghetti insulation or electrical tape

Table 1. Parts List for the 64K Modification

System Requirements

16K RAM
Color Basic

- COMPUTER SHACK -

COLOR GRAPHICS EDITOR by Soft Sector

Color Graphics Editor (CGE) is a machine language program that any person who does any programming on the COCO must have. It is a tremendous time saver. It makes doing graphics fun. CGE is designed to make writing high resolution graphics programs for the COCO much easier and faster. It allows you to create on the screen high resolution graphics, such as game characters. Then you can copy the numbers that generate the characters into the data area of your program. If you have a disk system, CGE allows you to save the numbers directly to a file in the form of FDB statements or in a basic data statement. The FDB statements can be loaded directly into an editor/assembler. It comes on Cassette but loads to disk easily.
Only **$19.95**

INVOICE SYSTEM

New program that keeps a file of your customers. Then you can print a new invoice with each purchase. Prints on NEBS forms or will print its own form on plain paper..... **$39.95**

BILLING SYSTEM

MOD. I OR III, 48k DISK..... **$39.00**
A billing system written by a businessman for his own use. It is simple, fast and easy to use. Has a screen editor for quick error correction. Prints out invoices, then will send a monthly bill to each customer. It will add interest or carrying charges. This is not a complicated accounts receivable it is a simple but effective way to keep track of who owe's you money. For the company the doesn't do alot of credit business.

TELEWRITER - 64

Best word processor for the Color Computer.
Tape..... **$49.95** Disk..... **$59.95**

DRAGONQUEST

A new text adventure by Charles Forsythe. You must rescue the princess from the Smaaegor Monarch of Dragonfolk. All Machine language. Fast, Exciting and only **$15.95**

MADNESS AND THE MINOTAUR

A classic adventure game utilizing two word commands.
Price..... **$19.95**

BUGOUT

A compact but very powerful monitor for the 6809 microprocessor.
Only..... **$19.95**

MISADVENTURE SERIES

MAOAM ROSA'S MASSAGE PARLOR

Tape **$15.00**

WET T-SHIRT CONTEST

Tape **$15.00**

COMPUTER SHACK'S BOOK STORE

NEW! NEW!

ASSEMBLY LANGUAGE GRAPHICS FOR THE TRS-80 COLOR COMPUTER

By Don Inman **$14.95**

Written specifically for the TRS-80 Color Computer, this book uses sound and graphics to show how 6809 assembly language can be used to perform tasks that would be difficult or impossible with BASIC. All of the explanations are hands-on, so that the manual can serve as a tutorial. Included are video screen displays which explain each step of the process of creating graphics. 288 pages.

PROGRAMMING THE 6809

By Rodney Zaks & William Labiak **$14.95**

This book explains how to program the 6809 in assembly language, covering all aspects progressively and systematically. Beginning with the basics of programming, **Programming the 6809** goes on to explain registers and buses, subroutines, the 6809 instruction set, addressing modes, I/O techniques and devices, and finally, data structures. With this knowledge you will be able to give your 6809 processor 16-bit performance with 8-bit economy. No prior programming knowlede is required.

TRS-80 COLOR PROGRAMS

by Tom Rugg and Phil Feldman **$19.95**

Here are 37 fully documented programs ready to type into your color computer. These programs promise to be educational, practical, and in almost all cases, fun. 332 pages.

TRS-80 COLOR COMPUTER GRAPHICS

by Don Inman **$14.95**

Explore the creative and imaginative blending of computers and color using Color Computer Graphics. This book will enable you to explore all the graphics capabilities of Extended Basic. you will learn how to create interesting graphics to enhance you own computer programs. The book also provides application programs and useful subroutines. 303 pages

COLOR COMPUTER SONGBOOK

by Ron Clark **$7.95**

40 of the world's best known songs, scored for easy playing on the TRS-80 Color Computer, including many favorite popular, classical, folk and seasonal musical selections. Some of which include Dixie, Minuet, Greensleeves, Jingle Bells, Yellow Rose of Texas, etc. 96 pages

COMPUTER SHACK

1691 Eason ● Pontiac, Michigan 48054
Info: **(313) 673-8700** ● Orders: **CALL TOLL FREE (800) 392-8881**
Master Charge and VISA OK. Please add $3.00 for shipping in the U.S.A. $5.00 for Canada or Mexico. Proper postage outside of U.S., Canada, Mexico.
Dealers: We are distributors for all items in this ad. Write for our catalog and price list.

109

See List of Advertisers on page 138

Use a 60-watt or less soldering iron and preferably a small-diameter 60 or 40 rosin-core solder for all solder connections. Solder a small wire jumper at point D. We used approximately 1/4 inch of wire from the lead of a 1/4-watt resistor. Any solid conductor wire of about the same diameter would suffice. This connects the +5 volts to the old +12-volt line, which will provide the 64K RAM chips with +5 volts to their pins 8.

5. Turn the PC board to the component side. Locate capacitors C48, C70, C45, C67, C35, C64, C61, and C31. Using a soldering iron, carefully remove these capacitors.

6. On the component side of the PC board, locate the area above capacitor C75 to the right of pin 26 on the MC6883 SAM socket and below the screw hole. After you find this area, hold the PC board up to a light and mark a dot in the center, being careful not to mark over a land. Drill a small hole just large enough to pass an insulated wire size AWG 26 or AWG 28.

7. Prepare the 33-ohm resistor in the following manner:

- Cut one lead to 3/8 inch and solder about 6 inches of insulated wire to it. Cover the solder joint with spaghetti insulation or electrical tape.
- Bend the other lead at a 90-degree angle and put it into the hole previously occupied by capacitor C48. This is the hole closest to the bottom edge of the board.
- Solder the resistor in place.
- Route the insulated wire through the previously drilled hole to the foil side of the PC board. Route this wire to the land that connects to pin 35 of the MC6883 SAM socket.
- Cut the wire to length and remove approximately 1/8 inch of insulation from the end.
- Very carefully solder the stripped-wire end to the land of MC6883 pin 35. This now connects pins 9 of the 4164s to address line A7.

8. Check all connections, cuts, and other work to ensure that no solder bridges or metal fragments remain to short the lands.

9. On the top of the board, remove the 4 or 16K jumper that lies between the two MC6821 PIAs U4 and U8.

10. Wire-wrap a length of 30-gauge wire to the center post and connect the other end of the wire to pin 17 of PIA U8.

11. Remove the 1.0 ROM (labeled SCM91264, Tandy Corp. 80) and replace it with a new 1.1 ROM if needed.

12. If it is not already set, place the other 4 or 16K jumper into the 16K position.

13. Install the new 64K RAM chips and replace the SAM chip. Be sure to line up the notches in the sockets with the notches on the chips.

With this, the conversion to an E board is complete.

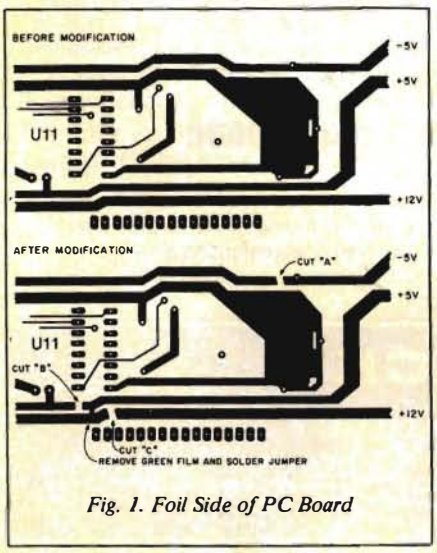


Fig. 1. Foil Side of PC Board

Installing E Boards

If you already have an E board with 32K, start with the next paragraph. If you have an E board with 4K or 16K, replace the RAMs with 4164s, then set all six jumpers for the 32K position. One jumper is to the right of U10 (the 6883 SAM chip), three are located just above the keyboard connector, and two are on either side of the 6821 PIA.

Remove capacitors C48, C70, C45, C67, C35, C64, C61, and C31. If it is not already there, add a jumper connecting the LOW and the unmarked center pins to the left of U8 (a 6821 PIA). You do not use the other pin marked HIGH. If two unconnected pins to the right of U10 (the 6883 SAM chip) are labeled R83, solder in place a 33-ohm, 1/4-watt, 10-percent resistor connecting the two pins. You now have what Radio Shack calls a 32K machine. For 64K machines, follow the instructions below.

Follow these steps to disable the ROMs during a write cycle. RAM will occupy the entire address space from $C000 to $FDFF. This will not affect the interrupt vectors because they reside in the protected area from $FF00 to $FFFF.

1. On the component side of the board, locate and remove the two ICs labeled U-11 and U-29. They should be a 74LS138 and a 74LS02.

2. To prepare the chips, carefully bend pins 4, 5, and 6 of the 74LS02 straight up. (Refer to Fig. 2.) Then bend pin 5 of the 74LS138 straight up. Solder a short piece of 30-gauge wire to pin 8 on the 74LS02. Solder this at the point where the pin enters the chip, because you must plug this pin back into the socket.

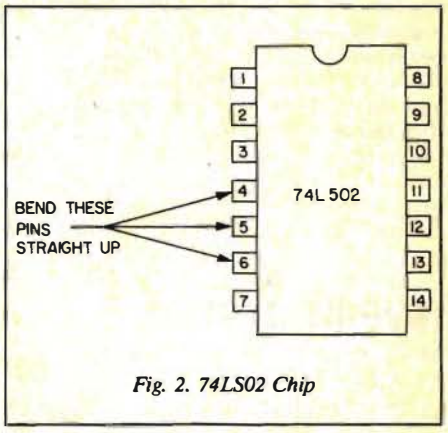


Fig. 2. 74LS02 Chip

Solder the other end of the wire to pin 6 of the same chip. At this point, replace the chips in their sockets. Solder a piece of 30-gauge wire from pin 5 of the 74LS138 to pin 4 of the 74LS02. Now locate TP1 and cut a length of 30-gauge wire to connect pin 5 of the 74LS02 to TP1. Solder one end of the wire to pin 5 and wire-wrap the other end to TP1.

Recheck your wiring and look for any shorts, especially between the 74LS02 and the shield. Then reassemble your machine.

This completes the hardware modifications. Turn on your computer and wait for the cursor and OK to come up. Then type PRINT MEM and hit enter. At this time, your computer should respond like a 32K machine.

64K Expansion

How do you get 64K? The Assembly-language Program Listing 1 will do the trick. The DNLDB loop copies Basic, Extended Basic, and your DOS into the lower 32K of RAM. It POKEs location $FFDF to program the SAM for memo-

```
        ORCC    #$50        INHIBIT INTERRUPTS
        LDX     #$8000
        LDY     #$2000
DNLDB   LDA     X+
        STA     Y+
        CMPY    #$8000
        BCS     DNLDB
        STA     FFDF
        LDX     #$2000
UPLDB   LDA     X+
        STA     Y+
        CMPX    #$8000
        BCS     UPLDB
        ANDC    #$AF        ENABLE INTERRUPTS
        RTS
```

Program Listing 1. 64K-Mod

ry map 1 (an all-RAM machine). The UPLDB loop copies Basic, Extended Basic, and your DOS back into their proper locations in RAM.

If you do not have Extended Basic or the DOS, this program will still work. Those of you without Extended Basic will have to change the hexadecimal in Program Listing 2 to decimal.

The program starts at $0E00 so that it will work with a tape or disk system.

```
10 FOR I = 3584 TO 3620
20 READ A$
30 POKE I,VAL("&H"+A$)
40 NEXT I
50 DATA 1A,50,8E,80,00,10,8E
60 DATA 20,00,A6,80,A7,A0,10
70 DATA 8C,80,00,25,F6,B7,FF
80 DATA DF,8E,20,00,A6,80,A7
90 DATA A0,8C,80,00,25,F7,1C
100 DATA AF,39
```

Program Listing 2

You do not need an assembler. Just run the Basic Program Listing 2 to put the code into memory. After running the Basic program, save Listing 1 to tape by typing:

```
CSAVEM "64K-MOD",3584,3619,3584
```

Now comes the big moment. Did you do it right? To find out, follow these steps:

1. Turn on the power to ensure a hard start.

2. Type CLEAR 200,8191 to ensure that you will not disturb the Basic pointers.

3. Load and EXEC Listing 1.

4. Type CLEAR 200,32767.

Using the PEEK and POKE commands, write a simple program to insert $AA into memory locations $E000 to $E00F and then print them to the screen after reading them.

Have you found an error in your Basic ROM? Would you like to customize Basic? Once the code is in RAM, it is patchable. Be sure to use a monitor program that does not use a part of the Basic code that you are patching.

Have you discovered an error in a program pack? If you tape over the cartridge-select pin, Listing 1 will put that code into RAM, and you can fix that, too. ■

Address correspondence to Richard Esposito, University of Baltimore, MD 21201.

See our other ad on page 389.

BY MARTIN H. GOODMAN

DEBUGGING DISK BASIC

I know of two moderately unpleasant bugs in Microsoft's Disk Extended Basic ROM for the Color Computer. The first manifests itself only at power up or after a cold start. The second surfaces only if you are using two or more disk drives other than Tandy's TEC drives that have a head-lift solenoid that you enable with the HS (head select) jumper on the drive.

The Head-Banger Bug

You may have noticed that just after power up or after a cold start, when you ask the disk to load a file, the drive will almost always make a very nasty rattling noise before loading the file. By an oversight in the Disk Basic, the software "thinks" that the head is at track 0 at power up. Actually, the head is usually not at track 0, but is wherever it was when you shut down the system. Often this is track 17 (directory track).

Because of this, when the software tries to go to track 17 to search for the file you asked the disk to load, it "thinks" it is starting at track 0 and runs off into the inner edge of the drive. It does recover after banging itself against a mechanical stop, but this banging is not good for the drive. The Teac owner's manual specifically cautions against using such software, although the drive is designed to accommodate such abuse. Still, it is most unfortunate that Microsoft built abusive access of a drive into its software.

System Requirements

Color Disk Basic
One Disk Drive

Perhaps you, too, have experienced problems with rattling disk drives and improper head settling.

The Head-Settle Bug

Sometimes the head-settle bug causes crashed disks, while at other times it results in bad data. It occurs unpredictably and at infrequent intervals.

The TEC drive that Tandy uses and the Tandon drive do not have solenoids that lift the head off the disk when it doesn't need to be there. Most other drives, such as Teac and MPI, do have a solenoid. The head-select solenoid lifts the heads of all drives in the system except the one that is being used at a given time, thereby decreasing wear on the heads and the disks. With a two-drive Tandy system, both heads are dragging on both disks every time you access one or the other.

Perhaps because the designers at Microsoft never thought about folks hooking up other drives to the controller, they failed to allow for an adequate settling time for the head when the software switches from one drive to another while the motors are running.

Whenever you access one drive, all the motors spin. Now, Microsoft's Disk Basic "thinks" that all the heads on all the drives are sitting on the media at all times. Therefore, in functions such as a BACKUP command, which repeatedly switches from using one drive to another, the software doesn't bother to wait for a head to descend onto the disk. Specifically, when you disassemble the code, you find that Microsoft allows less than one-tenth of a millisecond during the change from one drive to another, although a drive equipped with a solenoid requires 10 or more milliseconds for its head to settle.

This bug is very subtle and is seldom apparent to owners of two-drive, solenoid-equipped systems. It is only apparent if the owner has enabled the solenoid using the HS mode jumper. The reason for this is that the bug causes a problem only under these conditions: at the time of the switchover, the head is sitting on the track and sector for which the drive is looking; the motor is still running from a previous access to a different drive.

If this is not the case, the time spent finding the proper spot on the second drive will be enough for the head to settle in place. Thus, you could have a two-drive, solenoid-equipped system for quite a while before realizing that some of your back-ups and other disks that were written in the course of two-drive manipulations have errors on them.

What Is the Fix?

You can get around the head-banger bug by typing "EXEC &HDCCG" after power up and cold starts. This resets the head to track 0. The only convenient solution to bug 2 is to disable the HS jumper and enable the HM (head motor) jumper on solenoid-equipped drives. This tells the drives to keep all their heads down (as if the solenoids were not present) whenever any motor is spinning.

Some friends of mine implemented a hardware fix for bug 2, using a one-chip circuit added to the disk controller. This is a very delicate matter, however, and removes the option of having Tandy

service your controller board. If you are a good enough engineer to design such a circuit, you probably do not need Tandy to fix your stuff anyway.

Perhaps Tandy will take note of these problems and fix them in subsequent versions of the Disk Basic ROM. Merely running a fix in RAM is not a satisfactory solution because it precludes use of 64K-oriented software.

Tandy's View

I wrote to Tandy about these bugs. Their response follows. I hope it adequately presents their view to anyone deciding on buying non-Radio Shack disk drives:

We have not been experiencing excessive disk crashes, media wear, or drive failure based on what you've classified as "bugs" in Color Disk Basic. Therefore, no fixes are in the works for this ROM and these comments.

"Perhaps Tandy will take note of these problems and fix them in subsequent versions of the Disk Basic ROM."

The operating system is designed to operate the drives that are built to our approved specifications. The drives use a mechanical stepper motor unlike Tandon, which uses an electrical stepper motor. We cannot guarantee our operating system will support non-Color Disk Drives, not even Model I/III drives. The operating system is designed to operate at minimum time offering as fast an access as is possible. Unnecessarily slowing down read/write routines to support nonspec drives would result in slowing down spec drives also. This is something our customers have relayed to us.

Barry Thompson
Buyer—Color Computer ■

Address correspondence to Martin Goodman at 1529 Addison St., Berkeley, CA 94703.

ColorQuest™ GAMES

For The TRS-80 Color and TDP System 100

Fast Machine Code • Hi-res Color Graphics • Exciting Arcade Action and Sound

Fembots' Revenge™

3-D GRAPHIC ADVENTURE

Make love not war? Not with these sultry FEMBOTS! What a tale you'll tell IF you live to tell it! Cold steel never felt so HOT! The color and excitement of ARCADE ACTION combined with the sophistication, intellectual challenge and skill of an ADVENTURE GAME doesn't fully describe this cosmic shoot'em up.

16K Tape $29.95 **32K Disk $34.95**

MS. NIBBLER™

by Tom Czarnecki

The ONLY Ms. game around. A must for your PAC-like game collection.

16K Tape $19.95
16K Disk $24.95

TRS-80 is a trademark of Tandy Corp.

BEYOND THE CIMEEON MOON™

by Kevin Herrboldt & Tim Nelson

3-D GRAPHIC ADVENTURE

A dead star . . A derlict vessel . or is it? Trapped within you must venture the corridors; defend yourself against the merciless gauntlet of agents of the machine mind. A real-time, high-res, 3-D science fiction adventure game of mind-blowing magnitude.

16K Tape $24.95 **32K Disk $29.95**

Adventure Trilogy™

by Kevin Herrboldt & Tim Nelson

3-D GRAPHIC ADVENTURE

Clash steel with thy foe in the arena of gore. Proved worthy, go in guest of the elusive Eye of Dazmor. If ye findest the orb, hast ye the might to ward off skem and the fortitude to restore the Eye? The ultimate high-res, 3-D quest for even the most experienced adventurer!

16K Tape $24.95 **32K Disk $29.95**

For Orders ONLY Call Toll Free

1-800-328-2737

Fast Machine Code • Hi-res Color Graphics • Exciting Arcade Action and Sound

INTERCEPTOR™

by Scott Snyder

Goes beyond "DEFENDER" and "STARGATE" to offer the most realistic ARCADE simulation possible. Warp speed action, multi-colored terrain and long-range viewer make this game tops.

16K Tape $19.95
32K Disk $24.95

VEGAS GAMEPAK™

by Dan Nelson

Why fly to VEGAS when you can have a casino at home! The VEGAS GAMEPAK is five action packed games with great graphics & sound. SLOT MACHINE - BLACKJACK - UP AND DOWN THE RIVER - CRAPS & KENO.

16K Tape $19.95 16K Disk $24.95

THE NIBBLER™

by Tom Czarnecki

Fast paced maze chase game will entertain the entire family.

16K Tape $19.95
16K Disk $24.95

KOMET-KAZE™

by Tom Czarnecki

Shades of smartbombs and hurtling comets! Defending your planet from invasion was never so challenging. Disruptor fire is your main defense against the fierce alien attacks.

16K Tape $19.95 32K Disk $24.95

ColorQuest™

A Division of Softlaw Corp. 612/881-2777
9072 Lyndale Ave. So., Minneapolis, MN 55420

AUTHORS' SUBMISSIONS ARE ENCOURAGED

Available at Dealers everywhere.
If you Dealer is out of stock ORDER DIRECT!

ORDERING

Customer service and product support call (612) 881-2777
Make checks or money orders payable to Nelson Software Systems. Personal checks allow 3 weeks.
MAIL ORDERS: $2.00 U.S. Shipping ($4.00 CANADA $10 OVERSEAS) Add $2.00 for C.O.D.
ORDERS SHIPPED SAME DAY!

512

BY JAMES W. WOOD

ALIEN BOMBERS

Alien Bombers is a 4K Space Invader-type game that displays as many as eight colors on a black background, something for which Extended Color Basic isn't necessary. It uses high-speed string graphics for fast action. The game also features the use of a sound-making device that does not slow down the animation.

I borrowed my son's toy space gun for some of the audio effects (any 9-volt noise maker will do). Figure 1 shows the circuit used to switch the battery power on and off. Notice the red wire from one 9-volt battery snap is connected to the black wire from the other. This is necessary to maintain the correct polarity when the final connections are made. Photo 2 is the completed unit. Connections are made as in Photo 1.

You'll be surprised when you see this 4K arcade game, complete with sound effects and good action.

The commands MOTOR ON and MOTOR OFF switch the toy on and off. Now an alien ship can have a constant noise that will not slow down the action. You can eliminate MOTOR ON, MOTOR OFF, and the circuit with no loss of playability. There are also sounds for the laser from your base, for the ship being destroyed, and for the ship exploding.

Program Listing 1 is the 4K version of my game. Sorry about the long lines, but I had to conserve memory. See

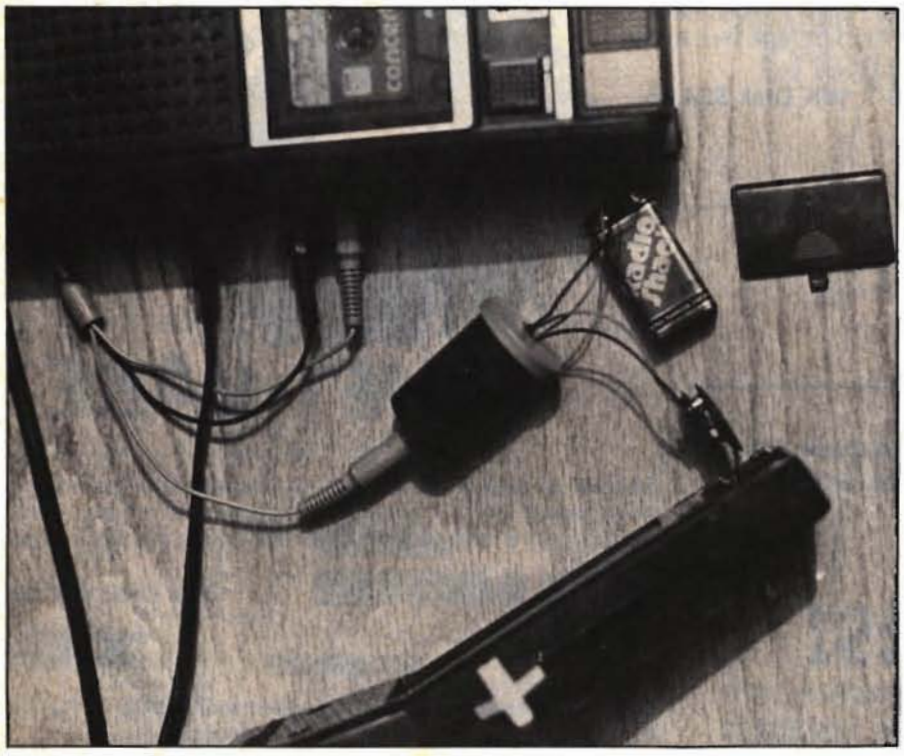


Photo 1. Connect the 1/8-inch plug from the "mic" connection on your recorder to the 1/8-inch jack. The battery fastens to one battery snap, the toy's battery connector attaches to the other.

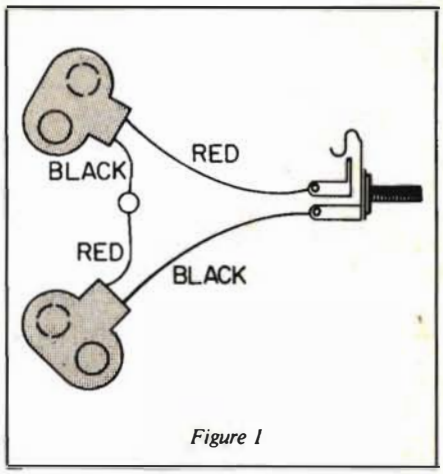


Figure 1

System Requirements

4K RAM
Color Basic
Any 9-volt noise maker (optional)

Table 1 for a line description of this program. If you want instructions, then you need Program Listing 2 recorded on your cassette tape also. It would be best to put Listing 2 before Listing 1 on the tape.

The game's purpose is to shoot the ships as they appear, using your movable base (Photo 3). If they are not

Photo 2. A simple circuit that allows one to borrow a toy, for computer games. Parts consist of two 9V battery snaps, a 1/8-inch jack, and a 35mm file container (improvise).

```
10 CLS:CLEAR160:FORX=1TO4:READU,V,W,UU,VV,WW:ST$(X)=CHR$(U)+CHR$
(V)+CHR$(W):SB$(X)=CHR$(UU)+CHR$(VV)+CHR$(WW):NEXTX:TH=20:NB=3:D
IMC$(15):FORA=1TO15:C$(A)=CHR$(176+A):NEXT:S$=CHR$(128):BL$=S$+S
$+S$+S$+S$
20 L1$=C$(2)+C$(7)+C$(2):L2$=C$(7)+C$(11):L3$=C$(7)+C$(11):L4$=C
$(7)+C$(7)+C$(2)+C$(7):G$=CHR$(191):B$=CHR$(159):B1$=G$+B$+G$+B$
+G$:B2$=G$+B$+B$+B$+G$:FORA=1TO31:R$=R$+CHR$(191):NEXT
30 FORX=1TO32:READU:L$(5)=L$(5)+C$(U):NEXTX
40 CLS0
50 FORA=1TO10:PRINT@RND(97),CHR$(193);:NEXT:B1=416+RND(25):TH=TH
+5:FORAS=416TO480STEP32:PRINT@AS,R$;:NEXTAS:PRINT@485,"BASES";:P
RINT@492,NB;
60 PRINT@357,L1$;:PRINT@368,L2$;:PRINT@372,L3$;:PRINT@379,L4$;:P
RINT@384,L$(5);
70 R3=RND(4):R1=RND(27):R2=RND(6):SD=0:MOTOR ON:IF TH>15 THEN TH
=TH-1:TT=0
80 SP=64+R2*32+R1
90 PRINT@B1,B1$;:PRINT@B1+32,B2$;:PRINT@500,TS;
100 IF SD=0 THENPRINT@SP,ST$(R3);:PRINT@SP+32,SB$(R3);
110 IFPEEK(345)=247 THENS1=PEEK(B1+994):S2=PEEK(B1+962):FORF=B1+
1026TOB1+706STEP-32:POKEF,255:NEXTF:POKEB1+994,S1:POKEB1+962,S2:
POKEB1+1026,191:SOUND150,1:FORF=B1+930TOB1+706STEP-32:POKEF,128:
NEXTF:GOTO130
120 GOTO140
130 IFSD=0ANDINT((B1-SP+1)/32)-(B1-SP+1)/32=0THENMOTOROFF:FORXX=
1TO3:EP$(1)="":EP$(2)="":FORX=1TO2:FORY=1TO3:EP$(X)=EP$(X)+CHR$(
128+RND(127)):NEXTY,X:PRINT@SP,EP$(1);:PRINT@SP+32,EP$(2);:SOUND
30,1:NEXTXX:PRINT@SP-1,BL$;:PRINT@SP+31,BL$;:TS=TS+10*R3:SD=1
140 IFPEEK(343)=247THENB1=B1-1:IFB1<416THENB1=416
150 IFPEEK(344)=247THENB1=B1+1:IFB1>442THENB1=442
160 IFSD=1 THEN IF RND(10)=1 THENGOTO70 ELSE GOTO 90
170 TT=TT+1:IFTT>TH THEN FOR X=8TO0 STEP-1:CLSX:SOUND200,1:NEXTX
:NB=NB-1:IFNB=0THENGOTO200ELSEGOTO50
180 IFTT+5>TH THENPRINT@SP+65,CHR$(239);
190 GOTO90
200 CLS:PRINT@235,"FINAL SCORE";TS:MOTOR OFF:FORTI=1TO500:NEXTTI
:NB=3:TH=20:TS=0:GOTO40
210 DATA171,175,167,168,172,164,173,163,174,160,172,160,173,163,
174,168,172,164,174,175,173,160,172,160
220 DATA11,2,0,1,15,15,15,15,11,7,2,1,7,11,1,1,7,15,15,11,7,15,1
5,11,2,7,7,15,15,15,15,15
```

Program Listing

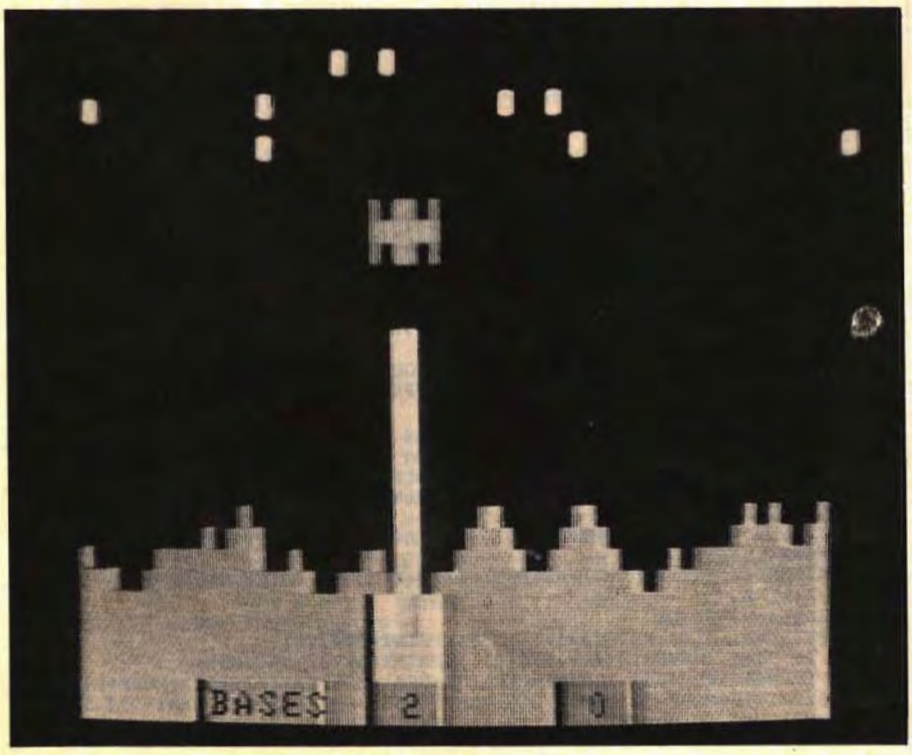


Photo 3. Alien Bomber's Movable Base.

See List of Advertisers on page 138

10	sets up string graphics for four types of alien ships, sets time before ship explodes, number of bases, reads landscape graphics, sets up string to erase blown-up ship
20	sets up string graphics for landscape and player's base
30	more landscape
40	blanks out screen to start game
50	prints stars, positions base, prints landscape
60	prints more landscape
70	determines random position of random-type ship
80	calculates ship's position
90	prints player's base
100	prints alien ship
110	fires laser
130	determines if alien was hit, graphics display, totals score
140–150	determine if left or right arrow pressed
160	develops random time pause between ships
170	graphic explosion of base
180	ship lowers bomb when time almost out
200	prints final score, pauses, sets up new game

Table I. Line Description for Program Listing 2

```
0 FORX=1TO4:READU,V,W,UU,VV,WW:ST$(X)=CHR$(U)+CHR$(V)+CHR$(W):SB
$(X)=CHR$(UU)+CHR$(VV)+CHR$(WW):NEXTX
8 CLS0:PRINT@34,ST$(1);:PRINT@66,SB$(1);:PRINT@41,ST$(2);:PRINT@
73,SB$(2);:PRINT@48,ST$(3);:PRINT@80,SB$(3);:PRINT@55,ST$(4);:PR
INT@87,SB$(4);:PRINT@130,"10";:PRINT@137,"20";:PRINT@144,"30";:P
RINT@151,"40";
9 PRINT@192,"MOVE BASE WITH LEFT+RIGHT ARROWS";:PRINT@262,"FIRE
WITH SPACE BAR";:PRINT@321,"HIT SHIPS BEFORE BOMBS EXPLODE";:PRI
NT@416,"LOAD GAME";
210 DATA171,175,167,168,172,164,173,163,174,160,172,160,173,163,
174,168,172,164,174,175,173,160,172,160
```

Program Listing 2

Program Listing 3

```
1 'JAMES W. WOOD, 424 N. MISSOURI,ATWOOD, IL, 61913
5 CLEAR200,16128:FORX=16128TO16142:READZ:POKEX,Z:NEXTX:DEF USR0=
16128:P$="L64O1AFBA"
10 CLS:FORX=1TO4:READU,V,W,UU,VV,WW:ST$(X)=CHR$(U)+CHR$(V)+CHR$(
W):SB$(X)=CHR$(UU)+CHR$(VV)+CHR$(WW):ET$(X)=CHR$(U+48)+CHR$(V+48
)+CHR$(W+48):EB$(X)=CHR$(UU+48)+CHR$(VV+48)+CHR$(WW+48):NEXTX:TH
=20:NB=3
15 CLS2:DIMC$(15):FORA=1TO15:C$(A)=CHR$(176+A):NEXT:S$=CHR$(128)
:BL$=S$+S$+S$+S$+S$+S$
20 CLS3:L1$=C$(2)+C$(7)+C$(2):L2$=C$(7)+C$(11):L3$=C$(7)+C$(11):
L4$=C$(7)+C$(7)+C$(2)+C$(7):G$=CHR$(191):B$=CHR$(159):B1$=G$+B$+
G$+B$+G$:B2$=G$+B$+B$+B$+G$:CLS7:FORA=1TO31:R$=R$+CHR$(191):NEXT
30 CLS4:FORX=1TO32:READU:L$(5)=L$(5)+C$(U):NEXTX
35 CLS0:PRINT@34,ST$(1);:PRINT@66,SB$(1);:PRINT@41,ST$(2);:PRINT
@73,SB$(2);:PRINT@48,ST$(3);:PRINT@80,SB$(3);:PRINT@55,ST$(4);:P
RINT@87,SB$(4);:PRINT@130,"10";:PRINT@137,"20";:PRINT@144,"30";:
PRINT@151,"40";
36 PRINT@192,"MOVE BASE WITH LEFT+RIGHT ARROWS";:PRINT@262,"FIRE
 WITH SPACE BAR";:PRINT@321,"HIT SHIPS BEFORE THEY EXPLODE";:PRI
NT@420,"PRESS ANY KEY TO START";
37 A$=INKEY$:IFA$=""THEN37
40 CLS0
50 FORA=1TO10:PRINT@RND(97),CHR$(193);:NEXT:B1=416+RND(25):TH=TH
+5:FORAS=416TO480STEP32:PRINT@AS,R$;:NEXTAS:PRINT@485,"BASES";:P
RINT@492,NB;
60 PRINT@357,L1$;:PRINT@368,L2$;:PRINT@372,L3$;:PRINT@379,L4$;:P
RINT@384,L$(5);
70 R3=RND(4):R1=RND(27):R2=RND(6):SD=0:MOTOR ON:IF TH>15 THEN TH
=TH-1:TT=0
80 SP=64+R2*32+R1
90 PRINT@B1,B1$;:PRINT@B1+32,B2$;:PRINT@500,TS;
100 IF SD=0 THENPRINT@SP,ST$(R3);:PRINT@SP+32,SB$(R3);
110 IFPEEK(345)=247 THENS1=PEEK(B1+994):S2=PEEK(B1+962):FORF=B1+
1026TOB1+706STEP-32:POKEF,255:PLAY"L255O3AB":NEXTF:POKEB1+994,S1
:POKEB1+962,S2:POKEB1+1026,191:FORF=B1+930TOB1+706STEP-32:POKEF,
```

Listing continued

destroyed quickly enough, they will release a bomb that levels everything in the area. Each ship has a shorter fuse than the previous one. The game is over soon, but costs less than a quarter a play.

Program Listing 3 is the 16K Extended Color Basic version.

All the SOUND commands are changed to PLAY for more speed. The releasing of a bomb was changed to a ship that rapidly changes color before it defuses. Losing a base in the 4K game caused a rapid flashing of the entire screen to different colors using the CLS command.

The 16K game uses a machine-language subroutine for a different effect. Program Listing 4 is the Assembly code for the subroutine. You will not need to type in Listing 4. I changed the code to base 10 and included it in lines 5 and 205 of Listing 3.

The result of calling this machine-language program by A = USR(0) is an instant change in color of everything on the screen. Any green graphic pattern will change to yellow, yellow changes to blue, blue to red, red to buff, buff to cyan, cyan to magenta, and magenta to orange. If any orange is on the screen when the call is made, it changes to non-graphic symbols (letters and numbers). I was careful not to have orange on the screen when a ship self-destructs.

How does it work? If the video memory of the screen position is increased by 16 for any graphic pattern on the screen, the pattern remains the same but the color changes to the next color in order of increasing CHR$ codes. Listing 4 loads the X register with hex 400, the beginning of video memory. The A register is loaded with the contents of memory location X.

In line 130, I add 16 (10 hex) to the contents of A. The resulting value is stored back to the same screen location. This is repeated for the entire screen, locations 400 to 5FF. Therefore, every position on the screen is changed to the next color. ■

James Wood can be reached at 424 N. Missouri, Box 507, Atwood, IL 61913.

Listing continued

```
128:NEXTF:GOTO130
120 GOTO140
130 IFSD=0ANDINT((B1-SP+1)/32)-(B1-SP+1)/32=0THENMOTOROFF:FORXX=
1TO3:EP$(1)="":EP$(2)="":FORX=1TO2:FORY=1TO3:EP$(X)=EP$(X)+CHR$(
128+RND(127)):NEXTY,X:PRINT@SP,EP$(1);:PRINT@SP+32,EP$(2);:PLAY
P$:NEXTXX:PRINT@SP-1,BL$;:PRINT@SP+31,BL$;:TS=TS+10*R3:SD=1
140 IFPEEK(343)=247THENB1=B1-1:IFB1<416THENB1=416
150 IFPEEK(344)=247THENB1=B1+1:IFB1>442THENB1=442
160 IFSD=1 THEN IF RND(10)=1 THENGOTO70 ELSE GOTO 90
170 TT=TT+1:IFTT>TH THEN A=USR(0):PLAY"O4L255AFBDEA":FORTI=1TO10
0:NEXTTI:CLS0:NB=NB-1:IFNB=0THENGOTO200ELSEGOTO50
180 IFTT+5>TH THENPRINT@SP,ET$(R3);:PRINT@SP+32,EB$(R3);:PLAY"L2
5503F"
190 GOTO90
200 CLS:PRINT@235,"FINAL SCORE";TS:MOTOR OFF:FORTI=1TO500:NEXTTI
:NB=3:TH=20:TS=0:GOTO40
205 DATA 142,4,0,166,132,139,16,167,128,140,5,255,38,245,57
210 DATA171,175,167,168,172,164,173,163,174,160,172,160,173,163,
174,168,172,164,174,175,173,160,172,160
220 DATA11,2,0,1,15,15,15,15,11,7,2,1,7,11,1,1,7,15,15,11,7,15,1
5,11,2,7,7,15,15,15,15,15
```

```
3F00                    00100          ORG     $3F00
3F00 8E   0400          00110 START    LDX     #$400
3F03 A6   84            00120 SCREEN   LDA     ,X
3F05 8B   10            00130          ADDA    #$10
3F07 A7   80            00140          STA     ,X+
3F09 8C   05FF          00150          CMPX    #$5FF
3F0C 26   F5            00160          BNE     SCREEN
3F0E 39                 00170 DONE     RTS
          0000          00180          END
00000 TOTAL ERRORS

DONE     3F0E
SCREEN   3F03
START    3F00
```

Program Listing 4

See List of Advertisers on page 138

BY ROCKY SMOLIN

MAY I SEE YOUR MENU?

Using a disk system? Create a convenient display of program files directly from the disk directory.

After I bought my disk-drive system for my Color Computer, it wasn't long before I had over 30 programs on one disk. My files flew past the screen when I used the DIR command. I wanted a better look at what was on my disks than the Radio Shack DOS allowed.

I wrote the program Menu (see the listing) to solve this problem. I just type RUN"MENU" and my files list eight at a time.

I used two Color Disk Basic commands to accomplish this: DSKI$ and DSKO$. These powerful and easy-to-use commands require five parameters: the drive number, the track number, the sector number, a string variable containing the first 128 bytes to be read or written, and a string variable containing the second 128 data bytes to be read or written.

I had to divide the buffer into two strings (255 bytes are the maximum allowed and one sector—the quantity directly read or written—is 256 bytes).

Also, the Color Computer's disk-system manual shows the layout of the directory entries and reveals the format of the file-allocation table in great detail.

Here's how Menu works:

Line 10 clears string space for 2,000 characters.

Line 20 dimensions a string array of 72 entries, which is the maximum number of files the disk directory holds.

In line 30, NE is a count of the number of entries in the M$ array—the number of Basic programs.

The directory entries are found on track 17 in sectors 3–11. So line 40 creates the loop that increments S, the sector variable, from 3–11.

Line 50 gives the command that reads the disk. The first parameter, 0, is the drive number; the second parameter, 17, is the track number; the third parameter, S, is the sector number, which is a value between 3 and 11 per the loop setup in statement 40. Parameter four, A$, is where the first 128 bytes of the sector will be delivered; and the last parameter, B$, will have the second 128 bytes.

In line 60 the two strings are concatenated. In order to stay within the 255-byte string limit of Basic, the last byte is left off of B$ (LEFT$(B$,127)).

Since each entry takes 32 bytes, you need to look at eight entries in this 256 byte sector. Line 70 creates a loop that will count from 0–7. Counting from 0–7 simplifies the MID$ calculations, as you will see.

This would be a good time to look at the format of the directory entry. The first 8 bytes are the file name, followed by 3 bytes of extension. It is this extension that tells us if the file is a Basic program.

The value of the next byte could also tell whether you are looking at a program, a data file, a machine-language program, or a text-editor source file. If you are running machine-language programs, you need to modify statement 80 to pick those programs as well for storage in the M$ array.

Byte 13 tells you whether this file is in binary or ASCII format. Byte 14 points to the first granule of the file (the system allocates disk space in granules, which

System Requirements

32K RAM
Color Disk Basic
1 Disk Drive

Bytes	Contents
1–8	Name of file. If deleted, first byte is 0
9–11	Extension
12	File type: 0 = Basic program, 1 = Basic data file, 2 = machine-language program, and 3 = text-editor source file
13	ASCII flag: 0 = binary format, 'FF' = ASCII
14	First granule in file (0–67)
15–16	Number of bytes in the last sector of this file
17–32	Not used

Table 1. Directory Entry Layout

```
10 CLEAR 2000
20 DIM M$(72)
30 NE=0
34 CLS
35 PRINT"READING SECTOR - ";
40 FOR S=3 TO 11
45 PRINT @17,S;
50 DSKI$ 0,17,S,A$,B$
60 C$=A$+LEFT$(B$,127)
70 FOR I=0TO7
80 IF MID$(C$,I*32+9,3)<>"BAS" THEN 110
90 IF ASC(MID$(C$,I*32+1,1))=0 THEN 110
100 NE=NE+1:M$(NE)=MID$(C$,I*32+1,8)
110 NEXT I
120 NEXT S
121 PRINT @32,"SORTING - ";
122 FOR I=1 TO NE-1
123 PRINT @42,I;
124 FOR J=1 TO NE-I
126 IF M$(J)>M$(J+1) THEN H$=M$(J):M$(J)=M$(J+1):M$(J+1)=H$
128 NEXT J,I
130 S=INT(NE/8): IF INT(NE/8)<> NE/8 THEN S=S+1
140 FOR I=1TOS
150 CLS
160 FOR J=1TO8
170 PRINT @((J-1)*32+106),RIGHT$(STR$(J),1);") ";M$((I-1)*8+J)
180 IF (I-1)*8+J=NE THEN 200
190 NEXT J
200 PRINT @394,"9) NEXT SCREEN"
210 PRINT @458,"WHUT'S YER PLESHER";:INPUT X$:X=VAL(X$)
220 IF X<1 OR X>9 THEN 210
230 IF X=9 THEN 260
240 P$=M$((I-1)*8+X)
250 LOAD P$,R
260 NEXT I
270 PRINT @490,"THAT'S ALL FOLK'S"
```

Program Listing

are nine contiguous sectors or half a track). One of the inefficiencies of this type of disk-allocation scheme is that even if a file contains only 2 bytes, it will still be allocated half a track.

Finally, bytes 15 and 16 tell you the number of bytes in the last sector of the file. Bytes 17–32 are unused.

In line 80, the second parameter of the MID$ function points to the file extension of the entry under examination and asks if it is a Basic file. If not, look at the next entry.

When you kill a file, the first byte of the file changes to a numeric zero. Therefore, if the entry under examination has passed the first test (that is, it is in fact a Basic file), then, before storing it in the M$ array, line 90 allows you to ask if the file still exists. If the ASCII value of that first byte is a zero, then the program GOTOs 110 and doesn't store it.

You have determined that this entry is indeed a Basic program that you haven't killed or deleted. Therefore, in line 100, NE, the number of entries and also the pointer to the last entry in the M$ array, is incremented and the name of the file is extracted and placed in the M$ array.

✓ See List of Advertisers on page 138

Line 110 looks at the next entry in C$.

After you have finished looking at the eight entries in this sector, line 120 gets the next one.

You have finished looking at all eight-entry-containing sectors and have placed them all in the M$ array. Now, since you want to display the program files eight at a time, line 130 calculates S as the number of times you will have to display programs.

Line 140 starts the display loop.

Line 150 clears the screen.

In line 160, J counts to eight, displaying one entry each time.

Line 170 lets you try different values of I and J to see how this statement pulls out the right entry from the M$ array and displays it with a number (1–8), so that they line up on the screen.

If you have reached the end of the entries, line 180 prohibits the display of any more.

Line 190 displays the next entry.

Line 200 causes each screen to end with the choice of displaying the next eight entries.

Line 210 asks for a selection from the user. Inputting a string value (X$) and converting it to a numeric value, instead of just getting X, will prevent the REDO? message from appearing if the user picks something other than a number. This is for aesthetics only.

In line 220, if X is not between 1 and 9, ask again.

If you selected next screen, line 230 shows the next screen.

If you didn't select next screen, line 240 puts that program's name into P$.

Line 250 loads it with the run option (it will execute as soon as it finishes loading).

Line 260 displays the next eight entries.

Line 270 shows that you have run out of entries. Maybe the program's on a different disk. Load another disk and run it.

Although there is about a 10-second delay from the time you type RUN until the first eight entries are displayed, I prefer this method to the manual dexterity required to start and stop the display (through the use of shift @) while using the DIR command. ■

Rocky Smolin can be reached at 11772 Sorrento Valley Road, San Diego, CA 92121.

Color by HOT CoCo

If you like color . . . you're going to *love* HOT CoCo magazine.

The exciting new monthly devoted exclusively to the TRS-80 Color Computer.* It's from the publisher of **80 Micro**.

Let **HOT CoCo** color *your* system with:

- Feature articles on color graphic techniques
- Computer art
- Games
- Specific color applications in home, education, business and hobbies

PLUS

- Ideas on patching, adding and trouble shooting
- Buyer's guides
- Product and book reviews
- Hardware interfacing and enhancing
- Programming techniques and tutorials

Best of all, **HOT CoCo** is written by users just like you.

The material is always up-to-date and useful. Hardware, software, books . . . what's new . . . what's best . . . what works. And you get 12 issues of **HOT CoCo** for only $24.97. Use the attached order form, the coupon, or call toll free **1-800-258-5473**. Subscribe Today!

YES! please sign me up for one year of Hot CoCo at $24.97.

☐MC ☐VISA ☐AE ☐CHECK/MO ☐BILL ME

Card#_____ **Exp. Date**_____

Signature_____ **Interbank #**_____

Name _____

Address _____

City_____ **State**_____ **Zip**_____

Canada & Mexico $27.97/1 yr. only, US Funds
Foreign surface $44.97/1 yr. only, US Funds drawn on US bank.
Please allow 6-8 weeks for delivery.

337B4

HOT CoCo

HOT CoCo•PO Box 975•Farmingdale NY 11737

**TRS-80 Color Computer is a trademark of Radio Shack, a division of Tandy Corp.*

BY JAMES J. BARBARELLO

PC BOARD PRIMER

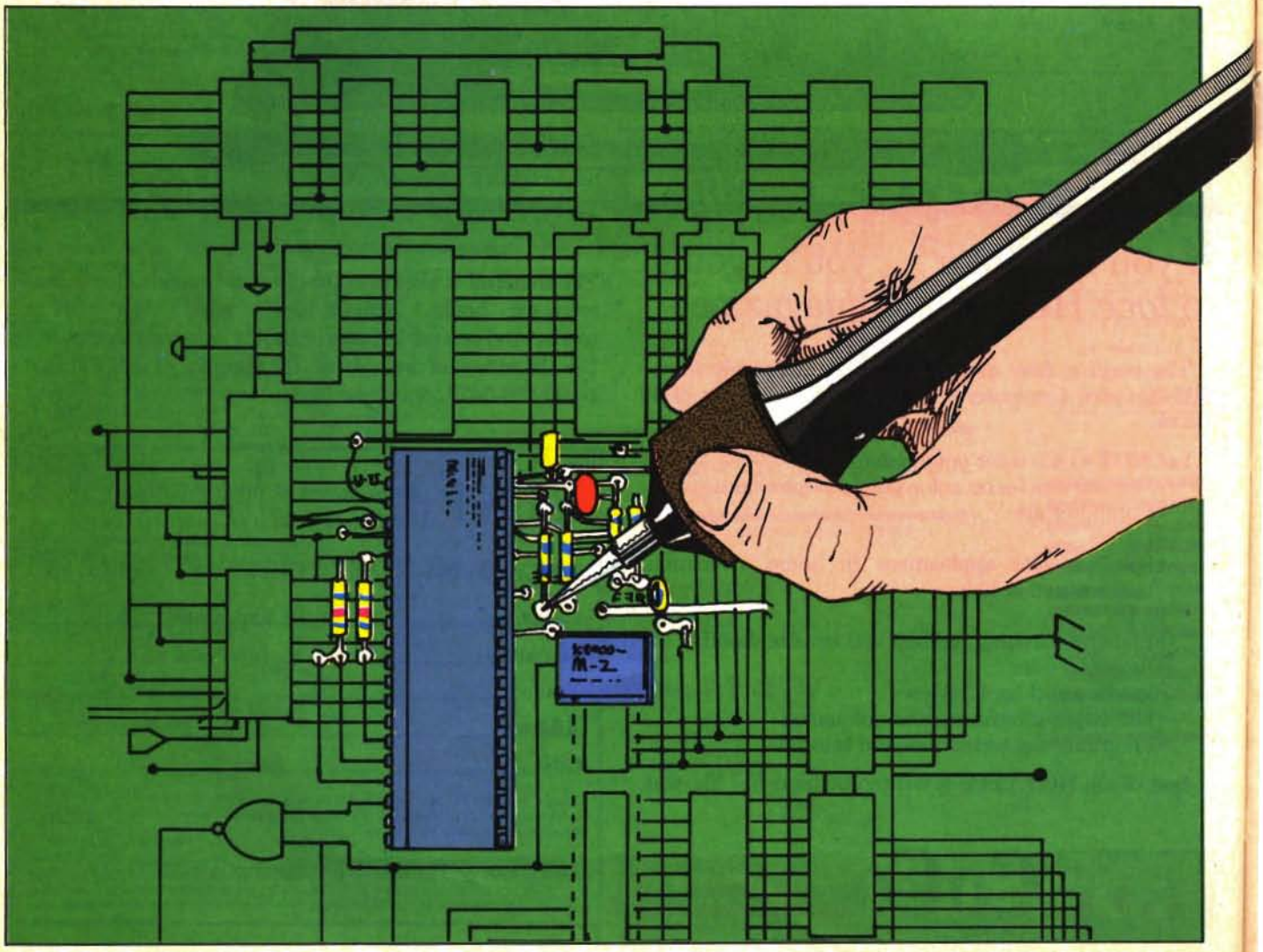
You may be a novice to computing or a crackerjack programmer but if you are like most CoCo owners, the thought of a hardware project sends chills up your spine. This hardware phobia is unwarranted, especially once you know the "secrets" of hardware construction.

The most mysterious hardware chore is constructing a printed circuit (PC) board. In this two-part series, I will introduce you to PC boards, show you how to make one from the layouts provided in magazines, and guide you through the complete process with a useful project. I will also show you how to convert your own design from a schematic diagram to a functioning board.

You can add many capabilities to your CoCo by etching your own PC boards—here's how.

What Is a PC Board?

A PC board holds components in place and electrically connects them in a predefined way. You can reproduce it



cheaply and accurately. Back in the dark ages before transistors, electronic circuits used vacuum tubes, which were placed in sockets. These sockets were fastened to an aluminum chassis, and the remaining resistors, capacitors, and diodes were strung between the pins on the sockets. This procedure required skilled labor because each chassis had to be hand wired and was, therefore, unique.

With the advent of transistors and integrated circuits (ICs), designers could no longer use this point-to-point wiring. Enter the PC board. It let designers conveniently mount the components, eliminated hand wiring and its associated errors, and was cheap.

The PC board starts out as a "blank," which consists of two parts. The first part is the board itself, which is an insulating material such as phenolic or glass epoxy that is about 1/16 inch thick. The second part, a layer of copper, is bonded to one side of the board. There are double-sided and multilayered boards, but I will discuss only the single-sided type. The thickness of the copper, stated in ounces, indicates the weight of the copper coating per square inch.

The commercial procedure for making a PC board from the blank follows:

- Determine the pattern to interconnect the parts that you will place on the finished board.
- Transfer that pattern to the blank and protect it with an acid-resistant material commonly called "resist."
- Place the blank in an acid solution to dissolve, or etch away, the unprotected copper.
- Clean the resist from the board, exposing the copper that remains.
- Drill holes to accept the component leads.

About now you might be asking, "Why bother with PC boards? Wouldn't it be better to wire the parts together on a perfboard?" Once you know how to construct a PC board, however, doing so will take less time than wiring the circuit on a perfboard and correcting your wiring errors. Add to that the PC board's durability and professional appearance and it wins hands down.

Although the PC board construction process *sounds* complicated, you can duplicate it at home with very modest equipment. You can obtain all the tools at your local Radio Shack, art supply, and electronic supply stores. The complete tool list appears in Table 1.

If a #62 drill is not available at your local electronics supply store, you can order it by mail from a machine-tool supplier such as Jensen Tools (1230 S. Priest Drive, Tempe, AZ 85281).

Before beginning, you should have all the tools on hand. Then you are ready to tackle any design described in a construction article.

Step 1

First, determine which circuit pattern you want to transfer to the PC board. This information is normally provided in the article's PC board layout figure. Your best bet is to photocopy the page containing the layout and use it as a template to locate each of the PC board holes and to draw the interconnecting lines, commonly called "lands."

Cut out the pattern, leaving about one inch of paper around its perimeter (see Fig. 1). Most PC layouts have markers at each corner consisting of two crossed lines. The inside surfaces of the lines indicate the outer edge of the board.

Next, cut the pattern as shown in Fig. 2. This creates four "flaps," which you can fold into a pattern that is the exact size of the board. Measure this and cut a piece of blank PC board to match.

Use the pattern as a drilling template. Unfold the flaps and place the copper side of the blank under the pattern. Then refold the flaps tightly and secure them with a small piece of masking tape (see Fig. 3). Notice that the pattern has a number of doughnut-shaped areas. These are called pads. The void in the middle of the pad is where you drill the hole. When the PC board is assembled, you will insert the component lead into this hole and solder it to the surrounding pad. This creates the desired electrical connection.

Drill a hole through each of the pads in your pattern. If you are using a drill press or Mototool and have a good eye, you can simply begin drilling. Otherwise, you might want to place a small dimple in the center of each pad with a center punch or awl. This helps guide the drill bit and ensure accurate location of the hole.

When you have finished, hold the pattern between you and a lamp. You should see the light coming through

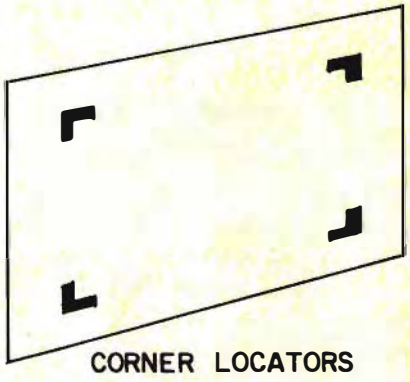


Fig. 1. Untrimmed Layout with One-Inch Paper Border Around Outer Edge

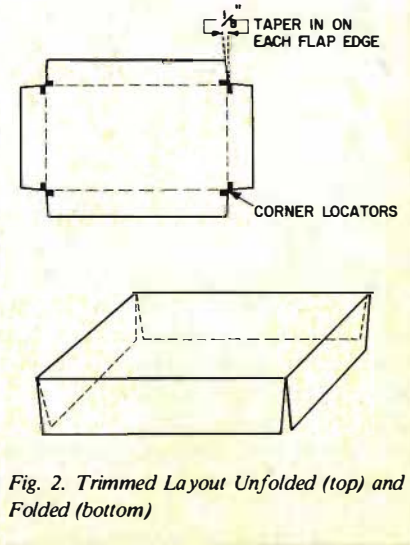


Fig. 2. Trimmed Layout Unfolded (top) and Folded (bottom)

- Circle template (1/16 inch to at least 1/4 inch in 1/64-inch increments; Pickett No. 1200 or equal)
- Plastic tray or box
- #62 drill bit (You can use a 1/16 inch drill bit if no ICs are involved.)
- Portable drill, drill press, or Mototool
- Masking tape
- "Pink Pearl" eraser
- Toothpicks
- #00 Steel wool (or nonsoap-filled scouring pad)
- Soap-filled scouring pad
- Etch-resist marking pen (Radio Shack 276-1530 or similar)
- Etchant solution (Radio Shack 276-1535 or similar)
- Solid copper PC board blank (Radio Shack 276-1586 or similar)

Table 1. List of Tools Needed to Construct a PC Board

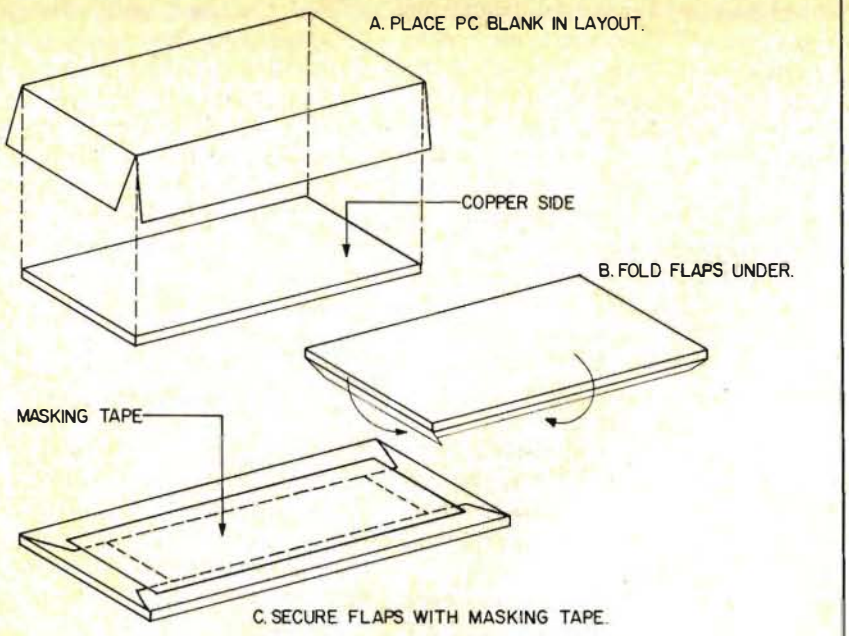


Fig. 3. How to Attach Pattern to PC Blank

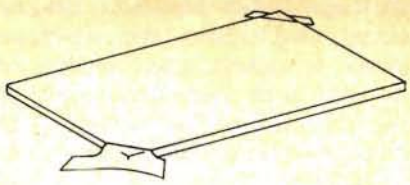


Fig. 4. Masking tape at diagonal corners secures drilled PC blank to the table.

each of the pads. If you do not, you missed one pad or did not drill all the way through the blank. Go back and complete the job. When you have drilled all the pads, you are ready for step 2.

Step 2

Carefully remove the pattern through which you drilled holes in step 1 and look at the PC board blank. Now that you have located the position of each pad on the blank, you can transfer the actual pattern (lands and pads) to the blank using your etch-resist pen.

The etch-resist pen is a type of felt-tip pen that has a hard tip and ink that the etching solution will not affect. Before you begin, thoroughly clean your blank. Any contaminants, such as the oils from your hand, will prevent the resist ink from adhering. Using the 00 steel wool pad, vigorously scrub the copper until it is bright and shiny. Then brush it off with a paper towel to remove any debris.

From here on, do not touch the copper—handle the blank by its ends. Place the blank on a board or table. Using two small pieces of masking tape, secure it to the board or table on diagonal ends of the blank. Make sure the tape is not in the area where you will be drawing the pattern (see Fig. 4).

When you draw the pattern on the blank, you must make sure that the ink flows sufficiently to cover the copper that is to remain. Start by drawing a series of squiggles on scrap paper to get the ink flowing freely. Then make a circle around each of the drilled holes. You can draw the circles freehand or, if you prefer, use the circle template.

Now, referring to the pattern, draw the lines that connect the pads. As you draw, go back to the scrap paper periodically to make sure the ink is flowing freely. If you make a mistake, wait a few seconds until the ink dries and remove the error with an eraser.

"The etchant is poisonous and corrosive, so avoid contact with your skin and use only in a plastic vessel."

When you are done, check each line and pad against the pattern. Now is the time to catch any errors or omissions. When you are sure you have transferred the pattern correctly, proceed to the next step.

Step 3

The blank is now ready for etching. The etchant is poisonous and corrosive, so avoid contact with the skin and use it only in a plastic vessel. Carefully pour the etchant into your plastic tray to a depth of about ¼ inch. Place the blank in the tray, copper side down. The blank should float on the top of the etchant. If it does not, turn the blank over so the copper is facing up. The object is to have the copper in contact with the etchant.

Using a toothpick, agitate the etchant back and forth every few minutes. After 15 to 20 minutes, remove the blank from the etchant and rinse it under running water. Make sure that the etchant has removed all excess copper. If not, place the blank back into the etchant for another five minutes or so.

When the etching is done, flush the used solution down the toilet. Thoroughly rinse the plastic tray and discard the toothpick.

Step 4

Rinse the etched board under running water for a minute or two. Then, using a soap-filled scouring pad, clean the copper side of the board under running water. As you remove the black resist ink, the shiny copper will appear. When you have removed all the resist, continue rinsing to remove all the soap from the surface of the board and the drilled holes. Dry the board with a paper towel.

Notice that you went through only four steps, while the commercial procedure contains five. I incorporated the fifth step—drilling the holes—into the process of transferring the pattern to the PC board blank. Commercial operations transfer the pattern by silk screening onto the blank with resist ink. My home process, though slower, produces the same quality results.

Tools for Soldering

The PC board forms a base on which to solder the circuit components. To round out part 1 of this article, I want to discuss soldering tools and techniques.

You need a soldering iron, solder, a heat sink, and a solder wick. There are two different types of soldering devices for making electrical connections—a soldering iron and a soldering gun. *Never use a soldering gun on a PC board.* It produces too much heat and can dam-

age the board and the components. In addition, the soldering gun produces a strong electromagnetic field that may damage delicate electronic components.

There are two basic types of soldering irons. One comes as an integral unit (e.g., Radio Shack's P/N 64-2070). The other allows you to "customize" by selecting different heating elements and tips (e.g., handle—RS P/N 64-2080; 33-watt heating element—RS P/N 64-2082; long-life light-duty tip—RS P/N 64-2089). Never use a soldering iron greater than 35 watts.

The proper solder is the difference between an excellent job and a poor one. Incorrect solder can result in loose, nonconductive joints. For electronic projects, always use a thin rosin-core solder. *Never use an acid-core solder.* A good choice is Radio Shack's P/N 64-006, which is a thin rosin-core solder designed especially for PC-board soldering.

If you have to remove a soldered component or correct a poor solder joint, you must first remove the existing solder with a remover wick such as Radio Shack's P/N 64-2090. A remover wick is easy to use. Simply place the wick on the joint and then place the soldering iron tip on top of the wick over the joint. When the wick becomes hot enough, it will draw the solder out of the joint. Remove the wick from the joint and cut off the portion of the wick that contains the solder.

How to Solder

Soldering joins two or more electrical conductors in an electromechanical bond. The primary purpose of soldering is to hold the conductors in place and provide electrical continuity.

Solder is a combination of two or more metals that melt, flow, and harden within a limited, precise temperature range. Solder also contains a chemical called "flux" (the "rosin" in rosin-core solder), which helps to bond the solder to the items being joined.

Soldering consists of heating the items until they are at the melting temperature of the solder. You then apply the solder to the joint, not the soldering iron. When the solder flows, covering the leads, remove the heat, and the solder hardens to complete the bond.

Remember to heat the items *before* applying the solder. A common technique is to place the tip of the soldering iron on the joint, holding the soldering iron at an angle similar to that at which you hold a pencil to write. When writing, however, you hold the pencil with the point facing away from you. When soldering, you hold the tip of the soldering iron sideways, much like you hold a fork when you are eating.

To mount a part on the board, place the leads through the holes on the non-

"A good solder joint looks shiny and smooth, . . . a poor joint looks dull and grainy like corroded aluminum."

copper side of the board. Place the soldering iron tip on the PC-board pad for two seconds or so. Then move the tip so that it also touches the component lead. Next, touch the solder to the other side of the lead (not the iron tip) and push in the solder as it melts. Apply only enough solder to surround the lead and form a pyramid shape, with the base on the PC-board pad.

As soon as you have made the proper joint, remove the solder and then the iron tip from the joint. A good solder joint looks shiny and smooth, while a poor joint looks dull and grainy like corroded aluminum. To correct a poor joint, remove the solder with a remover wick and redo it with new solder.

When soldering a diode, transistor, or other delicate component, use a heat sink. This allows you to heat the lead, but keeps the heat away from the electronic device. Heat-sinking means attaching a metal clip to the lead on the noncopper side of the PC board so that the heat flows into the clip, not into the component, much like water flows into your kitchen sink and is collected there. A small alligator clip, such as Radio Shack's P/N 270-380, makes an excellent heat sink.

Next Month

Part 2 of this article will describe how to construct a simple interface that allows external switches or an audio signal to trigger the CoCo. In addition to constructing the PC board, I will also discuss the applications software, including a program for intrusion detection and a voice- or switch-actuated "typewriter" for the handicapped. ■

Write James Barbarello at RD #1, Box 241H, Tennent Road, Englishtown, NJ 07726.

See List of Advertisers on page 138

BY DENNIS R. MARTIN

MORE COLORS IN PMODE 4

Have you ever looked enviously at the many colors in the graphics of a fancy game program or wondered how you might be able to use the red, white, and blue of a *Chromasette* cover? If you list the program, you will probably discover that the information you need is in machine code or, even worse, that it uses that strange technique known as string packing. So you return, discouraged, to the same old Basic routines.

Now, however, you can create more colors in your high-resolution graphics with no machine language. All you need are some of the Extended Color Basic commands already in your computer and the simple techniques described below.

As most users of Extended Color Basic graphics know, the numbers and combinations of colors available for high-resolution graphics are quite limited: green/yellow/blue/red and buff/cyan/magenta/orange in PMODE 1 and PMODE 3, and only black/green or black/buff in PMODEs 0, 2, and 4.

At last there is hope for Basic programmers wanting to display more creative and colorful graphics.

In addition, the color sets are inflexible, so some colors cannot be used simultaneously. For example, if you want to draw a flag (it is, after all, July), you will quickly discover that red, white, and blue are not available together in any of the five PMODEs or in any of the unimplemented graphics modes, but only in the semi-graphics modes.

And how, you may ask, are you going to draw stars with block graphics?

Color Artifacts

The answer to your color problems is a phenomenon known as color artifacts. Most Color Computer users probably have noticed that the buff in PMODE 4 is not always a true white. Solid objects, squares, and circles that are drawn on a black background and PAINTed are pure white, but the rag-

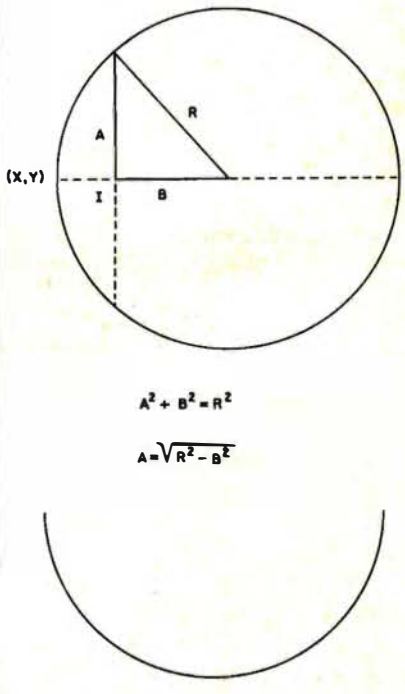


Fig. 1. Method for Finding the Length of Line A

Program Listing 1

```
100 '***************
110 '***POINTEST***
120 '***************
130 '
140 CLS:PRINT:PRINT" PRESS <ENTER> TO CLEAR THE       SCREEN AND
 DRAW LINES (10,10)-  (10,20) AND (12,10)-(12,20).    THE RESUL
T WILL BE A SINGLE,    WIDE, COLORED LINE."
150 PRINT:LINEINPUT" THEN PRESS THE <SPACE BAR> TO   RETURN TO
THE TEXT SCREEN AND   EXAMINE THE COLORS OF THE       POINTS (9
,11) THROUGH (13,11),  WHICH ARE ON BOTH SIDES AND     PART OF
THE COLORED LINE.";R$
160 PMODE 4,1:PCLS:COLOR 1,0:SCREEN 1,1
170 LINE (10,10)-(10,20),PSET:LINE (12,10)-(12,20),PSET
180 IF PEEK(345)<>247 THEN 180
190 CLS:PRINT" THE FOLLOWING WERE THE COLOR    NUMBERS OF THE G
IVEN POINTS":PRINT
200 FOR X=9 TO 13
210 PRINT"POINT ("X",11),"PPOINT(X,11)
```

Listing continued

System Requirements

16K RAM
Extended Color Basic

Listing continued

```
220 NEXT
230 PRINT:PRINT" NOTE THAT ONLY THE POINTS ON    THE ACTUAL LIN
ES DRAWN CAN BE    'SEEN' BY THE COMPUTER.  THE    OTHER POINTS
ARE INTERPRETED    AS BLACK (0)."
240 END
```

ged edges of an empty circle certainly are not.

Also, single points that are PSET often appear as blue or red, and a rainbow of colors can be produced when

Program Listing 2. RWB DEMO

```
100 '**********************
110 '****** RWB DEMO ******
120 '**********************
130 '
140 '***VARIABLES USED***
150 '  X,Y=STANDARD COORDINATES
160 '  I=COUNTER
170 '  R=RADIUS OF CIRCLE
180 '  A=IN CIRCLE, LENGTH OF A VERTICAL LINE BETWEEN THE DIAME
TER PARALLEL TO THE X-AXIS AND A POINT ON THE CIRCUMFERENCE
190 '  B=LENGTH BETWEEN CENTER OF CIRCLE AND INTERNAL END POINT
 OF LINE A.  A, B, AND R FORM A RIGHT TRIANGLE, WITH R AS THE H
YPOTENUSE, B AS THE BASE, AND A AS THE SIDE
200 '
210 '***INITIALIZATION***
220 PMODE 4,1:COLOR 1,0:PCLS:SCREEN 1,1
230 '***DRAW LARGE RED AND BLUE SQUARES IN TOP ROW***
240 X=20:Y=20:GOSUB790
250 X=185:Y=20:GOSUB790
260 '***DRAW WHITE SQUARE IN TOP ROW***
270 LINE (103,20)-(153,65),PSET,BF
280 '***RIGHT TRIANGLE, BOTTOM LEFT***
290 X=21:Y=110
300 FOR I=0 TO 50 STEP 2
310 LINE (X+I,Y+I)-(X+I,Y+50),PSET
320 NEXT
330 '***CIRCLE, BOTTOM CENTER***
340 R=25
```

Listing continued

"There are two ways to produce red and blue in PMODE 4—by setting points or by drawing lines. The latter is quicker and easier when writing and entering programs in Basic."

points or lines intersect or come close to one another, as in the Timebomb program in *Going Ahead with Extended Color Basic* or a kaleidoscope or spirograph program.

These colors are color artifacts and are not created by the computer direct-

See List of Advertisers on page 138

Listing continued

```
350 X=102:Y=135
360 FOR I=0 TO 2*R STEP 2
370 IF I<R THEN B=R-I
380 IF I>R THEN B=I-R
390 IF I=R THEN A=R:GOTO410
400 A=SQR(R^2-B^2)
410 LINE (X+I,Y-A)-(X+I,Y+A),PSET
420 NEXT
430 '***RED AND BLUE DIAMOND, BOTTOM RIGHT***
440 X=185:Y=135
450 FOR I=0 TO 24 STEP 2
460 LINE (X+I,Y-I)-(X+I,Y+I),PSET
470 NEXT
480 FOR I=27 TO 51 STEP 2
490 LINE (X+I,Y-(51-I))-(X+I,Y+(51-I)),PSET
500 NEXT
510 '***SERIES OF COLORED BLOCKS, MIDDLE LINE***
520 Y=80
530 FOR X=48 TO 200 STEP 25
540 FOR I=0 TO 10 STEP 2
550 LINE (X+I,Y)-(X+I,Y+10),PSET
560 NEXT I:NEXT X
570 LINE (0,85)-(255,85),PSET
580 '***'PAINTING' OBJECTS OR PARTS OF OBJECTS WHITE***
590 X=49
600 FOR I=0 TO 10 STEP 2
610 LINE (X+I,Y)-(X+I,Y+10),PSET
620 NEXT
630 X=76
640 FOR I=0 TO 4 STEP 2
650 LINE (X+I,82)-(X+I,88),PSET
660 NEXT
670 FOR Y=80 TO 90
680 LINE (198,Y)-(208,Y),PSET
690 NEXT
700 FOR Y=82 TO 88
710 LINE (175,Y)-(181,Y),PSET
720 NEXT
730 LINE (31,140)-(41,150),PSET,BF
740 CIRCLE(210,135),10
750 PAINT(210,135),5,5
760 GOTO760
770 END
780 '***SUBROUTINE TO DRAW LARGE COLORED BLOCKS, TOP ROW***
790 FOR I=0 TO 50 STEP 2
800 LINE (X+I,Y)-(X+I,Y+45),PSET
810 NEXT
820 RETURN
```

ly, but by the TV monitor. When the computer sends a signal to the television receiver to set a single point, that signal comes so quickly and is so strong that the receiver misinterprets it as also containing color information, which is not actually present or intended.

Points PSET at various distances from one another cause the television decoder to produce various colors. It is possible, however, to control this phenomenon and produce true colors in PMODE 4.

The techniques described below work well only with Color Set 0 (black/buff). The visual effect of Color Set 1 in PMODE 4 is green superimposed on the buff of Color Set 0. It is as if you are looking at a black/buff image through a green-screen add-on. As such, the color possibilities with Color Set 1 are only shades of greenish-gray. In Color Set 0, however, you can create many vivid colors, including red and blue.

Red and Blue

There are two ways to produce red and blue in PMODE 4—by setting points or by drawing lines. The latter is quicker and easier when writing and entering programs in Basic.

The principle is quite simple. Drawing two vertical lines on adjacent X coordinates produces a thick white line. An example is the following:

```
200 LINE (10,10)-(10,20),PSET:
```

Program Listing 3. July 4th

```
100 '***********************
110 '****** JULY 4TH ******
120 '***********************
130 '
140 ' BY DENNIS R. MARTIN
150 '   1 FEBRUARY 1982
160 'FOR 16K COLOR COMPUTER
170 ' EXTENDED COLOR BASIC
180 '
190 '***VARIABLES USED***
200 '  SP=STRIPE ARRAY
210 '  ST=STAR ARRAY
220 '  H=FULL VERTICAL LINE FOR LETTER ARRAY
230 '  CR=CROSS PIECE FOR LETTER ARRAY
240 '  HH=HALF VERTICAL LINE FOR LETTER ARRAY
250 '  X,Y=STANDARD COORDINATE VARIBLES
260 '  I=FOR/NEXT COUNTER VARIABLE
270 '  XX,YY=SINE WAVE COORDINATES
280 '  RD=VALUE OF ONE RADIAN
290 '  A,R,SN=SINE WAVE VARIABLES
300 '
310 '***INITIALIZATION***
320 POKE65495,0:PMODE 4,1:DIM SP(0,65),ST(0,4),H(0,4),CR(0,3),H
H(0,3)
330 COLOR 0,1:PCLS:SCREEN 1,1
340 '***DRAW AND "GET" TOP STRIPE***
350 FOR X=1 TO 255 STEP 2
360 LINE (X,30)-(X,39),PSET
370 NEXT X
380 GET (0,30)-(256,39),SP,G
390 '***DRAW OTHER STRIPES***
400 FOR Y=50 TO 160 STEP 20
410 PUT (0,Y)-(256,Y+9),SP,PSET
420 NEXT Y
430 '***REMOVE STRIPES FROM FIELD***
440 LINE (0,30)-(104,100),PRESET,BF
450 '***DRAW BLUE FIELD***
460 FOR X=2 TO 102 STEP 2
470 LINE (X,30)-(X,99),PSET
480 NEXT X
490 '***DRAW AND "GET" STAR***
500 COLOR 1,0
510 LINE (10,36)-(15,36),PSET
520 LINE (12,37)-(13,37),PSET
530 LINE (12,35)-(13,35),PSET
540 LINE (10,38)-(11,38),PSET
550 LINE (14,38)-(15,38),PSET
560 GET (10,35)-(15,38),ST,G
570 '***DRAW OTHER STARS***
580 Y=35
590 FOR I=1 TO 4
600 FOR X=10 TO 90 STEP 16
610 PUT (X,Y)-(X+5,Y+3),ST,PSET
620 NEXT X
630 Y=Y+7
640 FOR X=18 TO 82 STEP 16
650 PUT (X,Y)-(X+5,Y+3),ST,PSET
660 NEXT X
670 Y=Y+7
680 NEXT I
690 FOR X=10 TO 90 STEP 16
700 PUT (X,Y)-(X+5,Y+3),ST,PSET
710 NEXT X
720 '***CALL SONG SUBROUTINE***
```

Listing continued

If the same old news and reviews cause you to snooze then choose:

Forum Sixty-Eight

Forum Sixty-Eight is new to date
and will prove itself real soon.
So rouse from your slumber
and get the first number
Cause the first issue's coming in June.

Forum Sixty-Eight is the journal for Motorola Microprocessors. The forum covers business, scientific and recreational computing.

or

Color Computer News

Color Computer News will wake your computer
and open your eyes up wide.
And soon you'll discover
from cover to cover
there's lots of good info inside.

Color Computer News is the *original* Color Computer magazine covering the entire spectrum of Color Computing from beginner to advanced.

REMarkable Software, Inc.
P.O. Box 1192
Muskegon, MI 49443
(616) 728-9100 ↙1

The 12 issue subscription rate is:

United States	$21.00
Canada/Mexico	$38.00
Foreign	$66.00
Combination Subscription (U.S. only)	$39.00

Kelly Software Dist.
P.O. Box 11932
Edmonton, Alberta T5J 3L1
CANADA
Canadian subscriptions to Color Computer News only

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

☐ Visa/Mastercard # _____ Expiration Date: _____

☐ Color Computer News ☐ Forum Sixty-Eight ☐ Both

Subscription begins with next available issue

Allow 8-10 weeks for delivery

↙ See List of Advertisers on page 138

```
LINE (11,10)-(11,20),PSET
```

Drawing vertical lines on alternate even or odd coordinates generates a colored line. An example of this is:

```
200 LINE (10,10)-(10,20),PSET:
LINE (12,10)-(12,20),PSET
```

Likewise, setting two adjacent points, as in

```
200 PSET (10,10): PSET (10,11)
```

results in a large white (or nearly white) point, but setting alternating points, as in

```
200 PSET (10,10): PSET (10,12)
```

creates a colored point.

A horizontal line is always white, and drawing lines on alternate Y coordinates, as in

```
200  LINE (10,10)-(20,10),PSET:
LINE (12,10)-(12,20),PSET
```

produces two distinct white lines.

The color produced by a pair of vertical lines on alternate X coordinates is red or blue. Unfortunately, which of the two colors appears is to some extent unpredictable, at least initially. Sometimes lines drawn on even-numbered coordinates create blue, while lines on odd-numbered coordinates result in red.

Other times the reverse is true. I have found that the odds of either color appearing the first time I turn on my Color Computer are approximately equal, although in short tests the machine may seem to prefer one color or another.

Pressing the reset button can toggle the color set back and forth, reversing red and blue, but neither resetting nor turning off the computer will always reverse the colors. Occasionally, several tries are necessary.

Once in a particular mode, the computer remains in that mode until it is turned off or reset. Colors cannot be switched while the machine is running.

One problem is that the computer does not recognize that a new color is being generated. It is putting out a signal for two buff lines, which the TV receiver displays as a single colored line, but which the computer still perceives as two distinct buff lines. Because of this dichotomy between computer and display, it is not possible to test the color of a single point and get a reliable answer.

Program Listing I demonstrates this problem. Neither the PPOINT command nor a PEEK of a specific display address can be trusted to match what you see on your screen.

Consequently, the computer cannot help you determine which color will be displayed and it cannot switch the colors if they are wrong. You must correct the error manually. The correction is simple and lasts until the computer is turned off or reset.

Drawing Colored Objects

Once you understand the principle that parallel vertical lines on adjacent even- or odd-numbered X coordinates produce red and blue lines, drawing larger solid objects is simple. Squares and rectangles are especially easy. All you need is a FOR...NEXT loop, STEP 2 to increment the X coordinate, and a LINE command within the loop.

The same subroutine can draw red and blue squares by changing the beginning coordinate of the figure. You can even create a white object by drawing a block of one color and then superimposing a block of the other color on it.

"Once you understand the principle that parallel vertical lines on adjacent even- or odd-numbered X coordinates produce red and blue lines, drawing larger solid objects is simple. Squares and rectangles are especially easy."

Drawing objects other than squares and rectangles requires a little more thought and creativity in arranging the loops and changing the coordinates, but it is still relatively easy. You can produce triangles by changing the X and Y coordinates, and you can make a circle or ellipse if you remember a little trigonometry.

A white area within a colored object is even possible, using the LINE command to superimpose one color on another as described above. Also, the LINE (X1,Y1)-(X2,Y2),PSET,BF command creates a white rectangle or square, as does drawing a series of parallel horizontal lines, since horizontal lines are always white.

The CIRCLE and DRAW commands do not work well, nor does the PAINT command, since the computer sees the solid object as a series of white lines, which stops PAINT dead. Because of this, the only way to create a white circle or irregular shape within a colored object is by superimposition.

Program Listing 2, RWB DEMO, includes all the techniques and principles for creating red, white, and blue objects on a PMODE 4 screen. Lines 230–250 call a subroutine that draws the two large colored blocks in the top corners of the screen.

The subroutine is based on a FOR...NEXT loop that increments the X coordinates in STEPs of 2, plus a LINE command within the loop. It is quite simple and functions equally well for red and blue squares. The beginning coordinate, which you specify, determines the color. A white block is also added to the top row, using the simplest and quickest Basic command possible, the LINE ... , BF statement.

In lines 280–300 the loop counter increments the X and Y coordinates of the upper end of the line, resulting in the isosceles right triangle, bottom left. The diamond in the lower right corner carries this principle several steps further in lines 430–500. The counter increments and decrements the Y variable above and below its starting point, which has the effect of turning the triangle on its side. The process is then reversed, drawing a second triangle in the opposite color, back-to-back with the first. The color change, however, is caused by the starting coordinate, not by reversing the triangle.

You may notice that the two triangles do not touch each other to form a solid red-and-blue object. In PMODE 4, red and blue cannot be made to touch along a vertical line, although they can be directly above and below one another with good results. This, again, is due to peculiarities of the TV receiver.

If red and blue are placed directly side by side (on adjacent coordinates), a white or light-colored line appears where they touch. If the two colors are placed slightly farther apart with two points between them (the next closest position and the one found in the RWB DEMO), a black line separates them. This is not a serious problem, but it must be taken into consideration when designing any colored PMODE 4 graphics.

Perhaps the most interesting object on the screen is the circle in the middle of the bottom line. Creating it is similar to creating the diamond on the right,

Listing continued

```
730 GOSUB2350
740 '***DRAW BELL***
750 COLOR 1,0:PCLS
760 LINE (136,40)-(120,40),PSET
770 LINE -(120,46),PSET
780 LINE -(100,48),PSET
790 LINE -(96,52),PSET
800 LINE -(84,108),PSET
810 LINE -(80,116),PSET
820 LINE -(68,124),PSET
830 LINE -(64,128),PSET
840 LINE -(62,132),PSET
850 LINE -(194,132),PSET
860 LINE -(192,128),PSET
870 LINE -(188,124),PSET
880 LINE -(176,116),PSET
890 LINE -(172,108),PSET
900 LINE -(160,52),PSET
910 LINE -(156,48),PSET
920 LINE -(136,46),PSET
930 LINE -(136,40),PSET
940 PAINT (128,41),5,5
950 '***DRAW STANDARD HOLDING THE BELL***
960 FOR X=48 TO 60 STEP 2
970 LINE (X,36)-(X,52),PSET
980 NEXT
990 FOR X=62 TO 76 STEP 2
1000 LINE (X,24)-(X,52),PSET
1010 NEXT
1020 LINE (78,24)-(78,50),PSET
1030 LINE (80,24)-(80,47),PSET
1040 LINE (82,24)-(82,44),PSET
1050 LINE (84,24)-(84,42),PSET
1060 FOR X=86 TO 166 STEP 2
1070 LINE (X,24)-(X,40),PSET
1080 NEXT
1090 LINE (168,24)-(168,42),PSET
1100 LINE (170,24)-(170,44),PSET
1110 LINE (172,24)-(172,47),PSET
1120 LINE (174,24)-(174,50),PSET
1130 FOR X=176 TO 192 STEP 2
1140 LINE (X,24)-(X,52),PSET
1150 NEXT
1160 FOR X=194 TO 206 STEP 2
1170 LINE (X,36)-(X,52),PSET
1180 NEXT
1190 '***DRAW LINES ON BELL***
1200 FOR X=80 TO 176 STEP 2
1210 LINE (X,108)-(X,111),PRESET
1220 NEXT
1230 FOR X=94 TO 162 STEP 2
1240 LINE (X,52)-(X,55),PRESET
1250 NEXT
1260 '***DRAW NUMBERS ON BELL***
1270 LINE (105,76)-(105,92),PRESET
1280 FOR X=111 TO 121 STEP 2
1290 PRESET(X,76)
1300 NEXT
1310 LINE (121,76)-(121,92),PRESET
1320 FOR X=127 TO 137 STEP 2
1330 PRESET (X,76)
1340 NEXT
1350 LINE (137,76)-(137,92),PRESET
1360 FOR I=0 TO 16 STEP 8
1370 FOR X=143 TO 153 STEP 2
1380 PRESET (X,76+I)
1390 NEXT:NEXT
1400 LINE(143,76)-(143,92),PRESET
1410 LINE(153,84)-(153,92),PRESET
1420 '***CALL SONG SUBROUTINE***
1430 GOSUB2350
1440 PCLS
1450 '***DRAW WHITE OF FIRECRACKER***
1460 LINE (100,95)-(137,177),PSET,BF
1470 '***DRAW STRIPES ON FIRECRACKER***
1480 X=100:Y=90:GOSUB1570
1490 Y=115:GOSUB1570
1500 Y=140:GOSUB1570
1510 Y=165:GOSUB1570
1520 X=101:Y=102:GOSUB1570
1530 Y=127:GOSUB1570
1540 Y=152:GOSUB1570
1550 GOTO1620
1560 '***LINE-DRAWING SUBROUTINE***
1570 FOR I=0 TO 36 STEP 2
1580 LINE (X+I,Y+I/3)-(X+I,Y+5+I/3),PRESET
1590 NEXT
1600 RETURN
```

Listing continued

✓ See List of Advertisers on page 138

Listing continued

```
1610 '***DRAW SINE WAVE FOR FUSE***
1620 XX=118:YY=95:RD=57.29577951
1630 FOR A=-180 TO 179 STEP 4
1640 R=A/RD
1650 SN=SIN(R)*10
1660 PSET (XX,YY+SN)
1670 XX=XX+1
1680 NEXT
1690 '***CALL SONG SUBROUTINE***
1700 GOSUB2370
1710 '***DRAW FIRST LETTER AND "GET" DIFFERENT SEGMENTS"***
1720 Y=5
1730 FOR X=57 TO 61 STEP 2
1740 LINE (X,Y)-(X,Y+30),PSET
1750 NEXT
1760 GET (57,5)-(61,35),H,G
1770 X=73:GOSUB2120
1780 FOR X=57 TO 77 STEP 2
1790 LINE (X,Y+12)-(X,Y+17),PSET
1800 NEXT
1810 GET (57,17)-(77,22),CR,G
1820 GET (57,17)-(61,35),HH,G
1830 '***DRAW OTHER LETTERS***
1840 X=87:GOSUB2120:GOSUB2130:Y=19:GOSUB2130:Y=5
1850 X=103:GOSUB2120
1860 X=117:GOSUB2120:GOSUB2130:Y=19:GOSUB2130:Y=5
1870 X=133:GOSUB2140
1880 X=147:GOSUB2120:GOSUB2130:Y=19:GOSUB2130:Y=5
1890 X=163:GOSUB2140
1900 X=177:GOSUB2140:Y=19:GOSUB2130:Y=5
1910 X=193:GOSUB2140
1920 X=185:Y=19:GOSUB2140
1930 X=12:Y=52:GOSUB2140
1940 Y=65:GOSUB2130:Y=40
1950 X=28:GOSUB2120
1960 X=42:GOSUB2120:Y=65:GOSUB2130:Y=40
1970 X=58:GOSUB2120
1980 X=72:GOSUB2120:Y=65:GOSUB2130:Y=40
1990 X=102:GOSUB2140:Y=53:GOSUB2130
2000 X=110:GOSUB2140
2010 X=118:Y=40:GOSUB2140
2020 LINE (162,40)-(166,56),PSET,BF
2030 LINE (166,52)-(178,56),PSET,BF
2040 LINE (178,40)-(182,70),PSET,BF
2050 LINE (192,50)-(212,54),PSET,BF
2060 LINE (200,40)-(204,70),PSET,BF
2070 LINE (222,40)-(226,70),PSET,BF
2080 LINE (226,52)-(238,56),PSET,BF
2090 LINE (238,52)-(242,70),PSET,BF
2100 GOTO2160
2110 '***LETTER SEGMENT DRAWING SUBROUTINES***
2120 PUT(X,Y)-(X+4,Y+30),H,PSET:RETURN
2130 PUT (X,Y)-(X+20,Y+5),CR,PSET:RETURN
2140 PUT (X,Y)-(X+4,Y+18),HH,PSET:RETURN
2150 '***CALL SONG SUBROUTINE***
2160 GOSUB2380
2170 '***BURN FUSE***
2180 FOR A=180 TO -179 STEP -4
2190 R=A/RD
2200 SN=SIN(R)*10
2210 CIRCLE(XX,YY+SN),2
2220 CIRCLE(XX,YY+SN),2,0
2230 PRESET (XX,YY+SN)
2240 XX=XX-1
2250 NEXT
2260 '***EXPLOSIONS***
2270 CLS2:SCREEN0,0
2280 FOR I=1 TO 5
2290 CLS2:CLS4:CLS2:CLS4:CLS0:GOSUB2390
2300 NEXT
2310 '***RETURN TO RUN AGAIN***
2320 FOR I=1 TO 2000:NEXT:RUN
2330 END
2340 '***SONG AND SOUND SUBROUTINES***
2350 POKE65494,0:PLAY"V15O3L8.GL16EL4CEGO4L2CL8.EL16DL4CO3EF+L3
GP8L8GP16L16GO4L4.EL8DL4CO3L2BL8ABO4L8.CP16L4CO3GEC":POKE65495,
0:RETURN
2360 GOTO2360
2370 POKE65494,0:PLAY"V15O4L8EP16L32EP32L4EFL8.GP16L2GL8FEL4DEL
8.FP16L4.FP8L4FL4.EL8DL4CO3L2BL8ABO4L4CO3EF+L2G":POKE65495,0:RE
TURN
2380 POKE65494,0:PLAY"V15O3L4GO4L8.CP16CP16L8CO3BL8.AP16AP16L4A
O4DL8FEDL16CP16L4CO3L2.BP2L8GP16L16GO4L4.CL8DEFL1.GP2L8CDL4.EL8
FL4DL1.C":POKE65495,0:RETURN
2390 POKE65494,0:PLAY "O1L255V30CGFBEGACV28FABCDFDBV25FADECGBCV
23AEDBFECGV20EBFACDGFV18BDCAFBGEV15DABFADCGV13EADCBGBFV10CEBDAC
DGV8ECFDABDCV5GBFADCEGV3CDBECAGDV1CBFEAGDCADBCAGCDCV15":POKE654
95,0:RETURN
```

where the Y coordinates are incremented and decremented, while the X coordinate is incremented across the screen.

Determining the exact end points to produce a circle may seem to be a difficult problem at first, but it actually requires nothing more complicated than the Pythagorean theorm for a solution. Figure 1 demonstrates the method for finding the length of the line A, which must be subtracted from the beginning Y coordinate value to find the highest point of a particular line and added to find the lowest point. The equations are in lines 330–420.

You can create an ellipse by changing the value of A found in line 400.

"Remember, if the colors are reversed when they first appear on your screen, reset the computer and try running the program again."

Multiply A by some number greater or less than one, e.g.:

```
400 A=SQR(R↑2-B↑2)*1.5
```

or

```
400 A=SQR(R↑2-B↑2)*.5
```

The multiplier works like the height/width variable in Basic's CIRCLE command. Try adding the multiplier to RWB DEMO and watch your circle change shapes.

In lines 510–570, nested FOR... NEXT loops draw a series of small blocks of alternating colors, after which a horizontal line is drawn through them. You can see that the line is pure white and remains white, even when it passes through colored objects.

Next, several techniques paint (or try to paint) objects or parts of objects white. Lines 590–620 superimpose a second block of the opposite color on the leftmost block of the row, turning it white. The next four lines create a small white square in the second block from the left, using the same technique. The rightmost block is made white by program lines 670–690, which draw a series

PRO-COLOR-FILE

If you're through playing games and are ready to get serious about software, then PRO-COLOR-FILE is for you. Turn your TRS-80 32K Color Computer Disk system into a powerful data base manager.

We're serious about **PRO-COLOR-FILE.** It's the only program of its kind that gives so much flexibility and power to your color disk at a price that will fit your budget. In fact, it could be the least expensive software you'll ever buy.

PRO-COLOR-FILE is not just one program. It gives you the ability to create any application that requires information to be stored, searched, updated, sorted and reported. You can custom design your own mailing list, inventory, stock investment records, time manager, expense records, income records . . . . anything.

The best part about **PRO-COLOR-FILE** is that you don't have to be a programmer or even know a lot about disk input/output to use it. You design your application programs in a way that is easy for you to understand and use. In fact, the more you use **PRO-COLOR-FILE** the more you learn about data base development.

Only $79.95 + $2.00 Shipping and Handling.

We accept VISA, MASTERCHARGE, Checks or Money Orders. No C.O.D.'s please.

Call or write for more details:
DERRINGER SOFTWARE, Post Office Box 5300, Florence, S.C. 29502. Phone: (803) 665-5676 after 6:00 p.m. (EDT).
PRO-COLOR-FILE ©1983 Dennis Derringer.
*TRS-80 is a trademark of the Tandy Corp.

↙36

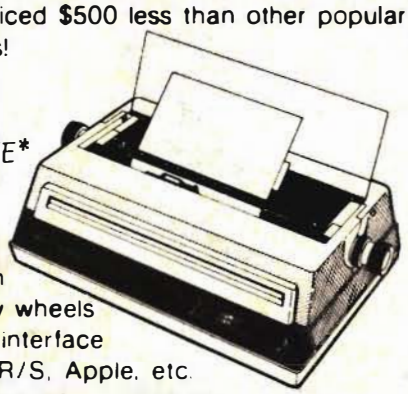
SCM

DAISY WHEEL

New Smith Corona TP-1

True letter quality printer for less than the cost of an office typewriter! Priced $500 less than other popular daisy wheel printers!

SALE PRICE:
$499.
LESS $50 REBATE
June-July 1983



FEATURES:

- ★ Friction feed
- ★ 15 cps, 120 wpm
- ★ Changeable daisy wheels
- ★ Parallel or serial interface
- ★ Compatible with R/S, Apple, etc.

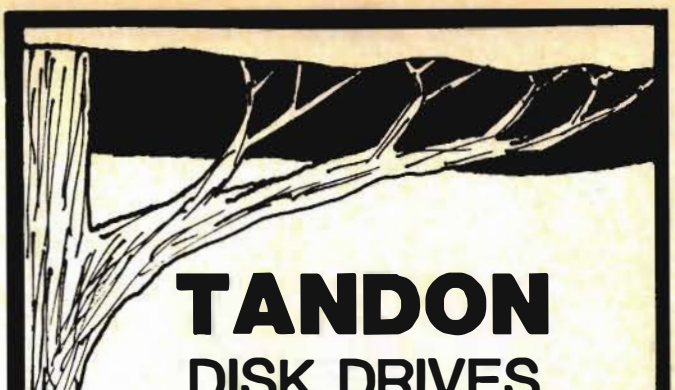
SUNLOCK SYSTEMS
4217 Carolina Ave. ↙456
Richmond, Va. 23222

ADDITIONAL PRINTER SPECIALS

Epson		Okidata		C.Itoh	(par)	(ser)
MX80	$369	82A	$419	8510	$399	$579
FX80	559	83A	639	1550	699	749
MX100	649	92	499	F10-40	1299	1299
		93	849	F10-55	1595	1595

WE WILL MEET OR BEAT ANY ADVERTISED PRICE

TO ORDER CALL TOLL FREE 800-368-9191
In Virginia call 804-321-9191
We accept MasterCard, Visa and CODs



TANDON
DISK DRIVES
for your COCO

Features

Fully software compatible
6ms track-to-track
40 tracks
Higher quality

DRIVE 0 $449.
DRIVE 1 $249.

PRINTERS

STAR GEMINI 10 $379.
STAR GEMINI 15 $519.
OKIDATA 80 $349.
PROWRITTER $469.
GX100P $249.
BOTEK PARRALLEL ADAPTER $69.

16K CHIP SET $14.95
64K CHIP SET $64.
WICO JOYSTICK $25.
WICO-COCO ADAPTER $17.95
HAYS SMART MODEM $239.
VERBATIM SS/DD 10box $25.95

USE OUR WATTS LINE FOR A QUOTE ON ANY COMPUTER PRODUCT

VISA, MASTER CARD, MONEY ORDERS, PERSONAL CHECKS REQUIRE 3 WEEKS

COMPUKIT

1-800-231-6671 order line
1-713-480-6000 technical line

16206D HICKORY KNOLL
HOUSTON, TEXAS 77059

↙455

↙ See List of Advertisers on page 138

of horizontal lines over the block. Lines 700–720 do the same for the center of the block beside it. Line 730 creates the block in the lower left triangle with a LINE. . . ,BF command, the simplest method by far.

Lines 730–740 demonstrate clearly that CIRCLE and PAINT do not work well. You cannot draw a white circle because some points on the circle are the same color as those already set in the figure, so they appear colored, not white. Consequently, they create gaps in the circle. Also, PAINT can only fill in the empty space between the two triangles. It stops when it hits one of the set colored points. A circle actually can be painted, however, by superimposition. To see one, add the following lines to your program:

```
751 R=5
752 X=112:Y=135
753 FOR I=0 TO 2*R
754 IF I<R THEN B=R-I
755 IF I>R THEN B=I-R
756 IF I=R THEN A=R:GOTO758
757 A=SQR(R↑2-B↑2)
758 LINE (X+I,Y-A)-(X+I,Y+A),PSET
759 NEXT
```

The same technique creates colored areas in white objects by using PRESET instead of PSET. With the above lines (751–759) still in your program, add the following:

```
760 X=118:Y=130
761 FOR I=0 TO 10 STEP 2
762 LINE (X+I,Y)-(X+I,Y+10),PSET
763 NEXT
765 GOTO765
```

To finish the color demonstration with RWB DEMO, reset the computer and run your program. Just watch the colors exchange places.

And Now, the Flag

Now we turn to an application of some of the concepts outlined above. First, the GET and PUT commands can be used in conjunction with the other techniques to speed up and simplify graphics.

Second, all the techniques described above work equally well regardless of which color, black or buff, is the foreground or background. Red and blue appear darker on the white background than on the black. This means that you can switch foreground and background colors to take advantage of the simplest method of creating a graphics figure.

Program Listing 3 creates a July 4th treat. It adds some sound to liven things up and speeds up the clock to draw the screens more quickly, but it must be slowed down for the sound to behave properly.

The program is in four sections, allowing you to enter it a section at a time, with allowances made for the sound subroutines. The only new idea is drawing the sine curve for the fuse and burning it. Doing so is simple, however, and has nothing to do with color production.

Remember, if the colors are reversed when they first appear on your screen, reset the computer and try running the program again.

We have produced a new high-resolution graphics color set, which combines aspects of PMODE 3 and PMODE 4. Solid white objects or lines are in the sharp PMODE 4 resolution, while colored areas are at a slightly lower resolution, resembling PMODE 3.

With careful choice and placement of colors, so that white is used where greater clarity is needed and red or blue where straight or more ragged lines suffice (as in the "bell" in Listing 3), the overall effect can be impressive. ■

Address correspondence to Dennis R. Martin, Minnesota Bible College, 920 Mayo Wood Road, S.W. Rochester, MN 55901.

See List of Advertisers on page 138

THE TOP–RATED COCO WORD PROCESSOR:

Colorware researched the word processors available for the Color Computer. We came to the very same conclusion that so many review articles have! Telewriter-64 is, by far, the superior word processor for the Color Computer.

Why is Telewriter so much better than the others? For one thing, it has overcome the 32x16 character display limitation of the Color Computer. No small feat, Telewriter accomplishes this by generating its own set of characters in software. You select 51x24, 64x24 or 85x24 character displays by merely issuing a format command. If you have ever used a word processing system, you know how important it is to be able to see a good portion of your text on the screen.

Telewriter-64 also generates true lower case characters. This is much preferable to the reverse characters that merely "represent" lower case letters in other co-co word processors.

Telewriter-64 is feature packed. Besides the standard features found in any word processor, Telewriter also includes: user-friendly full-screen editing, rapid cursor and scrolling control, page jump, right justification, menu-driven disk or cassette access, compatability with spelling checkers (such as Spell-and-Fix), and a clever double check that asks the user "Are you sure?" before executing any operation that would kill any sizeable amount of your text.

Telewriter-64 runs on any 16K, 32K, or 64K system (extended Basic not required) and works with any printer. It has all of the control codes necessary to take full advantage of all of the features in any printer. There is even a "typewriter" mode which sends typed lines directly to your printer.

With advanced word processing software such as this, your color computer becomes a truly powerful word processing system, with a price that makes sense for the personal user.

Beyond impressive capability, Telewriter-64 simply makes any kind of writing a pleasure. It is a truly sophisticated system that is marvelously easy to learn and enjoyable to use.

TELEWRITER-64

Disk $59.95
Cassette . $49.95

EXTENSION CABLE FOR YOUR MODEM/PRINTER

Place your modem or printer where you want. 15 ft. cable with four-pin male and four-pin female DIN connectors.

$19.95

COCO ROM/PROJECT/PRODUCT CASE

QUANTITY	PRICE EACH
2-4 (2 min.)	$5.50
5-9	3.50
10-99	2.75
100 & up	CALL

Give a Professional look to your project or product

- Designed especially for the Color Computer ROM slot.
- High quality 3 piece injection molded black plastic with spring-loaded door.
- Same size and specifications as Radio Shack ROMpak

QUALITY DISK DRIVE CABLES

High quality cable and high force, gold plated contacts ensure the utmost in connection reliability for your CoCo or TDP-100.

① ***Disk pack extender, 3 ft. . . $29.95***
Allows you to move your disk drive interface back and out of the way.

② ***One Drive Disk cable $19.95***

③ ***Two Drive Disk cable $29.95***

SUPER-PRO KEYBOARD

REPLACEMENT PROFESSIONAL KEYBOARD KIT...ONLY $69.95

- Contour molded, full travel keys for fast smooth typing.
- Custom made to fit precisely. Has same key layout.
- Complete, easy instructions for any CoCo or TDP-100.
- Ideal for word processing and other serious CoCo use.

Note: For computers manufactured after Oct. 1982, add $4.95

UPGRADE IN JUST MINUTES!

COLORWARE LIGHT PEN

ONLY $19.95

FREE PROGRAM CASSETTE INCLUDED

- Plugs directly into your joystick port.
- Comes with six fun & useful programs on tape.
- Easy instructions show how to use it with Basic.
- Comptible with light pen software such as Computer Island's "Fun-pak."

COLORWARE

COLORWARE INC.
78-03B Jamaica Ave.
Woodhaven, NY 11421
(212) 647-2864

VISA MasterCard

TOLL FREE ORDERING

800-221-0916

Orders only. NY & Info call (212) 647-2864

✓17

WE PAY

shipping on any order that includes at least one game
Use our convenient toll free 800 line.

GHOST GOBBLER

From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Tape: $21.95, Disk: $25.95

DONKEY KING

DONKEY KING

You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: $24.95, Disk: $27.95

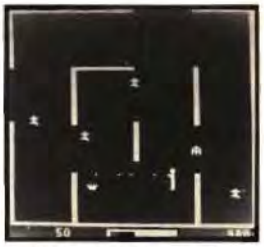
GHOST GOBBLER

PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: $24.95, Disk: $27.95

CREATURE FEATURE

From Color Software, comes a lightening swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: $17.95. Disk: $19.95



ANDROID ATTACK

Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: $21.95

FROGGER

Just released by The Cornsoft Group, this is the officially licensed version from Sega, the arcade manufacturer. It has it all! 4 lane super highway, snakes, turtles, logs, alligators, etc. Lots of action and laughs! Requires 16K. Tape: $19.95

INTERGALACTIC FORCE

Your space fighter roars into the Death Corridor. Lock-on and blast the enemy fighter from the sky. Now try dropping one into Death Star's narrow exhaust vent. It takes skill and guts. Good luck! With "Star Wars" theme song. From Anteco. Tape: $24.95

THE COLORCADE..

SUPER JOYSTICK MODULE

ONLY
$19.95

★ It's a Joystick Interface.

Now you can connect any Atari compatible joystick to your CoCo. These sticks are extremely rugged & provide very fast response and real arcade type action. They will improve the play of almost any game. The difference will amaze you!

★ It's a Rapid Fire Module!

Press the fire button on your joystick and get a great burst of fire instead of just a single shot! Adds tremendously to the many shooting type games that do not have repeat fire. With variable burst speed.

★ It's a 6ft. Extender Cord.

THE ATARI

ONLY
$8.50

A well proven joystick, the Atari is known for being rugged and reliable. It gives good response and is the standard among home video players. Now at a great price! Use with module above.

ZIRCON VIDEO COMMAND

ONLY
$14.95
A GREAT BUY!

This one has received outstanding reviews. Its unique design fits the hand beautifully and it has the truly fast and positive response needed for high speed play. Actually out-performs some joysticks that cost $50 or more.

WICO FAMOUS "RED BALL"

THE BEST YOU CAN BUY
$34.95

The high performance joystick from the people who make them for the arcade machines. Built to take the abuse of even the most enthusiastic player. This is the best! Wico #15-9730. Use with module above.

ORDERING INFORMATION

ADD $2.00 PER ORDER FOR SHIPPING.
WE ACCEPT VISA, MASTERCARD, CHECKS, M.O.
C.O.D. ADD $3.00 EXTRA.
NY RESIDENTS ADD SALES TAX.
OVERSEAS, FPO, APO, ADD 10%.
DEALER DISCOUNTS AVAILABLE.
IF ONE OR MORE GAMES ARE INCLUDED, SHIPPING IS FREE.

COLORWARE

COLORWARE INC.
78-03B Jamaica Ave.
Woodhaven, NY 11421
(212) 647-2864

VISA MasterCard

TOLL FREE ORDERING

800-221-0916

Orders only. NY & Info call (212) 647-2864

BY ROBERT P. BUSSELL

THAT'S A PRINT

Do you want your CoCo and printer to run in sync? If so, give these simple utility programs a try.

I recently purchased an Okidata 82A printer, which I have hooked up using the serial interface. I had no difficulty getting the printer to work properly. However, I discovered that I needed some printer utilities to take better advantage of the printer.

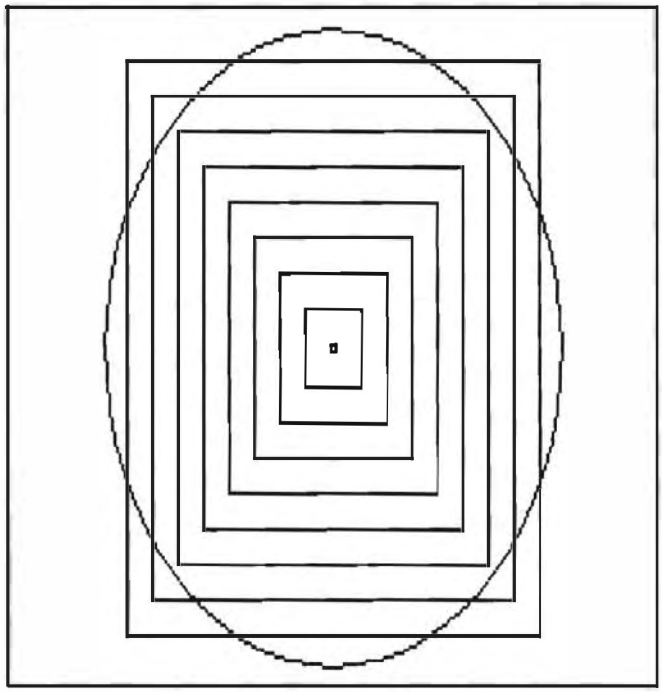
The first time I did an LLIST on a large program, the printer printed over the perforations at the bottom of each page. Program Listing 1 is my solution to this problem. This program keeps track of the number of lines printed, and after it has printed 55 lines it issues a page number and a form feed to space the paper to the beginning of the next page.

The program looks for a carriage return (0D hex, 13 decimal) to signify the end of a line. When it finds a carriage return, it increments the line count by one. If the line count is greater than the number of lines per page, the program prints a page number and issues a form feed to space the paper to the beginning of the next page.

Since many Basic program lines are longer than 80 characters, the program maintains a secondary counter. It increments the lines-per-page counter whenever a line exceeds 80 characters.

This program has two entry points. The first entry point is located at label SETUP and the second at label START. The first causes a "hook" in Basic to pass control to a separate routine whenever the program prints a character. This entry point also resets the line and page counters to zero prior to printing a new listing.

I wrote this program specifically for the Okidata 82A printer, but it is equally useful with other printers. If your printer does not have a form-feed com

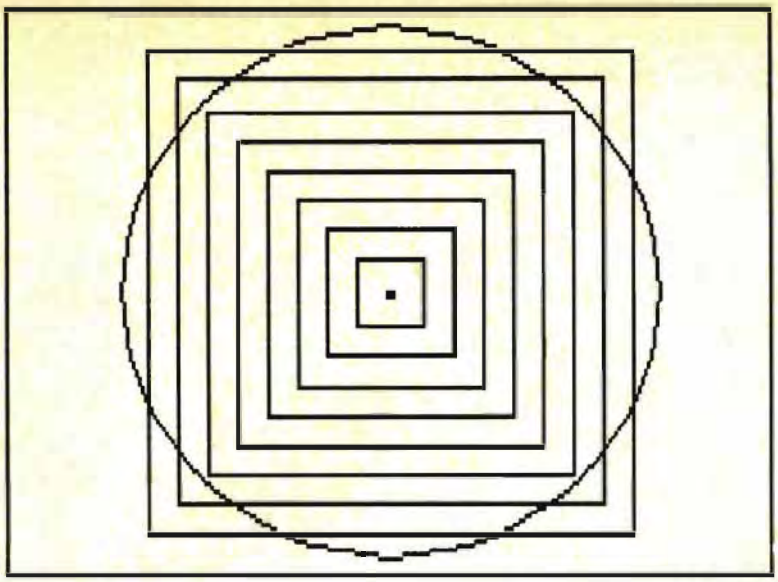


```
5 AD=1
10 PMODE4,1:PCLS:SCREEN1,0
20 FOR I=1 TO 90 STEP10
30 LINE(128-I,AD*(96-I))-(128+I,AD*(96+I)),PSET,B
40 NEXT I
50 CIRCLE(128,AD*96),90,,AD
52 LINE(00,00)-(255,AD*191),PSET,B
60 EXEC&H7A00
70 GOTO 70
```

Figure 1

System Requirements

16K RAM
Editor/Assembler
Okidata 82A or
Similar printer



```
5 AD=.717
10 PMODE4,1:PCLS:SCREEN1,0
20 FOR I=1 TO 90 STEP10
30 LINE(128-I,AD*(96-I))-(128+I,AD*(96+I)),PSET,B
40 NEXT I
50 CIRCLE(128,AD*96),90,,AD
52 LINE(00,00)-(255,AD*191),PSET,B
60 EXEC&H7A00
70 GOTO 70
```

Figure 2

mand (0C hex, 12 decimal), you must change line number 860 to a small routine to issue enough line feeds to position the print to the appropriate position on the next page. An example to space up 10 lines is shown below:

```
00860   LOOP3   LDA #10 LINEFEED
00862           LDB #10 NO OF LINES TO
                SPACE
00864           JSR $A285 PRINT IT
00866           DECB DECREMENT
                COUNTER
00868           BNE LOOP3 REPEAT
                UNTIL 10 LINES MOVED
```

If your printer requires a line feed with the carriage return to print properly, you can enter in this routine as follows:

```
00522           LDA #10 LINEFEED
00524           JSR $A285 PRINT IT
```

The second entry point is at label START and is called from the Basic operating system each time the program sends a character to the printer.

This utility routine will work with LLIST and PRINT #-2 commands. The entry point SETUP can be called from inside a Basic program to reset the counters. After loading it with a CLOADM command, you should ini-

✓ *See List of Advertisers on page 138*

```
                    00100 *       NAM LINEFEED
                    00110 *
                    00120 *       COPYRIGHT OCTOBER 1982
                    00130 *             BY
                    00140 *         ROBERT P. BUSSELL
                    00150 * THIS ROUTINE PLACES A PAGE NO. AT THE BOTTOM OF THE P
AGE AND SPACES
                    00160 * UP TO THE NEXT PAGE . THE VARIABLE PAGE MUST BE SET T
O
                    00170 * ZERO BEFORE PRINTING.
                    00180 *
                    00190 *     THE LINK AT 359-361(decimal) 167-169(hex) MUST BE
 CHANGED TO
                    00200 ******   7E7E00 from 7E8273
7E00                00210         ORG $7E00
        006F        00220 DEST    EQU $6F
7E00 34   10        00230 SETUP   PSHS X
7E02 30   8D 0014   00240         LEAX START,PCR LINK ADDRESS
7E06 BF   0168      00250         STX $168 SETUP LINK
7E09 30   8D 0087   00260         LEAX COUNT,PCR CLEAR PAGE COUNT
7E0D 6F   84        00270         CLR ,X CLEAR COUNT
7E0F 6F   01        00280         CLR 1,X CLEAR PAGE
7E11 6F   02        00290         CLR 2,X CLEAR TENS
7E13 6F   03        00300         CLR 3,X CLEAR UNITS
7E15 6F   04        00310         CLR 4,X CLEAR CHAR COUNT
7E17 35   10        00320         PULS X
7E19 39             00330         RTS
7E1A 34   16        00340 START   PSHS A,B,X
7E1C D6   6F        00350         LDB DEST OUTPUT FLAG
7E1E C1   FE        00360         CMPB #-2
7E20 26   21        00370         BNE EXIT NOT TO PRINTER
7E22 30   8D 006E   00380         LEAX COUNT,PCR
7E26 6C   04        00390         INC 4,X ADD TO CHAR COUNT
7E28 A6   04        00400         LDA 4,X
7E2A 81   50        00410         CMPA #80 80 CHAR PRINT LINE
7E2C 2F   04        00420         BLE CKCR JMP PRINT NOT FULL
7E2E 6F   04        00430         CLR 4,X RESET CHAR COUNT
7E30 6C   84        00440         INC ,X ADD TO PAGE COUNT
7E32 A6   E4        00450 CKCR    LDA ,S GET A FROM STACK
7E34 81   0D        00460         CMPA #$0D A CR?
7E36 26   0B        00470         BNE EXIT NOT EOL
7E38 A6   84        00480         LDA ,X GET COUNT
7E3A 4C             00490         INCA
7E3B 81   37        00500         CMPA #55 SKIP ON 55 LINES
7E3D 2C   09        00510         BGE SKIP
7E3F A7   84        00520         STA ,X
7E41 6F   04        00530         CLR 4,X
7E43 35   16        00540 EXIT    PULS A,B,X
7E45 7E   8273      00550         JMP $8273 CONT. OUTPUT PROCESSING
7E48 86   0A        00560 SKIP    LDA #10 LINE FEED
7E4A BD   A285      00570         JSR $A285
7E4D 86   20        00580         LDA #32 SPACE
7E4F C6   2D        00590         LDB #45 HORIZONTAL TAB
7E51 BD   A285      00600 LOOP    JSR $A285
7E54 5A             00610         DECB COUNT DOWN
7E55 26   FA        00620         BNE LOOP
7E57 30   8D 003E   00630         LEAX TEXT,PCR
7E5B A6   80        00640 LOOP1   LDA ,X+
7E5D BD   A285      00650         JSR $A285
7E60 81   00        00660         CMPA #0
7E62 26   F7        00670         BNE LOOP1
7E64 30   8D 002C   00680         LEAX COUNT,PCR
7E68 6F   84        00690         CLR ,X
7E6A 6C   01        00700         INC 1,X
7E6C A6   01        00710         LDA 1,X PAGE *TEMP*
7E6E 6F   02        00720         CLR 2,X
7E70 80   0A        00730 LOOP2   SUBA #10
7E72 2F   04        00740         BLE DIGIT
7E74 6C   02        00750         INC 2,X TENS
7E76 20   F8        00760         BRA LOOP2
7E78 A7   03        00770 DIGIT   STA 3,X UNITS
7E7A A6   02        00780         LDA 2,X
7E7C 8B   30        00790         ADDA #$30
7E7E BD   A285      00800         JSR $A285
7E81 A6   03        00810         LDA 3,X UNITS
7E83 8B   3A        00820         ADDA #$3A
7E85 BD   A285      00830         JSR $A285
7E88 86   0D        00840         LDA #$0D CR
7E8A BD   A285      00850         JSR $A285
7E8D 86   0C        00860         LDA #12 LINEFEED
7E8F BD   A285      00870         JSR $A285
7E92 20   AF        00880         BRA EXIT
7E94      00        00890 COUNT   FCB 0
7E95      00        00900 PAGE    FCB 0
7E96      00        00910 TENS    FCB 0
7E97      00        00920 UNITS   FCB 0
7E98      00        00930 CCNT    FCB 0
7E99      50        00940 TEXT    FCC /Page No. /
          61
          67
          65
          20
          4E
          6F
          2E
          20
7EA2      00        00950         FCB 0
                    00960
          7E00      00970         END SETUP
00000 TOTAL ERRORS
CCNT    7E98
CKCR    7E32
COUNT   7E94
DEST    006F
DIGIT   7E78
EXIT    7E43
LOOP    7E51
LOOP1   765B
LOOP2   7E70
PAGE    7E95
SETUP   7E00
SKIP    7E48
START   7E1A
TENS    7E96
TEXT    7E99
UNITS   7E97
```

Program Listing 1

Program Listing 2

```
                    00100 *       NAM DUMP GRAPHICS
                    00110 *       COPYRIGHT OCTOBER 1982
                    00120 *             BY
                    00130 *         ROBERT P. BUSSELL
                    00140 *
                    00150 * This program is a graphic screen dump program for the
 Microline 82A
                    00160 * printer without Okigraph.
                    00170 ************************************************
******************
        0600        00180 VIDRAM  EQU $600 START OF DISPLAY
        17A0        00190 ENDVID  EQU $17A0 LENGTH OF PMODE 4 DISPLAY
        0020        00200 W31     EQU 32 32 FOR PMODE 4,  16 FOR PMODE 2
                    00210
        A2BF        00220 PRINT   EQU $A2BF BASIC ROM PRINT ROUTINE
                    00230 ************************************************
******************
7A00                00240         ORG $7A00 ***
7A00 30   8D 00DB   00250 INIT    LEAX GWORD,PCR SET UP PRINTER
7A04 8D   71        00260         BSR PRNT 6LPI, 132 CHAR
7A06 8D   7B        00270         BSR GBUF INIT. BUF LINE
7A08 30   8D 00DB   00280         LEAX BUF,PCR 1ST WORD PRINT BUFFER
7A0C 108E 0600      00290         LDY #VIDRAM 1ST ADDR IN DISPLAY
                    00300
                    00310 ************************************************
******************
7A10 33   8D 0155   00320 MAIN    LEAU LOCB,PCR SET UP COUNTER
7A14 86   20        00330 NEXT3   LDA #W31 32 WORDS IN DISPLAY LINE
7A16 A7   C4        00340         STA ,U SAVE WORD COUNT
```

Listing continued

tialize it with the command EXEC &H7E00. I wrote it in position-independent code, so you can relocate it. Anytime you want to reset the page number back to one, execute the command EXEC &H7E00.

Graphics Screen Dump

The second printer utility program is a graphics screen-dump program. (See Program Listing 2.) Due to design limitations on the Okidata 82A and 83A printers, you cannot have both the built-in serial interface and the Okigraph ROM. To use the graphics ROM, you must buy a serial-to-parallel adaptor for the Color Computer. Fortunately, this program works with a standard serial interface and a Basic 1.1 ROM.

The program uses the graphics character set built in the Okidata printer. It allows you to produce high-resolution

✓ See List of Advertisers on page 138

Listing continued

```
7A18 E6   A0        00350 LOOPY1  LDB ,Y+ GET DISPLAY WORD TOP 1/3
7A1A 8D   7A        00360         BSR ROTL1 BITS 0,1 DISPLAY
7A1C 8D   78        00370         BSR ROTL1 BITS 2,3 DISPLAY
7A1E 8D   76        00380         BSR ROTL1 BITS 4,5 DISPLAY
7A20 8D   74        00390         BSR ROTL1 BITS 6,7 DISPLAY
7A22 6A   C4        00400         DEC ,U
7A24 A6   C4        00410         LDA ,U
7A26 81   00        00420         CMPA #0 TEST FOR END DISPLAY LINE
7A28 26   EE        00430         BNE LOOPY1
7A2A 30   8D 00B9   00440         LEAX BUF,PCR REPOSITION BUFFER TO START
7A2E 86   20        00450         LDA #W31 RESTORE COUNT
7A30 A7   C4        00460         STA ,U
7A32 E6   A0        00470 LOOPY2  LDB ,Y+ GET DISPLAY WORD MIDDLE 1/3
7A34 8D   75        00480         BSR ROTL2
7A36 8D   73        00490         BSR ROTL2
7A38 8D   71        00500         BSR ROTL2
7A3A 8D   6F        00510         BSR ROTL2
7A3C 6A   C4        00520         DEC ,U
7A3E A6   C4        00530         LDA ,U
7A40 81   00        00540         CMPA #0
7A42 26   EE        00550         BNE LOOPY2
7A44 30   8D 009F   00560         LEAX BUF,PCR REPOSITION BUFFER TO START
7A48 86   20        00570         LDA #W31
7A4A A7   C4        00580         STA ,U
7A4C E6   A0        00590 LOOPY3  LDB ,Y+ GET DISPLAY WORD LOWER 1/3
7A4E 8D   74        00600         BSR ROTL3
7A50 8D   72        00610         BSR ROTL3
7A52 8D   70        00620         BSR ROTL3
7A54 8D   6E        00630         BSR ROTL3
7A56 6A   C4        00640         DEC ,U
7A58 A6   C4        00650         LDA ,U
7A5A 81   00        00660         CMPA #0
7A5C 26   EE        00670         BNE LOOPY3
7A5E 30   8D 0085   00680         LEAX BUF,PCR START OF PRINT BUF
7A62 8D   13        00690         BSR PRNT PRINT 3 LINE GROUP
7A64 8D   1D        00700         BSR GBUF REINITIALIZE BUFFER
7A66 30   8D 007D   00710         LEAX BUF,PCR START OF PRINT BUF
7A6A 108C 1DA0      00720         CMPY #VIDRAM+ENDVID
7A6E 2F   A4        00730         BLE NEXT3 NOT AT END OF DISPLAY
7A70 30   8D 006F   00740         LEAX NWORD,PCR RESTORE  NORMAL CHARACTER MODE
7A74 8D   01        00750         BSR PRNT
7A76 39             00760 ENDD    RTS JOB DONE **TEMP REPLACE WITH 'RTS'
                    00770 ********************************************************
**********
                    00780 **      SUBROUTINES     **
                    00790
7A77 A6   80        00800 PRNT    LDA ,X+ GET CHARACTER
7A79 81   00        00810         CMPA #0 END?
7A7B 27   05        00820         BEQ EPRNT DONE
7A7D BD   A2BF      00830         JSR PRINT
7A80 20   F5        00840         BRA PRNT
7A82 39             00850 EPRNT   RTS RETURN
                    00860
7A83 34   16        00870 GBUF    PSHS A,B,X SAVEPARAMETERS
7A85 30   8D 005E   00880         LEAX BUF,PCR
7A89 C6   80        00890         LDB #128 BUF LENGTH
7A8B 86   80        00900         LDA #128 GRAPHIC BLANK
7A8D A7   80        00910 GBUF1   STA ,X+
7A8F 5A             00920         DECB DO NEXT CHAR
7A90 27   02        00930         BEQ EGBUF BRANCH DONE
7A92 20   F9        00940         BRA GBUF1 NOT DONE
7A94 35   96        00950 EGBUF   PULS A,B,X,PC RESTORE, RETURN
                    00960
7A96 4F             00970 ROTL1   CLRA
7A97 59             00980         ROLB
7A98 49             00990         ROLA
7A99 59             01000         ROLB
7A9A 49             01010         ROLA
7A9B 81   00        01020         CMPA #0
7A9D 27   07        01030         BEQ ADD1
7A9F 81   03        01040         CMPA #3
7AA1 27   03        01050         BEQ ADD1
7AA3 80   03        01060         SUBA #3
7AA5 40             01070         NEGA
7AA6 AB   84        01080 ADD1    ADDA ,X SET UPPER BITS
7AA8 A7   80        01090         STA ,X+ GET NEXT WORD
7AAA 39             01100         RTS RETURN
                    01110
7AAB 4F             01120 ROTL2   CLRA
7AAC 59             01130         ROLB
7AAD 49             01140         ROLA
7AAE 59             01150         ROLB
7AAF 49             01160         ROLA MOVE NEXT 2 BITS TO A
7AB0 81   00        01170         CMPA #0
7AB2 27   0B        01180         BEQ EROT2
7AB4 81   03        01190         CMPA #3
7AB6 27   03        01200         BEQ ADD2
7AB8 80   03        01210         SUBA #3
7ABA 40             01220         NEGA
7ABB 1C   FE        01230 ADD2            ANDCC #$FE CLEAR CARRY
7ABD 49             01240         ROLA
7ABE 49             01250         ROLA MULT BY 4
7ABF AB   84        01260 EROT2   ADDA ,X SET MIDDLE BITS
7AC1 A7   80        01270         STA ,X+ NEXT WORD
7AC3 39             01280         RTS RETURN
                    01290
7AC4 4F             01300 ROTL3   CLRA
7AC5 59             01310         ROLB
7AC6 49             01320         ROLA
7AC7 59             01330         ROLB
7AC8 49             01340         ROLA
7AC9 81   00        01350         CMPA #0
7ACB 27   0D        01360         BEQ EROT3
7ACD 81   03        01370         CMPA #3
7ACF 27   03        01380         BEQ ADD3
7AD1 80   03        01390         SUBA #3
7AD3 40             01400         NEGA
7AD4 1C   FE        01410 ADD3    ANDCC #$FE CLEAR CARRY
```

(256 by 192) screen dumps from Basic or machine-language programs that utilize the PMODE 3 and PMODE 4 resolutions. This utility should also work with the Basic 1.0 ROM if you have loaded the Radio Shack graphics print tape.

You will notice that the screen dumps are somewhat distorted from what appears on the screen. This is because a pixel displayed on the screen is rectangular, while a pixel sent to the printer is square. In Fig. 1 the circles and squares that appeared on the screen became ovals and rectangles in the printout. To produce a printer dump that does not distort the vertical (Y) values, it is necessary to apply an adjustment factor of approximately .717 to all Y values. (See Fig. 2.)

Like the first program, I wrote this utility in position-independent code, so you can relocate it. You can access it by using the command EXEC &H7A00. ■

Address correspondence to Robert Bussell, 104 Barley Court, Lexington Park, MD 20653.

Listing continued

```
7AD6 49             01420         ROLA MULT BY 16
7AD7 49             01430         ROLA
7AD8 49             01440         ROLA
7AD9 49             01450         ROLA
7ADA AB   84        01460 EROT3   ADDA ,X SET LOWER BITS
7ADC A7   80        01470         STA ,X+ NEXT WORD
7ADE 39             01480         RTS RETURN
                    01490
                    01500 ********************************************
**********
                    01510 **      VARIABLES AND TABLES    **
7ADF      1D        01520 GWORD   FCB $1D 16.5 CPI
7AE0      1B        01530         FCB $1B ESC
7AE1      38        01540         FCB $38 8 LINES PER INCH
7AE2      00        01550         FCB 0
                    01560
7AE3      1E        01570 NWORD   FCB $1E 10 CPI
7AE4      1B        01580         FCB $1B ESC
7AE5      36        01590         FCB $36 6 LINES PER INCH
7AE6      00        01600         FCB 0
                    01610
7AE7                01620 BUF     RMB 128 GRAPHIC DISPLAY BUFFER
7B67      0D        01630         FCB $0D CR, EOB
7B68      00        01640         FCB 0
                    01650
7B69      00        01660 LOCB    FCB 0
                    01670
                    01680 ********************************************
**********
          7A00      01690         END INIT
00000 TOTAL ERRORS
ADD1    7AA6
ADD2    7ABB
ADD3    7AD4
BUF     7AE7
EGBUF   7A94
ENDD    7A76
ENDVID  17A0
EPRNT   7A82
EROT2   7ABF
EROT3   7ADA
GBUF    7A83
GBUF1   7A8D
GWORD   7ADF
INIT    7A00
LOCB    7B69
LOOPY1  7A18
LOOPY2  7A32
LOOPY3  7A4C
MAIN    7A10
NEXT3   7A14
NWORD   7AE3
PRINT   A2BF
PRNT    7A77
ROTL1   7A96
ROTL2   7AAB
ROTL3   7AC4
VIDRAM  0600
W31     0020
```

BY EDWARD TOFANI

JULY 4TH CELEBRATION

If you are interested in Color Computer graphics, you will enjoy this program. July 4th is a series of subroutines that uses animated graphics to simulate a fireworks display. You set up each blast by first defining the variables and then calling the appropriate subroutines.

You can change the program to suit your own needs. For instance, lines 130–540 set up the separate shots. By adding lines or changing any variables between lines 130 and 540, you can develop your own fireworks display.

You can add as many lines as you want (depending on your computer's memory). To do so, first define all the appropriate variables, then choose the subroutines for the following functions:

- Draw a line or circle (GOSUB 890, 940, or 990)
- Create an explosion (GOSUB 830 or 1030)
- Clear the screen (GOSUB 130 or PCLS)
- Add an ending (GOSUB 780, 1170, or 1240).

To set up a line for additional fireworks, first decide where you want the fireworks to appear on the screen and define the X and Y coordinates. Then choose the size of the circle (L) and the step that the circles will be spaced apart (N). If you decide to use the left circle (GOSUB 990), you need to define R, B, and S, where R is the circle radius, B is the height/width ratio of the circle, and S is the endpoint of the circle. You will probably have to experiment with this to get the circle to line up with the explosion.

> This year you don't even have to leave your house to watch the Fourth of July fireworks display.

Now you have to decide which subroutines to use. There are three choices for the initial blast:

- A line from the right corner of the screen to the predesignated X,Y coordinates (GOSUB 890)
- A line from the left corner of the screen to the predesignated X,Y coordinates (GOSUB 940)
- A circle from the left corner of the screen.

After deciding where the shot will come from, you need to decide what kind of explosion you want. You can choose the small circle explosion (GOSUB 830) or a starburst (GOSUB 1020). To clear the starburst, I used a COLOR 0,0 statement and GOSUB 830. The program draws a black (color 0) circle from the center of the starburst outward, thereby erasing the starburst. You can clear the starburst with a PCLS command, which also works on the circle explosion as does GOSUB 1130.

I used the subroutines for spinning sparks, spark blast, falling circle, and sparks only in conjunction with the small circle explosion. All the subroutines for the sounds are built into the other subroutines and do not have to be added separately.

If you want to speed up the program, you can make the changes indicated in Table 1.

An easier way of doing this is to add only line 5. By doing so, however, the PLAYs don't sound quite right. In any case, you can sit back on Independence Day and watch the July 4th fireworks display on your computer. ■

Change lines 570, 600, 630, and 640 to read:

```
570 POKE 65494,0:PLAY"T255V31C":POKE 65495,0
600 POKE 65494,0:PLAY"T20001V31BV28AV24GV20FV16DV10C#V5C":POKE
    65495,0
630 POKE65494,0:PLAY"T25501V31BV30FV29DV28GV27EV25CV23FV21CV19GV1
    7E"
640 PLAY"V15T21002E-V13C#V11F#V9DV7AV5BV3EV1G":POKE 65495,0
```

Table 1. Changes to Speed Up Program

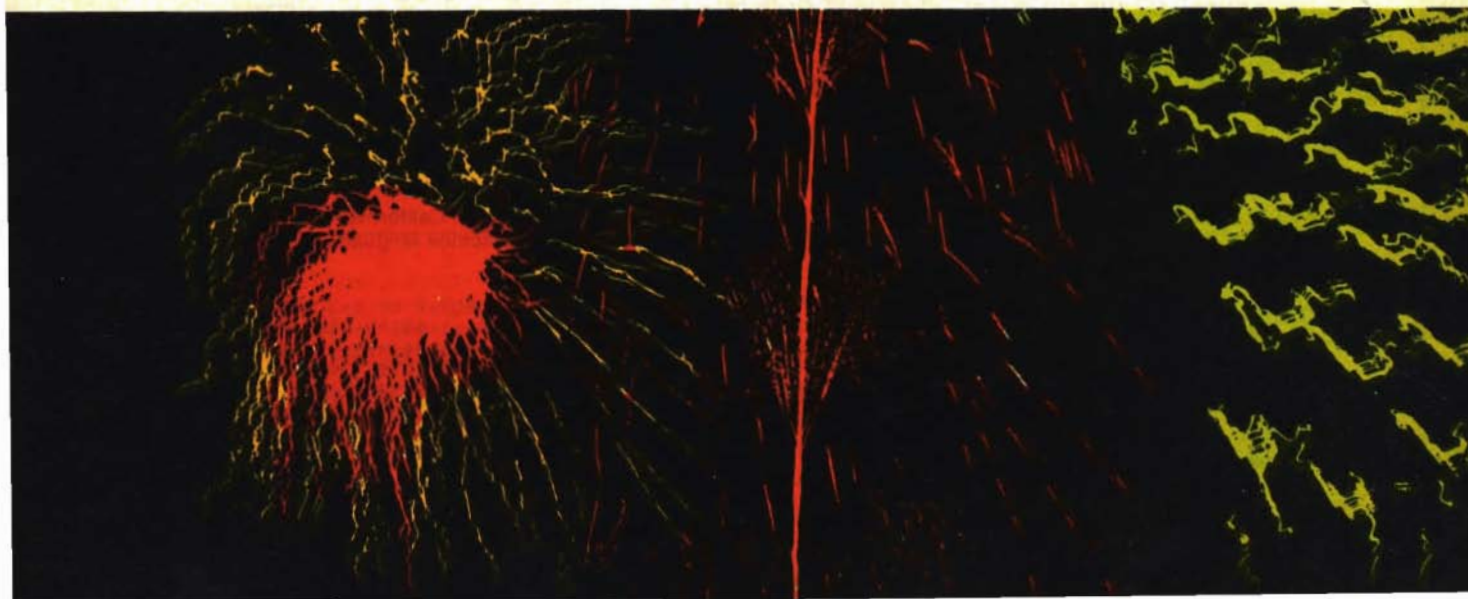
Edward Tofani can be reached at Salt Point Road, Poughkeepsie, NY 12601.

System Requirements

16K RAM
Extended Color Basic

Program Listing. July 4th

```
10 'JULY 4TH
20 'BY EDWARD (STRETCH) TOFANI
30 '620 SO. 9TH ST.
40 'PLATTSMOUTH,NEBRASKA
50 DIMA(5,10)
60 CLS:PRINT@235,"JULY 4TH"
70 FORD=1TO1000:NEXTD
80 DRAW"BM128,96U2E1U2E1U1E2R1F1D1F1D1L2G1D1G1D2G1D2"
90 DRAW"BM140,97U3H1U1H1L1U4E1U1E1R2F1D1F1D2F1D2"
100 DRAW"BM148,92U2H1L2H1L3G1L2G1"
110 GET(126,84)-(150,100),A
120 PMODE4,1:PCLS:SCREEN1,1
130 X=128:Y=96:L=10:N=2.5
140 GOSUB890:GOSUB830:PCLS:GOSUB790
150 X=70:Y=60:L=10:N=2.1
160 GOSUB950:GOSUB830:PCLS:GOSUB790
170 X=118:Y=45:L=12:N=2.6
180 GOSUB890:GOSUB830:PCLS:GOSUB790
190 X=127:Y=60:L=10:N=2.4
200 R=85:B=1.5:S=.75
210 GOSUB990:GOSUB830:PCLS:GOSUB790
220 X=157:Y=60:L=10:N=1
230 GOSUB890:GOSUB1030:COLOR0,0
240 GOSUB830:COLOR1,0
250 X=70:Y=60:L=10:N=2.2:GOSUB940
260 GOSUB830:GOSUB1130:GOSUB670
270 X=145:Y=60:L=12:N=2:R=47:B=3.5:S=.85
280 GOSUB990:GOSUB830:GOSUB1130
290 GOSUB1250:FORD=1TO150:NEXTD
300 X=50:Y=50:L=10:N=1:GOSUB940
310 GOSUB1030:COLOR0,0:GOSUB830:COLOR1,0
320 X=112:Y=80:L=12:N=4
330 GOSUB940:GOSUB830:PCLS:GOSUB1170
340 X=91:Y=31:L=10:N=1:GOSUB950
350 GOSUB1030:COLOR0,0:GOSUB830:COLOR1,0
360 X=198:Y=45:L=8:N=3
370 GOSUB890:GOSUB830:PCLS:GOSUB790
380 X=132:Y=60:L=9:N=2.7
390 R=90:B=1.5:S=.75
400 GOSUB990:R=100:S=.8:GOSUB990
410 GOSUB830:X=150:Y=53:GOSUB830:PCLS
420 X=90:Y=45:L=10:N=1:GOSUB940
430 GOSUB1030:COLOR0,0:GOSUB830:COLOR1,0
440 X=62:Y=30:L=12:N=2:GOSUB940
450 GOSUB830:GOSUB1130:GOSUB1170
460 X=190:Y=40:L=10:N=1:GOSUB890
470 FORD=1TO300:NEXTD
480 X=160:Y=50:GOSUB890
490 X=190:Y=40:GOSUB1030
500 X=160:Y=50:GOSUB1030
510 COLOR0,0:X=190:Y=40:GOSUB830
520 X=160:Y=50:GOSUB830:COLOR1,0
530 X=70:L=13:N=3:GOSUB940
540 GOSUB830:GOSUB1130:GOSUB1250
550 GOTO130
560 'SHOT
570 PLAY"T255V31C"
580 FORD=1TO30:NEXTD:RETURN
590 'SHORT EXPLOSION
600 PLAY"T200O1V31BV28AV24GV20FV16DV10C#V5C"
610 RETURN
620 'LONG EXPLOSION
630 PLAY"T255O1V31BV30FV29DV28GV27EV25CV23FV21CV19GV17E"
640 PLAY"V15T210O2E-V13C#V11F#V9DV7AV5BV3EV1G"
650 RETURN
660 'SPARKS
670 FORT=Y+10 TO Y+20STEP1.5
680 IFT>=Y+15 THEN GOTO710
690 PSET(X-7,T):PSET(X+5,T+1)
700 PSET(X+8,T-3)
710 PSET(X-1,T-1):PSET(X+13,T-4)
720 PSET(X-4,T-6):PSET(X+10,T+2)
730 FORD=1TO20:NEXTD
740 PCLS:NEXTT:RETURN
750 'ZING
760 PLAY"T255O5V5BAGFEDC"
770 RETURN
780 'SPARK BLAST
790 PUT(X-9,Y+1)-(X+15,Y+17),A
800 FORD=1TO70:NEXTD
810 PCLS:GOSUB670:RETURN
820 'SMALL CIRCLE EXPLOSION
830 FORP=1TO L STEP N
840 CIRCLE(X,Y),P
850 IFP=N+1 AND L<=10THENGOSUB600
860 IFP=N+1 AND L>=11THENGOSUB630
870 NEXTP:RETURN
880 'RIGHT LINE
890 GOSUB570
900 LINE(255,191)-(X,Y),PSET
910 LINE(255,191)-(X,Y),PRESET
920 GOSUB760:RETURN
930 'LEFT LINE
940 GOSUB570
950 LINE(0,191)-(X,Y),PSET
960 LINE(0,191)-(X,Y),PRESET
970 GOSUB760:RETURN
980 'LEFT CIRCLE
990 GOSUB570:CIRCLE(128,191),R,,B,.5,S
1000 CIRCLE(128,191),R,0,B,.5,S
1010 GOSUB760:RETURN
1020 'STAR BURST
1030 LINE(X,Y)-(X-8,Y),PSET
1040 LINE(X,Y)-(X+8,Y),PSET
1050 LINE(X,Y)-(X,Y-8),PSET
1060 LINE(X,Y)-(X,Y+8),PSET
1070 LINE(X,Y)-(X-8,Y-5),PSET
1080 LINE(X,Y)-(X+8,Y+5),PSET
1090 LINE(X,Y)-(X+8,Y-5),PSET
1100 LINE(X,Y)-(X-8,Y+5),PSET
1110 RETURN
1120 'PRESET CIRCLE EXPLOSION
1130 FORP=1TO L STEP N
1140 CIRCLE(X,Y),P,0
1150 NEXTP:RETURN
1160 'SPINNING SPARKS
1170 FORG=X-6 TO X+6 STEP4
1180 PLAY"T255V11O5CDEFGAB"
1190 LINE(X,Y)-(G,Y-6),PSET:PCLS
1200 LINE(X,Y)-(G,Y+6),PSET
1210 LINE(X,Y)-(X-6,G-46),PSET
1220 LINE(X,Y)-(X+6,G-46),PSET:PCLS
1230 NEXTG:RETURN
1240 'FALLING CIRCLE
1250 FORK=Y TO Y+20 STEP2
1260 CIRCLE(X,K),2:CIRCLE(X,K),2,0
1270 NEXTK:GOSUB600
1280 FORK=1TO5STEP2:CIRCLE(X,Y+19),K
1290 NEXTK:PCLS:RETURN
```



FAST, EFFICIENT
MACHINE LANGUAGE

Color Computer Action Games

NEW ARCADE GAMES

GLAXXONS / EL BANDITO / COSMIC CLONES

ARCADE GAMES

HAYWIRE / ASTRO BLAST / CAVE HUNTER / SPACE RAIDERS

ARCADE GAMES, CASSETTES 24.95—REQUIRE 16K / DISC 29.95—REQUIRES 34K

ADVENTURE GAMES

CALIXICO ISLAND / THE BLACK SANCTUM

ADVENTURE GAME CASSETTES 19.95—REQUIRES 16K

BUY FROM YOUR FAVORITE DEALER OR DIRECT FROM

MARK DATA PRODUCTS
24001 ALICIA PKWY., NO. 226, MISSION VIEJO, CA 92691 • (714) 768-1551

We pay shipping on all orders in the continental U.S. and Canada. Overseas add $3.00. California residents, please add 6% sales tax. We accept MasterCard and VISA. We are always looking for quality machine language programs. Contact us for details.

MD Mark Data Products

241

BY ADIB BEHI

ALPHAMETICS

Having fun with numbers is the object of this problem-solving program for puzzling alphametics.

After I bought a Color Computer with 16K Extended Color Basic, my main goal was to learn how to write programs for it. Since the best and fastest way to learn any new language is to get out the manuals and write a program to solve some problem, I decided to take that approach with the CoCo.

The problem I chose is called "alphametics," a term coined by J.A.H. Hunter, who writes a syndicated column called "Fun with Figures." Alphametics is a mathematical problem—usually addition, multiplication, or division—in which characters that are arranged in sensible phrases replace the numbers. Each character represents a number from 0 to 9, but no two characters represent the same number. See Table 1 for an example of this kind of problem.

As is the case with any written mathematical problem, leading zeros are omitted, so you can safely assume that the first characters are not zeros. I used this simple insight in the program to speed up solving any problem.

ELSIE
SELLS
HER
SHELL
SHARES

Table 1. Sample Alphametics Problem

The program I have written deals only with addition. Of course, if you have a subtraction problem, you can convert it to addition by the simple logic that if A − B = C, then A = B + C.

There's a Hard Way...

There is a very simple solution to this type of problem. I picked out all the unique characters (in Table 1 they are ELSIHRA) and used Program Listing 1. If you try it, however, you will see that it takes ages. In the worst case, where E = 9, it takes more than 9 million loops. And Basic is slow for that. To make matters worse, line 20 is a horrendous multiplication statement that slows each loop considerably.

I had to cut down on the number of loops and bypass line 20 as many times as possible.

I managed to make a significant reduction in the number of loops in the Basic program, but at the cost of adding processing time to each loop. To make a long story short, I dumped Basic. Of course, I learned a lot about Basic, and the program was elegant, if I may say so.

...And There's an Easy Way

I decided to write the whole evaluation routine in Assembly language. I divided the program into two parts. The first part, which is written in Basic, gets the inputs and does some initializations. (See Program Listing 2.) The main routine, which is written in machine language, does all the looping, bumping, calculating, and verifying—and it comes up with answers in a respectable time. (See Program Listing 3.)

The Basic Program

The Basic program (Listing 2) gets the inputs and sets up parameters for the machine-language program. Line 10 is important because it is related to the loading of the machine-language program, which is position independent. The value I have set is &H3C00 (decimal 15360), but you can change

```
5 REM LIST#1
10 FOR E=0 TO9:FOR L=0 TO 9:FOR S=0 TO9:....ETC
20 IF (E*10000+L*1000+S*100+I+10+E)+ (S*10000+E*1000+L*100+L*10+
S) +(H*100+E*10+R) + (S*10000+H*1000+E*100+L*10+L) = (S*100000+H
*10000+A*1000+R*100+E*10+S) THEN PRINT E;L;S;I;H;R;A:END
30 NEXT:NEXT:NEXT:NEXT:NEXT:NEXT:NEXT
40 PRINT"NO COMBINATION FOUND.":END
```

Program Listing 1

System Requirements

16K RAM
Extended Color Basic

ZS (ZS in machine language) is 10 bytes long and contains the value of each character as evaluated by the machine-language program.

EQ (XAS in machine language) is 10 bytes long and contains the "cannot be" values.

HG (XHS in machine language) is 10 bytes long and contains the "not higher than" values.

AS (IN in machine language) is 70 bytes long made up of 10 entries of 7 bytes each. The first 9 are the words to be added and the 10th is the "result" word.

AMT (NOR in machine language) is a value 1 to 10 denoting the number of unique characters.

RC (RETCD in machine language) is the return code as passed by the machine-language routine. A 99 means that no valid combination has been found.

Table 2. Variable List for Listing 3

Lines 40–70 POKE the parameters into machine language and on return get back the value of the different characters.

Line 90 clears the parameter fields to zeros.

Line 100 sets the "cannot be" fields to a high of 99.

Lines 110–160 add the individual words and go to the subroutine at 540 to pick up unique characters. A maximum of seven characters per word is allowed.

Lines 170–200 pick up the "result" word and go to subroutine 610 to get unique characters.

Lines 220–310 are very important to the speed of the program.

Lines 220–260 search the words and find the maximum word length and how many words of this length there are. In the ELSIE problem there are three words with five characters each (ELSIE, SELLS, SHELL).

Lines 270–290 check the "result" word for length greater than the above value. If it is higher, the first character in the "result" word cannot be higher than the number of maximum-length words minus one. In the ELSIE problem, SHARES has six letters, hence S cannot be higher than 3–1 = 2. This value is then set in the XH field for that character.

Lines 300–310 scan the XH field. If a position is found where a character cannot be higher than a certain value, then this location is switched with the first character encountered. In the ELSIE problem, S cannot be higher than 2, so the program swaps it with E, which is the first character. Therefore, ELSIHRS becomes SLEIHRA. This exchange terminates the evaluation earlier if no combination is found. It also speeds up processing. When you run the program for ELSIE, you will notice that S = 1 and E = 9. This makes E go to 9 more often.

Lines 320–380 POKE the words into AS (IN in machine language).

Lines 390–400 ask if you want to set a start value other than zero, which is the default.

Line 410 displays the characters on the screen. The machine-language program then displays the value of each as it changes.

Line 420 sets the timer to zero.

Line 430 branches to a subroutine at 40, which finally sets up the parameters and goes to the machine-language program.

Line 440 checks for the return code to see if the program found a valid combination. If not, **line 450** ends the program.

Line 500 calculates the time if the program finds a valid combination. At this point it is possible to continue the program and let it search for another valid combination. Entering a Y loads the machine-language program.

Table 3. Program Listing 3 Line Descriptions

Program Listing 2. Basic Routine

```
10 CLEAR100,&H3C00-1:RTN=&H3C00:ZS=RTN:EQ=ZS+10:HG=EQ+10:AS=HG+1
0:AMT=AS+70+10:RC=AMT+1:DEFUSR1=RC+3:POKE65496,0
20 DIM XA(10),XH(10),F$(11),A$(10),R$(10)
30 GOTO80
40 POKE AMT,NOR:POKE ZS,Z2:POKE ZS+1,Z1:POKE ZS+2,Z2:POKE ZS+3,Z
3:POKE ZS+4,Z4:POKE ZS+5,Z5:POKE ZS+6,Z6:POKE ZS+7,Z7:POKE ZS+8,
Z8:POKE ZS+9,Z9:FORI=0TO9:POKE(EQ+I),XA(I+1):POKE(HG+I),XH(I+1):
NEXTI
50 RD=USR1(0)
60 Z2=PEEK(ZS):Z1=PEEK(ZS+1):Z2=PEEK(ZS+2):Z3=PEEK(ZS+3):Z4=PEEK
(ZS+4):Z5=PEEK(ZS+5):Z6=PEEK(ZS+6):Z7=PEEK(ZS+7):Z8=PEEK(ZS+8):Z
9=PEEK(ZS+9)
70 RETURN
80 L=1:P=1:N=0
```

Listing continued

this to anywhere within a 256-byte boundary—i.e., the lower-address byte should be zero. This is because the program uses the DP register. Just make sure that CLOADM specifies the correct address. This is one example:

```
CLOADM "CALC01",&H3C00
```

That is all you need to run the program. The rest of line 10 defines the location of the parameters. See Table 2 for a list of variables and Table 3 for line descriptions of the program.

Machine-Language Program

The machine-language program is position independent. I used the direct-page (DP) register to reference the fields NOR (number of characters), RETCD (return code to Basic program), CARRY (used in the evaluation routine to keep track of the carry value), and CNT (a pointer to the entry in the IN field).

I used the DP register for these few fields because the main concern of this exercise is speed, and every method that speeds up even one instruction in a loop helps to cut down the total time significantly. The U register references fields ZS, XAS, XHS, IN, and NOS.

ZS keeps track of the value of each character. The first entry is for the first character and the last for the tenth. When I want to reference the lowest character, as in the bump routine, I use the value of NOR and the decimal instruction to locate its position in ZS.

XAS contains either 99 or 0. This is the "cannot be" field. It has a one-to-one relation to the ZS entries. XHS contains either zero or a value that says that the corresponding position in the ZS field "cannot be higher" than this value. The Basic initialization routine sets up XAS and XHS.

Note that you can set the XAS field to other values if you develop a logic that can determine that a character "cannot be" a certain value. I use it mainly for all first characters in a word.

If you are brave and clever enough to develop a method of determining that a character "must be" a certain value, then you can add a few instructions of code to the bump routine to check for it. This might involve a new field of 10 entries, with XEQ added after the XHS field.

The IN Field

If you look carefully at the Basic program, you will notice that each word entry is put in backward. Let me explain for the ELSIE problem.

FINALLY!

A REAL SPREAD-SHEET PROGRAM FOR THE COLOR COMPUTER

DYNACALC™

Business people use spread-sheets to organize columns and rows of figures. DYNACALC simulates the operation of a spread-sheet without the mess of paper and pencil. Of course, corrections and changes are a snap. Changing any entered value causes the whole spread-sheet to be re-calculated based on the new constants. This means that you can play, 'what if?' to your heart's content.

But DYNACALC isn't just for accountants. DYNACALC can be used for just about any type of job. Not only numbers, but alphanumeric messages can be handled. Engineers and other technical users will love DYNACALC's sixteen-digit math and built-in scientific functions. There's even a built-in sort command, so you can use DYNACALC to manage small data bases - up to 256 records.

DYNACALC will let your computer do just about anything you can imagine. Ask your friends who have VisiCalc, or a similar program, just how useful an electronic spread-sheet program can be for all types of household, business, engineering, and scientific applications.

DYNACALC is designed to be used by non-programmers, but even a Ph.D. in Computer Science can understand it. Built-in HELP messages are provided for quick reference to operating instructions.

DYNACALC has a beautifully simple method of reading and writing FLEX data files, so you can communicate both ways with other programs on your system, such as the Text Editor, Text Processor, Sort/Merge, RMS data base system, or other programs written in BASIC, C, PASCAL, FORTRAN, and so on.

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

Color Computer DYNACALC works with the FLEX operating system from Frank Hogg Laboratory (64k required). If you aren't already using this powerful operating system, we have a special deal for you: order DYNACALC (regularly $200) and FHL Color FLEX (regularly $99) together for only $250.

To order, see your local DYNACALC dealer, or order directly from CSC at the address below. We accept telephone orders from 10 am to 6 pm, Monday through Friday. Call us at 314-576-5020. Your VISA or MasterCard is welcome. Be sure to specify that you want the Color Computer version.

ORDER YOUR DYNACALC TODAY!

Computer Systems Center
13461 Olive Blvd.
Chesterfield, MO 63017
(314) 576-5020

CSC

507

See List of Advertisers on page 138

Listing continued

```
 90 FORI=RTN TO RC+2:POKE(I),0:NEXT
100 FORI=1TO10:XA(I)=99:NEXTI
110 INPUT"TYPE IN NOS.";AA$
120 IF LEN(AA$)>7OR LEN(AA$)<1THENGOTO110
130 IF LEFT$(AA$,2)="??"THENGOTO170
140 F$(P)=AA$:P=P+1
150 GOSUB540
160 N=N+1:IFP<10THENGOTO110
170 INPUT"TYPE IN ANSWER";AA$
180 IFLEN(AA$)>7 ORLEN(AA$)<1THENGOTO170
190 F$(P)=AA$
200 GOSUB610
210 CLS:PRINT@416,"INITIALISING"
220 FORI=1TO (P-1)
230 IF LEN(F$(I))>ICNT THEN ICNT=LEN(F$(I)):NCNT=1:GOTO250
240 IF LEN(F$(I))=ICNT THEN NCNT=NCNT+1
250 NEXTI
260 IF LEN(F$(P))<=ICNT THENGOTO300
270 FORI=1TO NOR
280 IF LEFT$(F$(P),1)=R$(I) THEN XH(I)=NCNT-1:IF XH(I)=0THEN XH(
I)=1:GOTO300ELSEGOTO300
290 NEXTI
300 FOR I=1TONOR:IFXH(I)>0ANDI<>1THENGOTO310ELSENEXT:GOTO320
310 SV=XH(I):XH(I)=XH(1):XH(1)=SV:SV=XA(I):XA(I)=XA(1):XA(1)=SV:
RS$=R$(I):R$(I)=R$(1):R$(1)=RS$
320 K=0:FORV=LEN(F$(P))TO1STEP-1:FORW=1TONOR
330 IFMID$(F$(P),V,1)=R$(W)THENPOKE(AS+63+K),W:W=NOR:K=K+1
340 NEXT:NEXT
350 FORU=1TON:K=0
360 FORV=LEN(F$(U))TO1STEP-1:FORW=1TONOR
370 IFMID$(F$(U),V,1)=R$(W)THENPOKE(AS+(U-1)*7+K),W:W=NOR:K=K+1
380 NEXT:NEXT:NEXT
390 K$=INKEY$:K$="":PRINT@416,"START VALUE FOR ";R$(1)
400 K$=INKEY$:IFK$=""THEN400ELSEIFK$<"1"ORK$>"9"THEN410ELSEZZ=VA
L(K$)
410 CLS:FORI=1TONOR:PRINTR$(I);"...":NEXT:PRINT@416,"EVALUATING"
420 TIMER=0
430 GOSUB40
440 IF PEEK(RC)<>99THENGOTO480
450 PRINT@416,"NO COMBINATION FOUND"
460 POKE65494,0
470 END
480 '
490 TL=TIMER
500 PRINT@416,"DURATION=";INT(TL/60/60);" MINS ";INT((TL-(INT(TL
/60/60))*60*60)/60);" SECS"
510 PRINT@448,"CONTINUE FOR MORE COMBINATION?":K$=INKEY$:K$=""
520 K$=INKEY$:IFK$=""THEN520ELSEIFK$="Y"THEN410
530 PRINT@416," ":POKE65494,0:END
540 '
550 FORI=1TOLEN(AA$):FORJ=1TO10
560 IFMID$(AA$,I,1)=A$(J)THENK=J:J=10:GOTO580
570 IFA$(J)=""THENNOR=NOR+1:A$(J)=MID$(AA$,I,1):K=J:J=10:GOTO580
580 NEXTJ
590 IFI=1THEN XA(K)=0
600 NEXTI:L=L+1:RETURN
610 '
620 FORI=1TO10:R$(I)=A$(I):NEXTI
630 FORI=1TOLEN(AA$):FORJ=1TO10
640 IFMID$(AA$,I,1)=R$(J)THENK=J:J=10:GOTO660
650 IFR$(J)=""THENNOR=NOR+1:R$(J)=MID$(AA$,I,1):K=J:J=10:GOTO660
660 NEXTJ
670 IFI=1THEN XA(K)=0
680 NEXTI:RETURN
```


The seven unique character values are:

```
E L S I H R A
1 2 3 4 5 6 7
```

A one-to-one relation would be:

ESLIE	12341
SELLS	31223
HER	516
SHELL	35122
SHARES	357613

The IN field shows the values reversed:

```
1432100
3221300
6150000
2215300
0000000
0000000
0000000
0000000
0000000
3167530
```

The first nine entries are the words to be added, and the tenth entry is the result field. I used this method because it made the Assembly program easier, shorter, and faster. The addition goes left to right.

Line 120 gets the program counter in the D register. Register A contains the high-order address byte, which line 130 transfers to the DP register. Then the program clears the B register and transfers the register to the U register. Hence, U points to where the program is loaded. If you add any extra fields after XHS and the total length of the parameters is greater than 255, then this method won't work.

Line 160 sets up the X register to point to the ZS field. Initially, ZS is all zeros. By going directly to ADDONE in the evaluation subroutine, I let the bump routine set up the initial configuration. Notice the very high number at which the program starts evaluating. In a jiffy, the program bypasses millions of loops.

Lines 180–190 are important. Be aware that you should clear the DP before returning to Basic.

The Bump Routine

On entry, the B register points to the ZS field entry to be incremented. This is an interesting routine. It does a lot of juggling for its small size. Of course, it was a behemoth of a routine when I started, but as I became more proficient, I pared it down to its present size.

When a position is to be bumped, the

program adds one to it (line 130) and checks if the result is greater than nine (line 240). If it is more than nine, the program first checks if it is the highest character being bumped. If so, the program has tried all possible combinations, and so it returns with an error condition after setting RETCD to 99. Line 320 is a method of indicating an error condition from a subroutine.

COMA sets the carry flag, which the calling routine then tests. On an okay condition, the program performs a CLRA, which clears the flag (line 720).

If any position is bumped, the program sets all lower positions to zeros (lines 350–390). This is important so that the program does not miss any valid combination. Later steps set the zeros to the lowest legal value in that combination.

Now comes the beaut. I had to find a way to check for double numbers and to set the lowest value in just one pass. At the same time the program must check for "cannot be" and "not higher than" values.

I accomplished this by having a new work area (NOS) of 10 entries represent the numbers 0–9. First, lines 410–460 clear the work area (note the automatic increment of the Y register). Starting with the highest character position, I get its value (line 480) and check its position in NOS (lines 500–510).

If the position is set, the program looks at the next higher number and picks up the first free number. If the program finds no free number, it sets the offending field in ZS to nine and goes back to the bump routine (lines 740–800).

When it finds a free number, it checks if this number is disallowed (lines 530–550). If so, the program bumps the position in ZS. If not, it checks the position against the "not higher than" field. If the value is greater than this field, the program sets the value to 9 and goes to the bump routine (lines 560–650).

If all the conditions are satisfied, the program sets the corresponding position in NOS (lines 660–670) and puts the value in the ZS position (line 680). It then points to the next lower position in ZS and checks if the process is complete. If not, it goes through the whole rigmarole again (lines 690–730). When you reach lines 720–730, each location is a unique and valid value.

The evaluation routine is quite straightforward. In the beginning (lines 830–910), I inserted a section to display the values of each character every time the program reaches a valid combination. In fact, the routine is executed whenever the fussy bump routine says everything is okay. The routine is fast because it sticks the values directly into the text mode screen area, which starts at location 1024.

The Basic program prints the characters before surrendering the rest of the hard calculations to the machine-language program. The machine-language program has no inkling of the actual characters. It works on just the data

Program Listing 3. Machine-Language Program

```
                00      00010          SETDP   $0
                0000    00020 ZS       EQU     0
                000A    00030 XAS      EQU     ZS+10
                0014    00040 XHS      EQU     XAS+10
                001E    00050 IN       EQU     XHS+10
                0064    00060 NOS      EQU     IN+70
0000                    00070          RMB     NOS+10
006E                    00080 NOR      RMB     1       NUM OF CHAR
006F                    00090 RETCD    RMB     1       99 IF NO
                                                       COMB
0070                    00100 CARRY    RMB     1
0071                    00110 CNT      RMB     1
0072 1F   50          00120 START    TFR     PC,D    GET PROG
                                                       CNTR
0074 1F   8B          00130          TFR     A,DP    XFER DIRECT
                                                       PG VALUE
0076 5F               00140          CLRB            PROG AT 256
                                                       -BYTE BOUND
0077 1F   03          00150          TFR     D,U     U CONTAINS
                                                       PARM ADDR
0079 30   40          00160          LEAX    ZS,U    X POINTS TO
                                                       CHARACTERS
007B 17   00CA        00170          LBSR    ADDONE  GO & EVAL
007E 4F               00180          CLRA            DRCT PG REG
007F 1F   8B          00190          TFR     A,DP    MUST BE
                                                       CLEARED
0081 39               00200          RTS             RET TO BAS
                      00210 *
0082 A6   85          00220 BUMP     LDA     B,X     GET NUM
0084 4C               00230          INCA            ADD ONE
0085 81   09          00240          CMPA    #9      IS IT >9?
0087 23   0D          00250          BLS     B2A     NO, GO CHCK
                                                       HI, LO
0089 C1   00          00260          CMPB    #0      IF HIGHEST
                                                       NUM IS 9
008B 23   03          00270          BLS     NOCOMB  ...THEN NO
                                                       MORE
008D 5A               00280          DECB            POINT TO
                                                       NEXT HIGHER
008E 20   F2          00290          BRA     BUMP    ...AND GO
                                                       BUMP
0090 86   63          00300 NOCOMB   LDA     #99     SET ERROR
0092 97   6F          00310          STA     RETCD   ...CODE
0094 43               00320          COMA            INDCT ERROR
0095 39               00330          RTS             ...& RETURN
0096 A7   85          00340 B2A      STA     B,X     STORE IN ZS
0098 5C               00350 B2       INCB            NXT LOW NUM
0099 D1   6E          00360          CMPB    NOR     ALL DONE?
009B 24   04          00370          BHS     B3      YES, GO CHK
                                                       HI, LO
009D 6F   85          00380          CLR     B,X     SET TO ZERO
009F 20   F7          00390          BRA     B2      DO NEXT LOW
                                                       NUMBER
00A1 31   C8 64       00400 B3       LEAY    NOS,U   THS FLD USD
00A4 CC   0000        00410          LDD     #0      ...TO CHECK
                                                       FOR DUPS
00A7 ED   A1          00420          STD     ,Y++    CLEAR ALL
00A9 ED   A1          00430          STD     ,Y++    ...NOS TO
00AB ED   A1          00440          STD     ,Y++    ...ZERO
00AD ED   A1          00450          STD     ,Y++    ...
00AF ED   A4          00460          STD     ,Y      ...
00B1 31   C8 64       00470 B3A      LEAY    NOS,U   GET ADDR OF
                                                       SET FLDS
00B4 A6   85          00480 B3B      LDA     B,X     GET # FM ZS
00B6 34   04          00490          PSHS    B       SAVE THIS
                                                       PTR
00B8 E6   A6          00500 B3C      LDB     A,Y     IS THIS NUM
00BA 26   2B          00510          BNE     B5      ...ALREADY
                                                       SET?
00BC 35   04          00520          PULS    B       NO,THEN GET
                                                       BACK POINTR
00BE 31   4A          00530          LEAY    XAS,U   GET 'CANNOT
                                                       BE' FIELD
00C0 A1   A5          00540          CMPA    B,Y     IS THIS NUM
                                                       NOT ALLOWD?
00C2 27   BE          00550          BEQ     BUMP    IF SO, GO
                                                       BUMP POSIT
```

Listing continued

Listing continued

```
00C4 31   C8 14    00560          LEAY    XHS,U    GET 'NOT >'
                                                   FIELD
00C7 34   02       00570          PSHS    A        SAV ZS VAL
00C9 A6   A5       00580          LDA     B,Y      GET HIGH
00CB 35   02       00590          PULS    A        RESTORE A
00CD 27   0A       00600          BEQ     B4       DO NOT CHK
                                                   IF NULL
00CF A1   A5       00610          CMPA    B,Y      IS IT HIGH?
00D1 23   06       00620          BLS     B4       NO
00D3 86   09       00630          LDA     #9       ELS SET TO9
00D5 A7   85       00640          STA     B,X      ...SO THAT
                                                   IT GETS
00D7 20   A9       00650          BRA     BUMP     ...BCK TO 0
00D9 31   C8 64    00660 B4       LEAY    NOS,U    SET INDCTOR
00DC 6C   A6       00670          INC     A,Y      ...FOR THIS
                                                   NUMBER
00DE A7   85       00680          STA     B,X      SET THIS
                                                   NUM IN ZS
00E0 5C            00690          INCB             POINT TO
                                                   NEXT LOWER
00E1 D1   6E       00700          CMPB    NOR      DONE?
00E3 D1   CF       00710          BLO     B3B      NO
00E5 4F            00720          CLRA             IND. ALL OK
00E6 39            00730          RTS              GO BACK TO
                                                   EVALUATE
00E7 4C            00740 B5       INCA             PT TO NXT
                                                   FLD IN NOS
00E8 81   0A       00750          CMPA    #10      HAVE WE
                                                   REACHED 9?
00EA 25   CC       00760          BLO     B3C      NO, GO CHK
                                                   IF SET
00EC 35   04       00770          PULS    B        GET BACK
                                                   ZS POINTER
00EE 86   09       00780          LDA     #9       SET TO 9
00F0 A7   85       00790          STA     B,X      ...TO BUMP
00F2 16   FF8D     00800          LBRA    BUMP     ...TO ZERO
                   00810 *
                   00820 *
00F5 108E 0404     00830 EVAL     LDY     #1024+4  START OF
                                                   DISPLAY
00F9 4F            00840          CLRA             CHAR COUNT
00FA E6   86       00850 EVAL1    LDB     A,X      GET NUM
00FC CB   30       00860          ADDB    #48      TO GIVE GRN
                                                   ON BLACK
00FE E7   A4       00870          STB     ,Y       PUT TO SCRN
0100 31   A8 20    00880          LEAY    32,Y     POINT TO
                                                   NEXT LINE
0103 4C            00890          INCA             BUMP CHAR
                                                   COUNT
0104 91   6E       00900          CMPA    NOR      DONE?
0106 25   F2       00910          BLO     EVAL1    NO, WRITE
                                                   NEXT CHAR
0108 31   C8 1E    00920 EVAL2    LEAY    IN,U     POINT TO
                                                   ENTRIES
010B CC   0000     00930          LDD     #0
010E 0F   70       00940 LP1A     CLR     CARRY    CLR CARRY
                                                   VALUE
0110 97   71       00950 LP1      STA     CNT      POINTS TO
                                                   'INS' VAL
0112 A6   A6       00960          LDA     A,Y      GET VALUE
                                                   INTO ZS
0114 27   03       00970          BEQ     LP1B     IF NULL,
                                                   NOTH TO ADD
0116 4A            00980          DECA             TO GET LOCA
                                                   IN ZS
0117 EB   86       00990          ADDB    A,X      NOW ADD
0119 96   71       01000 LP1B     LDA     CNT      GET POINTER
011B 8B   07       01010          ADDA    #7       BUMP TO NXT
011D 81   3E       01020          CMPA    #62      ALL NUMS
                                                   DONE?
011F 23   EF       01030          BLS     LP1      NO, GO ADD
                                                   AGAIN
0121 C1   0A       01040 LP2      CMPB    #10      INSTEAD OF
                                                   DIVIDE
0123 25   06       01050          BLO     LP3      ...SUB 10
0125 C0   0A       01060          SUBB    #10      ...TILL <10
0127 0C   70       01070          INC     CARRY    ...INCR CRY
                                                   EACH TIME
0129 20   F6       01080          BRA     LP2      DO TILL <10
012B A6   A6       01090 LP3      LDA     A,Y      GET ANS VAL
012D 27   14       01100          BEQ     CHKCR2   IF NULL
012F 4A            01110          DECA             TO GET ZS
                                                   VALUE
0130 E1   86       01120          CMPB    A,X      IS ADDED=
                                                   ANSWER?
0132 26   14       01130          BNE     ADDONE   NO, SKIPF
                                                   REST & BUMP
0134 D6   70       01140          LDB     CARRY    ELSE GET
```

Listing continued

passed to it as parameters—i.e., the number of characters, the "cannot be" and "not higher than" restrictions for each character position, and the actual words entered in coded form.

Line 860, which adds a value of decimal 48 (hex 30) to the number, gives the green-on-black display for each number.

The validation routine (lines 920–1290) adds up each digit position of the problem (lines 960–1030). Although this is a normally clumsy way to divide, the program does subtraction by 10 and adds one to carry after each subtraction until the result is less than 10 (lines 1040–1080).

Then the program compares the remainder against the same position in the answer field as indicated by the tenth entry of the IN field. If it does not match, it quits and goes to ADDONE to bump the lowest character position by one. If it does match, the program loads CARRY as the starting value and adds the next digit positions.

This continues until all the values match. This is important because it stops adding anytime a match does not occur, thus preventing unnecessary calculations.

I have tried the program with innumerable examples, and it has been true to me. It solves most problems quickly, but the speed depends on the combination of letters. It is interesting to watch the numbers, especially in the lower-range characters, whiz away. It also shows the advantage of machine-language programming.

Program Operation

The operation of the program is quite simple, but you do need an assembler. (See Program Listing 4 for the decimal values of the machine-language object code if you do not have an assembler.) Type in the instructions and assemble the program with object code to cassette. If you are using EDTASM+, use A CALCO/WE/LP to assemble the program, where CALCO is the object code name. LP is necessary if you want a listing.

Type in the Basic program. Use CLOADM to load the object code at the location you have specified in your Basic program. For example, if you have RTN=&H3C00, then type

```
CLOADM "CALCO",&H3C00
```

If you do not have an assembler, just follow the usual method of including data statements and reading them into the desired locations. Remember that

Survival Kit for the 80's

Don't program without it.

Technology in transition. Changes in hardware, software, disk systems, printers and modems—the list goes on. It's all happening so fast. How do you survive in the fast-paced computer world?

With the help of 80 MICRO, the largest single source of information for your TRS-80*. It's required reading for those who want to discover:

- •TUTORIALS—To help you become a better programmer whether you're a beginner or an old hand.
- •UTILITY PROGRAMS—Designed to let you get the most from your system.
- •NEW APPLICATIONS—In science, business, and the home.
- •NEW PRODUCT REVIEWS— Straightforward evaluations of state-of-the-art hardware and software that give you the facts before you buy.
- •NEW GAMES—Scores of innovative new games offering a real challenge and lots of fun.

With 80 MICRO in hand you won't just survive. You'll prosper in the Age of the Computer.

Subscribe today. Use the coupon, the attached card, or call toll free **1-800-258-5473.**

*TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.

Yes, I want to subscribe to 80 MICRO. Send me 12 issues for only $35.97. I understand that with payment enclosed or credit card order I will receive a free issue making a total of 13 issues for $35.97.

☐CHECK/MO ☐MC
☐VISA ☐AE ☐BILL ME

Card# _____

Signature _____ Exp. Date _____

Name _____

Address _____

City _____ State _____ Zip _____

Canada & Mexico $44.97/1 yr. only US Funds.
Foreign Surface $54.97/1 yr. only US Funds drawn on US Bank.
Please allow 6-8 weeks for delivery

337B4

80 MICRO•PO Box 981•Farmingdale, NY 11737

the address you choose should be within the 256-byte boundary. It is best to think in hexadecimal, where the low-order address byte should be zero.

Let's say it is hex 3C00, which is decimal 15360. Since the actual machine-language code starts at hex 72 (decimal 114) from the load point, you have to start reading your data statements from location 15360 + 114 = 15474. The number of bytes to read 225—that's how small the machine-language program is.

Add your Basic statements at location 21. For example:

```
21  LO=15360+114:FORI=0 TO 224
22  READ LO+I:NEXT
```

Put the data statements at the end of the Basic program.

Now type RUN and enter the words one at a time. Each word should not have more than seven characters, or the program will reject it without any indication of rejection. You can enter a maximum of nine words, one at a time. If you enter fewer than nine words, type ?? to ask for the answer word.

Please note that after each input there is a slight delay due to input verification and character searches. Then the program goes through the initialization routine, which takes a few seconds.

It then asks if you want a start value for X, where X is the first character that it has picked. If you want to choose a start value, press any number from 1 to 9. Otherwise, press enter to allow the program to continue. If the program has already determined that the value cannot be higher than a certain number and you enter a higher value, the program displays "No Combination Found." Under certain circumstances, setting the initial value can speed up the program.

Now sit back while the program tries all combinations. You can see that no two characters have the same value. If the program comes back with an answer, you can type Y to check for further combinations or press enter to terminate the program.

See Table 4 for a few examples of alphametics. These are reprinted with permission from J.A.H. Hunter's books *Challenging Mathematical Teasers* and *Mathematical Brain-Teasers* and also from his column in the *Toronto Globe and Mail*. The numbers on the left are the time in which the program solved the problem. It is in minutes/seconds (mm/ss).

The problems marked with a plus

Listing continued

```
                                                        CARRY VALUE
0136 96   71      01150          LDA     CNT          GET POINTER
                                                        TO 'INS'
0138 80   37      01160          SUBA    #55          TO POINT TO
                                                        NEXT DIGIT
013A 81   06      01170          CMPA    #6           REACHD END?
013C 23   D0      01180          BLS     LP1A         NO, GO ADD
013E D6   70      01190 CHKCRY   LDB     CARRY        WAS THERE A
                                                        CARRY
0140 26   06      01200          BNE     ADDONE       YES,WRONG
                                                        AGAIN
0142 39           01210          RTS                  ELSE FOUND
0143 C1   00      01220 CHKCR2   CMPB    #0           PREV ADD
                                                        HAD CARRY?
0145 26   01      01230          BNE     ADDONE       YES,GO BUMP
0147 39           01240          RTS                  ELSE FOUND
0148 D6   6E      01250 ADDONE   LDB     NOR          GET NUM OF
                                                        CHARACTERS
014A 5A           01260          DECB                 POINT TO ZS
014B 17   FF34    01270          LBSR    BUMP         GO BUMP
                                                        LOW DIGIT
014E 1024 FFA3    01280          LBCC    EVAL         ALL OD SO
                                                        EVALUATE
0152 39           01290          RTS                  GO BACK TO
                                                        BASIC
                  01300 *
          0000    01310          END
00000 TOTAL ERRORS

ADDONE    0148
B2        0098
B2A       0096
B3        00A1
B3A       00B1
B3C       00B8
B4        00D9
B5        00E7
BUMP      0082
CARRY     0070
CHKCR2    0143
CHKCRY    013E
CNT       0071
EVAL      00F5
EVAL1     00FA
EVAL2     0108
IN        001E
LP1       0110
LP1A      010E
LP1B      0119
LP2       0121
LP3       012B
NOCOMB    0090 | START    0072
NOR       006E | XAS      000A
NOS       0064 | XHS      0014
RETCD     006F | ZS       0000
```

```
5 REM LISTING #4
700 DATA 31,80,31,139,95,31,3,48
710 DATA 64,23,0,202,79,31,139,57
720 DATA 166,133,76,129,9,35,13,193
730 DATA 0,35,3,90,32,242,134,99
740 DATA 151,111,67,57,167,133,92
750 DATA 209,110,36,4,111,133,32,247
760 DATA 49,200,100,204,0,0,237,161
770 DATA 237,161,237,161,237,161
780 DATA 237,164,49,200,100,166,133
790 DATA 52,4,230,166,38,43,53,4
800 DATA 49,74,161,165,39,190,49,200
810 DATA 20,52,2,166,165,53,2,39,10
820 DATA 161,165,35,6,134,9,167,133
830 DATA 32,169,49,200,100,108,166
840 DATA 167,133,92,209,110,37,207,79
850 DATA 57,76,129,10,37,204,53,4,134
860 DATA 9,167,133,22,255,141,16,142,4,4
870 DATA 79,230,134,203,48,231,164,49,168
880 DATA 32,76,145,110,37,242,49,200
890 DATA 30,204,0,0,15,112,151,113
900 DATA 166,166,39,3,74,235,134,150
910 DATA 113,139,7,129,62,35,239,193,10
920 DATA 37,6,192,10,12,112,32,246,166
930 DATA 166,39,20,74,225,134,38,20
940 DATA 214,112,150,113,128,55,129,6
950 DATA 35,208,214,112,38,6,57,193
960 DATA 0,38,1,57,214,110,90,23,255
970 DATA 52,16,36,255,163,57
```

Program Listing 4. Decimal Values of Machine-Language Object Code

sign have more than one combination. For example, ORYX+ORYX+RUN +ON=KAROO has at least 16 combinations. After each result you must press Y to continue.

Two asterisks after the time mean that the time is approximate. Unfortunately, the timer cycle on the CoCo is about 18 minutes. It had no way of knowing some problems would take longer than that, so I had to guess some of the times.■

Send correspondence to Adib Behi, 391A Palmerston Blvd., Toronto, Ontario, Canada M6G 2N5.

Time MM/SS	Alphametic
0/02	EAT + IT + EAT = MISS
0/32	ELSIE + SELLS + HER + SHELL = SHARES
0/01	TOOT + TOOT + TWO = HOOTS
0/00	NO + ONE + NO + ONE = GONE
0/01	DON + DON + NO = SUDS
2/20	LETS + EAT + SAYS = SUSIE
2/35	THEN + WHERE + WERE + THOSE = OTHERS
0/21	PETER + RANKS + A + TEA = TASTER
0/41	MOMMA + MOMMA + NO = DINNER
1/43	HERE + HERE + REAL = NEWS
3/24	TRY + FAIL + AND + TRY = AGAIN
14/38	NOT + TO + WORRY = PETER
3/35	OUR + CROSS + WORD + CLUES + DO = DELUDE
0/10	NO + NO + DAN = SAID
0/02	OH + NO + NOT = THIS
5/31	LET + THE + LAST + BE = FIRST
2/03	NO + DODO + NO + MORE = DADDY
9/00	GUIDE + DOGS + DO + GOOD = DEEDS
45A**	DEAR + READER + WE + DO = EQUATE
0/39	IT + AINT + TOO + HOT = TOOTS
0/01	LOOK + LOOK + NAN + A = PANDA
0/14	LING + KWONG + LEE + LIKEE = LICHEE
0/03	NINE + LESS + TWO = SEVEN
2/54	AND + SO + TO + BED + SAYD = PEPYS
5/58	KATES + KITTEN + HATES + THESE = STEAKS
10/17	KNOCK + KNOCK + ITS + THE = POSTIE
1/18+	ORYX + ORYX + RUN + ON = KAROO
0/47	REST + BREAK + AT + BAKER = STREET
2/54	PASHAS + HUBBLE + BUBBLE = BUBBLES
8/17	PRETTY + POLLY + PARROT = REPEATS
1/57	SHAKE + SHAKE + PIPS + IN = PIPPIN
1/06	LILY + LIKES + SILKY + SILKY = NYLONS
4/03	SUSIE + SEES + A + BLUE + BLUE = BEETLE
6/11	WHEN + IN + ROME + BE + A = ROMAN
0/59	ALL + A + RUDDY + RUDDY = MUDDLE
12/35	MEIN + PAPA + LILLI + PALMER = TRILLED
3/48	ESKIMO + MISS + MISSES + ICE = ICICLES
4/41	HOLMES + SOLVED + MOOD = MURDERS
1/59	SEE + KOOKY + KOOKS = STREAK
26/**	SUSIES + SISTER + SISSIE + SKIS + IN + SUSIES = BIKINIS
0/03	THE + TEN + MEN = MEET
2/33	NINE + SEVEN + SEVEN + SEVEN = THIRTY
0/05	CELLAR + MURDER + CLERIC = CLEARED
0/01+	STOP + IT + STOP = POPS
0/13+	LETS + SEE + THE = TEST
0/15+	NERO + ONE + MEAN + MAD = ROMAN
8/06	NO + SPORT + IN + DIRTY = SPORTS
0/32	TOADS + DARE + TO + CROSS = ROADS
7/09	THE + SEVEN + SEAS = OCEANS
0/03	PINS + NIPS = SNIP
5/51	CRACKS + TRACKS = RACKET
0/43	TRIED + RIDE = STEER

\+ more than one combination
** approximate time

Table 4. Alphametics Examples

⌐ See List of Advertisers on page 138

BY HOWARD BASSEN

CLEAN SCREEN FOR COCO

I've finally gotten a clean, trouble-free, high-resolution video display for my Color Computer, after using the right combination of shielding, cables, and a filter. I'll tell you how, but first I'll give a brief description of radio-frequency interference (RFI) sources, and practical, low-cost techniques that you can use to correct the RFI problem.

The world of RFI engineering is the opposite of the digital computer world where there are only on and off states. Ideally, circuits and programs will behave the same from one time to the next and from one system to the next.

This means that if a circuit works in one system, someone else can build it using standard design rules, and it will work perfectly in the new system. This is why you can CSAVE a program on tape, load it into your computer, CSAVE the program on another tape, load the new copy, repeat this process many times, and the last copy of the program will be just as good as the first copy.

Eliminate interference on your video screen with this background information and instruction.

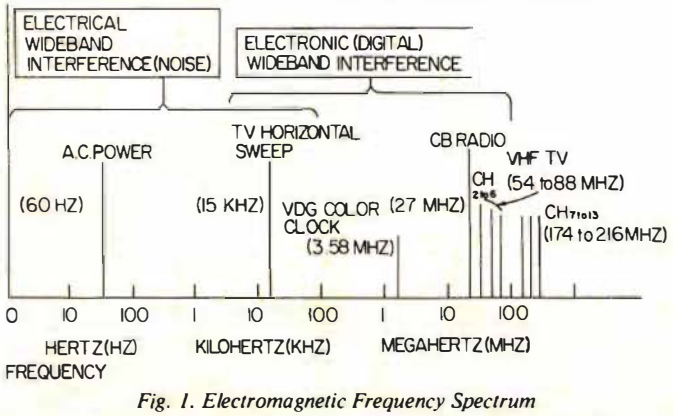


Fig. 1. Electromagnetic Frequency Spectrum

In contrast, RF circuitry is strictly in the analog electronic world, excluding the high-technology area of monolithic, very-high-speed integrated circuitry. This means that in an RF circuit every fraction of an inch of wire or component lead, every crack in the joint between a metal box and the cover that houses the circuit, and every adjustment made to the circuit is critical and not exactly repeatable.

Since your Color Computer's video output is in the form of a modulated RF signal, your computer system is part of the analog/RF world, which you should understand if you want to know and use your system in the best way possible.

The Video Output and RF Modulator

The video display, whether it is a high-resolution graphic image or a screen filled with text, is a constant array of digital code residing in your computer's memory. This code is sent to the video data generator (VDG) chip in your computer, where it is converted into a serial stream of complex signal information and synchronization (sync) pulses. These pulses are generated many thousand times every second, even if there is no change in the image.

The repeated data stream is referred to as a video field, and it contains high-frequency signals that represent every

picture element (pixel) in the field. This data is sent out on a single line, or wire, to the RF modulator in your computer.

The modulator mixes the video data with a 60-megahertz (MHz or million cycles per second) RF signal, which simulates the standard VHF TV signal that usually enters your TV receiver through the antenna. This allows any TV set to become a computer video monitor without any modification other than the installation of a cable-to-antenna adapter (the RF switch that is supplied with your Color Computer).

The Frequency Spectrum

The Color Computer generates many signals that range from very low frequencies (60 cycles per second or 60 Hz) to 70 million cycles per second (70 MHz). All these signals create electromagnetic fields around the computer, and therefore, can unintentionally receive them.

The electrical motors and switches in your home generate many signals that travel along the ac power lines and outlets running through your house. These signals are also broadcast or radiated throughout your home and beyond. Outside signals from auto ignitions, CB transmitters, ham radios, and commercial radio/TV broadcast stations enter your house continuously. The frequency-spectrum diagram in Fig. 1 shows the relative strength of signals that bombard your TV receiver.

"The Color Computer operates at a clock frequency of 0.89 MHz or 1.8 MHz. . ."

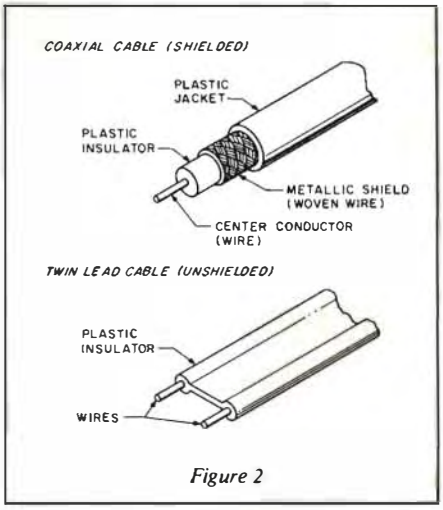


Figure 2

Cables and the Input to Your TV Receiver

Television stations broadcast high-power RF signals that channels 2-13 receive (VHF band). By the time they reach your home, these signals are very weak. Your receiver is designed so that it can receive a signal of 1 millivolt clearly. The RF modulator generates a VHF signal, but the signal must be fed to your receiver's input terminals (antennae), which are merely screw connectors, in a way that allows the desired signal to enter the set without the other signals existing around your receiver overriding it.

You must remove the rabbit-ear antennae from your receiver's input terminals and efficiently connect the RF modulator to your set, using a shielded coaxial cable consisting of an inner wire (conductor) surrounded by a plastic insulating layer and an outer metallic shield or jacket (Fig. 2).

The metal shield completely surrounds the inner conductor, and the inner conductor carries the modulated RF signal from your computer to the receiver. The shield protects your receiver from interference by the many stray

See List of Advertisers on page 138

fields existing around it.

Radio Shack and most other computer manufacturers have used an inexpensive adapter to connect the coaxial cable to any TV set. This adapter allows the connection of the computer and its coaxial cable to the antenna input terminals. The antenna input terminals usually accept only the type of cable that comes from the TV dipole (rabbit-ear) antenna, a balanced or twin-lead cable (see Fig. 2). The problem is that the twin-lead cable is unshielded and receives all other radiated signals to some extent.

Some sets have a coaxial input connector, as well as the two-screw connectors for twin-lead cable. This is common on many of the newer TV receivers that accept cable TV. The twin-lead input configuration and the short section of twin-lead cable running from the RF switch are a major source of RF interference on the Color Computer.

RFI Shielding for the Color Computer

Digital electronic circuitry generates RF interference signals that radiate from the circuit wiring to the outside world. The fast action of digital circuit elements generates high-frequency energy that spreads across the entire RF frequency band (1–100 MHz) as shown in Fig. 1. This wideband interference occurs as a result of the current being switched, and increases in its frequency span as the speed of switching increases.

The Color Computer operates at a clock frequency of 0.89 MHz or 1.8 MHz depending on the computer's immediate mode of operation.

The microprocessor chip, the SAM chip, the memory chips, and associated logic chips comprise the fast, high-current switching circuits in the Color Computer. They are completely enclosed in a metal box called the RFI shield. This enclosure with a removable lid serves to contain the RFI energy generated by the digital circuitry, but only if the lid is completely closed and no cracks longer than about an inch and wider than about 1/16 inch exist between the lid and the box.

The TV Receiver and RFI-Sensitive Components

Certain components of the TV receiver are important in terms of the TV's susceptibility to RF interference; they are shown in the block diagram of Fig. 3. The RF input to the TV receiver consists of the antenna terminals that feed directly into a tuner section. This section consists of circuitry that selects and amplifies only a narrow band of frequencies centered at one of the VHF channel frequencies. For channel 3 the tuner accepts signals from 60–66 MHz, and for channel 4 the receiver accepts signals from 66–72 MHz.

"The synchronization circuitry in the Color Computer generates the vertical and horizontal sync pulses, and refreshes the computer's RAM chips."

The tuner cannot discriminate among a TV station's broadcast, the Color Computer's RF output, or any other signal whose frequency lies within the 6-MHz band of the selected channel. The receiver rejects all other signals to a large degree, but it cannot completely reject strong signals at other frequencies.

The input to the tuner is usually only two screw terminals that accept the twin-lead cable coming from the rabbit-ear antennae on the set. A second twin-lead cable continues inside of the TV receiver to the tuner.

In most sets, just before the cable enters the actual tuner subsystem inside the set, a small transformer converts the balanced twin-lead (where neither line is ground) to an unbalanced configuration (where the tuner's metal enclosure is ground, and a single wire carries the signal via coax).

In many older sets the metal chassis, including the tuner housing, is directly connected to one of the two wires of an unpolarized ac line cord that goes to the wall outlet with 110 V ac 60 Hz power. You can connect these older sets with their nonpolarized, two-prong plugs so that either one prong or the other is connected to the "hot" side of the ac line.

Connecting a grounded coaxial cable, such as the one from the Color Computer, to the TV set will generate a dangerous short circuit in the power line if the hot line is connected to the TV chassis while the computer's ground line is at true ground potential.

A 50-percent chance exists that the hot line is connected to the chassis of these older sets. However, the twin-lead screw terminals can go to an RF transformer in these older sets, eliminating the possibility of this condition, as shown in Fig. 3.

When working with TV receivers having two-prong ac plugs, the possibility of an accident demands that great care be taken if you make any external wires or connections from the TV chassis to another object attached to the ac power line. The coaxial switch supplied with your computer also has a balanced-to-unbalanced RF transformer in it to allow the coaxial cable from the computer to mate with the two screw terminals and their balanced-input configuration. This transformer also provides ac line isolation.

The synchronization circuitry in the Color Computer generates the vertical and horizontal sync pulses, and refreshes the computer's RAM chips. This explains why computer-generated RFI can be in perfect sync with the video-display timing signals. What results from this type of RFI is a steady set of lines or small boxes on the screen.

The sync circuitry of a TV set operates on a 3.58-MHz clock. In the highest-resolution display mode, the Color Computer generates each pixel at this rate. The computer also generates lower-frequency signals that are in sync with the computer's internal clock. At a frequency of about 15,000 Hz (15 kHz)

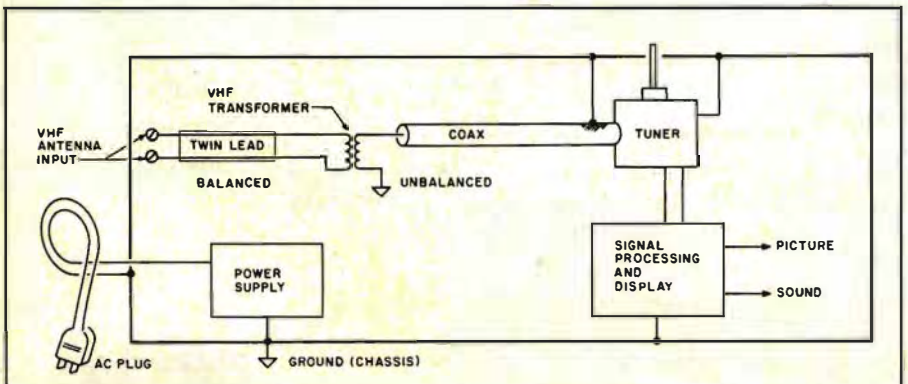


Fig. 3. TV Receiver System Elements

Micronix Proudly Introduces Our New *Premium Keyboard* for your Color Computer

All the features of our popular Professional Keyboard:

* No gluing, soldering, or cutting—plugs right in
* Four function keys complete the matrix
* High quality construction assures years of trouble-free operation
* Complete documentation included

PLUS these exciting new features:

* Attractive low profile
* Extended Radio Shack layout
* Silk-smooth feel—uses ALPS keyswitches

Our Versakey software enhances the keyboard's utility

* Auto-repeat, n-key rollover and type-ahead
* F1 becomes DEFINE, F4 becomes CTRL
* May define up to 128 keys (including their SHIFT, CTRL, and SHIFT-CTRL combinations) as strings of up to 80 characters each.
* Supplied on cassette, may be copied to disk

"Have Josie ship yours today!"

The Premium Keyboard	$89.95
The Professional Keyboard	$69.95
Versakey software	$9.95

Both keyboards carry a 90-day limited warranty.

Please specify your computer's PC board type if known. Otherwise, specify the complete catalog number and serial number.

Micronix Systems Corporation ↙203

7 Gibraltar Square
St. Charles, MO 63301
(314) 441-1694

Terms: Prepaid check or money order, Mastercard or Visa.
Shipping Charges: U.S. $2.00, Canada $5.00, COD $3.50 (No COD's to Canada).

↙ See List of Advertisers on page 138

each horizontal TV line sweeps across the screen, as controlled by the sync circuitry.

Another area of the receiver that can cause interference on the computer display is the audio modulation/demodulation circuitry. The Color Computer mixes the sound signal and the video signal in the RF modulator. Then a composite signal is fed to the RF modulator and carried out of the computer on the single coaxial cable to your receiver.

To do this, the low-frequency sound signal (about 100–5,000 Hz) is converted to a 4.5-MHz frequency-modulated signal that is then mixed with the video signal. This mixing of sound and picture signals can cause interference in the TV receiver.

This type of crosstalk interference appears on your screen only when a sound is generated, and it is not in sync with the picture. Therefore, a moving band of horizontal or diagonal line scan appears on the picture.

The correction to this problem may require adjustments inside the RF modulator or in the TV receiver. Disconnecting the audio input to the modulator will eliminate the problem completely. You must then use an external audio amplifier and speaker.

Radiated and Conducted Interference

One general category of interference is termed conducted interference. It enters the receiver through input or output wires such as the ac power line, RF input cable, cassette tape cable, or printer cable.

Unwanted signals can also enter the TV receiver without being conducted through the input or output cables, or other wires connected to the set. This type of interference enters the receiver from the air via electromagnetic coupling. Wires in the receiver act as small antennae to capture stray fields surrounding the receiver, and then they convert these signals to small electrical currents. This radiated interference will often change in appearance and strength if you move around your receiver, wave your hands around the set, or move a large metal object near the set.

"A signal originating from a source that is producing rapidly varying, on/off electrical current flow (transients) produces wideband interference."

Wideband and Narrowband Interference

An interfering signal that consists of a single frequency or a group of frequencies close together with respect to their average frequency is termed narrowband interference. An example of this is a CB transmitter near enough to your TV receiver to cause noticeable interference. This type of interference will usually produce a random, nonstationary type of line pattern on your display screen, since it is not in sync with the computer's video signals.

A signal originating from a source that is producing rapidly varying, on/off electrical current flow (transients) produces wideband interference. Sources of wideband interference include electrical motors in home appliances (vacuum cleaners, hair dryers, power tools), or unshielded digital electronic circuitry.

This type of interference usually appears as a band or screenful of white dots (Photo 1) that appear at close but random locations on the display, and cause a static sound on your audio output.

Computer Self-Interference

The computer itself can cause interference with the video display. Because it can be in sync with the video timing signal, self-interference can appear stationary on the display in a checkerboard or herringbone pattern (Photo 2).

The Cable Solution

A high-quality coaxial cable sold for outdoor antenna or cable TV connections should be used in place of the audio (not RF) coax cable supplied with your computer. Also, twin-lead cable should be eliminated wherever possible in the link from the computer's RF output to the VHF tuner input of your receiver. Adapters are readily available to convert the phono plug output of the computer to a coaxial connector.

Alternatively, you can make your own cable assembly by buying a 6-foot section of RG 58, RG 223, or similar cable, and soldering a phono connector on one end and the appropriate connector on the other end. Connectors should only be put on coaxial cable by those who know how to properly strip and fit the cable with RF connectors, since bad connections at VHF frequencies are possible with little indication of the problem appearing during visual inspection.

If you have a coaxial input connector on your set, it is possible to make a coaxial connection from the output of the computer directly to this connector; you simply do not use the switch provided with your computer. This should reduce RFI problems significantly.

If you wish, you can add an RF

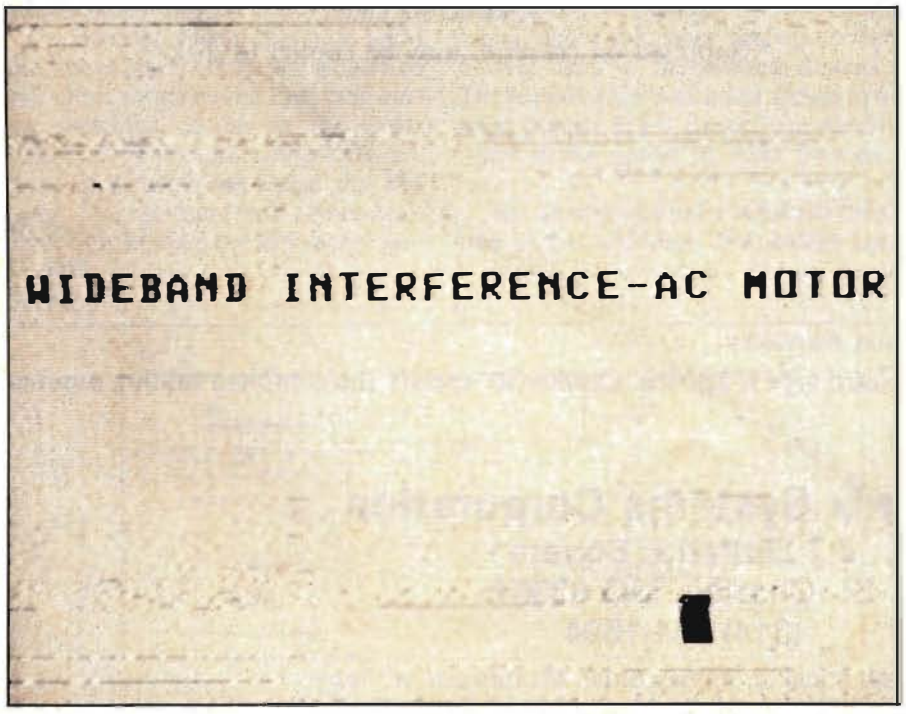


Photo 1. Wideband Interference

switch with two coaxial input connectors and one coaxial output connector. These switches are available for less than $15. You can convert your rabbit-ear antenna's twin-lead cable to a coaxial cable with a $5 transformer, and then connect this coaxial antenna output cable to the coax switch.

You should also check your coaxial cable's shield for a broken connection to the outer body of the connector. Flexing the cable at this point while watching your display will indicate whether a marginal junction exists. Also, you should make sure that each connector on the cable is tightly fitted into its mating connector. Scrape dirt or oxidation off the inner and outer contacts of all connectors as well.

RFI Shielded Enclosures

The Color Computer's RFI shield that encloses critical RF emitters should be well maintained.

If your computer has been modified with components that extend beyond the top of the shield, preventing perfect closure of the lid, you should close up all cracks that are more than 1/16 inch wide and 1 inch long.

Use either the 3M company's aluminum or copper foil tapes (available only in long rolls for about $35), or strips of aluminum foil held in place with a covering of electrical insulating tape.

If the foil moves slightly at some later time, make sure it will not short out any of the printed circuit board's component leads. Instead of foil, you can solder pieces of thin sheet metal over

Photo 2. On Screen Self-Interference

See List of Advertisers on page 138

large cracks. You can even use hookup wire soldered at 1-inch intervals along a crack.

Recently I learned of a new fix that a friend installed in his early-model Color Computer with a disk system. The shield was a piece of sheet metal that fit below the entire keyboard. The metal slid under the keyboard connector and was clipped to the ground plane of the main computer circuit board.

Also, he installed a set of grounding clips on his expansion port connector, where the disk controller ROM pack is located. He noted, however, that the clips did not actually mate with the disk controller board, making this fix useless on his computer. This means that the disk system of the Color Computer increases the RFI problem and must be dealt with through standard grounding and shielding techniques.

Circuit Modifications or Additions

If circuitry that is handling fast digital signals is modified, you must use proper grounding and shielding techniques to eliminate RFI. New dc supply lines that you've added or extended should have 0.001 to 0.01μF ceramic disk capacitors with short leads (less than ½ inch) connecting the dc line to ground.

Avoid long ground wires and make ground connections directly to the RFI shield itself or to the ground plane. In addition, you can slide ferrite beads over long wires carrying dc or low-frequency current to reduce RFI.

Digital circuitry or wiring that is placed outside the RFI shield (such as in the ROM pack/expansion connector area) can radiate strong RFI signals. Complete metal enclosures should surround these items.

Interference Filters

After the above measures have been taken to minimize interference, you can add external filters to further eliminate problems. You can buy high-pass RF filters and ac line filters for less than $10 each, but unless you use them for the proper situation, they will not help reduce interference.

Ideally, a high-pass filter allows all signals above a specified frequency to pass through the filter, while blocking all signals below this frequency. By referring to Fig. 1, you'll see that a high-pass filter with a cutoff frequency of 45 MHz could eliminate CB (27 MHz) and lower-frequency interference.

Installing an RF high-pass filter, specified as a CB interference filter, as closely as possible to the VHF terminals of the TV receiver will often eliminate conducted RF interference that appears on the display as a stationary set of patterns (see Photo 2), a moving set of lines, or small patterns. You must make good RF connections to this filter, so that you add as little unshielded wire or twin-lead as possible to the system (less than ½ inch).

"Before using filters, the source of interference should be located and, if possible, removed or isolated."

Before using filters, the source of interference should be located and, if possible, removed or isolated. A filter for line-noise emitters can be put on the ac plug of the interference-generating device. Next, you can insert an interference filter in the ac receptacle supplying the computer and its peripherals.

There are even radiated ac noise filters that are installed in series with the twin lead from a receiver's antenna. There are high-pass filters that are similar to the CB interference filter, but are designed to be more effective in eliminating signals at the lower end of the frequency spectrum.

AC Grounding

Another interference problem can occur in electronic systems that are composed of different system components tied together with a shielded cable, and are plugged into different ac receptacles. For example, if your printer is plugged into a different ac socket than your computer, and the sockets are separated by a long run of ac wiring, ground-loop voltages can develop. This means that the chassis of the computer and the chassis of the printer will develop a voltage difference even though they are both grounded with the third prong of their ac line plugs.

The solution to this problem is to plug all units into the same ac receptacle. Another solution is to use a three-prong to two-prong ac adapter on all but one of the three-prong ac plugs on your equipment.

Leaving the third ground prong disconnected will usually eliminate ground loops, but for safety from electrical shock, you must be sure that each chassis is well-grounded to each other, and that one unit has a good connection to the third ground prong of the ac receptacle. This can also solve some noise and intermittent problems that are not display interference problems.

Applications

My experience with the Color Computer can illustrate the unpredictable nature of interference reduction techniques. When I installed a memory-upgrade board in the computer, it was mounted directly above the memory chips and was supposed to fit neatly below the lid of the RFI shield. However, I could not plug the board into all four widely spaced IC sockets that were to mate with the upgrade kit's circuit board.

I learned that the misalignment of the pins and components on this board and the underlying computer board could be corrected by installing four low-profile IC sockets between the computer board's sockets and the upgrade board's pins.

This solved the problem of the misalignment of the two boards, but it increased the overall height of the circuitry contained in the RFI shield, and the lid would not completely close on all four sides.

Using the computer this way created

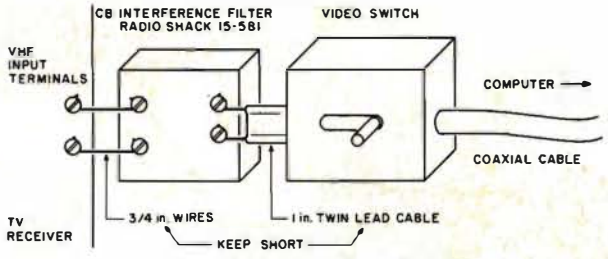


Fig. 4. Interference Filter Installation Detail

EDU-CADE

MATH DRILL **$14.95**

Provides drills in addition, subtraction, multiplication and division. The number of problems in a set and the difficulty level is user selectable. For ages 3-adult, MATH DRILL has both speed drills and teaching drill.
Requires 16K Extended Basic.

SPELLING MASTER **$14.95**

Conquer spelling! A word list is provided or user can input an unlimited number of words such as weekly spelling tests. Allows unlimited number of tries, but correct answer is given upon request. User voice recording playback is an option.
Requires 16K Extended Basic.

MORE EDU-CADES
16 K EXTENDED BASIC

•

FOREIGN LANGUAGE GAMES
French, Spanish, Italian . . . . $9.95 ea

DOLLARS AND SENSE
Money Matters for Kids $14.95

CIRCUS $10.00
Develops Reading Skills

TYPING TEACHER **$19.95**

A complete cassette based typing instruction course comprised of 15 separate lessons designed to take the beginning or rusty typist from scratch to typing proficiency at his own pace. The first 13 lessons stress eye-finger coordination while lessons 14-15 promote accuracy and develop speed. The final lessons will point out your specific errors so that you will be able to recognize a pattern of errors if one exists.
Requires 16K Extended Basic.

GEOGRAPHY PAC **$29.95**

A great way to teach or learn geography!
A collection of five Extended Basic programs designed to teach the topological location of countries (or states), their capitals, major industry, largest city and currency (or statehood date). A four-color high resolution map is displayed and the country to be identified is highlighted. It must be recognized from its shape and relative location on the continent.
A separate program for the U.S., Europe, Asia, Africa and South America is in the Geography Pac. Extended Basic and 16K RAM are required. Each program is $9.95 or all five together at $29.95.

FLEXPLUS DOS.....$69.95

A powerful, easy-to-use disk operating system!

FLEXPLUS is a powerful, easy-to-use disk operating system. Spectral Associates has adapted TSC's FLEX to the best DOS completely compatible with Radio Shack software for use on the Color Computer. Eliminate the need for Radio Shack's TRS DOS — use **FLEX PLUS** with Editor/Assembler and have the options of a full range of utilities. **FLEXPLUS** works on the 32K Radio Shack disk system with 64K memory chips with a High Resolution multi-screen format that supports a 24 line by 51 character display! Also included are special enhancements to Radio Shack's Disk system when you are running FLEX with single or double sided, single or double density, 35, 40 and 80 track drives.

SUPERCHARGER $39.95

Allows machine language access to all 64K RAM in a Series E PC board. No hardware mods

- Best price anywhere
- Wealth of existing software
- Easy start-up — just type "RUN FLEX+"
- Allows you to save RS compatible binary disk files from **FLEXPLUS**
- NO HARDWARE MODIFICATIONS NEEDED
- Warranty will not be voided — no need to open computer
- MOST FLEX compatible software will run.

FLEXPLUS $69.95
for new F Boards

FLEXPLUS with Supercharger $89.95
for use with E and F Boards

- Print Spooling - print while editing, assembling, etc.
- ALL FLEX compatible software will run including INTERRUPT DRIVEN SOFTWARE

Editor/Assembler $49.95

Quality Hardware and Software Support

TRS-80 COLOR COMPUTER
TDP SYSTEM 100
DRAGON 32

BEST SELECTION AVAILABLE

ARCADE GAMES
BASIC GAMES
UTILITIES
BOOKS
EDUCATIONAL SOFTWARE
FLEX + DOS
MEMORY EXPANSION
MODEM

For Orders Only

1-800-426-1830

except WA, AK, HI

Call or write for a complete catalog
Business Office and Information Call:
.....(206) 581-6938
Office open 8:30—4:30 P.S.T.

We accept VISA, MASTERCARD, AMERICAN EXPRESS.
Add 3% for shipping. NO C.O.D.
All prices U.S. FUNDS.
WA residents add 7.8% sales tax.

SPECTRAL ASSOCIATES

3420 South 90th Street ↵119
Tacoma, Wa 98409

↵ *See List of Advertisers on page 138*

a bad case of on-screen self-interference as shown in Photo 2. The stationary pattern indicated that the interference was in sync with the computer's display timing circuitry. I used copper foil tape to eliminate all open cracks or spaces (greater than about 1/16 inch) between the lid and body of the RFI shield.

This eliminated most of the interference on my screen, but after a few days the problem returned. There had been enough stress in the partially open lid to force the tape to lose its grip on the metal.

I retaped the cracks and put the case on again, using a wooden block arranged under the outer case to apply gentle pressure on the RFI shield lid when the computer case was closed; however, the problem kept returning.

Next, I installed a Radio Shack CB interference filter (number 15-581) between the VHF input of the receiver and the video switch connecting the coaxial cable from the computer to the twin-lead input screws. I installed the filter so that the length of the wires connecting its output to the screw terminals was less than ½ inch (Fig. 4).

This eliminated the problem fairly well when I also reapplied the copper foil tape. The problem recurred after a few days when I was running a machine-language program.

I noticed that moving the metal lid about one foot away from the computer board while the computer was running greatly increased the interference. This indicated that radiated interference was occurring in addition to the conducted interference that was eliminated by putting the filter in series with the RF input cable.

I decided to try to eliminate any antenna effects in the external wiring near the RF input of the receiver. I moved the video switch arm back and forth between the computer and TV positions and noted that the interference would change in its strength. I replaced the switch with another one that I had and the interference was reduced, but not completely gone.

Then I replaced the audio coax cable, supplied with the computer, with a 6-foot length of RG 58/U coaxial cable. I soldered RCA phono plugs on each end.

I then decided to cut the only twin lead that remained in the system. This was the 2-inch piece running from the video switch to the interference filter (see Fig. 4).

Since this last fix, my system has worked well with only the slightest bit of interference. Only a direct connection to the coax input connector of my set will completely solve the RFI problem.

Let me also mention a fix that a friend told me about. In order to operate in Basic at high speed (1.8 MHz) while using his disk, he had to remove capacitor C85 (250 pF), which went from the clock line to ground. He did not remove the other two smaller capacitors (C73 and C75) that also ran from the clock line to ground.

Not only did this allow him to operate at high speed when he typed POKE 65495,0, but it removed a great deal of the RF interference he had seen on his screen. This fix should have increased the interference, since it sharpened the clock-pulse rise time and generated more high-frequency components.

Interference reduction is an art as well as a science. You should plan ahead before buying all the hardware items mentioned in this article; you can save yourself time and money by avoiding unnecessary fixes. ■

Address correspondence to Howard Bassen, 3505 Hutch Plaza, N. Chevy Chase, MD 20825.

LUNAR-ROVER PATROL - Guide your Lunar Rover along the moon's surface following every bump and crevice as a barage of obstacles hinder your movement. No MOON-PATROL type features left out of this game.

WHIRLYBIRD RUN - Your mission is to reach and destroy the enemy base hidden deep within the Tunnel of Doom encountering missiles, saucers, and deadly gas clouds along the way. If you like SCRAMBLE, you will love WHIRLYBIRD RUN.

For Orders Only
1-800-426-1830
except WA, AK, HI

Call or write for a complete catalog
Business Office and Information Call:
.....(206) 581-6938
Office open 8:30—4:30 P.S.T.

We accept VISA, MASTERCARD, AMERICAN EXPRESS.
Add 3% for shipping. NO C.O.D.
All prices U.S. FUNDS.
WA residents add 7.8% sales tax.

SPECTRAL ASSOCIATES
3420 South 90th Street
Tacoma, WA 98409

DEALER INQUIRIES INVITED

119

See List of Advertisers on page 138

BY CAREY L. WOOD

VIVE LE COCO

Using a program to help my French students learn their verb conjugations was my first experience with computers in the classroom.

As any foreign-language teacher (or student) knows, much class time is spent on verbs. It is difficult to make the verb drills interesting, so I try to teach verbs by using them in conversation. Although this ensures correct pronunciation, the problem of correct spelling remains. Having each student write the sentence on the board or spell the verb aloud became too time consuming, so I decided to computerize verb drills.

Teaching French to high-school students has never been so easy. Learn how the CoCo can help you.

Program Listing 1. Verb Conjugation

```
10 CLS2:SOUND89,2:SOUND89,2:SOUND133,4:SOUND133,4:SOUND147,4:SOU
ND147,4:SOUND176,6:SOUND159,2:SOUND133,4:CLS
20 PRINT"COMMENT VOUS APPELEZ-VOUS":INPUTNA$
22 IFNA$=""THENPRINT"NEED A NAME":GOTO20
30 A$(1)="FIRST PERSON SINGULAR"
40 A$(2)="SECOND PERSON SINGULAR"
50 A$(3)="THIRD PERSON SINGULAR"
60 A$(4)="FIRST PERSON PLURAL"
70 A$(5)="SECOND PERSON PLURAL"
80 A$(6)="THIRD PERSON PLURAL"
100 CLS:PRINT"      LES VERBES FRANCAIS":PRINT"      OMETTEZ LES
 ACCENTS"
110 FORTI=1TO500:NEXTTI
120 NV=50
125 FORX=1TO15
130 RESTORE:A=RND(NV):C=RND(6)
140 FORB=1TOA:FORD=1TO7:READV$(D):NEXTD,B:CLS:PRINTX:PRINT:PRINT
TAB(8)V$(1):PRINT
150 PRINTA$(C)
155 INPUTF$:PRINT:IFF$=V$(C+1)THENPRINT"C'EST CORRECT, ";NA$;" !
":K=K+1 ELSE SOUND10,5:PRINT"JE REGRETTE; VOUS AVEZ TORT!":PRINT
:PRINTV$(2);TAB(15)V$(5):PRINTV$(3);TAB(15)V$(6):PRINTV$(4);TAB(
15)V$(7)
158 PRINT:PRINT:PRINT"    PRESS ANY KEY TO CONTINUE"
159 JW$=INKEY$:IFJW$=""THEN159ELSECLS8
160 NEXTX
161 IF K<14 THEN GOTO170
162 FORQQ=1TO2:SOUND89,4:SOUND108,4:SOUND125,4:SOUND89,4:NEXTQQ
163 FORQQ=1TO2:SOUND125,4:SOUND133,4:SOUND147,8:NEXTQQ
164 FORQQ=1TO2:SOUND147,2:SOUND159,2:SOUND147,2:SOUND133,2:SOUND
125,4:SOUND89,4:NEXTQQ
165 FORQQ=1TO2:SOUND89,4:SOUND32,4:SOUND89,8:NEXTQQ
170 PRINT"C'EST TOUT! ":PRINTK;" D'ENTRE 15 SONT CORRECTS"
210 END
2001 DATAACHETER,J'ACHETE,TU ACHETES,IL ACHETE,NOUS ACHETONS,VOU
S ACHETEZ,ILS ACHETENT
2002 DATAAIDER,J'AIDE,TU AIDES,IL AIDE,NOUS AIDONS,VOUS AIDEZ,IL
S AIDENT
2003 DATAANNONCER,J'ANNONCE,TU ANNONCES,IL ANNONCE,NOUS ANNONCON
S,VOUS ANNONCEZ,ILS ANNONCENT
2004 DATAAPPELER,J'APPELLE,TU APPELLES,IL APPELLE,NOUS APPELONS,
VOUS APPELEZ,ILS APPELLENT
2005 DATAAPPROCHER,J'APPROCHE,TU APPROCHES,IL APPROCHE,NOUS APPR
OCHONS,VOUS APPROCHEZ,ILS APPROCHENT
```

Listing continued

The only problem with this program is that it does not allow for accents. Although accents are important, I prefer that spelling be correct and that they work on accents in handwritten work.

This program is not intended to be an independent unit. It does not teach students to conjugate verbs, but simply supplements the teacher's instruction. With my instruction and the drill on the computer, my students have a more thorough knowledge of verbs.

Before using the computer, getting students to study verbs on their own was

System Requirements

16K RAM
Extended Color Basic

like pulling teeth. Now, however, they are standing in line to study verbs.

As an incentive, any student getting a perfect score on the program gets to play one game of Space Assault. The competition is so great to have the highest score on Space Assault that I know they have to be studying their verbs at home to win the chance to play the game.

". . . any student getting a perfect score. . . gets to play. . . Space Assault."

Other Problems

Another problem is building vocabulary. Besides supplying the students with vocabulary lists in each new chapter, I have two computer games that help increase vocabulary. Program Listing 2 gives a French word and asks for an antonym, while Program Listing 3 gives a French word and asks for a synonym. (See Tables 2 and 3.) When a student does not understand a word in

Listing continued

```
2006 DATAARRETER,J'ARRETE,TU ARRETES,IL ARRETE,NOUS ARRETONS,VOU
S ARRETEZ,ILS ARRETENT
2007 DATABROSSER,JE BROSSE,TU BROSSES,IL BROSSE,NOUS BROSSONS,VO
US BROSSEZ,ILS BROSSENT
2008 DATACACHER,JE CACHE,TU CACHES,IL CACHE,NOUS CACHONS,VOUS CA
CHEZ,ILS CACHENT
2009 DATACASSER,JE CASSE,TU CASSES,IL CASSE,NOUS CASSONS,VOUS CA
SSEZ,ILS CASSENT
2010 DATACHANTER,JE CHANTE,TU CHANTES,IL CHANTE,NOUS CHANTONS,VO
US CHANTEZ,ILS CHANTENT
2011 DATACHERCHER,JE CHERCHE,TU CHERCHES,IL CHERCHE,NOUS CHERCHO
NS,VOUS CHERCHEZ,ILS CHERCHENT
2012 DATACOMMANDER,JE COMMANDE,TU COMMANDES,IL COMMANDE,NOUS COM
MANDONS,VOUS COMMANDEZ,ILS COMMANDENT
2013 DATACOMMENCER,JE COMMENCE,TU COMMENCES,IL COMMENCE,NOUS COM
MENCONS,VOUS COMMENCEZ,ILS COMMENCENT
2014 DATACONNAITRE,JE CONNAIS,TU CONNAIS,IL CONNAIT,NOUS CONNAIS
SONS,VOUS CONNAISSEZ,ILS CONNAISSENT
2015 DATACOUCHER,JE COUCHE,TU COUCHES,IL COUCHE,NOUS COUCHONS,VO
US COUCHEZ,ILS COUCHENT
2016 DATACROIRE,JE CROIS,TU CROIS,IL CROIT,NOUS CROYONS,VOUS CRO
YEZ,ILS CROIENT
2017 DATADANSER,JE DANSE,TU DANSES,IL DANSE,NOUS DANSONS,VOUS DA
NSEZ,ILS DANSENT
2018 DATADESCENDRE,JE DESCENDS,TU DESCENDS,IL DESCEND,NOUS DESCE
NDONS,VOUS DESCENDEZ,ILS DESCENDENT
2019 DATADEVENIR,JE DEVIENS,TU DEVIENS,IL DEVIENT,NOUS DEVENONS,
VOUS DEVENEZ,ILS DEVIENNENT
2020 DATADIRE,JE DIS,TU DIS,IL DIT,NOUS DISONS,VOUS DITES,ILS DI
SENT
2021 DATAEMPRUNTER,J'EMPRUNTE,TU EMPRUNTES,IL EMPRUNTE,NOUS EMPR
UNTONS,VOUS EMPRUNTEZ,ILS EMPRUNTENT
2022 DATAENDORMIR,J'ENDORS,TU ENDORS,IL ENDORT,NOUS ENDORMONS,VO
US ENDORMEZ,ILS ENDORMENT
2023 DATAESPERER,J'ESPERE,TU ESPERES,IL ESPERE,NOUS ESPERONS,VOU
S ESPEREZ,ILS ESPERENT
2024 DATAESSAYER,J'ESSAIE,TU ESSAIES,IL ESSAIE,NOUS ESSAYONS,VOU
S ESSAYEZ,ILS ESSAIENT
```

Listing continued

↙ See List of Advertisers on page 138

Listing continued

```
2025 DATAESSUYER,J'ESSUIE,TU ESSUIES,IL ESSUIE,NOUS ESSUYONS,VOU
S ESSUYEZ,ILS ESSUIENT
2026 DATAHABILLER,J'HABILLE,TU HABILLES,IL HABILLE, NOUS HABILLO
NS,VOUS HABILLEZ,ILS HABILLENT
2027 DATAINVITER,J'INVITE,TU INVITES,IL INVITE,NOUS INVITONS,VOU
S INVITEZ,ILS INVITENT
2028 DATAJETER,JE JETTE,TU JETTES,IL JETTE,NOUS JETTONS,VOUS JET
TEZ,ILS JETTENT
2029 DATALAISSER,JE LAISSE,TU LAISSES,IL LAISSE,NOUS LAISSONS,VO
US LAISSEZ,ILS LAISSENT
2030 DATALAVER,JE LAVE,TU LAVES,IL LAVE,NOUS LAVONS,VOUS LAVEZ,I
LS LAVENT
2031 DATALIRE,JE LIS,TU LIS IL LIT,NOUS LISONS,VOUS LISEZ,ILS LI
SENT
2032 DATAMANGER,JE MANGE,TU MANGES,IL MANGE,NOUS MANGEONS,VOUS M
ANGEZ,ILS MANGENT
2033 DATAMONTER,JE MONTE,TU MONTES,IL MONTE,NOUS MONTONS,VOUS MO
NTEZ,ILS MONTENT
2034 DATA MOURIR,JE MEURS,TU MEURS,IL MEURT,NOUS MOURONS,VOUS MO
UREZ,ILS MEURENT
2035 DATANAGER,JE NAGE,TU NAGES,IL NAGE,NOUS NAGEONS,VOUS NAGEZ,
ILS NAGENT
2036 DATANAITRE,JE NAIS,TU NAIS,IL NAIT,NOUS NAISSONS,VOUS NAISS
EZ,ILS NAISSENT
2037 DATANETTOYER,JE NETTOIE,TU NETTOIES,IL NETTOIE,NOUS NETTOYO
NS,VOUS NETTOYEZ,ILS NETTOIENT
2038 DATA OFFRIR,JE OFFRE,TU OFFRES,IL OFFRE,NOUS OFFRONS,VOUS O
FFREZ,ILS OFFRENT
2039 DATAORGANISER,JE ORGANISE,TU ORGANISES,IL ORGANISE,NOUS ORG
ANISONS,VOUS ORGANISEZ,ILS ORGANISENT
2040 DATAOUBLIER,J'OUBLIE,TU OUBLIES,IL OUBLIE,NOUS OUBLIONS,VOU
S OUBLIEZ,ILS OUBLIENT
2041 DATAPASSER,JE PASSE,TU PASSES,IL PASSE,NOUS PASSONS,VOUS PA
SSEZ,ILS PASSENT
2042 DATAPEIGNER,JE PEIGNE,TU PEIGNES,IL PEIGNE,NOUS PEIGNONS,VO
US PEIGNEZ,ILS PEIGNENT
2043 DATAPERMETTRE,JE PERMETS,TU PERMETS,IL PERMET,NOUS PERMETTO
NS,VOUS PERMETTEZ,ILS PERMETTENT
2044 DATAPREFERER,JE PREFERE,TU PREFERES,IL PREFERE,NOUS PREFERO
NS,VOUS PREFEREZ,ILS PREFERENT
2045 DATAPRETER,JE PRETE,TU PRETES,IL PRETE,NOUS PRETONS,VOUS PR
ETEZ,ILS PRETENT
2046 DATA PROMENER,JE PROMENE,TU PROMENES,IL PROMENE,NOUS PROMEN
ONS,VOUS PROMENEZ,ILS PROMENENT
2047 DATAPROMETTRE,JE PROMETS,TU PROMETS,IL PROMET,NOUS PROMETTO
NS,VOUS PROMETTEZ,ILS PROMETTENT
2048 DATAPRONONCER,JE PRONONCE,TU PRONONCES,IL PRONONCE,NOUS PRO
NONCONS,VOUS PRONONCEZ,ILS PRONONCENT
2049 DATAQUITTER,JE QUITTE,TU QUITTES,IL QUITTE,NOUS QUITTONS,VO
US QUITTEZ,ILS QUITTENT
```

Program Listing 2. Antonyms

```
10 CLS:AN=79:DIMAA(AN):FORA=1TO11:BL$=BL$+CHR$(128):NEXTA:FORA=0
TO480STEP32:PRINT@A,BL$;:NEXTA:FORA=1TO6:GB$=GB$+CHR$(128):NEXTA
20 FORA=1TO481STEP32:PRINT@A,CHR$(255);:PRINT@A+7,CHR$(255);:NEX
TA:FORA=1TO6:O$=O$+CHR$(255):NEXTA:PRINT@2,O$;:FORA=386TO482STEP
32:PRINT@A,O$;:NEXTA
```

Listing continued

conversation, the class can help him or her by giving an antonym or synonym.

The French hangman game in Program Listings 4A and 4B is helpful in improving spelling and makes the student think in French. (See Table 4.) The English-to-French translation program in Listing 5 tests the student's knowledge of the infinitives of verbs in the verb-conjugation program. For example, it might ask for the French equivalent of "to speak." If the student answers "parler," the program continues to the next selection.

"Before using the computer, getting students to study verbs on their own was like pulling teeth."

This program has also been helpful in checking if students know the meanings of verbs that they have been conjugating in Listing 1.

By using these programs, the students study spelling, verbs, and vocabulary words on their own. I can spend more class time on conversation, supplementary reading, and short writing assignments—all in French. ■

Address correspondence to Carey L. Wood, 424 N. Missouri Ave., Box 507, Atwood, IL 61913.

AARDVARK

TRS-80 COLOR COMMODORE 64 VIC-20 SINCLAIR/TIMEX TI99

QUEST – A NEW IDEA IN ADVENTURE GAMES! Different from all the others. Quest is played on a computer generated map of Alesia. Your job is to gather men and supplies by combat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time. 16k TI99, TRS-80 Color, and Sinclair, 13K VIC-20. $14.95 each.

32K TRS 80 COLOR Version $24.95.

Adds a second level with dungeons and more Questing.

CATERPILLAR

O.K., the Caterpillar does look a lot like a Centipede. We have spiders, falling fleas, monsters traipsing across the screen, poison mushrooms, and a lot of other familiar stuff. COLOR 80 requires 16k and Joysticks. This is Edson's best game to date. $19.95 for TRS 80 COLOR.

ADVENTURES!!!

The Adventures below are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer, commands like "Look in the Coffin" and "Light the torch.")

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC. Now available for TI99. Any Commodore 64.

$14.95 Tape – $19.95 Disk.

ESCAPE FROM MARS
(by Rodger Olsen)

This ADVENTURE takes place on the RED PLANET. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

PYRAMID (by Rodger Olsen)

This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!

DERELICT
(by Rodger Olsen & Bob Anderson)

New winner in the toughest adventure from Aardvark sweepstakes. This one takes place on an alien ship that has been deserted for a thousand years – and is still dangerous!

NEW **Dungeons of Death** – Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. At the normal price for an Adventure ($14.95 tape, $19.95 disk), this is a giveaway.

WIZARDS TOWER – This is very similar to Quest (see above). We added wizards, magic, dragons, and dungeons to come up with a Quest with a D&D flavor. It requires 16k extended color BASIC. $14.95 Tape, $19.95 Disk. VIC 20 Commodore 64.

NEW **PLANET RAIDERS** – Not just another defenders copy, this is an original program good in its own right. You pilot a one man ship across a planetary surface dogfighting with alien ships and blasting ground installations while you rescue stranded troopers. Rescue all the troopers and be transported to another harder, faster battle. Joysticks required. ALL MACHINE CODE! EDSONS BEST! 16K Tape TRS80COLOR $19.95 – 32K Disk $21.95.

BASIC THAT ZOOOMMS!!
AT LAST AN AFFORDABLE COMPILER!

The compiler allows you to write your programs in easy BASIC and then automatically generates a machine code equivalent that runs 50 to 150 times faster.

It does have some limitations. It takes at least 8k of RAM to run the compiler and it does only support a subset of BASIC– about 20 commands including FOR, NEXT, END, GOSUB, GOTO, IF, THEN, RETURN, END, PRINT, STOP, USR (X), PEEK, POKE, *, /, +, -, >, <, =, VARIABLE NAMES A-Z, SUBSCRIPTED VARIABLES, and INTEGER NUMBERS FORM 0-64K.

TINY COMPILER is written in BASIC. It generates native, relocatable 6502 or 6809 code. It comes with a 20-page manual and can be modified or augmented by the user. $24.95 on tape or disk for OSI, TRS-80 Color, VIC 20, or Commodore 64.

SEAWOLFE – ALL MACHINE CODE In this high speed arcade game, you lay out patterns of torpedoes ahead of the attacking PT boats. Requires Joysticks, at least 13k RAM, and fast reflexes. Lots of Color and Sound. A fun game. Tape or Disk for Vic20, Commodore 64, and TRS-80 Color.

$14.95 Tape - $19.95 Disk.

Dealers – We have the best deal going for you. Good discounts, exchange programs, and factory support. Send for Dealer Information.

Authors – Aardvark pays the highest commissions in the industry and gives programs the widest possible advertising coverage. Send a Self Addressed Stamped Envelope for our Authors Information Package.

Adventures and Quest now available for TI99

Please specify system on all orders

ALSO FROM AARDVARK – This is only a partial list of what we carry. We have a lot of other games (particularly for the TRS-80 Color and OSI), business programs, blank tapes and disks and hardware. Send $1.00 for our complete catalog.

AARDVARK

2352 S. Commerce, Walled Lake, MI 48088 / (313) 669-3110

Phone Orders Accepted 8:00 a.m. to 4:00 p.m. EST. Mon.-Fri. ↙107

$2.00 shipping on each order

↙ See List of Advertisers on page 138

Listing continued

```
30 PRINT@388,CHR$(254)+CHR$(253);:PRINT@420,CHR$(242)+CHR$(241);
40 Y1$=CHR$(156)+CHR$(157)+CHR$(159)+CHR$(159)+CHR$(159)+CHR$(15
9):Y2$=CHR$(128)+CHR$(128)+CHR$(128)+CHR$(156)+CHR$(157)+CHR$(15
9):PRINT@34,Y1$;:PRINT@66,Y2$;
50 PRINT@11,"BEAT THE GUILLOTINE";:PRINT@76,"GIVE ANTONYM OF";
60 PRINT@395," 20 QUESTIONS TOTAL";
70 PRINT@430,"CORRECT";:PRINT@462,"INCORRECT";
80 PO=34
90 FORJW=1TO20
100 RESTORE
110 R=RND(AN)
120 IFAA(R)=1THEN110ELSEAA(R)=1
130 FORC=1TOR:READA$,B$:NEXTC
140 ONRND(2)GOTO150,170
150 PRINT@107,A$;:PRINT@139,"";:INPUTAN$:IFAN$=B$THENNC=NC+1ELSE
PRINT@171,"WRONG, IT IS-";:PRINT@204,B$;:GOTO190
160 SOUND150,2:GOTO200
170 PRINT@107,B$;:PRINT@139,"";:INPUTAN$:IFAN$=A$THENNC=NC+1ELSE
PRINT@171,"WRONG, IT IS-";:PRINT@204,A$;:GOTO190
180 SOUND150,2:GOTO200
190 SOUND5,1:FORA=34TO290STEP32:PRINT@A,GB$;:PRINT@A+32,Y1$;:PRI
NT@A+64,Y2$;:FORTI=1TO5:NEXTTI:NEXTA:PRINT@322,GB$;:PRINT@354,GB
$;:FORTI=1TO800:NEXTTI:PRINT@34,Y1$;:PRINT@66,Y2$;
200 WO$="                ":FORA=107TO235STEP32:PRINT@A,WO$;:
NEXTA:PRINT@440,NC;:PRINT@472,JW-NC;:NEXTJW
210 IFJW=20THENPRINT@386,GB$;:PRINT@366,CHR$(34);"NO CASUALTIES"
;CHR$(34);:END
220 PRINT@386,"MAYBE NEXT TIME";:END
```

Listing continued

Line description:

10	opening music
30–80	sets up strings
120–150	picks a verb and which tense you are to respond with
155	determines if response is correct and displays entire conjugation if not
161–165	musical reward for missing no more than one question
2001–2044	data, verbs and their conjugations

Table 1. Verb conjugation Program, Listing 1

Line description:

10–70	sets up screen display
110–130	prevents one set of antonyms from being asked twice
140	randomizes which one of the antonym pair will be asked
150,170	asks for antonym, determines if correct
160,180	audio reward for correct answer
190	guillotine drops
200	clears screen of old question and answer
210–220	ending message
230–1010	data, antonym pairs

Table 2. Antonyms Program, Listing 2

Line description:

10–60	sets up screen display
110–130	prevents one set of synonyms from being asked twice
140	randomizes which one of the synonym pair will be asked
150,170	asks for synonym, determines if correct
160,180	audio reward for correct answer
200	clears screen of old question and answer
210	determines if all 13 questions were answered correctly
220	graphic reward for all 13 questions correct
240–680	data, synonym pairs

Table 3. Synonyms Program, Listing 3

Listing continued

```
230 DATA ABSENT,PRESENT
240 DATA ACCEPTER,REFUSER
250 DATA ACHETER,VENDRE
260 DATA ALLER,VENIR
270 DATA L'AMI,L'ENNEMI
280 DATA ANCIEN,MODERNE
290 DATA ARRIVER,PARTIR
300 DATA L'AUTOMNE,LE PRINTEMPS
310 DATA AVANT,APRES
320 DATA AVEC,SANS
330 DATA BAS,HAUT
340 DATA BEAU,LAID
350 DATA BEAUCOUP,PEU
360 DATA BIEN,MAL
370 DATA LE BRUIT,LE SILENCE
380 DATA CHAUD,FROID
390 DATA CHER,BON MARCHE
400 DATA LE COMMENCEMENT,LA FIN
410 DATA COMMENCER,FINIR
420 DATA COURT,LONG
430 DATA DEBOUT,ASSIS
440 DATA DEMANDER,REPONDRE
450 DATA DEVANT,DERRIERE
460 DATA DROIT,GAUCHE
470 DATA EMPRUNTER,PRETER

480 DATA ENTRER,SORTIR
490 DATA L'EST,L'OUEST
500 DATA L'ETE,L'HIVER
510 DATA FACILE,DIFFICILE
520 DATA FERMER,OUVRIR
530 DATA FORT,FAIBLE
540 DATA LE GARCON,LA JEUNE FILLE
550 DATA GRAND,PETIT
560 DATA LA GUERRE,LA PAIX
570 DATA HEUREUX,TRISTE
580 DATA HEIR,DEMAIN
590 DATA L'HOMME,LA FEMME
600 DATA ICI,LA
610 DATA LA JEUNESSE,LA VIEILLESSE
620 DATA JOUER,TRAVAILLER
630 DATA LE JOUR,LA NUIT
640 DATA LARGE,ETROIT
650 DATA LEGER,LOURD
660 DATA LE LENDEMAIN,LA VEILLE
670 DATA LE MARI,LA FEMME
680 DATA MIDI,MINUIT
690 DATA MONTER,DESCENDRE
700 DATA NE,MORT
710 DATA LE NORD,LE SUD

720 DATA OBEIR,DESOBEIR
730 DATA OTER,METTRE
740 DATA PARAITRE,DISPARAITRE
750 DATA PARESSEUX,TRAVAILLEUR
760 DATA PAUVRE,RICHE
770 DATA LE PLANCHER,LE PLAFOND
780 DATA PLEIN,VIDE
790 DATA PLEURER,RIRE
800 DATA PLUS,MOINS
810 DATA POLI,IMPOLI
820 DATA POSSIBLE,IMPOSSIBLE
830 DATA PREMIER,DERNIER
840 DATA PRES DE,LOIN DE
850 DATA PROPRE,SALE
860 DATA QUELQUE CHOSE,RIEN
870 DATA QUELQU'UM,PERSONNE
880 DATA LA QUESTION,LA REPONSE
890 DATA REUSSIR,ECHOUER
900 DATA LE ROI,LA REINE
910 DATA S'AMUSER,S'ENNUYER
920 DATA LE SOLEIL,LA LUNE

930 DATA SOUVENT,RAREMENT
940 DATA SUR,SOUS
950 DATA UTILE,INUTILE
960 DATA LA VIE,LA MORT
970 DATA LA VILLE,LA CAMPAGNE
980 DATA VITE,LENTEMENT
990 DATA VIVRE,MOURIR
1000 DATA VOICI,VOILA
1010 DATA VRAI,FAUX
```

Program Listing 3. Synonyms

```
10 CLS:SN=45:DIMAA(SN):FORA=1TO9:BL$=BL$+CHR$(128):NEXTA:FORA=0T
O480STEP32:PRINT@A,BL$+CHR$(128)+CHR$(128);:NEXTA
20 FL$=CHR$(175)+CHR$(175)+CHR$(175)+CHR$(207)+CHR$(207)+CHR$(20
7)+CHR$(191)+CHR$(191)+CHR$(191)
30 FORA=0TO31:SET(1,A,2):NEXTA
40 FORA=417TO481STEP32:PRINT@A,FL$;:NEXTA
50 PRINT@11,"RAISE THE FRENCH FLAG";:PRINT@76,"GIVE SYNONYME OF"
;
60 PRINT@430,"CORRECT";:PRINT@462,"INCORRECT";
70 PO=417
80 FORJW=1TO13
90 PRINT@440,NC;:PRINT@472,JW-NC-1
100 RESTORE
110 R=RND(SN)
120 IFAA(R)=1THEN110ELSEAA(R)=1
130 FORC=1TOR:READA$,B$:NEXTC
140 ONRND(2)GOTO150,170
150 PRINT@107,A$;:PRINT@139,"";:INPUTSY$:IFSY$=B$THENNC=NC+1:PO=
PO-32:PRINT@PO,FL$;:PRINT@PO+96,BL$;ELSEPRINT@171,"WRONG, IT IS-
";:PRINT@204,B$;:GOTO190
160 SOUND150,2:GOTO200
170 PRINT@107,B$;:PRINT@139,"";:INPUTSY$:IFSY$=A$THENNC=NC+1:PO=
PO-32:PRINT@PO,FL$;:PRINT@PO+96,BL$;ELSEPRINT@171,"WRONG, IT IS-
";:PRINT@204,A$;:GOTO190
180 SOUND150,2:GOTO200
190 SOUND5,1:FORTI=1TO800:NEXTTI
200 WO$="                    ":FORA=107TO235STEP32:PRINT@A,WO$;:
NEXTA,JW
210 IFJW=13THENCLS0ELSEPRINT@366,CHR$(34);"MAYBE NEXT TIME";CHR$
(34);:END
220 FORZ=1TO10:F1$=F1$+CHR$(175):F2$=F2$+CHR$(207):F3$=F3$+CHR$(
191):NEXTZ:FF$=F1$+F2$+F3$:FORA=1TO481STEP32:PRINT@A,FF$;:NEXTA
230 FORA=1TO1000:NEXTA:CLS:PRINT@70,"CONGRADULATIONS":END
240 DATA ALLER,SE PORTER
250 DATA ARRIVER,SE PASSER
260 DATA AUSSITOT QUE,DES QUE
270 DATA LE BATIMENT,L'EDIFICE
280 DATA CAR,PARCE QUE
290 DATA CELEBRE,FAMEUX
300 DATA CERTAIN,SUR
310 DATA LE CHEMIN,LA ROUTE
320 DATA COMMENCER A,SE METTRE A
330 DATA EMPLOYER,SE SERVIR DE
340 DATA L'ENDROIT,LE LIEU
350 DATA L'ESPECE,LA SORTE
360 DATA LA FAUTE,L'ERREUR
370 DATA FAVORI,PREFERE
380 DATA LA FIGURE,LE VISAGE
390 DATA LA FIN,LE BOUT
400 DATA FINIR,TERMINER
410 DATA GRAVE,SERIEUX
420 DATA HABITER,DEMEURER
430 DATA HEUREUX,CONTENT
440 DATA L'IMAGE,LE TABLEAU
450 DATA IMMEDIATEMENT,TOUT DE SUITE
460 DATA LE PROFESSEUR,L'INSTITUTEUR
470 DATA LA MANIERE,LA FACON
480 DATA MECHANT,MAUVAIS
490 DATA LE MEDECIN,LE DOCTEUR
500 DATA MENER,CONDUIRE
510 DATA LE MILIEU,LE CENTRE
520 DATA LA NATION,LE PAYS
530 DATA LE PALAIS,LE CHATEAU
540 DATA LA PENSEE,L'IDEE
550 DATA PREFERER,AIMER MIEUX
560 DATA PUIS,ENSUITE
570 DATA QUAND,LORSQUE
580 DATA QUELQUEFOIS,PARFOIS
590 DATA REFLECHIR,PENSER
600 DATA ROMPRE,CASSER
610 DATA SE RAPPELER,SE SOUVENIR DE
620 DATA SEULEMENT,NE...QUE
630 DATA SONGER A,PENSER A
640 DATA LE SUD,LE MIDI
650 DATA TRISTE,MALHEUREUX
660 DATA LES VETEMENTS,LES HABITS
670 DATA VITE,RAPIDEMENT
680 DATA VOULOIR,DESIRER
```

```
1 CLS0
2 SP$="12345678901234567890123456789012345678901234567890123456
8901234"
3 PS$="12345678901234567890123456789012345678901234567890123456
8901234"
4 KK=VARPTR(SP$):K1=VARPTR(PS$)
5 SS=PEEK(KK+3)+256*PEEK(KK+2)
6 S1=PEEK(K1+3)+256*PEEK(K1+2)
7 FORII=SS TO SS+63:READDD:POKEII,DD+176:NEXTII
8 FORII=S1 TO S1+63:READDD:POKEII,DD+176:NEXTII
9 PRINT@161,SP$;
10 PRINT@225,PS$;
11 GOTO11
12 DATA 2,0,0,3,3,2,0,3,3,0,1,3,0,2,0,2,3,3,0,3,3,0,3,3,2,3,3,2,
2,0,2,0,10,0,0,10,0,0,0,10,0,10,10,0,10,10,0,10,10,0,10,10,0,10,
10,0,0,10,0,10,10,0,10,0
13 DATA 10,0,0,14,12,0,0,14,12,2,10,0,10,10,0,10,14,14,0,14,14,0
,14,12,0,14,12,10,10,0,10,0,11,3,2,11,3,2,0,11,3,8,9,3,8,11,3,10
,10,4,2,10,4,2,11,3,2,10,0,10,11,3,10,0
```

Program Listing 4. Hangman

Type in listing 3A and run it. This will string pack variables SP$ and PS$ for a fast graphics title. Now delete lines 4, 5, 6, 7, 8, 11, 12, and 13 and add lines 20–460 of Listing 3B.

Line description:

20	timer for title
30–150	data, words to guess
160–190	sets up screen
200	finds word
210–290	determines if letter guessed is in word given
300	directs program to line to draw proper body part
320	audio reward if word is completely guessed
340–430	draws body parts
440–450	graphic and audio effects for losing

Table 4. Hangman Program, Listings 4A and 4B

Program Listing 4b.

```
1 CLS0
2 SP$=">ANDAND==>AND==ANDOR=AND>AND>==AND==AND==>==>>AND>ANDLETA
NDANDLETANDANDANDLETANDLETLETANDLETLETANDLETLETANDLETLETANDLETLE
TANDANDLETANDLETLETANDLETAND"
3 PS$="LETANDANDPRESETPCLSANDANDPRESETPCLS>LETANDLETLETANDLETPRE
SETPRESETANDPRESETPRESETANDPRESETPCLSANDPRESETPCLSLETLETANDLETAN
DLINE=>LINE=>ANDLINE=TROFFDEF=TROFFLINE=LETLET<>LET<>LINE=>LETAN
```

Listing continued

```
DLETLINE=LETAND"
9 PRINT@161,SP$;
10 PRINT@225,PS$;
20 FORTI=1TO600:NEXTTI
30 DATA L'ABEILLE,L'ABRICOT,L'ACHAT,ACHETER,L'ACTEUR,L'ADVERBE,L
'ADDITION,L'AFFICHE,L'AGENT,L'AIL,AIMER,L'ALGEBRE,AMUSANT,L'ANNE
E,L'ANNIVERSAIRE,APPORTER,APPROACHER,L'APRES-MIDI,L'ARITHMETIQUE
,ARRETER,L'ASSIETTE,ASSURER,ATTENDRE,AU-DESSUS DE,AUSSI
40 DATAAUTANT,L'AUTOBUS,AVANT,AVOIR,AVRIL,LES BAGAGES,LE BAIN,LA
 BANDE,LA BARBE,LE BAS,LE BATEAU,BEAUCOUP,LE BEURRE,LA BIERE,LE
BILLET,BOIRE,LA BOITE,BONJOUR,LA BOUCHE,LE BOULANGER,LA BOUTEILL
E,LE BRAS,BROSSER,LE BRUIT,COMME CI,LE CASHIER,LE CAMION
50 DATA LE CANARD,LA CARTE,CASSER,CE QUE,CE SONT,LA CEINTURE,CEP
ENDANT,LA CHAMBRE,LA CHANSON,SE CHARGER DE,LE CHAT,AVOIR,LA CHEM
ISE,CHERCHER,LES CHEVEUX,LA CHIMIE,LA MOUSSE AU CHOCOLAT,QUELQUE
 CHOSE,LA CIGALE,CINQUANTE,LA CLEF,LE COCHON,LA COLLINE
60 DATA COMME,COMMENCER,LE COMPLET,LA CONFITURE,CONSTRUIRE,LE CO
NTRAIRE,LA COPINE,LE CORPS,COUCHER,LE COULOIR,LE COUTEAU,LA CRAI
E,LA CUISINE,LA DAME,DEBOUT,DEJEUNER,LA DEMI-HEURE,LA DENT,DESCE
NDRE,DEUX,DEVENIR,DIFFICILE,LE DINDON,LE DINER,LE DISQUE
70 DATA LE DIVAN,DIX-SEPT,LE DOIGT,DORMIR,LE DRAP,L'ECHARPE,ECOU
TER,L'EGLISE,ELECTRONIQUE,EMBRASSER,EMPRUNTER,ENERGIQUE,ENSEMBLE
,ENTRER,L'EPAULE,L'ESCALE,L'ESCARGOT,ESSAYER,L'ESTOMAC,L'ETAT,L'
ETOILE,ETROIT,ETUDIER,L'EVIER,L'EXCURSION,LE FACTEUR,FAIR
80 DATA LA FAMILLE,LE FAUTEUIL,LA FENETRE,LA FETE,LA FIEVRE,LA F
ILLE,LA FLEUR,LA FORME,LA FOURMI,LA FRAISE,LE FRERE,LE FROMAGE,L
E GANT,LE GARDE,LE GENOU,LA GEOMETRIE,LE GIGOT,LA GORGE,LA GRAND
-MERE,LA GRENADINE,GROSSIR,HABILLER,HABITER,L'HERBE
90 DATA HEUREUSEMENT,HIER,L'HIVER,L'HORAIRE,L'HOTEL,HUIT,IMPRESS
IONNER,INDIQUER,S'INQUIETER,INTERESSANT,IRREGULIER,LA JAMBE,LE J
ARDIN,JEUNE,LA JOURNEE,LA JUPE,LE LAC,LA LAITUE,LA LANGUE,LE LEG
UME,LIBRE,LA LIGNE,LE LIT,LONGTEMPS,LA LUNE,MADAME
100 DATA LE MAGASIN,LE MAGNETOPHONE,LA MAIN,MALADE,MALHEUREUSEME
NT,LA SALLE A,LE MARCHE,LE MARI,LES MATHEMATIQUES,LA MATIN,LE ME
DECIN,LA MIETTE,MINERALE,LA MODE,LE MOIS,LA MONNAIE,LA MONTAGNE,
MONTRER,LA MOTO,MOURIR,LE MOUTON,LA MUSIQUE,LA NAPPE
110 DATA NEANMOIS,NECESSAIRE,LA NEIGE,NETTOYER,LE NEZ,LE NOM,LE
NORD-OUEST,NOUVEAU,LA NUIT,L'ONCLE,L'OREILLE,OUBLIER,OUI,OUVRIR,
LE PAIN,LE PAMPLEMOUSSE,LE PANIER,LE PAPIER,LE PAQUET,PARCE QUE,
PARIER,LA PARTIE,PASSER,PATINER,PAUVRE,LA PECHE,PEIGNER
120 DATA PENSER,LA PHARMACIE,LA PHYSIQUE,LE PIED,LE PIQUE-NIQUE,
PLEUVOIR,LE POETE,LA POIRE,LE POISSON,LA POMME,LA PORTE,POSER UN
E QUESTION,POUVOIR,PREMIER,LE PRIX,PROMENER,LE PROVERBE,LE PUPIT
RE,QUATORZE,QUATRE,QUELQUEFOIS,QUINZE,LE RAPPORT,RECEVOIR
130 DATA LE REFRIGERATEUR,REGRETTER,REMPLACER,LES RESEIGNEMENTS,
REPASSER,SE REPOSER,LE RETOUR,REUSSIR,REVEILLER,AU REVOIR,LE RHU
ME,RISQUER DE,LA ROBE,LE ROSBIF,LA ROUTE,LA RUE,AU COIN DE LA,LE
 RYTHME,LA SAISON,LE SAUCISSON,LA SAUTERELLE,SCOLAIRE
140 DATA LE SERPENT,LA SERVIETTE,LE SINGE,LE SOIR,LE SOMMEIL,LA
SOUCOUPE,SOUVENT,LE STAGE,LE STYLO,LE SUD-OUEST,LA SUITE,SURTOUT
,LE TABLEAU,LE TAPIS,LA TASSE,LE TEMPS,SE TERMINER,LE TIGRE,LA T
OMATE,LA TRANCHE,TRAVERSER,TYPIQUE,LES VACANCES,LA VACHE
150 DATA LE VELO,VENDRE,LE VENT,LE VERRE,LA VIEILLESSE,LA VILLE,
LA VITRINE,LA VOITURE,PARTIR EN,LE ZOO
160 CLS:DIMA$(30):FORA=1TO14:BL$=BL$+CHR$(128):NEXTA:FORA=201TO4
89STEP32:PRINT@A,BL$;:NEXTA
170 PRINT@235,CHR$(159)+CHR$(156)+CHR$(156)+CHR$(158)+CHR$(156)+
CHR$(156)+CHR$(157)+CHR$(156);
180 PRINT@267,CHR$(159)+CHR$(128)+CHR$(150);
190 PRINT@299,CHR$(159)+CHR$(150);:FORA=331TO491STEP32:PRINT@A,C
```

Listing continued

Listing continued

```
HR$(159);:NEXTA
200 T=RND(307):FORY=1TOT:READA$:NEXTY
210 B=LEN(A$):FORQ=1TOB:A$(Q)=MID$(A$,Q,1):NEXTQ
220 PRINT@96,"LETTERS USED,";:FORA=1TOB:PRINT@38+A,"-";:NEXTA
230 PRINT@160,"WHAT LETTER?";
240 PRINT@172," ";
250 IK$=INKEY$
260 B$=INKEY$:IFB$=""ORB$=CHR$(13)THEN260
270 PRINT@172,B$;:FORTI=1TO40:NEXTTI
280 FORQ=1TOB:IFB$=A$(Q)THENPRINT@Q+38,B$;:SOUND150,1
290 NEXTQ
300 FORQ=1TOB:IFB$<>A$(Q)THENNEXTQ:G=G+1:SOUND5,1:ON G GOSUB 340
,350,360,370,380,390,400,410,420,430
310 PRINT@W+110,B$;:W=W+1
320 FORQ=1TOB:IFCHR$(PEEK(1062+Q))=A$(Q)ORPEEK(1062+Q)=64+ASC(A$
(Q))THENNEXTQ:FORT=1TO10:PRINT@12,"CORRECT";:FORTT=1TO10:NEXTTT:
PRINT@12,"       ";:SOUND150,1:FORTT=1TO10:NEXTTT:NEXTT:RUN
330 GOTO230
340 PRINT@272,CHR$(158)+CHR$(159)+CHR$(157);:PRINT@304,CHR$(157)
+CHR$(159)+CHR$(158);:RETURN
350 PRINT@336,CHR$(143)+CHR$(143)+CHR$(143);:PRINT@368,CHR$(143)
+CHR$(143)+CHR$(143);:PRINT@400,CHR$(175)+CHR$(175)+CHR$(175);:P
RINT@432,CHR$(172)+CHR$(172)+CHR$(172);:RETURN
360 PRINT@432,CHR$(175);:PRINT@464,CHR$(175);:RETURN
370 PRINT@434,CHR$(175);:PRINT@466,CHR$(175);:RETURN
380 PRINT@335,CHR$(142);:PRINT@367,CHR$(138);:RETURN
390 PRINT@339,CHR$(141);:PRINT@371,CHR$(133);:RETURN
400 PRINT@399,CHR$(158);:RETURN
410 PRINT@403,CHR$(157);:RETURN
420 PRINT@495,CHR$(177)+CHR$(183);:RETURN
430 PRINT@498,CHR$(187)+CHR$(178);
440 PRINT@0," THE WORD IS ";CHR$(34);A$;CHR$(34):SOUND89,8:SET(3
3,17,2):SOUND89,8:RESET(33,17):SOUND89,4:SET(36,17,2):SOUND89,8:
RESET(36,17):SOUND117,8:SET(33,17,2):SOUND108,4:RESET(33,17):SOU
ND108,8:SET(36,17,2):SOUND89,4:RESET(36,17):SOUND89,8
450 SET(36,17,2):SOUND78,4:SET(33,17,2):SOUND89,8:RUN
460 FORE=1TO307:READA$:NEXT:PRINTA$
```

Line description:

10	sets up string to clear questions and answers from screen, sets starting points for bar graph
20-1250	data, translations
1260-1300	sets up screen
1330-1340	finds word to translate, prevents repeats
1350	centers question
1370	determines if first try is correct
1400	determines if second try is correct
1410	answer given
1430	audio reward for first attempt correct, extends bar graph
1450	audio reward for second try correct, extends bar graph
1460	extends total questions bar graph
1510-1520	ending message

Table 5. Translate Program, Listing 5

Program Listing 5. Translate

```
10 DIMA(126):G$="                ":X=393:Y=425:Z=457
20 DATA ACCOMPAGNER,TO ACCOMPANY
30 DATA ACHETER,TO BUY
40 DATA AIDER,TO HELP
50 DATA AIMER,TO LIKE
60 DATA ALLER,TO GO
70 DATA ANNONCER,TO ANNOUNCE
80 DATA APPELER,TO CALL
90 DATA APPORTER,TO BRING
100 DATA APPRENDRE,TO LEARN
110 DATA APPROCHER,TO APPROACH
120 DATA ARRETER,TO STOP
130 DATA ARRIVER,TO ARRIVE
140 DATA AVOIR,TO HAVE
150 DATA BROSSER,TO BRUSH
160 DATA CACHER,TO HIDE
170 DATA CASSER,TO BREAK
180 DATA CHANTER,TO SING
190 DATA CHERCHER,TO LOOK FOR
200 DATA CHOISIR,TO CHOOSE
210 DATA COMMANDER,TO ORDER
220 DATA COMMENCER,TO BEGIN
230 DATA COMPRENDRE,TO UNDERSTAND
240 DATA CONNAITRE,BE ACQUAINTED WITH
250 DATA COUCHER,TO PUT TO BED
260 DATA CROIRE,TO BELIEVE
270 DATA DANSER,TO DANCE
280 DATA DEBARRASSER,TO CLEAR
290 DATA DECIDER,TO DECIDE
300 DATA DEJEUNER,TO LUNCH
310 DATA DEMANDER,TO ASK
320 DATA DESCENDRE,TO GO DOWN
330 DATA DEVENIR,TO BECOME
340 DATA DINER,TO DINE
350 DATA DIRE,TO SAY
360 DATA DONNER,TO GIVE
370 DATA DORMIR,TO SLEEP
380 DATA ECOUTER,TO LISTEN
390 DATA ECRIRE,TO WRITE
400 DATA EMPRUNTER,TO BORROW
410 DATA ENDORMIR,TO PUT TO SLEEP
420 DATA ENTENDRE,TO HEAR
430 DATA ENTRER,TO ENTER
440 DATA ESPERER,TO HOPE
450 DATA ESSAYER,TO TRY
460 DATA ESSUYER,TO WIPE
470 DATA ETRE,TO BE
480 DATA ETUDIER,TO STUDY
490 DATA FAIRE,TO MAKE
500 DATA FERMER,TO CLOSE
510 DATA FINIR,TO FINISH
520 DATA HABILLER,TO DRESS SOMEONE
530 DATA HABITER,TO LIVE
540 DATA INVITER,TO INVITE
550 DATA JETER,TO THROW
560 DATA JOUER,TO PLAY
570 DATA LAISSER,TO LET OR ALLOW
580 DATA LAVER,TO WASH
590 DATA LEVER,TO RAISE
600 DATA LIRE,TO READ
610 DATA MANGER,TO EAT
620 DATA METTRE,TO PUT
630 DATA MONTER,TO GO UP
640 DATA MONTRER,TO SHOW
650 DATA MOURIR,TO DIE
660 DATA NAGER,TO SWIM
670 DATA NAITRE,TO BE BORN
680 DATA NETTOYER,TO CLEAN
690 DATA OFFRIR,TO OFFER
```

Listing continued

Listing continued

```
700 DATA ORGANISER,TO ORGANIZE
710 DATA OUBLIER,TO FORGET
720 DATA OUVRIR,TO OPEN
730 DATA PARLER,TO SPEAK
740 DATA PARTIR,TO LEAVE
750 DATA PASSER,SPEND TIME
760 DATA PEIGNER,TO COMB SOMEONE'S HAIR
770 DATA PERDRE,TO LOSE
780 DATA PERMETTRE,ALLOW
790 DATA PLEUVOIR,TO RAIN
800 DATA PORTER,TO WEAR
810 DATA POUVOIR,TO BE ABLE
820 DATA PREFERER,TO PREFERE
830 DATA PREPARER,TO PREPARE
840 DATA PRETER,TO LEND
850 DATA PROMENER,TO WALK
860 DATA PROMETTRE,TO PROMISE
870 DATA PRONONCER,TO PRONOUNCE
880 DATA QUITTER,TO LEAVE
890 DATA RASER,TO SHAVE
900 DATA RECONNAITRE,TO RECOGNIZE
910 DATA REGARDER,TO LOOK AT
920 DATA RENCONTRER,TO MEET
930 DATA RENDORMIR,TO PUT BACK TO SLEEP
940 DATA REPETER,TO REPEAT
950 DATA REPONDRE,TO ANSWER
960 DATA RESTER,TO STAY
970 DATA REVEILLER,TO WAKE SOMEONE UP
980 DATA REVENIR,TO COME BACK
990 DATA S'APPELER,TO BE CALLED
1000 DATA S'ARRETER,TO STOP
1010 DATA SAVOIR,TO KNOW
1020 DATA SE BROSSER,TO BRUSH ONE'S HAIR
1030 DATA SE CHARGER,TO BE IN CHARGE OF
1040 DATA SE COUCHER,TO GO TO BED
1050 DATA SE DEPECHER,TO HURRY
1060 DATA SE LAVER,TO WASH
1070 DATA SE LEVER,TO GET UP
1080 DATA S'ENDORMIR,TO GO TO SLEEP
1090 DATA SE PEIGNER,TO COMB ONE'S HAIR
1100 DATA SE RASER,TO SHAVE
1110 DATA SE RENCONTRER,TO MEET
1120 DATA SE RENDORMIR,TO GO BACK TO SLEEP
1130 DATA SE REVEILLER,TO WAKE UP
1140 DATA SERVIR,TO SERVE
1150 DATA SE TROUVER,TO BE LOCATED
1160 DATA S'HABILLER,TO GET DRESSED
1170 DATA S'INTERESSER,TO BE INTERESTED IN
1180 DATA SORTIR,TO GO OUT
1190 DATA TOMBER,TO FALL
1200 DATA TRAVAILLER,TO WORK
1210 DATA TROUVER,TO FIND
1220 DATA VENIR,TO COME
1230 DATA VISITER,TO VISIT
1240 DATA VOIR,TO SEE
1250 DATA VOULOIR,TO WANT
1260 CLS:FORA=1TO32:BL$=BL$+CHR$(128):NEXTA:FORA=320TO448STEP32:
PRINT@A,BL$;:NEXTA
1270 PRINT@339,"111111111112";:PRINT@361,"01234567890123456789O";
1280 PRINT@386,"1ST TRY";:PRINT@418,"2ND TRY";:PRINT@452,"TOTAL"
;
1290 PRINT@X,CHR$(163);:PRINT@Y,CHR$(179);:PRINT@Z,CHR$(195);
1300 PRINT@32,"GIVE THE FRENCH EQUIVALENT FOR-";
1310 FORJW=1TO20
1320 FORA=64TO256STEP32:PRINT@A,G$;:NEXTA
1330 R=RND(124):IFA(R)=1THEN1330ELSEA(R)=1
1340 RESTORE:FORA=1TOR:READA$,B$:NEXTA
1350 PRINT@111-LEN(B$)/2,CHR$(34);B$;CHR$(34);
1360 PRINT@160,"";:INPUTC$
1370 IFC$=A$ THEN 1430
1380 PRINT@195,"TRY ONCE MORE.":SOUND50,2
1390 INPUTC$
1400 IFC$=A$THEN 1450
1410 PRINT@257,"SORRY, IT IS ";CHR$(34);A$;CHR$(34):SOUND10,4
1420 GOTO1460
1430 SOUND200,4:PRINT@64,"CORRECT";:X=X+1:PRINT@X,CHR$(163);:GOT
O1460
1440 GOTO1460
1450 SOUND150,5:PRINT@64,"CORRECT";:Y=Y+1:PRINT@Y,CHR$(179);:GOT
O1460
1460 Z=Z+1:PRINT@Z,CHR$(195);:PRINT@482,"PRESS <ENTER> TO CONTIN
UE";
1470 IK$=INKEY$
1480 D$=INKEY$:IF D$=""THEN1480
1490 IF ASC(D$)=13 THEN1500 ELSE1480
1500 PRINT@480,G$;:NEXTJW
1510 CLS4:PRINT@132,X-393;"CORRECT ON FIRST TRY";:PRINT@196,Y-42
5;"CORRECT ON SECOND TRY";:PRINT@260,"OUT OF A POSSIBLE TWENTY";
1520 FORTI=1TO1000:NEXTTI:PRINT@416,"";
```

COLOR COMPUTER/TDP-100

COLOR ALIEN DEFENSE

by Doug Schwartz

One of the fastest action arcade games! Written in Machine Language.
16K Cassette **$19.95**

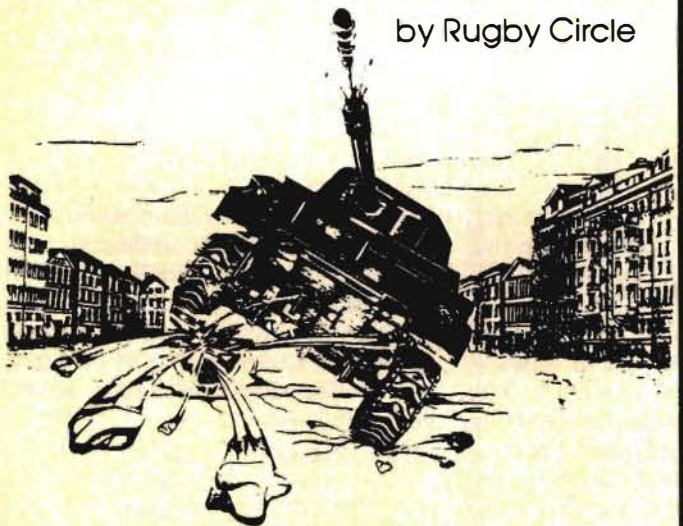
COLOR CATERPILLAR®

by Rugby Circle

Don't settle for less. Be sure to ask if the program was produced by Soft Sector Marketing so you don't get the wrong version.
16K Cassette **$19.95**
Machine Language

DEATH TRAP

by Rugby Circle



A larger-than-screen maze game. Arcade style, fast-action. Written in Machine Language. Requires Joystick.
16K Cassette **$19.95**

COLOR GRAPHIC EDITOR

by Larry Ashmun

At last, a true Graphic Drawing program that permits the creation of graphic pictures on the screen storing them in one of 4 locations, and recalling them as needed for review.

The pictures can be saved to disk to be loaded into the micro works disk editor. The graphics are saved in Assembler format or Basic Data Statements, but details are provided for using the information in a BASIC program. Works on cassette or disk systems.

Cassette **$19.95**

Written in Machine Language, but requires Extended or Disk Basic.

87

See List of Advertisers on page 138

BY R. F. MILLER

COLORFUL ABCs

The two greatest frustrations for Color Computer users must be the inability to combine text with high-resolution graphics and the lack of true lowercase characters. Do you want to label and print the scales on your graphs, or add scores and instructions to your game displays? Do the reverse characters that substitute for lowercase give you eyestrain? Do you wish you had special characters like π, λ, ↙, subscripts, and underlining?

If you're willing to invest an evening or two, you can have your 16K Color Computer with Extended Color Basic doing all these things. And if you have a printer with graphics capability, such as the Line Printer VII, you can produce printouts with these same features.

First, let's look at the way the Color Computer produces a high-resolution graphics display. Figure 1 represents the upper-left portion of a PMODE 4 screen. The little square with the X in it is screen location X = 0, Y = 0. The following program sets this point:

```
10 PMODE 4,1:PCLS:SCREEN 1,0
20 PSET(0,0)
30 GOTO 30
```

The extreme corner points can be very difficult to find. If you can't see this point clearly, change line 20 to PSET (5,5).

The dark outlines in Fig. 1 contain PRINT@ locations 0 and 1, with the letter A blocked in at location 0. You could put this letter on the screen by figuring out all the X,Y pairs that must be set and writing PSET statements for each of them. If you have a spare week, you can probably get through most of the alphabet before you become a candidate for a straitjacket. Using the Line, Draw, and Circle statements helps but not very much. Fortunately, there is an easier way.

The (0,0) point is the first of a row of eight dots, which are labeled 1536 in the figure. The first row in the next PRINT@ location is labeled 1537, and so on. The labels are the graphics-screen memory locations. Make the following change in line 20 of the previous program and rerun it:

```
20 POKE 1536,128
```

You should see the same point set at (0,0) that you saw before. Now substitute:

```
20 POKE 1536,1
```

and finally:

```
20 POKE 1536,255
```

POKEing 1 sets the right point in location 1536. In X,Y coordinates, this point is X = 7, Y = 0. POKEing 255 into the location sets all eight points. If you convert these decimal numbers to binary (there is a table on p. 184 of *Going Ahead with Extended Color Basic*), you get:

Decimal	Binary
128	10000000
1	00000001
255	11111111

You can use alphanumeric characters with graphics and obtain true lowercase with this method.

```
1 PCLEAR 4
10 PMODE 4,1:PCLS:SCREEN 1,0
20 FOR I=0 TO 6
30 READ D
40 POKE 1600+32*I,D
50 NEXT
60 DATA 8,20,34,34,62,34,34
70 GOTO 70
```

Program Listing 1

System Requirements

Extended Color Basic
16K RAM
Printer Optional

The binary numbers bear a striking resemblance to the patterns just seen on the screen.

If you want to experiment further, each number between 0–255 sets a pattern when POKEd into screen memory. Those patterns will always match the equivalent binary number. To create the 5-by-7 dot-matrix characters that are standard with the Color Computer, pick the correct seven numbers and POKE them into the proper locations. For A, the numbers are 8, 20, 34, 34, 62, 34, and 34.

Program Listing 1 duplicates Fig. 1. You can form other characters by changing the data statement or you can move them around the screen by changing 1600 to some other starting location between 1536 and 7487.

"The data is not a machine-language program, but it looks like one to the computer."

Program Listing 2 puts the standard ASCII 96-character set into memory, with a few changes as shown in Table 1. Before typing in this program enter PMODE 0,1: PCLEAR 1 to free adequate memory.

It takes seven numbers to produce the standard 5-by-7 characters. The data statements in Listing 2 each contain nine numbers. I used a 5-by-9 matrix to provide descenders on lowercase letters and for subscripts and underlining. The last two values are zero except for

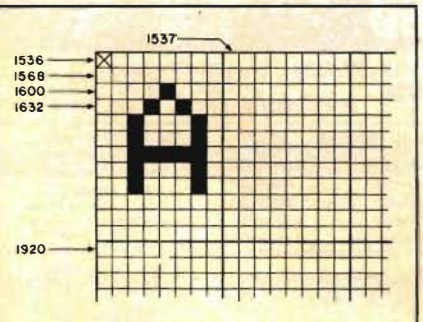


Figure 1

See List of Advertisers on page 138

```
1 PMODE 0,1:PCLEAR 1:CLEAR 200,9999:PCLEAR 1:CLS:CS=0
2 '
3 '  PDATA BY R.F.MILLER,JR.
4 '
5 'THIS PROGRAM LOADS THE DATA
6 'TO MIX TEXT WITH GRAPHICS
7 '
8 FOR I=10000 TO 10863
9 READ D:POKE I,D:CS=CS+D
10 NEXT I
11 IF CS<>15221 THEN 20
12 CLS:PRINT:PRINTTAB(10)"GOOD LOAD"
13 PRINT:PRINT"INSERT TAPE IN YOUR RECORDER."
14 PRINT"REWIND AND SET TO RECORD."
15 PRINT"TYPE IN THE FOLLOWING:"
16 A$="CSAVEM"+CHR$(34)+"TEXT"+CHR$(34)+",10000,10863,10000"
17 PRINTTAB(1) A$
18 PRINT"AND HIT <ENTER> TO SAVE.
19 POKE 157,39:POKE 158,16:END
20 CLS:PRINT:PRINTTAB(8)"ERROR IN DATA"
21 PRINT:PRINT"CHECKSUM="CS"."
22 PRINT"IT SHOULD=15221."
23 PRINT"CHECK DATA ENTRY AND TRY AGAIN."
24 PRINT"IF YOU WANT TO SAVE IT ANYWAY,"
25 PRINT"HIT <Y>. OTHERWISE, HIT <N>."
26 A$=INKEY$:IF A$="" THEN 26
27 IF A$="Y" THEN 13
28 IF A$="N" THEN 19
29 GOTO 26
32 DATA 0,0,0,0,0,0,0,0,0
33 DATA 8,8,8,8,8,0,8,0,0
34 DATA 20,20,20,0,0,0,0,0,0
35 DATA 20,20,54,0,54,20,20,0,0
36 DATA 8,30,32,28,2,60,8,0,0
37 DATA 18,2,4,8,16,32,36,0,0
38 DATA 16,40,40,16,42,36,26,0,0
39 DATA 8,8,16,0,0,0,0,0,0
40 DATA 4,8,16,16,16,8,4,0,0
41 DATA 16,8,4,4,4,8,16,0,0
42 DATA 8,42,28,28,42,8,0,0,0
43 DATA 0,8,8,62,8,8,0,0,0
44 DATA 0,0,0,0,8,8,16,0,0
45 DATA 0,0,0,62,0,0,0,0,0
46 DATA 0,0,0,0,0,0,8,0,0
47 DATA 2,2,4,8,16,32,32,0,0
48 DATA 28,34,38,42,50,34,28,0,0
49 DATA 8,24,8,8,8,8,28,0,0
50 DATA 28,34,2,28,32,32,62,0,0
51 DATA 28,34,2,12,2,34,28,0,0
52 DATA 4,12,20,36,62,4,4,0,0
53 DATA 62,32,60,2,2,34,28,0,0
54 DATA 28,32,32,60,34,34,28,0,0
55 DATA 62,2,4,8,16,32,32,0,0
56 DATA 28,34,34,28,34,34,28,0,0
57 DATA 28,34,34,30,2,2,28,0,0
58 DATA 0,0,8,0,8,0,0,0,0
59 DATA 0,0,8,0,8,8,16,0,0
60 DATA 4,8,16,32,16,8,4,0,0
61 DATA 0,0,62,0,62,0,0,0,0
62 DATA 16,8,4,2,4,8,16,0,0
63 DATA 28,34,4,8,8,0,8,0,0
64 DATA 28,34,2,26,42,58,12,0,0
65 DATA 8,20,34,34,62,34,34,0,0
66 DATA 60,18,18,28,18,18,60,0,0
67 DATA 28,34,32,32,32,34,28,0,0
68 DATA 60,18,18,18,18,18,60,0,0
69 DATA 62,32,32,60,32,32,62,0,0
70 DATA 62,32,32,60,32,32,32,0,0
71 DATA 30,32,32,38,34,34,28,0,0
72 DATA 34,34,34,62,34,34,34,0,0
73 DATA 28,8,8,8,8,8,28,0,0
74 DATA 2,2,2,2,2,34,28,0,0
75 DATA 34,36,40,48,40,36,34,0,0
76 DATA 32,32,32,32,32,32,62,0,0
77 DATA 34,54,42,34,34,34,34,0,0
78 DATA 34,50,42,38,34,34,34,0,0
79 DATA 28,34,34,34,34,34,28,0,0
80 DATA 60,34,34,60,32,32,32,0,0
81 DATA 28,34,34,34,42,36,26,0,0
82 DATA 60,34,34,60,40,36,34,0,0
83 DATA 28,34,16,8,4,34,28,0,0
84 DATA 62,8,8,8,8,8,8,0,0
85 DATA 34,34,34,34,34,34,28,0,0
86 DATA 34,34,34,20,20,8,8,0,0
87 DATA 34,34,34,34,42,54,34,0,0
88 DATA 34,34,20,8,20,34,34,0,0
89 DATA 34,34,20,20,8,8,8,0,0
90 DATA 62,2,4,8,16,32,62,0,0
91 DATA 0,0,62,52,20,20,20,0,0
92 DATA 12,18,34,62,34,36,24,0,0
93 DATA 16,8,8,12,20,34,34,0,0
94 DATA 8,28,42,8,8,8,8,0,0
95 DATA 8,8,8,8,42,28,8,0,0
96 DATA 8,20,20,8,0,0,0,0,0
97 DATA 0,0,24,4,28,36,26,0,0
98 DATA 32,32,44,50,34,34,60,0,0
99 DATA 0,0,30,32,32,32,30,0,0
100 DATA 2,2,26,38,34,34,30,0,0
101 DATA 0,0,28,34,62,32,30,0,0
102 DATA 12,18,16,56,16,16,16,0,0
103 DATA 0,0,2,28,34,34,30,2,28
104 DATA 32,32,44,50,34,34,34,0,0
105 DATA 8,0,24,8,8,8,28,0,0
106 DATA 2,0,6,2,2,2,2,18,12
107 DATA 32,32,36,40,48,40,36,0,0
108 DATA 24,8,8,8,8,8,28,0,0
109 DATA 0,0,20,42,42,42,34,0,0
110 DATA 0,0,44,18,18,18,18,0,0
111 DATA 0,0,28,34,34,34,28,0,0
112 DATA 0,0,44,50,34,34,60,32,32
113 DATA 0,0,26,38,34,34,30,2,2
114 DATA 0,0,38,24,16,16,16,0,0
115 DATA 0,0,30,32,28,2,60,0,0
116 DATA 16,60,16,16,16,18,12,0,0
117 DATA 0,0,36,36,36,36,26,0,0
118 DATA 0,0,34,34,20,20,8,0,0
119 DATA 0,0,34,42,42,42,20,0,0
120 DATA 0,0,34,20,8,20,34,0,0
121 DATA 0,0,34,34,34,38,26,2,12
122 DATA 0,0,62,4,8,16,62,0,0
123 DATA 24,4,8,28,0,0,0,0,0
124 DATA 0,0,0,0,0,16,40,40,16
125 DATA 0,0,0,0,0,16,48,16,56
126 DATA 0,0,0,0,0,48,8,16,56
127 DATA 0,0,0,0,0,0,0,0,255
```

Program Listing 2

Telewriter-64™

the Color Computer Word Processor

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

THE ORIGINAL

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

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

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

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

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

TELEWRITER-64

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

64K COMPATIBLE

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

64 COLUMNS (AND 85!)

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

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

RIGHT JUSTIFICATION & HYPHENATION

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

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

FEATURES & SPECIFICATIONS:

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

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

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

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

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

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

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

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

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

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

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

PROFESSIONAL WORD PROCESSING

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

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

To order, send check or money order to:

Cognitec
704 N. Nob St.
Del Mar, CA 92014 ✓ 121

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

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

characters that go below the line.

The line numbers for the data statements are the ASCII codes for the respective characters. This isn't necessary, just convenient. For example, the ASCII code for K is 75. Line 75 contains the data used to form K. If you want to change any of the characters, it's easy to find the statement that must be changed.

If you make any mistakes keying in the data, an "error in data" message prints when you run the program. After a good run, the program will instruct you to save the data with a CSAVEM instruction. The saved data is called TEXT. When you want to use it, you can just load it directly from tape to memory with a CLOADM instruction. The data is not a machine-language program, but it looks like one to the computer.

You should also save the entire PDATA program with a CSAVE instruction. You'll want to use PDATA if you ever create any of your own special characters, and it gives you a back-up if anything happens to the text data tape.

The CSAVEM instruction has a big advantage over the regular CSAVE. You do not have to run the program to generate the table of data, and by adding an offset to the CLOADM instruction, you can move the data to any convenient part of memory. I'll explain more about this later.

Two-Color Graphics

Listing 1, which put an A in PRINT@ location 0, used the two-color mode PMODE 4. This is the highest-resolution mode and produces characters identical to those normally seen on the text screen. Program Listing 3 is a demonstration program that displays the full character set.

"This is the highest-resolution mode and produces characters identical to those normally seen on the text screen."

You can save the subroutine at line 55000 for future use in any program requiring text on a PMODE 4 screen. In the main program, the variable TEXT$ is set equal to the string to be printed and LOC is set to the PRINT@ location of the first character in the string. The Color Computer manuals have figures showing the PRINT@ locations.

Program Explanation

Line 55010 PEEKs into scratchpad memory to find where the TEXT data starts. Locations 157 and 158 contain the jump location for the EXEC command; the CLOADM command puts the correct address in these locations. Line 55020 sets constants. S5 is the first location used in PRINT@ location 0. C5 is the number of characters per line. D5 is the number of memory locations to skip to get from the end of one line of text to the beginning of the next.

Line 55030 starts a FOR...NEXT loop to look at each character in TEXT$. Line 55040 calculates the first graphics screen memory location used by the next character. Line 55050 sets A$ equal to the next character in TEXT$.

Line 55060 starts a FOR...NEXT loop to POKE the nine data values into screen memory. Line 55070 PEEKs into the stored data to get the next value for character A$. Line 55080 calculates the POKE location for the value just

ASCII Character	Code	Substitution
[	91	π
\	92	⊖
]	93	λ
^	94	↑
/	95	↓
_	96	° (degrees)
{	123	² (exponent)
|	124	₀ (subscript)
}	125	₁ (subscript)
~	126	₂ (subscript)
	127	_ (underline)

Table 1. Substitutions for ASCII Characters

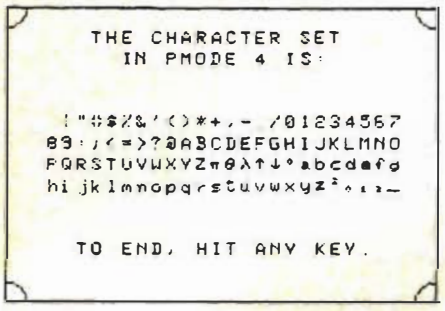


Fig. 2. Character Set in PMODE 4

```
1 CLEAR 200,15519:PCLEAR 4
10 '
20 'DEMONSTRATION OF TEXT ON
30 'PMODE 4 GRAPHICS SCREEN
40 '
50 'START OF MAIN PROGRAM
60 PMODE 4,1:PCLS:SCREEN 1,0
70 LINE(12,12)-(243,179),PSET,B
80 CIRCLE(12,12),12,,1,0,.25
90 CIRCLE(243,12),12,,1,.25,.5
100 CIRCLE(243,179),12,,1,.5,.75
110 CIRCLE(12,179),12,,1,.75,1
120 TEXT$="THE CHARACTER SET"
130 LOC=71
140 GOSUB 55000
150 TEXT$="IN PMODE 4 IS:"
160 LOC=105
170 GOSUB 55000
180 FOR I=0 TO 3
190 L=196+32*I
200 FOR J=0 TO 23
210 TEXT$=CHR$(32+J+24*I)
220 LOC=L+J
230 GOSUB 55000
240 NEXT J,I
250 TEXT$="TO END, HIT ANY KEY."
260 LOC=390
270 GOSUB 55000
280 A$=INKEY$:IF A$="" THEN 280
290 END
55000 '
55001 'SUB TO PRINT TEXT ON
55002 'PMODE 4 GRAPHICS SCREEN
55003 'BY R.F.MILLER,JR.
55004 '
55010 M5=256*PEEK(157)+PEEK(158)
55020 S5=1600:C5=32:D5=352
55030 FOR J5=0 TO LEN(TEXT$)-1
55040 R5=S5+LOC+J5+INT((LOC+J5)/C5)*D5
55050 A5$=MID$(TEXT$,J5+1,1)
55060 FOR I5=0 TO 8
55070 V5=PEEK(M5+9*(ASC(A5$)-32)+I5)
55080 POKE R5+C5*I5,V5
55090 NEXT I5,J5
55100 RETURN
```

Program Listing 3

Figure 3

```
55000 '
55001 ' PTEXT.2
55002 ' 2-COLOR TEXT SUBROUTINE
55003 ' BY R.F.MILLER,JR.
55004 '
55010 M5=256*PEEK(157)+PEEK(158)
55020 IF PEEK(182)=4 THEN X5=8 ELSE X5=16
55030 C5=256/X5:D5=11*C5
55040 IF PEEK(182)=0 THEN Y5=INT(Y/2) ELSE Y5=Y
55050 Q5=INT(X/X5)
55060 P5=1536+Q5+C5*Y5
55070 N5=LEN(TEXT$)-1
55080 FOR J5=0 TO N5
55090 R5=P5+J5+INT((J5+Q5)/C5)*D5
55100 A5$=MID$(TEXT$,J5+1,1)
55110 A5=ASC(A5$)
55120 IF A5=127 THEN F5=8 ELSE F5=0
55130 L5=M5+9*(A5-32)
55140 FOR I5=F5 TO 8
55150 V5=PEEK(L5+I5)
55160 IF PEEK(178)=0 THEN V5=255-V5
55170 POKE R5+C5*I5,V5
55180 NEXT I5,J5
55190 RETURN
```

Program Listing 4

PEEKed and POKEs V5 into that location. The loop will do this for each of the nine values. Line 55090 ends both FOR...NEXT loops and line 55100 returns to the main program.

To run this program first load the tape of TEXT data made earlier. Type CLEAR 200,15519 and press enter. Then enter CLOADM"TEXT",5520. Key in Program Listing 3 and run it. If all goes well your screen will look like Fig. 2.

You may want to use the two other two-color graphics modes: PMODE 2 and 0. It is often more convenient to use X, Y coordinates instead of PRINT@ locations to place characters on the screen. Program Listing 4 is a subroutine that provides the flexibility.

"The generalized subroutine is longer and slower than the PMODE 4 routine." To speed it up remove any unnecessary statements and paste more statements on each line."

Line 55020 PEEKs location 182 to see which PMODE is being used and sets constants accordingly. Lines 55040–55060 use X and Y, which must be set in the main program, to calculate the first graphics screen location of the first characters of TEXT$. Line 55120 prevents erasing a character as it is being underlined.

Line 55160 PEEKs location 178 to see if the background and foreground colors have been reversed by a Color statement and reverses the character colors if they have.

The generalized subroutine is longer and slower than the PMODE 4 routine. To speed it up remove any unnecessary statements and pack more statements on each line. For example, if you don't plan to underline, remove line 55120. Remove line 55160 if you're not using Color statements. Use a POKE 65495,0 statement to speed up Basic by 30–35 percent, but remember to POKE 65494,0 before you use your cassette or printer.

Figure 3 shows the appearance of the characters in PMODE 2 (top) and PMODE 0 (bottom). On a 12-inch TV screen the PMODE 2 letters are slightly more than ¼-inch high while the PMODE 0 letters are about 9/16-inch high.

Four-Color Graphics

A demonstration program and a subroutine to put text on the four-color screens is shown in Program Listing 5. Load the TEXT data as before, type in the program, run it, and respond to the input queries. As you experiment with different color combinations, you'll find that some are very pleasing while others make the characters almost impossible to read. Pick your own favorite combinations—mine is magenta on buff.

Statements 1–6 must be included in the main program whenever you use this subroutine to protect memory and read the data into array T5 before the subroutine is entered. Statement 55040 PEEKs scratchpad memory to determine the foreground color (the color of the characters). They will be red in color set 0 and orange in color set 1 unless you change them by using a Color statement. The actual values found in location 178 will be 0–3, where 0 is the lowest-numbered color in the set (green in 0, buff in 1), 1 the next lowest (yellow or cyan), and so on.

Machine Language

The Basic subroutines are fast enough for labeling graphs and even for word-processing programs if you're not an 80-words-per-minute typist. However, they are painfully slow if you want to include them in a fast-action game. Program Listings 6a and 6b are Basic programs that POKE machine-language versions of PTEXT.2 and PTEXT.4 into memory.

```
1 CLEAR 200,15519:PCLEAR 4
3 DIM T5(15,1)
4 FOR I=0 TO 15:READ T5(I,0),T5(I,1):NEXT
5 DATA 0,255,1,252,4,243,5,240,16,207,17,204,20,195,21,192
6 DATA 64,63,65,60,68,51,69,48,80,15,81,12,84,3,85,0
10 '
20 'DEMONSTRATION OF TEXT ON
30 '4-COLOR GRAPHICS SCREENS
40 '
50 CLS:POKE 65495,0     'SPEED-UP
60 PRINT"FOLLOW INPUT INSTRUCTIONS."
70 PRINT"WHEN DISPLAY IS COMPLETE,"
80 PRINT"HIT # TO END OR ANY OTHER"
90 PRINT"KEY TO ENTER NEW INSTRUCTIONS."
100 PRINT
110 INPUT"PMODE(1 OR 3)";M
120 INPUT"COLOR SET(0 OR 1)";S
130 INPUT"BACKGROUND COLOR(1 TO 4)";B
140 INPUT"FOREGROUND COLOR(1 TO 4)";F
150 INPUT"X,Y";X,Y
160 INPUT"TEXT TO BE PRINTED";TEXT$
170 PMODE M,1:COLOR F,B:PCLS:SCREEN 1,S
180 GOSUB 55000
190 A$=INKEY$:IF A$="" THEN 190
200 IF A$="#" THEN POKE 65494,0:END
210 CLS:GOTO 100
55000 '
55001 ' PTEXT.4
55002 ' 4-COLOR TEXT SUBROUTINE
55003 ' BY R.F.MILLER,JR.
55004 '
55010 M5=256*PEEK(157)+PEEK(158)
55020 X5=16:C5=32:D5=352:K5=16
55030 IF PEEK(182)=1 THEN Y5=INT(Y/2) ELSE Y5=Y
55040 H5=PEEK(178)
55050 Q5=4*INT(X/X5)
55060 P5=1536+Q5+C5*Y5
55070 N5=LEN(TEXT$)-1
55080 FOR J5=0 TO N5
55090 R5=P5+2*J5+INT((2*J5+Q5)/C5)*D5
55100 A5$=MID$(TEXT$,J5+1,1)
55110 A5=ASC(A5$)
55120 IF A5=127 THEN F5=8 ELSE F5=0
55130 L5=M5+9*(A5-32)
55140 FOR I5=F5 TO 8
55150 V5=PEEK(L5+I5)
55160 U5=INT(V5/K5)
55170 W5=V5-K5*U5
55180 Z5=R5+C5*I5
55190 POKE Z5,H5*T5(U5,0) OR (PEEK(Z5) AND T5(U5,1))
55200 POKE Z5+1,H5*T5(W5,0) OR (PEEK(Z5+1) AND T5(W5,1))
55210 NEXT I5,J5
55220 RETURN
```

Program Listing 5

After the checksum indicates you have a good run, CSAVE the Basic loader program in case of disaster and immediately load the TEXT data starting in the next available byte following the machine-language program. For PTEXT.2M, use CLOADM"TEXT", 217; for PTEXT.4M the offset is 262. Now save the machine-language program and data together. The instructions are CSAVEM"PTEXT.2M, 10000,11080,10217 or CSAVEM "PTEXT.4M", 10000,11125,10262. You can then load the program and data with one instruction whenever they are used. For a 16K machine the maximum offset in the CLOADM instruction will be 5303 for PTEXT.2M or 5258 for PTEXT.4M.

To use the machine-language programs, your main program must:

- Clear adequate memory, limiting Basic to 17 bytes below the starting address of the machine-language program.
- Use a DEFUSR statement to define the entry address for the machine-language program.
- POKE the X screen location 16 bytes below the entry address and the Y location 15 bytes below.
- Pass the string to the machine-language program with the USR function.

As an example, let's assume you are going to load PTEXT.2M with the maximum offset of 5303. To load, you will use:

```
CLEAR 200,15286
CLOADM"PTEXT.2M",5303
```

If you want more string space, increase the 200 value in the Clear statement. Your Basic program will contain the statements:

```
1 PMODE 0,1:PCLEAR1:CLEAR200,9983:C=0
2 '
3 'BASIC LOADER FOR PTEXT.2M
4 'BY R.F.MILLER,JR.
5 '
8 CLS
10 FOR I=0 TO 216:READ D:POKE 10000+I,D:C=C+D:NEXT I
12 PRINT"CHECKSUM ="C
14 PRINT"CHECKSUM SHOULD = 23852"
16 PRINT"IF IT DOES, CSAVEM THE PTEXT.2M"
18 PRINT"MACHINE LANGUAGE PROGRAM"
20 PRINT"STARTING AT 10000 AND ENDING"
22 PRINT"AT 10216."
24 PRINT"ALSO SAVE THIS PROGRAM"
26 PRINT "AS BACKUP."
30 END
40 DATA &H33,140,253,&H81,0,&H26,1,&H39,&HAF,94,&H64,&H50
50 DATA &H64,&H50,&H64,&H50,&H7D,0,182,&H26,2,&H64,&H51
60 DATA &HB6,0,182,&H81,4,&H26,6,&H86,32,&HA7,93,&H20,6
70 DATA &H86,16,&HA7,93,&H64,&H50,&HE6,&H51,&H3D,&H1C,254
80 DATA &HEB,&H50,&H89,0,&HC3,6,0,&HED,91,&H6F,90
90 DATA &HEC,&H5E,&HC3,0,2,&HED,84,&HEC,&HD8,244
95 DATA &HED,&H54,&HA6,&HD8,254,&HA1,90,&H26,1
100 DATA &H39,&H4F,&HE6,&H50,&HEB,&H5A,&H89,0,&H10
110 DATA &H83,0,0,&H27,37,&HE7,&H59,&H86,255,&HA0,93
120 DATA &H8B,1,&HA4,&H59,&HA1,&H59,&H26,23,&HB6,0,182
130 DATA &H81,4,&H26,9,&HEC,91,&HC3,1,96,&HED,91,&H20,7
140 DATA &HEC,91,&HC3,0,176,&HED,91,&HEC,91,&HEB,&H5A
150 DATA &H89,0,&HED,82,&H6F,87,&HA6,&HD8,244,&H81,127
160 DATA &H26,4,&H86,8,&HA7,87,&H86,8,&HA7,88
170 DATA &HE6,&HD8,244,&HC0,32,&H86,9,&H3D
175 DATA &HEB,&H57,&H89,0,&HF3,0,157,&H1F,2
180 DATA &HEC,84,&HC3,0,1,&HED,84,&HA6,87,&HE6,93
190 DATA &H3D,&HE3,82,&H1F,1,&H4F,&HB1,0,178,&H26,6
200 DATA &H86,255,&HA0,&HA0,&H20,2,&HA6,&HA0,&HA7,132
210 DATA &HA6,87,&HA1,88,&H27,4,&H6C,87,&H20,221
220 DATA &H6C,&H5A,&H16,255,109
```

Program Listing 6a

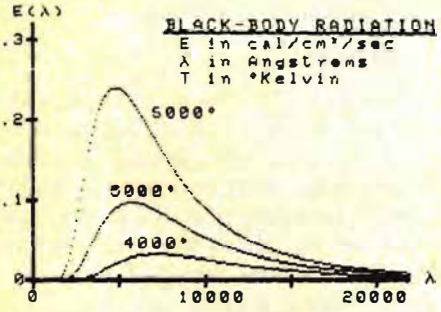


Figure 4

Program Listing 6b

```
1 PMODE0,1:PCLEAR1:CLEAR200,9983:C=0
2 '
3 'BASIC LOADER FOR PTEXT.4M
4 'BY R.F.MILLER,JR.
5 '
8 CLS
10 FOR I=0 TO 261:READ D:POKE 10000+I,D:C=C+D:NEXT I
12 PRINT"CHECKSUM ="C
14 PRINT"CHECKSUM SHOULD = 29727"
16 PRINT"IF IT DOES, CSAVEM THE PTEXT.4M"
```

Listing continued

See List of Advertisers on page 138

Listing continued

```
 18 PRINT"MACHINE LANGUAGE PROGRAM"
 20 PRINT"STARTING AT 10000 AND ENDING"
 22 PRINT"AT 10261."
 24 PRINT"ALSO SAVE THIS PROGRAM"
 26 PRINT"AS BACKUP."
 30 END
 40 DATA &H33,140,253,&H81,0,&H26,1,&H39,&HAF,94,&H64,&H50
 50 DATA &H64,&H50,&H64,&H50,&H64,&H50,&H86,1,&HB1,0,182
 60 DATA &H26,2,&H64,&H51,&H68,&H50,&HE6,&H51,&H86,32,&H3D
 70 DATA &HEB,&H50,&H89,0,&HC3,6,0,&HED,&H5C,&H6F,&H5B
 80 DATA &HEC,&H5E,&HC3,0,2,&HED,&H56,&HEC,&HD8,246
 90 DATA &HED,&H56,&HA6,&HD8,254,&HA1,&H5B,&H26,1,&H39
100 DATA &H4F,&HE6,&H50,&HEB,&H5B,&H89,0,&HEB,&H5B
110 DATA &H89,0,&H10,&H83,0,0,&H27,15,&HE7,&H5A
120 DATA &HC4,&HE0,&HE1,&H5A,&H26,7,&HEC,&H5C,&HC3,1,96
130 DATA &HED,&H5C,&HEC,&H5C,&HEB,&H5B,&H89,0,&HEB,&H5B
140 DATA &H89,0,&HED,&H54,&H6F,&H58,&HA6,&HD8,246
150 DATA &H81,127,&H26,4,&H86,8,&HA7,&H58,&H86,8
160 DATA &HA7,&H59,&HE6,&HD8,246,&HC0,32,&H86,9,&H3D
170 DATA &HEB,&H58,&H89,0,&HF3,0,157,&H1F,2,&HEC,&H56
180 DATA &HC3,0,1,&HED,&H56,&HA6,&H58,&HC6,32,&H3D
190 DATA &HE3,&H54,&H1F,1,&H34,&H40,&H33,&H8C,66
200 DATA &HA6,&HA4,&H84,&HF0,&H44,&H44,&H44,&H44
210 DATA &HE6,&HC6,&HE4,&H84,&HE7,&H5F,&HF6,0,178
220 DATA &H8B,16,&HA6,&HC6,&H3D,&HEA,&H5F,&HE7,&H80
230 DATA &HA6,&HA0,&H84,&H0F,&HE6,&HC6,&HE4,&H84
240 DATA &HE7,&H5F,&HF6,0,178,&H8B,16,&HA6,&HC6,&H3D
250 DATA &HEA,&H5F,&HE7,&H84,&H35,&H40,&HA6,&H58
260 DATA &HA1,&H59,&H27,4,&H6C,&H58,&H20,182,&H6C,&H5B
270 DATA &H16,255,84,0,255,252,243,240,207,204,195,192
280 DATA 63,60,51,48,15,12,3,0,0,1,4,5,16,17,20,21,64
290 DATA 65,68,69,80,81,84,85
```

```
 1 CLEAR 200,14646:PCLEAR 4
 2 DIM S(7,7)
 3 '
 4 'GRAPHICS DEMONSTRATION
 5 ' BY R.F.MILLER,JR.
 6 '
10 PMODE 4,1:PCLS:SCREEN 1,0
20 DEFUSR0=14663
30 GOSUB 1000
40 DATA 8.9352E+04,1.4388E+05
50 READ C1,C2
60 FOR T=4000 TO 6000 STEP 1000
70 FOR X=30 TO 240
80 LAMBDA=0.1*(X-20)
90 E=C1/((LAMBDA^5)*(EXP(C2/(T*LAMBDA))-1))
100 Y=172-INT(500*E+0.5)
110 PSET(X,Y,1)
120 NEXT X,T
500 X=0:Y=0
510 GET(X,Y)-(X+7,Y+7),S,G
520 A$=INKEY$:IF A$="" THEN PUT(X,Y)-(X+7,Y+7),S,NOT:GOTO 520
530 PUT(X,Y)-(X+7,Y+7),S,PSET
535 IF A$=CHR$(12) THEN 535
540 IF A$="!" THEN A$=CHR$(96)
550 IF A$="#" THEN A$=CHR$(123)
560 IF A$="%" THEN A$=CHR$(127)
570 IF A$=CHR$(9) AND X<248 THEN X=X+8:GOTO 510
580 IF A$=CHR$(9) AND X>=248 THEN 660
590 IF A$=CHR$(8) AND X>7 THEN X=X-8:GOTO 510
600 IF A$=CHR$(94) AND Y>0 THEN Y=Y-1:GOTO 510
610 IF A$=CHR$(10) AND Y<191 THEN Y=Y+1:GOTO 510
620 IF A$=CHR$(94) OR ASC(A$)<32 THEN 520
630 POKE 14647,X:POKE 14648,Y
640 B$=USR0(A$)
650 IF X<248 THEN X=X+8:GOTO 510
660 IF Y<180 THEN Y=Y+12:X=0:GOTO 510
670 IF Y<191 THEN Y=Y+1:X=0:GOTO 510
680 GOTO 520
1000 'SUB TO GENERATE AXES
1010 LINE(20,12)-(21,176),PSET,BF
1020 LINE(16,171)-(240,172),PSET,BF
1030 FOR X=70 TO 220 STEP 50
1040 LINE(X,169)-(X+1,175),PSET,BF
1050 NEXT X
1060 FOR Y=22 TO 122 STEP 50
1070 LINE(17,Y)-(23,Y+1),PSET,BF
1080 NEXT Y
1090 RETURN
```

Program Listing 7

```
1    CLEAR 200,15286
2    DEFUSR0=15303
n    POKE 15287,X:POKE 15288,Y
n+1  A$=USR0(TEXT$)
```

Statements n and n+1 will occur after the statements defining X,Y, and TEXT$. You can repeat these statements several times with different values. Program Listing 7 demonstrates this, but because I also used the Radio Shack Screen-Print Utility, I moved everything down 640 bytes.

The Clear statement must limit Basic to 17 bytes below the start of the program. This space is used for X, Y, and temporary storage for variables while the program is running. This was a poor choice of locations, but these were my first machine-language programs. I don't have an editor/assembler so I hand assembled everything.

"If you still consider the CC a games computer only, Fig. 4. should change your mind."

Graphics Printers

I have Radio Shack's Line Printer VII and consider it quite satisfactory. With this printer, Radio Shack's Screen-Print Utility Program (26-3021), and the subroutines in this article, you can print out mixed text and graphics directly from the screen. The Screen-Print Utility is a good value for $4.95. The LP VII manual tells Color Computer owners to get the 8-bit Printer Driver (70-2013) to use the graphics features. Don't bother because the 8-bit driver is included in the Screen-Print Utility.

If you still consider the CC a game computer only, Fig. 4 should change your mind. I generated the graph first, then added the text using PTEXT.2M, and printed the screen. Listing 7 is for those who want to follow the process. Lines 1-20 are initialization, line 30 calls the subroutine at line 1000 to draw the axes, and lines 40-120 use Planck's formula to calculate the points for each of the three curves.

Lines 500-680 are the most interesting. They cause a blinking cursor to ap-

pear. You can move the cursor around the screen with the four arrow keys. You can move it over existing text or graphics without erasing them. If you want to erase something, put the cursor on it and hit the space bar.

```
1 PCLEAR 4
2 '
3 'SEMIGRAPHICS DEMO
4 '
5 POKE 65495,0     'SPEED-UP
10 CLS:INPUT"ENTER MODE(8,12, OR 24)";MODE
15 PRINT:PRINT"YOU CAN TRY DIFFERENT BACKGROUND"
20 PRINT"COLORS (0-8), BUT TRY ZERO FIRST"
25 INPUT"BACKGROUND COLOR (0-8)";CO
35 PRINT:PRINT"THIS TAKES A WHILE"
40 GOSUB 50000
70 X0=128:Y0=96:R=24:C=4:GOSUB 1000
80 X0=128:Y0=96:R=48:C=5:GOSUB 1000
90 X0=128:Y0=96:R=72:C=3:GOSUB 1000
100 X0=60:Y0=96:R=40:C=6:GOSUB 1000
110 X0=196:Y0=96:R=40:C=6:GOSUB 1000
120 '
130 T8$="THESE CIRCLES ARE DRAWN"
140 L8=421
150 GOSUB 55000
160 T8$="IN SEMIGRAPHICS MODE"
170 L8=453
180 GOSUB 55000
190 T8$=STR$(MODE)
200 L8=473
210 GOSUB 55000
220 T8$="TO CHANGE MODE, HIT ANY KEY."
230 L8=482
240 GOSUB 55000
250 POKE 65494,0
260 A$=INKEY$:IF A$="" THEN 260 ELSE 2
1000 '
1001 'SUB TO CALCULATE POINTS FOR A CIRCLE
1002 '
1010 YL=Y0:YH=Y0:RS=R*R
1020 FOR X=X0-R TO X0+R STEP 4
1030 YA=INT(SQR(RS-(X-X0)*(X-X0)))
1035 IF YA=0 AND YL=Y0-YA THEN 1070
1040 IF Y0-YA>YL THEN A=-1 ELSE A=1
1050 FOR Y=Y0-YA TO YL STEP A:GOSUB 2000:NEXT
1060 FOR Y=YH TO Y0+YA STEP A:GOSUB 2000:NEXT
1070 YL=Y0-YA:YH=Y0+YA
1080 NEXT X
1090 RETURN
2000 '
2001 'SUB TO SET (OR RESET) POINTS
2002 '
2010 LO=1536+INT(X/8)+INT(MODE*Y/24)*32
2020 IF INT(Y/12)=INT((Y+6)/12) THEN B1=12 ELSE B1=3
2030 IF INT(X/8)=INT((X+4)/8) THEN B2=10 ELSE B2=5
2040 P0=NOT(B1 AND B2) AND PEEK(LO)
2050 P1=(16*(C-1)) OR ((B1 AND B2) OR (PEEK(LO)AND 143))
2060 IF C=0 THEN PV=P0 ELSE PV=P1
2070 POKE LO,PV
2080 RETURN
50000 '
50001 'SUB TO SET SEMIGRAPHICS MODE
50002 '
50004 IF CO=0 THEN V=128 ELSE V=143+16*(CO-1)
50005 HM=1535+256*MODE
50006 FOR I=1536 TO HM:POKE I,V:NEXT
50010 FOR I=0 TO 6:READ DT:POKE 65478+I*2+DT,0
50020 DATA 1,1,0,0,0,0,0
50030 POKE 65472,0
50040 IF MODE=12 THEN POKE 65474,0 ELSE POKE 65475,0
50050 IF MODE=8 THEN POKE 65476,0 ELSE POKE 65477,0
50060 POKE 65314,PEEK(65314) AND 7
50130 RETURN
55000 '
55001 'SUB TO PRINT SEMIGRAPHICS TEXT
55002 '
55010 FOR J8=0 TO LEN(T8$)-1
55020 Q8=1536+L8+J8+INT((L8+J8)/32)*32*(MODE/2-1)
55030 FOR I8=0 TO MODE/2-1
55040 D8$=MID$(T8$,J8+1,1)
55050 IF ASC(D8$)<64 THEN P8=ASC(D8$)+64 ELSE P8=ASC(D8$)
55060 POKE Q8+32*I8,P8
55070 NEXT I8,J8
55080 RETURN
```

Program Listing 8

Lines 540–560 let you access some of the special characters from Table 1 that have no keyboard equivalent. Lines 630 and 640 access the machine-language program to put a character on the screen when you press any key except one of the arrows. After you have typed all your text, line 535 allows you to turn off the cursor by pressing the clear key. The effect is similar to a full-screen editor that lets you move anywhere to add, delete, or make changes. You can move the cursor to any Y position, but it moves only in steps of eight in the X direction. If you look back to Fig. 1 and remember that one memory location controls eight points on the screen, the reason for this restriction should be clear.

"The only advantage semigraphics offers is it can use all eight colors (nine including black) on the screen at once."

If you use the Screen-Print Utility, you must load and execute it before loading TEXT or PTEXT.2M.

Semigraphics

The Color Computer has a built-in way of combining text and graphics. Why not use the semigraphics modes? The graphics are coarse, slow, and very hard to program. None of the graphics statements (PSET, PRESET, Line, Circle, Draw, and so on) work in semigraphics. The only advantage semigraphics offers is it can use all eight colors (nine including black) on the screen at once. Unless you absolutely need the extra colors, don't bother.

Program Listing 8 displays the three highest-resolution semigraphics modes. With this program and the article by Richard Esposito "POKE A, Color Computer," (*80 Micro*, December 1981), you have a fighting chance to use semigraphics. But I strongly suggest that you stick with the regular graphics modes, use the programs in this article, and have fun!■

Address correspondence to R.F. Miller, 18606 Heather Court, Homewood, IL 60430.

Reader's Forum

Reader's Forum is a monthly column that will act as a clearinghouse of reader-provided technical tips and programming suggestions.

HOT CoCo *encourages readers to submit items to Reader's Forum. We will pay $25 for each item we use. Address your Reader's Forum submissions to* HOT CoCo, *Reader's Forum, Pine St., Peterborough, NH 03458.*

Finding the Start, End, and Transfer Addresses of a Disk Binary File

On several occasions I have had the need to copy a machine-code program from disk to either a cassette or another disk, without doing an entire disk back-up on a single-drive system. RS DOS provides the facility to copy machine-code files with the SAVEM and CSAVEM commands, but these commands require the start, end, and transfer addresses of the file.

```
10 'PROGRAM TO FIND START, END
20 ' AND TRANSFET ADDRESSES OF
30 ' A DISK MACHINE LANGUAGE
40 ' FILE
50 ' JIM D'OTTAVI
60 ' MARMORA, N.J. 08223
70 CLEAR 300: DIM A(5): CLS: S=1:TB=0:FIRST=1
110 INPUT "ENTER FILE NAME"; F$:IF F$=""THEN STOP
120 INPUT "OUTPUT TO LINE PRINTER(Y/N)";R$
130 IF LEFT$(R$,1)="Y" THEN UN=-2 ELSE UN=0
140 PRINT #UN,"FILE NAME =";F$
150 PRINT #UN,"ALL ADDRESS ARE IN HEX"
160 OPEN"D ",1,F$
170 BP=1:GOSUB 330
180 IF A(1)<>0 THEN 440
190 BC=A(2)*256+A(3):SA=A(4)*256+A(5)
200 IF FIRST THEN FA=SA:FIRST=0:GOTO 220
210 IF LA+1<>SA THEN GOSUB420:FA=SA
220 LA=SA+BC-1
230 TB=TB+BC+5
240 SC=FIX((TB)/256):BP=(TB)-(SC*256)+1
250 S=SC+1
260 GOSUB 330
270 IF A(1)=0 THEN 190
280 IF A(1)<>&HFF OR A(2)<>0 OR A(3)<>0 THEN 440
290 TA=A(4)*256+A(5)
300 GOSUB 420
310 PRINT #UN, "TRANSFER = ";HEX$(TA)
320 CLOSE:END
330 GOSUB 400
340 FOR I=1 TO 5
350 IF BP>128 THEN BB=BP-128:D1$=D2$ ELSE BB=BP
360 A(I)=ASC(MID$(D1$,BB,1)):BP=BP+1
370 IF BP>256 THEN BP=1:S=S+1:GOSUB 400
380 NEXT I
390 RETURN
400 FIELD #1,128 AS D1$, 128 AS D2$:GET #1,S
410 RETURN
420 PRINT #UN, "START = ";HEX$(FA);" END = ";HEX$(LA)
430 RETURN
440 PRINT "ERROR IN FILE TYPE"
450 STOP
```

Program Listing

The program in the following listing runs under RS DOS. It reads the disk file; locates the start, end, and transfer addresses; and prints them to the screen or printer. It supports both single- and multiple-load blocks and is written in Basic so that it can be modified for other applications.

To use the program, type it into the CoCo and save a copy to disk. The program asks you for the name of the file to be searched. You then enter the file name exactly as listed in the directory, including the extension. Example: PROG/BIN.

If the program detects a multiple-block file that does not load in a continuous section of memory, it will list the start and end addresses of each continuous section separately. If the file consists of multiple blocks, but all the blocks are continuous in memory, it will list the start and end addresses of the entire file.

If the file does not exist, or if the file is not a machine-code program, the program will print an error message and then stop. If this should happen, check the file name and make sure it is a machine-code program.

To make a copy of a machine-code program, run this program to find the needed addresses and copy them down for future use. Remember, the numbers printed are in hex. Next, LOADM the file into memory. If you load with an offset, don't forget to add the offset to the printed addresses.

After the program is loaded into memory, ready the cassette recorder (record mode, past leader) and type CSAVEM "FILENAME", &HSSSS,&HEEEE,&HTTTT, substituting the start address for SSSS, the end address for EEEE, and the transfer address for TTTT. Remember the &H prefix to specify hex.

Jim D'Ottavi
14 Hilltop Drive
Marmora, NJ 08223

RENUMing a Lost Program

If you accidentally press the reset button on the TRS-80 Color Computer while RENUMing a long program, the program may appear to be hopelessly destroyed.

If you are caught in this situation, I have found that 90 percent of the time you can regain your program by typing RENUM a second time. If you list your program, you should find it again complete.

Steven Cherry
176 Marc Lane
Huntingdon Valley, PA 19006

Problems with the EDTASM+ ROM Pak

I have been using EDTASM+ for the Color Computer to write machine programs, but I found several problems with the EDTASM+ ROM pak.

Upon trying to assemble and write out the program to tape using the A command, I found the tape is written in a GAP format, instead of the expected continuous format of machine tapes. Therefore, the machine tape I created will not load, because it encounters an FF GAP byte on the tape when using CLOADM.

There is an error on p. 32 of the *Color Computer Tech Manual*, in that it states that the GAP byte should be 01 for machine tapes. However, the CLOADM routine in ROM at A6D1—TEST 01E4, which is where the GAP byte is stored after reading a tape—test for a zero byte. The funny thing is that the routine should continue even though an FF may be found there, because the ROM routine should read the program in continuous blocks. However, the CLOADM stops with an FM error.

EDTASM+ also will not assemble a program in memory using the A/IM/AO command if the start of the program (the ORG) is below the end of the edit buffer. This is logical, since the edit buffer would be overwritten by the assembled program; however, it is contrary to what the EDTASM manual states on p. 15.

I have been able to get a good tape by starting the EDTASM+ at a very high location (setting the BEGTEMP: in a 32K CoCo, put $40 into location $FF, use $20 in a 16K machine), and then using ZBUG GC006 as stated in the manual on p. 15. I then assemble my program in memory, but use the program ORG as the start address by using the A/IM/AO command instead of the MO switch.

After assembly in memory below the edit buffer, I can go to ZBUG to punch out the newly-assembled program from the CoCo's memory. The tape written by ZBUG has a zero GAP byte and loads in continuous format without errors.

Steven R. Abrams
1600 44th Ave.
San Francisco, CA 94122

The CoCo's Ability to Pass Variable Parameters

Many Color Computer users are not aware of its ability to pass variable parameters to the Extended Color Basic commands DRAW and PLAY. For example, a statement such as DRAW"U"+STR$(X) can be entered instead as DRAW"U=X;". When the computer reads the equal sign, it expects a variable to follow. A semicolon must then follow the variable to make the syntax complete.

The value of the variable must be within the range 0–255, inclusive. Any decimal digits are truncated. This method of passing parameters to the commands DRAW and PLAY is over twice as fast as the equivalent DRAW"U"+STR$(X). It may even be faster when the computer performs string housekeeping, because no new strings have been created.

For example, to hear all notes produced by the PLAY command, type:

```
10 PLAY"V31L4T4"
20 FOR OCTAVE=1 TO 5
30 FOR NTE=1 to 12
40 PLAY"O=OCTAVE;N=NTE;"
50 NEXT NTE, OCTAVE
```

Also, compare the two variations of the same program:

```
10 PMODE 4,1:PCLS:SCREEN1,1
20 TIMER=0:FOR X=0 TO 191
30 DRAW"BM"+STR$(X)+",191U"+STR$(X)
40 NEXT
50 T=TIMER
60 IF INKEY$=" " THEN 60
70 PRINT"TIME:";T
```

```
10 PMODE 4,1:PCLS:SCREEN1,1
20 TIMER=0:FOR X=0 TO 191
30 DRAW"BM=X;,191U=X;"
40 NEXT
50 T=TIMER
60 IF INKEY$=" "THEN 60
70 PRINT"TIME:";T
```

```
Valid syntax:   =X;      =A(1);      =X(B);
Invalid syntax: =1;      =X+2;       =C(2+A);
```

I also found that the Extended Color Basic ROM contains a check for the @ character after a few commands. Therefore, syntax, such as the following examples show, is allowed.

```
CIRCLE @ (X,Y), 96
PAINT @ (X,Y)
LINE @ (X,Y)-(X1,Y1),PSET
```

Charles Goricanec
94 Willowridge Road
Weston, Ontario M9R 3Z4
Canada

↙ See List of Advertisers on page 138

Re:FLEX

THE DISK I/O ROUTINE AND A FIFTH FLEX

by David Wasler

Last month I introduced you to four sources of Color Computer FLEX: Atomic City, Data Comp, Frank Hogg Laboratory, and Spectral Associates. Now there is a fifth entry into the CoCo FLEX world from F&D Associates, 1210 Todd Road, New Plymouth, OH 45654.

F&D's product is called the RDC-1 disk controller card, and it's somewhat different from the rest, simply because it comes in a kit. The kit consists of a printed circuit card that is drilled and etched to be used with the WD1793 disk-controller chip. The chip is not supplied with the kit but is available separately from F&D Associates.

You get a Standard Microsystems 9216B with the card. It separates the data information from the clock pulses that are stored with it on the disk.

The RDC-1 also comes with software to load in FLEX without the help of Extended Basic or Disk Extended Basic, although it is still compatible with the Radio Shack Extended Basic ROM and the Radio Shack Disk ROM. I'll provide more information on the RDC-1 next month.

Last month I said very little about why you would prefer FLEX 09 DOS over the Radio Shack Color Computer DOS. A DOS system must be easy to use and have good quality software that is readily available to it. FLEX DOS has both of these assets. Also, a FLEX user can choose from several languages: Basics and Extended Basic (not to be confused with Radio Shack Basic and Extended Basic), C, Pascal, Fortran, and Forth. All these languages come in compiled or interpreted form.

There is a wealth of software that runs under FLEX, and nearly as many vendors that support it. The following is a partial listing of software and some of its suppliers:

- Forth—Frank Hogg Laboratory, Talbot Microsystems
- Word Processing—Alford & Associates, Frank Hogg Laboratory, Great Plains Computer Company, Computer System Center, Star-Kits
- C—Telecon Systems, Introl Corp., Worstead Laboratories, Dugger's Growing Systems
- Pascal—Frank Hogg Laboratory, Lucidata Ltd., Omegasoft
- Disassembler—Computer Systems Consultants, Computer Systems Center, Frank Hogg Laboratory, Granite Computer Systems.

These sources provide software for the beginner and the experienced FLEX user. Software from a computer language to data base and business programs to the powerful utilities are now available.

Adapting the FLEX DOS

All versions of CoCo FLEX start out with the same general FLEX 09 DOS, but at this point FLEX DOS has no real power to run on its own. In order to have it do so, you must write I/O routing to interface the CoCo to FLEX DOS.

Technical Systems Consultants Inc. (TSC) doesn't support the CoCo, and they leave it up to the supplier of CoCo FLEX to write these routines that interface FLEX DOS to the CoCo keyboard, the display area, and the disk-drive routine. This makes each version of CoCo FLEX unique.

In this article, and in the ones to follow, I will discuss the ways in which each source has adapted the CoCo to FLEX DOS. I will keep all my terms to TSC standards to be consistent with the general FLEX 09.

To adapt FLEX 09 DOS to the CoCo, one must become familiar with the working of FLEX core (what I call the FLEX 09 DOS body). It resides from $C000 to $DDFF as it comes from TSC, and it has no input/output (I/O) routine support. TSC provides information on the working of the FLEX 09 core when you buy general FLEX 09 from them, but only to explain which register passes data in and out, and how each does so.

I look at the FLEX core as two parts: the inner and the outer I/O routines. Inner refers to anything between $C000 and $DDFF (see Fig. 1 for the FLEX 09 memory map) and how it works. Outer refers to the I/O routine from $DE00 and upwards and how it handles the I/O. When these routines are appended to the core, then I consider it to have become the FLEX 09 DOS.

These input and output routines are those that are needed to communicate (able to pass data in and out via the registers) with the FLEX core. Once again, one of the FLEX sources supplies these routines. TSC doesn't provide any support for the outer I/O routines for the CoCo; it is up to the vendor to supply it.

The supplier of the CoCo FLEX must consider two important vector tables or jump tables in order to pass data in and out of the core: the console I/O table and the disk-driver I/O table.

The console I/O table consists of 12 3-byte addresses, and it outputs to a CRT terminal and printer. However, the CoCo doesn't use it often.

The Disk I/O table passes data in and out from the core to the disk; it consists of 10 3-byte addresses.

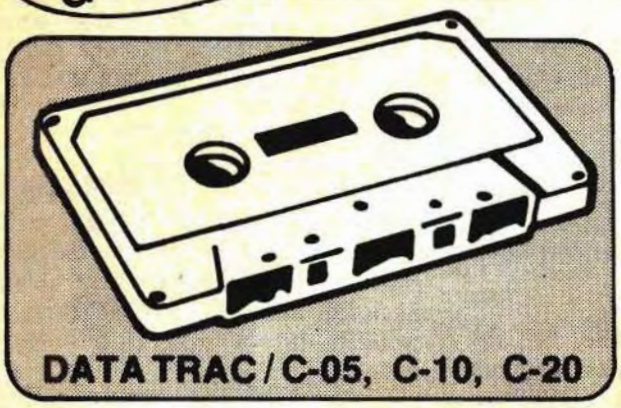
Console I/O Routine

The console vector table provides the jump address for the screen routine, the keyboard routine, the interrupt vector for the printer spooler

YORK 10™ BASF-DPS
WORLD STANDARD TAPE

MONEY BACK GUARANTEE

COMPUTER GRADE BLANK CASSETTES
PREMIUM 5-SCREW SHELL WITH LEADER FITS ALL STANDARD RECORDERS
PREFERRED BY SOFTWARE PRODUCERS, SCHOOLS AND BUSINESSES NATIONWIDE



DATA TRAC / C-05, C-10, C-20

HERE'S WHAT USERS SAY ABOUT YORK 10 CASSETTES:

"It's nice to have a tape you can rely on 100% of the time to perform with such quality. And the fast, courteous service was a pleasant surprise."
Tom Parkinson–Madison, OH

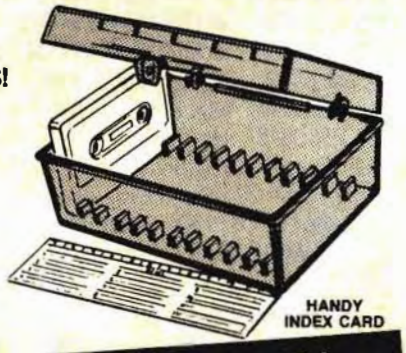
"We monitored the output to the computer with a specially built meter and found absolutely no dropouts throughout the tape . . ."
Stace Papadopoulos–Beaverton, OR

"YOU'VE TRIED THE REST, NOW BUY THE BEST"

CASSETTE STORAGE CADDY

NEW! ORGANIZE YOUR TAPES!
$2.95 EACH

STACKABLE



HANDY INDEX CARD

FINEST QUALITY PHILIPS (NORELCO) TYPE HARD BOXES

TRACTOR FEED DIE-CUT BLANK CASSETTE LABELS

INTRODUCTORY OFFER!
ORDER 2 DOZ. CASSETTES AND 1 CADDY
GET 1 CADDY FREE! ORDER 4 DOZ. CASSETTES AND 2 CADDIES — GET 2 FREE
OFFER EXPIRES AUGUST 1, 1983

Call: 213/710-1430
FOR IMMEDIATE SHIPMENT
on Credit Card Orders.

ORDER NOW Mail To . . . **YORK 10™ Computerware**
24573 Kittridge St., #HC, Canoga Park, CA 91307
156

ITEM	1 DOZEN	2 DOZEN	TOTAL
C-05	☐ 7.50	☐ 13.50	
C-10	☐ 8.00	☐ 14.40	
C-20	☐ 10.00	☐ 18.00	
Hard Box	☐ 2.50	☐ 4.00	
Storage Caddy @ $2.95 ea.: Quantity:_____ FREE: Quantity:_____			
Blank labels	☐ 4.00/100	☐ 30.00/1000	
		SUB TOTAL	
Calif. residents add 6% sales tax			
Shipping/handling 1 doz. $2; 2 doz. $3.50; 3 doz. $4.50; each additional doz. $.50.			
For Parcel Post instead of UPS $1 additional			
Outside Continental USA, $2 additional			
		TOTAL	

Each cassette includes two YORK 10 labels only. Boxes are sold separately. Shipments are by U.P.S. unless Parcel Post requested. Boxes, caddies, and blank labels are free of shipping charges when ordered with cassettes. When ordered without cassettes, shipping charges: Boxes—$1.00/doz., Caddies $1.00 each. MINIMUM SHIPPING/HANDLING ON ANY ORDER—$2.00.

Check or M.O. enclosed ☐ **Charge to Credit Card:** ☐ **VISA** ☐ **MASTERCARD**

Card No. _____ Exp. _____

Name _____

Address _____

City _____ State/Zip _____

Signature _____

Computer make & model _____ Disk?(y/n) _____

☐ CHECK HERE FOR QUANTITY DISCOUNTS PRICE LIST

See List of Advertisers on page 138

routine, and the monitor routine. The console I/O vector table has 12 3-byte jump addresses, and these are located between $D3E5 and $D3FC.

● $D3E5-INCHNE—Routine inputs a single character into the A register with no echo.

● $D3E7-IHNDLR—Provides the jump address for the IRQ interrupt.

● $D3E9-SWIVEC—Provides the jump address for the SW13 interrupt.

● $D3EB-IRQVED—Is the jump address for the IRQ interrupt.

● $D3FD-TMOFF—Turns the print-spooler timer off.

● $D3FF-TMON—Turns the print-spooler timer on.

● $D3F1-TMINT—Initializes the print-spooler routine.

● $D3F3-MONIT—Is the jump address to monitor routine.

● $D3F5-TINIT—Is the initialization address for the terminal I/O.

● $D3F7-STAT—Checks to see if a character has been typed in from the keyboard.

● $D3F9-OUTCH—Outputs the character in the A register to an output device.

● $D3FB-INCH—Provides a routine to get one ASCII character from the terminal and return it to the A register. It will loop until the character is input.

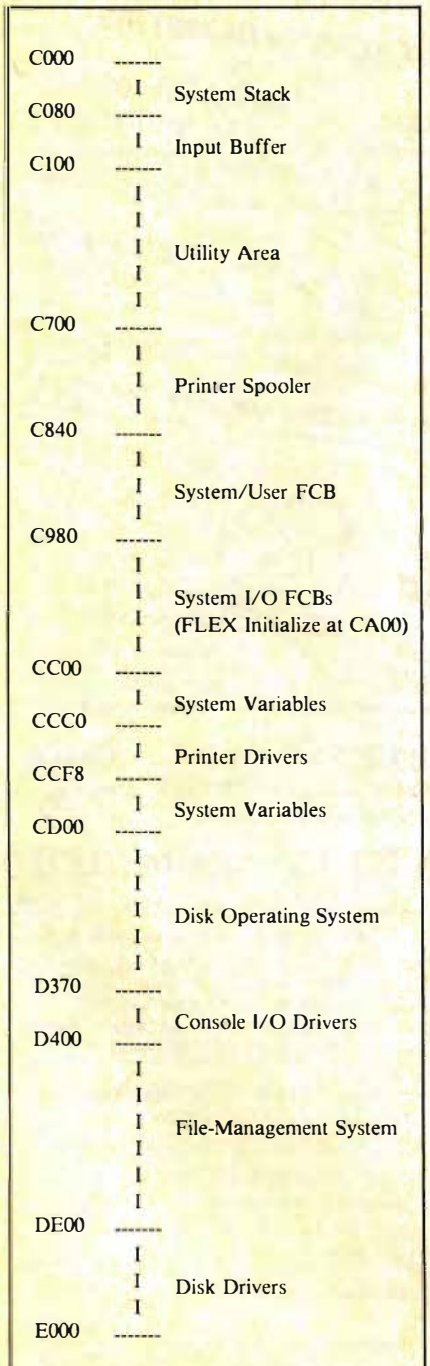


Fig. 1. 6809 FLEX Memory Map

Disk-Driver Routines

The disk-driver routine, like the console I/O routine, has its own jump table, residing from $DE00 to $DE1D. The disk vector table provides the path out of FLEX for all the disk communication routines via the user disk-hardware controller. (The CoCo uses the Western Digital 1793 disk-controller chip, the preferred disk-controller chip for the FLEX 09.) The supplier of the CoCo FLEX must write these disk I/O routines.

The FLEX core relies heavily on the X, A, B registers to pass data in and out of the core. For example, to perform a read-sector command, FLEX would use the following registers to perform the task:

The X register is the starting address of the buffer area in which the data that is read in from the disk is stored.

The A register is the track number.

The B register is the sector number.

In this example, the FLEX core would issue a read command via the file-management system (FMS). The FMS takes care of the housekeeping chores when the FLEX core communicates with the disk I/O routine.

The FMS provides the correct data in the proper register. It then uses the jump address at $DE00 to continue on and reads sector 2 from track 5. For each source of the CoCo FLEX, these addresses at the disk I/O jump table will be different. I will be listing these addresses for each source of the CoCo FLEX in the coming month.

The following is a list of disk I/O jump addresses and what each one does:

● $DE00—READ reads 255 bytes from a specified track and sector into memory by loading the proper track and sector information into the correct register.

X = Buffer address of where to store the data from the disk.

A = Track number (0–FF).

B = Sector to read (1–FF).

● $DE03—WRITE writes 255 bytes of data to a specified track and sector.

X = Buffer address, tells the program where to store the data that is read from the disk.

A = Track number (0–FF).

B = Sector number (0–FF).

● $DE06—VERIFY verifies the last sectors just written to the disk by checking the CRC sum. There are no specified registers assigned to this command, and it must be called immediately after a write to a single sector.

● $DE09—RESTORE returns the disk-drive head to track 00.

X = Drive number.

● $DE0C—DRIVE

● $DE0F—CHKRDY checks to see if a specified drive is ready and returns this status in the condition code register. This routine will delay a bit to wait for the drive to come up to speed and then set the proper status bit.

X = Drive number.

C = Status of the drive; ZERO bit = 1 if the drive is ready, and 0 if it is not ready.

The carry bit = 0 if the drive is ready, and 1 if not.

● $DE12—QUICK is the same as CHKRDY, but it doesn't wait for drive to come to speed.

● $DE15—INIT initializes the drives from a cold start.

● $DE18—WARM is called after a warm start and before each disk command.

● $DE1B—SEEK lets you go to a specified track and side.

A = Track number.

B = Sector number, used to determine the side.

Next month, I will continue discussing the disk I/O routine. I'll also give the jump addresses for each source of CoCo FLEX. I welcome reader response to Re: FLEX. ■

Write to David Wasler, Box 2919, Fullerton, CA 92633.

TOM MIX SOFTWARE

•FOR THE COLOR COMPUTER & TDP 100 • 3424 College N.E., Grand Rapids, MI 49505 (616) 364-4791•

NEW

"THE FROG"

(C) 1983

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

16K MACHINE LANGUAGE
$27.95 TAPE
$30.95 DISK

NEW

SPACE SHUTTLE

1983
32K Ext. Basic

$28.95 TAPE ONLY

This program gives you the real feeling of flight. Full instrumentation complete to the max. Actual simulation of space flight. **32K Ext. Basic**

THE KING

1982
32K Machine Language
$26.95 tape
$29.95 disk

ARCADE ACTION - How high can you climb? Four full graphic screens. Exciting Sound - Realistic graphics. Never before has the color computer seen a game like this. Early reviews say: Just like the arcade - Simply outstanding!

NEW

"TRAPFALL"

By KEN KALISH
(C) 1983

ARCADE ACTION
The "Pitfalls" in this game are many. Hidden treasures, jump over the pits, swing on the vine, watch out for alligators, beware of the scorpion. Another game for the Color Computer with the same high resolution graphics as "The King."

16K MACHINE LANGUAGE
TAPE $27.95
DISK $30.95

NEW

"YAAZEE"

(C) 1983

$19.95
16K MACHINE LANGUAGE
EXT. BASIC

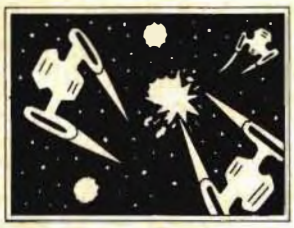
Yaazee is a 2 player game using five dice to get the best poker hand. After game is loaded flashing digit below player number determines which player rolls dice at the start of the game.

KATERPILLAR ATTACK

Outstanding graphics and sound will end all of those trips to the arcade. So much like the arcade you have to see it to believe it. Requires Ext. Basic.

16K MACHINE LANGUAGE **$21.95**
DISK **$24.95**

PROTECTORS



Exciting fast paced arcade game that looks and plays like the popular arcade game "DEFENDER",
Wave after wave of enemy fighters drop bombs on your city. Destroy them before they destroy your city. Soon the mother ships appear firing laser blasts at you. Watch for the heat seeking mines.

$24.95 TAPE $27.95 DISK 32K MACHINE CODE

OTHER GREAT GAMES

ALL PROGRAMS REQUIRE 16K

MOON LANDER•Fantastic Graphics. Land on the Moon if you can. 2 Programs. Ext. Basic **$17.95**

DANCING DEVIL•Watch him dance to music or program him yourself. Machine Language. **$14.95**

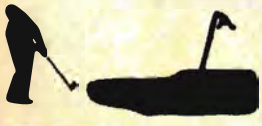
WAR KINGS•Battle to save your castle and king. High resolution graphics with outstanding sound make this one a real winner. 16K Machine Language **$17.95**

ADVENTURES

TREK-16-Travel thru space with Spock and Capt. Kirk. Adventure. Tough! Ext. Basic. **$17.95**

SHIPWRECK-Escape from a desert isle if you can. Great Adventure! Ext. Basic. **$14.95**

ESCAPE FROM SPECTRE (Graphic Adventure)-You are a secret agent for British Intelligence sent on a mission to obtain the secret nerve gas formula being developed by S.P.E.C.T.R.E. to destroy the world. **16K Ext. Basic** **$17.95**



COLOR GOLF

Now sit at your computer and play nine or eighteen holes. Outstanding graphics in the fairway or on the green. Helps your game.
32K EXTENDED BASIC **$17.95**

Call our BBS Number 616-364-8217 24 Hours a Day

VISA MasterCard

ADD $1.00 POSTAGE & HANDLING • TOP ROYALTIES PAID
MICHIGAN RESIDENTS ADD 4% SALES TAX • LOOKING FOR NEW SOFTWARE

✓177

✓ See List of Advertisers on page 138

PRODUCT NEWS

Edited by Mark E. Reynolds

The information used in the New Products section is supplied through manufacturers' press releases. *HOT CoCo* has not tested or reviewed these products and cannot guarantee any manufacturer's claim.

Multi-Purpose Graph Program

Kwikgraf is a new Color Computer program for producing bargraphs (histograms).

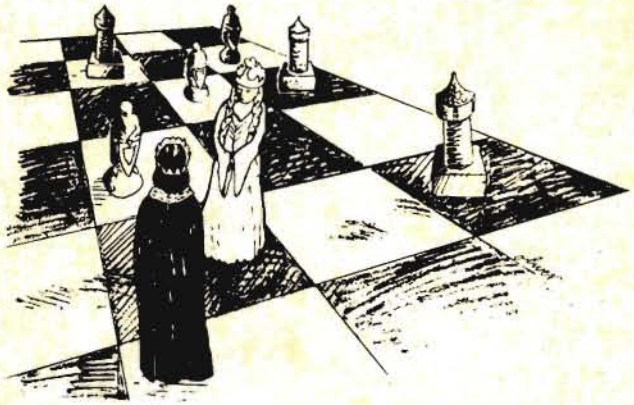
This program integrates the Color Computer and the Epson MX-80 printer to produce camera-ready bargraphs in approximately three minutes.

Kwikgraf is modular. It gives screened instructions and permits rapid keyboard changes of data and design. The listing can also be altered for even more extensive changes.

This program will work with other printers besides the Epson MX-80, but you will have to modify the program listing. You do not need a screen-print program, though.

Kwikgraf requires 4K and Extended Color Basic. It costs $12.50, postpaid, and is available from West Bay, Route 1, Box 666, White Stone, VA 22578. Send a self-addressed, stamped envelope for sample graph copies.

Reader Service ✓557



En Passant!

It may not be quite the same as sitting across the board from Boris Spassky, but Chess-D is a challenging new chess-play program for the CoCo and other 6809 microprocessors.

Chess-D inspects 10,000 moves per second and, at tournament-level play (1.5 minutes per move), can look ahead at least five ply. You can set or change the look-ahead level from novice to expert at any point during play.

Chess-D recognizes or plays all moves, including en passant and promotion of any piece.

The CoCo version of Chess-D uses high-resolution graphics and requires 32K and Extended Color Basic. It is available on cassette for $39.95 and on disk for $49.95 (price includes documentation) from Computer Systems Distributors, P.O. Box 9769, Anaheim, CA 92802, 714-772-1390.

Reader Service ✓554

The Gift Of Speech

The Voice uses a special large-scale integrated circuit to produce any one of 64 English phonemes at four different inflections. Because the phoneme is a basic unit of speech, The Voice can reproduce any word in English, as well as many in other languages.

You can connect The Voice to your TV speaker, or you can connect the built-in audio amplifier to an external speaker.

The Voice comes assembled, tested, and burned in with all the necessary hardware and software. You also get a complete manual with many examples to get you started developing your own Basic or machine-language programs that use speech.

This product is completely memory decoded, so it does not conflict with the Radio Shack disk controller. Disk owners with an expansion interface can produce speech from disk with The Voice in one slot and the disk in another.

The Voice costs $179.95 and is available from Speech Systems, 38 W. 255 Deerpath Road, Batavia, IL 60510, 312-879-6880.

Reader Service ✓561

The Voice

Stereo Music On Your CoCo

The Stereo Composer music synthesizer is a hardware/software package for the music lover.

The software provided allows you to program four separate voices, with a seven-octave range. The composer supports dotted and double-dotted notes, as well as eighth, quarter, and standard triplet notes. You can play the music at any tempo and in any key. In fact, you can change the tempo and key as the music plays.

The hardware features two 8-bit digital-to-analog converters that drive two audio power amplifiers. These amplifiers supply enough audio power to drive your own external speakers.

If you like, you can connect the output to your home stereo system to further increase fidelity. Two phono connectors provide the connection.

Two built-in volume controls allow you to adjust the volume of each channel separately. The use of higher-quality digital-to-analog converters increases music fidelity.

The Stereo Composer comes assembled, tested, and burned in, with all the software and hardware you need. It is completely memory decoded, so it does not conflict with the Radio Shack disk controller. Therefore, disk owners with an expansion interface can produce music from disk with the composer in one slot and the disk controller in another.

The Stereo Composer sells for $119.95 and is available from Speech Systems, 38 W. 255 Deerpath Road, Batavia, IL 60510, 312-879-6880.

Reader Service ✓560

Stereo Composer

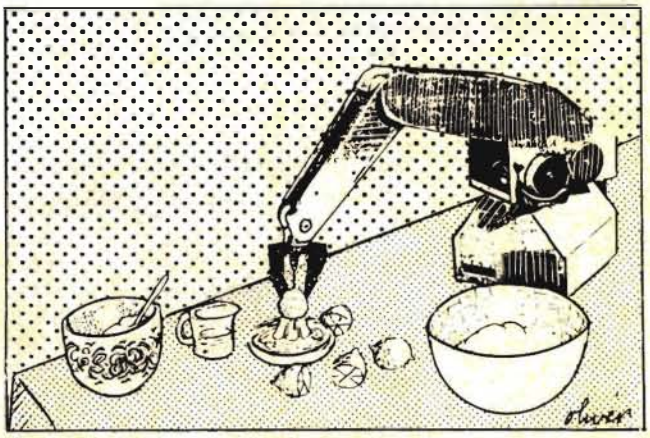
Book/Software Package

TRS-80 Color Programs, from dilithium Press, is a book and software package specifically for the TRS-80 Color Computer.

TRS-80 Color Programs contains a total of 37 fully-documented programs for every level and ability. About 50 percent of these are games, about 25 percent are educational, and about 25 percent are for practical use. All the programs are written in Basic and run only on the CoCo.

This 323-page book and cassette software package sells for $29.95. For more information, contact dilithium Press, 11000 S.W. 11th St., Suite E, Beaverton, OR 97005, 503-646-2713.

Reader Service ✓565



"Armdroid, Klaatu Verada Nikto"

If you can't tear yourself away from your computer long enough to do those little chores around the house, Armdroid I may be your answer. It's a computer-programmable robotic arm with five axes of rotation (base, shoulder, elbow, wrist up and down, and wrist rotate) and a three-fingered gripper.

It's a continuous path, stepper-motor-driven machine that can move several joints at once and perform a programmed move sequence. The arm has a 17-inch reach, 10-ounce lifting power, a gripping force of 5 pounds, and a resolution of .15 inches.

Armdroid will operate with any microcomputer but requires a latched 8-bit parallel port to interface. Micro switches to aid position sensing are optional.

You can special order a hand-held control box that uses separate center-off switches to operate each of the six motors. A separate interface board that is interchangeable with the computer board is used for manual control.

The Armdroid I is available in kit form for $745 or in assembled form for $895. For further information, contact Colne Robotics Inc., P.O. Box 23416, Fort Lauderdale, FL 33307-3416, 305-566-3101.

Reader Service ✓568

64K Screen Expander

The 64K Screen Expander from Computerware allows the 64K Color Computer to have a 51-by-24 upper- and lowercase display for everything. This includes Basic and all Assembly-language programs that use text displays.

The product includes a character editor that transfers all your ROMs to RAM and then modifies them to use its new high-resolution display.

The Screen Expander also expands the PRINT command. This command now works with true coordinate positions (absolute cursor positioning). You simply give PRINT@ the Y and X coordinates of the position you want to print.

The 64K Screen Expander requires 64K and Extended Color Basic.

PRODUCT NEWS

Manufacturer's tests indicate that it does not affect any software and stays even after resetting.

It costs $24.95 on cassette and $29.95 on disk (plus $2 shipping and handling). It's available from Computerware dealers or directly from Computerware at Box 668, 4403 Manchester Ave., Suite 103, Encinitas, CA 92024, 619-436-3512.

Reader Service ↙566

Programmer's Sourcebook

Ocean Inc. has released their *TRS-80 Programmer's Sourcebook* that lists application and system software. It also includes a listing of reference publications, plus a short list of clubs that welcome TRS-80 users.

The *Sourcebook* is divided into sections according to the respective computer models, which helps the user find software that will work on his particular model.

The first edition was released in January 1983, and contains 80 pages. The publication will be issued in January and July of each year.

The cost of the *TRS-80 Programmer's Sourcebook* is $4.95 (plus $1 shipping and handling). For more details, contact Ocean Inc., P.O. Box 2331, Springfield, VA 22152-0331, 703-323-1928.

Reader Service ↙567

Help for Home Money Managers

Household Budget Worksheet is a new approach to home money management for Color Computer owners. It is written in Extended Color Basic and operates without files to provide an updated monthly financial worksheet.

The program uses the date to downstep contractual loans to new balances and months remaining. Screen-oriented prompts signal the user to update variable expenses, budget categories, and exceptional (one-time) expenses or income. Direct variable assignments imbedded within the program eliminate files.

Household Budget Worksheet sells for $6.95 plus 75¢ shipping and handling. It is available from CoCoDATA Enterprises, 1215 Emeralda Drive, Orlando, FL 32808 (phone number unavailable).

Reader Service ↙563

Basic Math and Language Lessons

Micro School Programs—Bertamax Inc. has developed a series of educational programs to teach math and language skills on the TRS-80 and TDP-100 CoCos. These programs are designed for home or classroom use. They employ high-resolution graphics, color, and sound and require 32K and Extended Color Basic.

The Essential Math series offers material for first and second graders and for junior-high students. Each level consists of a number of programs that are in turn broken down into several different lessons and games. This series includes a teacher's manual with each program.

Math Games That Teach emphasizes concept and skill development for children from grades three to nine. It is a series of seven programs that reinforce skills in addition, subtraction, multiplication, division, and related basic facts.

Spelling in Context is designed for grade levels one through eight. The lesson flashes a word on the screen and then asks the child to type that word in a blank

space in a given sentence. Incorrectly spelled words are reviewed at the end of the lesson.

Reading Games That Teach is a series of eight programs that take kindergarteners and first graders through the beginning steps of reading. The first lessons teach children to recognize various aspects of the letters of the alphabet, while later lessons allow them to mix choices to produce their own stories.

These programs are available on tape or disk. Prices for individual programs begin at $24.85 per tape and $29.50 per disk. For a free catalog and price list, contact Micro School Programs—Bertamax Inc., 101 Nickerson St., Suite 202, Seattle, WA 98109, 206-282-6249.

Reader Service ✓562

Number Relationships For Children

Number Relationships is designed for children from four to eight years of age. To play, the child should be able to count to 20. From this point, options in the program allow a choice of skill levels geared to eight-year olds.

The program teaches the child to identify numbers in ascending and descending sequence, to recognize number patterns, to count by 2's, 5's, 10's, and so on, and to add and subtract.

The game displays a series of numbers with one number omitted. The child guides a spacecraft to select the correct number from among a group of random numbers.

Numerous options permit the parent or teacher to select a level equal to the child's ability. One child can use the program, or two can compete with separate spacecraft to see who can get the correct answer first.

Number Relationships uses color, sound, and high-resolution graphics. It works on the TRS-80 CoCo or TDP-100 and requires 16K, Extended Color Basic, and joysticks. The program costs $14.95 and is available from Programs by Mr. Bob, P.O. Box 94, Montrose, CA 91020.

Reader Service ✓555

Expansion Chassis/DOS

The Colormate provides an external expansion chassis for the TRS-80 Color Computer and the TDP-100, allowing access to 64K of RAM, a programmable baud rate RS-232 serial port, and an 8-bit parallel port/Winchester disk interface. The Colormate plugs into the cartridge port and provides another cartridge port to allow the simple attachment of Radio Shack disk drives.

The Colormate comes with the Software Dynamics SDOS(R) 1.1 operating system, Basic compiler, assembler, and editor.

SDOS handles up to four Radio Shack floppy disks. It supports a serial printer using either the CoCo's serial port or the Colormate serial port for higher data rates. With SDOS, the keyboard can

✓ See List of Advertisers on page 138

type ahead and generate all the control characters. You can use a true CRT on the Colormate serial port.

The Basic compiler allows structured programs, long names, true subroutines/parameters, powerful terminal and disk I/O facilities for variable-size records, along with 10-digit BCD floating-point and high-speed execution. A keyed file-access facility is available as an option.

The assembler supports the complete 6809 instruction set and allows conditional assembly and INCLUDE files. The editor allows you to use SEARCH, CHANGE, DELETE, REMOVE and other commands to edit large blocks of text.

The system comes with complete documentation. Word-processing and accounting applications and a Winchester disk drive are available.

The Colormate is priced at $495 and is available from Computer Systems Distributors, P.O. Box 9769, Anaheim, CA 92802, 714-772-1390.

Reader Service ✓559

Monitor Those Kilowatt Hours

The ECM (Electricity Consumption Monitor) is a CoCo program that uses text and graphic presentations to produce a daily display of home electricity consumption.

ECM charts high, low, and average days, offers a 20-day trend percentage analysis, and predicts bills to help you plan effective energy management.

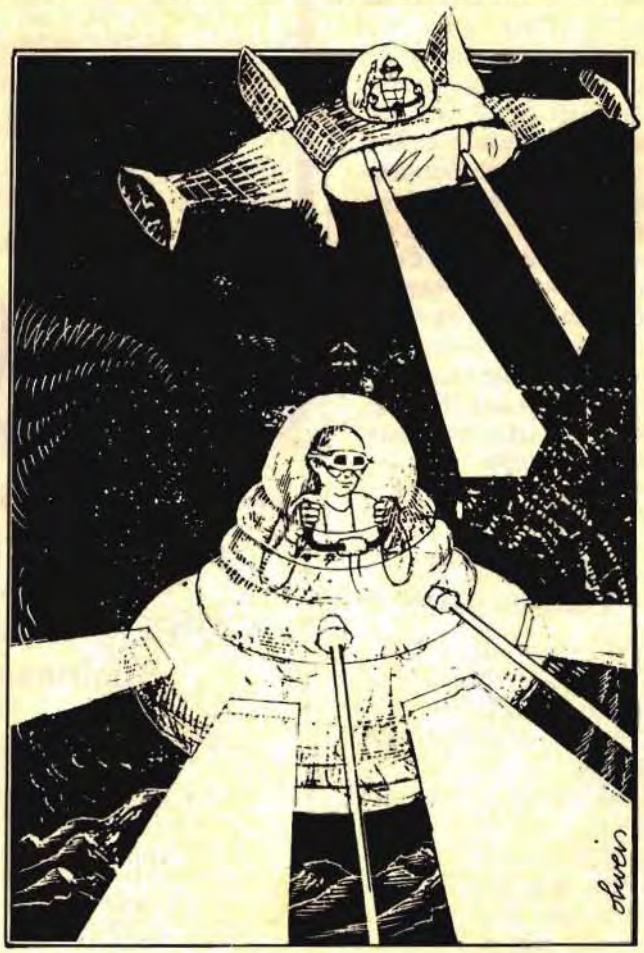
This program requires 16K and Extended Color Basic. It sells for $10.95 (plus 75¢ shipping and handling) from CoCoDATA Enterprises, 1215 Emeralda Drive, Orlando, FL 32808.

Reader Service ✓552

Take a Trip on the Real 3-D Line

DanGar Enterprises has recently released Star-Empire, the first of their Real 3-D line.

In this game, you must pilot your spacecraft through a mysterious, guarded vortex into another universe. Once in this universe, you must overcome various perils and attempt to find and destroy a powerful base ship.



Star-Empire gives a 3-D, pilot's-eye view and comes complete with 3-D glasses. It requires 16K, Extended Color Basic, and joysticks.

Star-Empire is available on cassette only for $24.95 from DanGar Enterprises, 16471 Rio Nido Road, Guerneville, CA 95446, 707-869-3420.

Reader Service ✓556

Use Four Cassette Recorders At Once!

Starflower Technology Inc. has developed TIXIM model CC, a cassette port expander that allows you to interface up to four cassette recorders to your CoCo.

The package contains several software utilities, a power transformer module and cord, a reference manual, a tape containing eight program files, one port connection cable, and four labels used to identify cables.

Although their tests show that TIXIM meets all FCC requirements, Starflower Technology states that because the FCC has not yet granted their product Class B Certification, it cannot be offered for sale. However, if you are interested, send them your name and address, and they will notify you when TIXIM is available.

TIXIM will sell for $139.95. For more information, contact Starflower Technology Inc., 1031 E. Duane Ave., Suite H, Sunnyvale, CA 94806.

Reader Service ✓569

A Data-Management System

Filmastr is a machine-language data-management system with features that include custom screens with up to 20 user-definable fields, fast form fill-in with no garbage-collection delays, full-screen editing, user-formatted printouts, and field totals. It can also copy fields from previous records, create subfiles, and append files.

Filmastr can sort fields and files quickly, and locate any record or group of records.

A screen window provides you with menu selections, procedure instructions, and reports. Documentation is included.

Filmastr requires Extended Color Basic and at least 16K. It is available on tape for $29.95 or on disk for $34.95 from The Computer House, Box 1051, Dubois, PA 15801, 814-371-4658.

Reader Service ✓558

A Line of Modems and a Speed-Select I/O Board

Universal Data Research Inc. has developed a new line of modems and an I/O board that connect any RS-232 serial interface terminal or computer with the phone line.

UDRI offers acoustic ($149), direct ($179), and auto-answer ($219) modems that operate at 300 baud

and provide half- and full-duplex operation in originate, answer, and auto-answer modes.

The 1,200-baud direct ($449) and auto-answer ($499) modems provide full-duplex operation with switch-selectable local echo.

The 212A auto-answer modem ($549) and the 212A auto-dial ($599) transmit at 300 or 1,200 baud. They do not require special wiring or interfacing.

UDRI also offers an I/O board ($199) that works with the 212A modems and automatically selects the appropriate baud rate.

For more information, contact Cynthia Dylis Wilson, Director of Marketing, Universal Data Research Inc., 2457 Wehrle Drive, Buffalo, NY 14221, 716-631-3011.

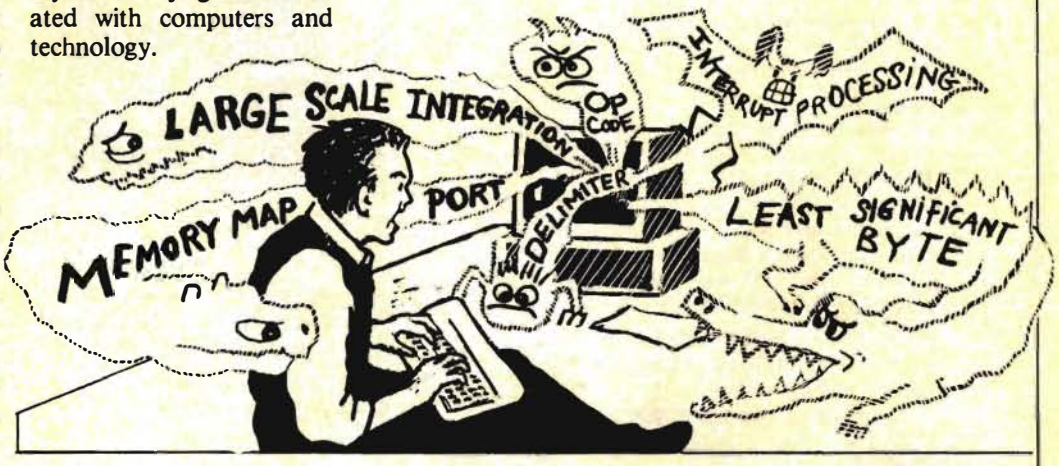
Reader Service ✓551

The Computer Glossary for Everyone

The idea of owning or operating a computer may be an intimidating thought to the novice. Perhaps even more intimidating is the mysterious jargon associated with computers and technology.

The Computer Glossary for Everyone, by Alan Freedman, demystifies the jargon and helps supply the confidence needed to take that first step into the computer world. Students, business people, and personal-computer users will find more than 1,000 definitions—many with illustrations—all presented in a simple, concrete manner.

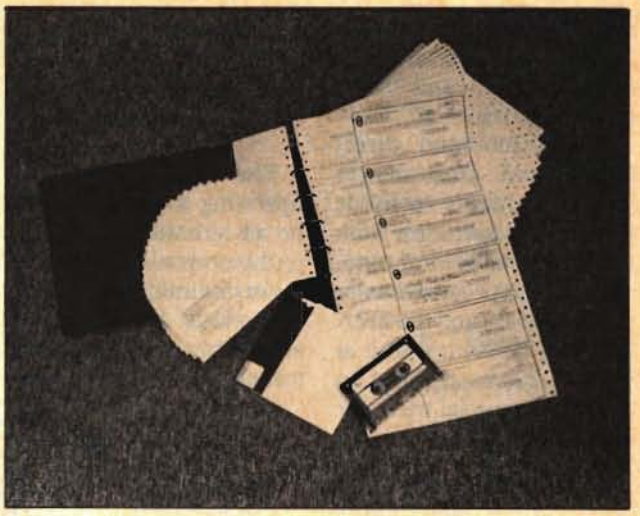
This reference book is geared to all computer users, from beginner to expert. It contains 302 pages in an 8½-by-11 paperback format and sells for $14.95. Look for it at your favorite



Are you intimidated by computer jargon?

✓ See List of Advertisers on page 138

PRODUCT NEWS



The fan-fold check package

Check Printing for the Small Business

Synergetic Solutions has put together a fan-fold check package for small businesses. These 9½-inch checks with end stubs come three to a page and can be used on any tractor-, pin-, or friction-feed printer capable of printing 10 characters per inch (80 columns per line).

The package includes a choice of 200 or 500 checks, a data-ring checkbook, dual-windowed envelopes, and Checkbook-Checkwriter II, a program that helps you use the system.

With a few keystrokes, the program prints single checks or batches of regularly or even irregularly scheduled checks. Checkbook-Checkwriter II also prints the check stub and creates the data files.

The 200-check package with program cassette sells for $59.95. The 500-check package is $79.95. Either computer bookstore, or write Prentice-Hall, Englewood Cliffs, NJ 07632, for more information.

Reader Service ✓550

Hurray! A Replacement Keyboard

Super-Pro is a full-travel, replacement keyboard kit for the TDP-100 and the TRS-80 Color Computers.

This replacement model maintains the same key layout and nomenclature as on the original keyboard, thereby assuring compatibility and operator convenience.

The Super-Pro, complete with instructions, sells for $69.95. An additional plug adapter, priced at $4.95, is necessary for upgrading computers manufactured after October 1982 (approximate).

Super-Pro is available from your favorite dealer or directly from Mark Data Products, 24001 Alicia Parkway, No. 226, Mission Viejo, CA 92691, 714-768-1551.

Reader Service ✓564

package with the program on disk costs an additional $2. For more information, contact Synergetic Solutions, 4715 Shepherd Road, Mulberry, FL 33860, 813-646-6557.

Reader Service ✓553

✓ See List of Advertisers on page 138

Index to Advertisers

Reader Service Number		Page Number
107	Aardvark	107
26	Access Unlimited	145
227	Accolade Computer Products	57
110	Amdek Corporation	5
499	Armadillo Int'l Software	136
493	Atomic City Electronics	81
248	Basic Technology	63
184	Baudy House Computer Products	132
562	Bertamax, Inc.	135
*	Bottom Line, The	65
140	Bumblebee Software	41
267	Challenge Software	33
158	Chattanooga Choo Choo Software	54
102	Chromasette Magazine	102
350	CoCo Warehouse	142
543	CoCoDATA Enterprises	93
563	CoCoDATA Enterprises	134
552	CoCoDATA Enterprises	136
121	Cognitec	117
568	Colne Robotics, Inc.	133
1	Color Computer News	67
512	Color Quest	50,51
74	Color Software Services	105
17	Colorware	74,75
455	Compukit	71
483	Computek	55
549	Computer Entrepreneur Pub. Co., The	43
255	Computer House, The	31
558	Computer House, The	136
116	Computer Island	141
420	Computer Peripheral Resources	112
18	Computer Plus	7
109	Computer Shack	45
134	Computer Shack	47
453	Computer Shack	49
507	Computer Systems Center	87
223	Computer Systems Consultants	9
393	Computer Systems Distributors	79
554	Computer Systems Distributors	130
559	Computer Systems Distributors	136
369	Computerware	CIII
566	Computerware	134
536	Cybertron	55
213	Data-Comp	77
304	Dataman, The	72
36	Derringer Software	71
565	dilithium Press	133
412	Double Density Software	136
216	EAP Company	29
154	Eigen Systems	137
*	80 Micro Subscriptions	91
159	Electronic Specialists	125
283	Endicott Software	118
262	Frank Hogg Labs	CIV
379	Gamester Software	9
54	Gimix	146
9	H & E Computronics	139

Reader Service Number		Page Number
359	Homebase Computer Systems	141
*	HOT CoCo Subscriptions	59
*	HOT CoCo Subscription Problems	142
*	Instant Software	137
*	Instant Software	72
249	Intellectronics	17
198	Intracolor Communications	13
198	Intracolor Communications	106
101	J & M Systems	99
42	JPC Products	119, 133
68	Kelco Int'l Corporation	121
172	Liberty Hill Software	39
92	Maple Leaf Systems	58
241	Mark Data Products	37,84
564	Mark Data Products	136
132	Micro80	29
96	Micro Management Systems	116
316	Micro Solutions	18
125	Micro Works	25
203	Micronix Systems Corp.	97
*	Nanos Card Systems	81
128	Nelson Software	34,35
567	Ocean, Inc.	134
124	Perry Computers	72
262	Phillipps Systems	93
310	Phone Line, The	81
486	Powerbyte Software	133
94	Practical Programs	93
339	Prentice Hall	9
550	Prentice Hall	136
555	Programs by Mr. Bob	135
80	Program Store, The	23
245	Programmer's Institute	27
296	Rainbow, The	58
*	Real Software	73
64	Renaissance Game Design	20
510	Scott Tasso Associates	142
83	Screen Play	CII, 3
87	Soft Sector Marketing	113
327	Software Support	143
119	Spectral Associates	101, 103
525	Spectrum Projects	115
561	Speech Systems	130
569	Starflower Technology, Inc.	136
432	Starkits	69
434	Strictly Color Software	54
144	Sugar Software	137
456	Sunlock Systems	71
230	Synergetic Solutions	29
553	Synergetic Solutions	136
389	TCE Programs, Inc.	95
177	Tom Mix Software	129
551	Universal Data Research, Inc.	137
46	Virginia Company, The	53
29	Washington Computer Service	135
*	Wayne Green Books	11
557	West Bay	130
156	York 10 Computerware	127

***This advertiser prefers to be contacted directly.**

For further information from our advertisers, please use the Reader Service card.

You've invested a lot of time and money into your computer . . . . .
It's time that investment paid off!

THE COLOR ACCOUNTANT

Introducing The Color Accountant (from The Programmer's Institute), the only complete personal financial package specifically designed for the TRS-80 Color Computer. This unique package includes:

1. **Complete Checkbook Maintenance**
2. **Chart of Accounts Maintenance**
3. **Income/Expense Accounts**
4. **Net Worth Statement**
5. **Payments/Appointments Calendar**
6. **Color Graph Design Package (graphs any files)**
7. **Check Search**
8. **Home Budget Analysis**
9. **Decision Maker**
10. **Mailing List**

After the initial setup, **THE COLOR ACCOUNTANT** requires less than an hour of data input each month.

The checkbook maintenance program is the key to the entire package. Once your checkbook is balanced, the checkbook summary file will automatically update the home budget analysis, net worth, and income/expense statements. You can then graph any file, record bills and appointments, make decisions, print a mailing list, analyze various accounts or stocks, and even calculate taxes.

All programs are menu-driven and allow add/change/delete. Each file and statement can be listed to screen or printer, and saved to cassette or diskette. **THE COLOR ACCOUNTANT** also comes with 40 pages of documentation that leads you step-by-step through the entire package. The TRS-80 COLOR Ext. Basic requires 16K for this package.

$74.95 Cassette **$79.95** Diskette

Send $2 For Our New 64-Page Catalog (#11) Which Contains More Than 500 Software Products.
(Catalog is provided FREE with any order)

To Order:
Write or call Toll-Free (800) 431-2818
(N.Y.S. residents call 914-425-1535)

THE COMPUTRONICS INC.
50 NORTH PASCACK ROAD ✓9
SPRING VALLEY, N.Y. 10977

* add $3 for shipping in UPS areas
* add $4 for C.O.D. or non-UPS areas
* add $5 to CANADA or MEXICO
* add proper postage elsewhere


30-DAY MONEY BACK GUARANTEE

*** ALL PRICES AND SPECIFICATIONS SUBJECT TO CHANGE ***
DELIVERY SUBJECT TO AVAILABILITY

BUSINESS PAC 100

Now Available for the TRS-80 Color Computer!

Includes Inventory Control, Payroll, Accounts Receivable, Accounts Payable, Checkbook Maintenance, and more. Comes with 128-page user's manual.

Interest apportionment by Rule of 78's • Annuity computation program • Time between dates • Day of year a particular date falls on • Interest rate on lease • Breakeven analysis • Straightline depreciation • Sum of the digits depreciation • Declining balance depreciation • Double declining balance depreciation • Cash flow vs. depreciation tables • Print checks with daily register • Checkbook maintenance program • Mortgage amortization table • Compute time needed for money to double, triple, etc. • Determine salvage value of an investment • Rate of return on investment with variable inflows • Rate of return on investment with constant inflows • Effective interest on a loan • Future value of an investment (compound interest) • Present value of a future amount • Amount of payment on a loan • Equal withdrawals from investment to leave zero over • Simple discount analysis • Equivalent & nonequivalent dated values for obligations • Present value of deferred annuities • Percent markup analysis for items • Sinking fund amortization program • Value of a bond • Depletion analysis • Black-Scholes options analysis • Expected return on stock via discounts dividends • Value of a warrant • Estimate of future earnings per share for company • Compute alpha and beta variables for stock • Portfolio selection model • Option writing computations • Value of a right • Expected value analysis • Bayesian decisions • Value of perfect information • Value of additional information • Derive utility function • Linear programming solution by simplex method • Transportation method for linear programming • Economic order quantity inventory model • Single server queueing model • Cost-volume-profit analysis • Conditional profit tables • Opportunity loss tables • Fixed quantity economic order quantity model • Cost-benefit waiting line analysis • Net cash-flow analysis for simple investment • Profitability index of a project • Weighted average cost of capital • True rate on loan with compensating balance required • True rate on discounted loan • Merger analysis computations • Financial ratios for a firm • Net present value of project • Laspeyres price index • Paasche price index • Construct seasonal quantity indices for company • Time series analysis linear trend • Time series analysis moving average trend • Future price estimation with inflation • Mailing list system • Letter writing system (links with mailing list system) • Sort lists of names • Shipping label maker • Name label maker • DOME business bookkeeping system • Compute week's total hours from timeclock info. • In-memory accounts payable system • Generates invoices on screen and print on printer • In-memory inventory control system • Computerized telephone directory • Time use analysis • Use of assignment algorithm for optimal job assignment • In-memory accounts receivable system • Compare 3 methods of repayment of loans • Compute gross pay required for given net • Compute selling price for given after-tax amount • Arbitrage computations • Sinking fund depreciation • Computerized UPS zone table • Type envelope with return address • Automobile expense analysis • Insurance policy file • In-memory payroll system • Dilution analysis • Loan amount a borrower can afford • Purchase price for rental property • Sale-leaseback analysis • Investor's rate of return on convertable bond

100 Ready-To-Run Business Programs

only $99.95

(Available on diskette only)
Also available for TRS-80 Models I, II and III, Apple, Atari, Osborne, Kaypro, all Commodore Computers and most CP/M systems.

✓ See List of Advertisers on page 138

SPIROMANIA

IF ONLY PICASSO HAD A COCO

by Jake Commander

This is the start of a series of articles I'll be doing for *HOT CoCo* about one of my favorite topics—spirals. To be more precise, it is about spirals used to create artistic designs with the Color Computer.

The idea for all this started back in May 1982, when *80 Micro* published "Spiromania." In that article I stated that I hoped to pursue the cause of simple generation of spiral patterns. What I'll be doing in this column is pursuing these spirals wherever they happen to twist my ideas.

Maybe I should take time to defend the cause of computer-generated art as it applies here. Spirals are naturally occurring shapes that hold a fascination all their own. From objects as huge as a spiral nebula to the tiny spiral motion of a euglena in pond water, spirals were already in motion long before we were so much as a twinkle in Mother Nature's eye. It is so easy to close your eyes and visualize a spiral curve—perhaps the shape itself is buried deep within our consciousness.

Whew! I'll call a halt before I get too heavy, but I hope you see the point—because spirals are a natural shape, you shouldn't feel guilty about enjoying their simple beauty.

As regards their artistic value, that is up to you. With beauty being in the eye of the beholder and all that, you can use Spiromania to create all kinds of designs. By the time I have completed this series, however, you should have enough examples to try out your own ideas.

The first program is more or less a repeat of the machine-code driver routine that *80 Micro* published last year (June/July 1982, p. 106). This version, however, does have a couple of enhancements to allow for more experimentation.

Also, this time the code is in EDTASM+ format, which should have a wider appeal. One problem in my previous article was that Radio Shack had not yet released an editor/assembler for the Color Computer, so I used SDS80C, the development package from Micro Works in California.

Unfortunately, this was a little too expensive for many people, and I ended up publishing source code for too small an audience. Not only that, but I used some of the more esoteric features of SDS80C, which were not easily translated to other assemblers.

This version should give you no such problems. You can now spend two or three hours typing in the source code knowing it will work.

When you have the source code in the machine, assemble it and check that your printout matches the Program Listing. If all the addresses match up and your final assembly address is $7DA5, all should be well. Otherwise, it's back to the keyboard until you find your error.

Next time around, I'll discuss how to use this code from Basic and how you can mix various shapes to create some interesting designs. I'll also be getting into some of those weird things called color artifacts, which will enable you to produce color spirals even in black-and-buff mode. ■

Program Listing

```
                        00100
7C00                    00110           ORG     $7C00
                        00120
7C00 BD  B3ED           00130 STRT      JSR     $B3ED   ;USR ARG TO D
7C03 8E  02D0           00140           LDX     #360*2  ;# DEGS EVEN
7C06 C5  01             00150           BITB    #1      ;EVEN ARG?
7C08 27  03             00160           BEQ     STRT1   ;IF SO
7C0A 8E  0168           00170           LDX     #180*2  ;#DEGS ODD
7C0D AF  8C 4A          00180 STRT1     STX     <CIRC.PCR
7C10 9E  8A             00190           LDX     <$8A    ;CONSTANT ZERO
                        00200
7C12 4F                 00210 STEP      CLRA            ;IGNORE MSB
7C13 34  16             00220           PSHS    A,B,X   ;LOBES/ANGLE
7C15 BD  9FB5           00230           JSR     $9FB5   ;D*X TO Y,U
7C18 1F  30             00240           TFR     U,D     ;RESULT TO D
7C1A 17  00A7           00250           LBSR    SIN1    ;SIN(LOBES*ANGLE)
7C1D 86  00             00260           LDA     #0      ;# TIMES
7C1F 27  06             00270           BEQ     STEP2   ;IF NONE
7C21 5A                 00280 STEP1     DECB            ;OR WHATEVER
7C22 12                 00290           NOP
7C23 12                 00300           NOP
7C24 4A                 00310           DECA            ;DONE ALL?
```

Listing continued

Listing continued

```
7C25 26 FA      00320          BNE     STEP1     ;NO
7C27 34 04      00330 STEP2    PSHS    B         ;SAVE RADIUS
7C29 8D 34      00340          BSR     XY        ;GET COORDS
7C2B 32 61      00350          LEAS    1,S       ;RESTORE STACK
7C2D 21 08      00360          BRN     DOT       ;USE BRA FOR DOTS
7C2F AE 62      00370          LDX     2,S       ;ANGLE
7C31 26 0D      00380          BNE     DOT1      ;IF NOT 1ST
7C33 97 C4      00390          STA     <$C4      ;STEUP LINE START
7C35 D7 C6      00400          STB     <$C6      ;Y LINE START
7C37 97 BE      00410 DOT      STA     <$BE      ;X DOT COORD
7C39 D7 C0      00420          STB     <$C0      ;Y DOT COORD
7C3B BD 9374    00430          JSR     $9374     ;SET PIXEL
7C3E 20 13      00440          BRA     DOT2
7C40 34 06      00450 DOT1     PSHS    A,B       ;X,Y COORDS
7C42 96 C4      00460          LDA     <$C4      ;PREV LINE START
7C44 D6 C6      00470          LDB     <$C6      ;DITTO Y COORD
7C46 97 BE      00480          STA     <$BE      ;LINE START X
7C48 D7 C0      00490          STB     <$C0      ;LINE START Y
7C4A 35 06      00500          PULS    A,B
7C4C 97 C4      00510          STA     <$C4      ;LINE END X
7C4E D7 C6      00520          STB     <$C6      ;LINE END Y
7C50 BD 94A1    00530          JSR     $94A1     ;DRAW LINE
7C53 35 16      00540 DOT2     PULS A,B,X        ;LOBES/ANGLE
7C55 30 89 0101 00550          LEAX    >1,X      ;BUMP ANGLE
7C59 8C 02D0    00560          CMPX    #360*2    ;DONE CIRCLE?
                7C5A   00570 CIRC      EQU     *-2
7C5C 25 B4      00580          BCS     STEP      ;NOT YET
7C5E 39         00590          RTS
                00600
7C5F EC 65      00610 XY       LDD     5,S       ;CURRENT ANGLE
7C61 8D 5E      00620          BSR     SIN       ;SIN TO B
7C63 A6 62      00630          LDA     2,S       ;RADIUS
7C65 8D 1F      00640          BSR     SRAD      ;GYRATE X
7C67 8D 3C      00650          BSR     SCL       ;SCALE FOR VID
7C69 CB 20      00660          ADDB    #32       ;RSTR CENTER
7C6B C4 FF      00670          ANDB    #$FF
7C6D 34 04      00680          PSHS    B         ;SAVE X COORD
7C6F EC 66      00690          LDD     6,S       ;CRNT ANGLE
7C71 8D 4B      00700          BSR     COS       ;COS TO B
7C73 53         00710          COMB              ;INVRT FOR VID
7C74 A6 63      00720          LDA     3,S       ;RADIUS
7C76 8D 0E      00730          BSR     SRAD      ;GYRATE Y
7C78 8D 2B      00740          BSR     SCL       ;SCALE FOR VID
7C7A CB 00      00750          ADDB    #0        ;Y OFFSET
7C7C C4 FF      00760          ANDB    #$FF
7C7E C1 C0      00770          CMPB    #192      ;>MAX?
7C80 25 02      00780          BCS     XY1       ;NO
7C82 C0 C0      00790          SUBB    #192      ;WRAP AROUND
7C84 35 82      00800 XY1      PULS    A,PC      ;GET X & RTS
                00810
7C86 34 02      00820 SRAD     PSHS    A         ;RADIUS
7C88 4D         00830          TSTA              ;>127?
7C89 2B 01      00840          BMI     SR1       ;YES
7C8B 43         00850          COMA              ;MAKE > 127
7C8C 80 80      00860 SR1      SUBA    #128      ;GET 0-127
7C8E 34 04      00870          PSHS    B         ;CRNT SIN/COS
7C90 5D         00880          TSTB              ;>127?
7C91 2B 01      00890          BMI     SR2       ;YES
7C93 53         00900          COMB              ;MAKE > 127
7C94 C0 80      00910 SR2      SUBB    #128      ;GET 0-127
7C96 3D         00920          MUL               ;(7 BIT)
7C97 58         00930          LSLB              ;GRAB
7C98 49         00940          ROLA              ;EXTRA BIT
7C99 8B 80      00950          ADDA    #128
7C9B 1F 89      00960          TFR     A,B       ;RSLT TO B
7C9D 35 02      00970          PULS    A         ;CRNT SIN/COS
7C9F A8 E0      00980          EORA    ,S+       ;RADIUS SIGN
7CA1 2A 01      00990          BPL     SR3       ;SIGNS SAME
7CA3 53         01000          COMB              ;ELSE RVRSE RSLT
7CA4 39         01010 SR3      RTS
                01020
7CA5 86 FF      01030 SCL      LDA     #255      ;SCALE FACTOR
7CA7 8D DD      01040          BSR     SRAD      ;SCAL RADIUS
7CA9 5D         01050          TSTB              ;=0?
7CAA 26 01      01060          BNE     SC1       ;NO
7CAC 5A         01070          DECB              ;ELSE -1
7CAD 1F 98      01080 SC1      TFR     B,A
7CAF 84 03      01090          ANDA    #3        ;SAVE LO BITS
7CB1 34 02      01100          PSHS    A         ;TO STACK
7CB3 54         01110          LSRB              ;1/2
7CB4 54         01120          LSRB              ;1/4
7CB5 34 04      01130          PSHS    B
7CB7 EB E4      01140          ADDB    ,S        ;2/4
7CB9 EB E0      01150          ADDB    ,S+       ;3/4
7CBB EB E0      01160          ADDB    ,S+       ;+ LO BITS
7CBD 39         01170          RTS
```

Listing continued

✓ See List of Advertisers on page 138

SPIROMANIA

Listing continued

```
                        01180
                        01190 * ENTRY D=ANGLE*2 (DEGS <=65535)
                        01200 * EXIT B=SIN/COS. 1 - 255
                        01210
7CBE C3   00B4          01220 COS       ADDD    #90*2     ;COSINE E.P.
7CC1 C3   0000          01230 SIN       ADDD    #0        ;ANGULAR OFFSET
7CC4 34   10            01240 SIN1      PSHS    X
7CC6 83   02D0          01250 SIN2      SUBD    #360*2    ;GET ANGLE
7CC9 24   FB            01260           BCC     SIN2      ;BETWEEN
7CCB C3   02D0          01270           ADDD    #360*2    ;0 - 359.5
                        01280
                        01290 * GET ANGLE 0-179.5
                        01300 * SET CF IF >= 180
                        01310
7CCE 83   0168          01320           SUBD    #180*2    ;ANGLE > 180?
7CD1 34   01            01330           PSHS    CC        ;CF SET IF < 180
7CD3 24   03            01340           BCC     SIN3
7CD5 C3   0168          01350           ADDD    #180*2    ;READJUST
                        01360
                        01370 * GET MIRROR IMAGE
                        01380 * IF ANGLE >= 90
                        01390
7CD8 1083 00B4          01400 SIN3      CMPD    #90*2     ;ANGLE > 90?
7CDC 25   07            01410           BCS     SIN4      ;IF ANGLE < 90
7CDE 34   06            01420           PSHS    A,B       ;ANGLE TO STK
7CE0 CC   0168          01430           LDD     #180*2    ;180 DEGS
7CE3 A3   E1            01440           SUBD    ,S++      ;MINUS ANGLE
                        01450
                        01460 * GET SINE VALUE FROM TABLE
                        01470 * NEGATE IT IF ANGLE WAS >= 180
                        01480
7CE5 30   8C 09         01490 SIN4      LEAX    <SINTBL,PCR ;=> TABLE
7CE8 E6   8B            01500           LDB     D,X       ;GET SIN VALUE
7CEA 35   01            01510           PULS    CC
7CEC 25   01            01520           BCS     SIN5      ;ANGLE WAS >= 180
7CEE 53                 01530           COMB              ;NOT NEGB
7CEF 35   90            01540 SIN5      PULS    X,PC
                        01550
7CF1      80            01560 SINTBL    FCB     $80
7CF2      7E            01570           FCB     $7E
7CF3      7D            01580           FCB     $7D
7CF4      7C            01590           FCB     $7C
7CF5      7B            01600           FCB     $7B
7CF6      7A            01610           FCB     $7A
7CF7      79            01620           FCB     $79
7CF8      78            01630           FCB     $78
7CF9      77            01640           FCB     $77
7CFA      76            01650           FCB     $76
7CFB      74            01660           FCB     $74
7CFC      73            01670           FCB     $73
7CFD      72            01680           FCB     $72
7CFE      71            01690           FCB     $71
7CFF      70            01700           FCB     $70
7D00      6F            01710           FCB     $6F
7D01      6E            01720           FCB     $6E
7D02      6D            01730           FCB     $6D
7D03      6C            01740           FCB     $6C
7D04      6B            01750           FCB     $6B
7D05      69            01760           FCB     $69
7D06      68            01770           FCB     $68
7D07      67            01780           FCB     $67
7D08      66            01790           FCB     $66
7D09      65            01800           FCB     $65
7D0A      64            01810           FCB     $64
7D0B      63            01820           FCB     $63
7D0C      62            01830           FCB     $62
7D0D      61            01840           FCB     $61
7D0E      60            01850           FCB     $60
7D0F      5F            01860           FCB     $5F
7D10      5E            01870           FCB     $5E
7D11      5C            01880           FCB     $5C
7D12      5B            01890           FCB     $5B
7D13      5A            01900           FCB     $5A
7D14      59            01910           FCB     $59
7D15      58            01920           FCB     $58
7D16      57            01930           FCB     $57
7D17      56            01940           FCB     $56
7D18      55            01950           FCB     $55
7D19      54            01960           FCB     $54
7D1A      53            01970           FCB     $53
7D1B      52            01980           FCB     $52
7D1C      51            01990           FCB     $51
7D1D      50            02000           FCB     $50
7D1E      4F            02010           FCB     $4F
7D1F      4E            02020           FCB     $4E
7D20      4D            02030           FCB     $4D
7D21      4C            02040           FCB     $4C
```

Listing continued

✓ See List of Advertisers on page 138

Listing continued

```
7D22  4B  02050  FCB  $4B
7D23  4A  02060  FCB  $4A
7D24  49  02070  FCB  $49
7D25  48  02080  FCB  $48
7D26  47  02090  FCB  $47
7D27  46  02100  FCB  $46
7D28  45  02110  FCB  $45
7D29  44  02120  FCB  $44
7D2A  43  02130  FCB  $43
7D2B  42  02140  FCB  $42
7D2C  41  02150  FCB  $41
7D2D  40  02160  FCB  $40
7D2E  3F  02170  FCB  $3F
7D2F  3E  02180  FCB  $3E
7D30  3D  02190  FCB  $3D
7D31  3C  02200  FCB  $3C
7D32  3B  02210  FCB  $3B
7D33  3A  02220  FCB  $3A
7D34  39  02230  FCB  $39
7D35  38  02240  FCB  $38
7D36  38  02250  FCB  $38
7D37  37  02260  FCB  $37
7D38  36  02270  FCB  $36
7D39  35  02280  FCB  $35
7D3A  34  02290  FCB  $34
7D3B  33  02300  FCB  $33
7D3C  32  02310  FCB  $32
7D3D  31  02320  FCB  $31
7D3E  30  02330  FCB  $30
7D3F  30  02340  FCB  $30
7D40  2F  02350  FCB  $2F
7D41  2E  02360  FCB  $2E
7D42  2D  02370  FCB  $2D
7D43  2C  02380  FCB  $2C
7D44  2B  02390  FCB  $2B
7D45  2B  02400  FCB  $2B
7D46  2A  02410  FCB  $2A
7D47  29  02420  FCB  $29
7D48  28  02430  FCB  $28
7D49  27  02440  FCB  $27
7D4A  26  02450  FCB  $26
7D4B  26  02460  FCB  $26
7D4C  25  02470  FCB  $25
7D4D  24  02480  FCB  $24
7D4E  23  02490  FCB  $23
7D4F  23  02500  FCB  $23
7D50  22  02510  FCB  $22
7D51  21  02520  FCB  $21
7D52  20  02530  FCB  $20
7D53  20  02540  FCB  $20
7D54  1F  02550  FCB  $1F
7D55  1E  02560  FCB  $1E
7D56  1E  02570  FCB  $1E
7D57  1D  02580  FCB  $1D
7D58  1C  02590  FCB  $1C
7D59  1B  02600  FCB  $1B
7D5A  1B  02610  FCB  $1B
7D5B  1A  02620  FCB  $1A
7D5C  19  02630  FCB  $19
7D5D  19  02640  FCB  $19
7D5E  18  02650  FCB  $18
7D5F  17  02660  FCB  $17
7D60  17  02670  FCB  $17
7D61  16  02680  FCB  $16
7D62  16  02690  FCB  $16
7D63  15  02700  FCB  $15
7D64  14  02710  FCB  $14
7D65  14  02720  FCB  $14
7D66  13  02730  FCB  $13
7D67  13  02740  FCB  $13
7D68  12  02750  FCB  $12
7D69  12  02760  FCB  $12
7D6A  11  02770  FCB  $11
7D6B  10  02780  FCB  $10
7D6C  10  02790  FCB  $10
7D6D  0F  02800  FCB  $0F
7D6E  0F  02810  FCB  $0F
7D6F  0E  02820  FCB  $0E
7D70  0E  02830  FCB  $0E
7D71  0D  02840  FCB  $0D
7D72  0D  02850  FCB  $0D
7D73  0C  02860  FCB  $0C
7D74  0C  02870  FCB  $0C
7D75  0B  02880  FCB  $0B
7D76  0B  02890  FCB  $0B
7D77  0B  02900  FCB  $0B
7D78  0A  02910  FCB  $0A
7D79  0A  02920  FCB  $0A
7D7A  09  02930  FCB  $09
7D7B  09  02940  FCB  $09
7D7C  09  02950  FCB  $09
7D7D  08  02960  FCB  $08
7D7E  08  02970  FCB  $08
7D7F  07  02980  FCB  $07
7D80  07  02990  FCB  $07
7D81  07  03000  FCB  $07
7D82  06  03010  FCB  $06
7D83  06  03020  FCB  $06
7D84  06  03030  FCB  $06
7D85  05  03040  FCB  $05
7D86  05  03050  FCB  $05
7D87  05  03060  FCB  $05
7D88  05  03070  FCB  $05
7D89  04  03080  FCB  $04
7D8A  04  03090  FCB  $04
7D8B  04  03100  FCB  $04
7D8C  04  03110  FCB  $04
7D8D  03  03120  FCB  $03
7D8E  03  03130  FCB  $03
7D8F  03  03140  FCB  $03
7D90  03  03150  FCB  $03
7D91  02  03160  FCB  $02
7D92  02  03170  FCB  $02
7D93  02  03180  FCB  $02
7D94  02  03190  FCB  $02
7D95  02  03200  FCB  $02
7D96  02  03210  FCB  $02
7D97  01  03220  FCB  $01
7D98  01  03230  FCB  $01
7D99  01  03240  FCB  $01
7D9A  01  03250  FCB  $01
7D9B  01  03260  FCB  $01
7D9C  01  03270  FCB  $01
7D9D  01  03280  FCB  $01
7D9E  01  03290  FCB  $01
7D9F  01  03300  FCB  $01
7DA0  01  03310  FCB  $01
7DA1  01  03320  FCB  $01
7DA2  01  03330  FCB  $01
7DA3  01  03340  FCB  $01
7DA4  01  03350  FCB  $01
7DA5  01  03360  FCB  $01
      0000  03370  END
00000 TOTAL ERRORS

CIRC    7C5A
COS     7CBE
DOT     7C37
DOT1    7C40
DOT2    7C53
SC1     7CAD
SCL     7CA5
SIN     7CC1
SIN1    7CC4
SIN2    7CC6
SIN3    7CD8
SIN4    7CE5
SIN5    7CEF
SINTBL  7CF1
SR1     7C8C
SR2     7C94
SR3     7CA4
SRAD    7C86
STEP    7C12
STEP1   7C21
STEP2   7C27
STRT    7C00
STRT1   7C0D
XY      7C5F
XY1     7C84
```

System Requirements

16K RAM
EDTASM+

the ACCESS UNLIMITED MICRO SHOPPING CENTER

SPECIAL OF THE MONTH:

NEW "Star Gemini" Printer
Dot Matrix With Graphics, 100 CPS
Model 10 Serial — Reg. Retail $499.00 Sale **$409.00**
Model 15 Serial — Reg. Retail $799.00 Sale **$499.00**

"C-Itoh F10 Starwriter" Printer
Uses "Diablo" Printwheels & Ribbons, 40 CPS
Only **$1595.00**
Forms Tractor Sale **$199.95**

"Brother" HR1 Daisywheel Printer
Affordable/Letter Quality/17 CPS
Serial — New Low Price **$799.00**

SAVE on an "Arrick Quick Switch"
Changes a "TRS-80" printer port or a peripheral between computers instantly and easily. Available for "RS-232" and "Centronics." Plugs included.
Now from $99.95. Cables from $31.95.

"PAGEMATE" Typing Easels — $14.95

Anti-Static Mats — Colors: Russett, Blue & Gold, Natural Brown, & Golden Brown.
3' x 5' — Reg. $ 75.60 Sale: **$ 57.00**
4' x 6' — Reg. $120.90 Sale: **$ 91.00**
4' x 8' — Reg. $161.30 Sale: **$122.00**

"PERCOM DATA" Floppy Disk Drives
- **Completely Compatible**
- **Fully Tested**

Single sided/Single density Your Price **$279.00**

MEDIA FOR LESS

NEW! 5¼" SOFT SECTOR DISKETTES W/Hub Ring

BASF 5¼" Single Sided Double Density
Lifetime Limited Warranty. reg. $44.95 now **$24.90** bx of 10

SENTINAL complete with hub rings, lifetime limited warranty.
Single sided Single density **$18.70** bx of 10
Single sided Double density **$20.70** bx of 10
Double sided Double density **$27.80** bx of 10

VERBATIM Single Sided Double Density **$30.90** bx of 10
Single Sided Single Density **$26.90** bx of 10

BUY DISKETTES IN BULK . . . *And Save!*
Single sided Single density Only **$179.00** bx of 10

"Color Coder" — A complete diskette filing system by "Color Kits." Five different colored library cases — each case will store 10 diskettes.
Reg. Retail $39.95 Now Only **$19.95**/set

HOT OFF THE PRESSES:

INSIDE PERSONAL COMPUTER DISK STORAGE SYSTEMS
THE Necessary Basic Book,
NEW From "Percom"— Only **$5.95**

We have added approximately $400,000.00 worth of brand new business and game software.

Save $$ on our most popular items!

NEW STYLE Smoked Plastic File Box —
Holds 75 Diskettes Reg. Retail $49.95 Sale **$24.95**

"Perfect Data" Head Cleaning Kit Only $19.95

Drive Numbering Tabs, pkg. 0-3 (reg. $4.50) now **$ 3.95**
Flip-N-File 5¼" (reg. $39.95) now **$19.95**
Flip-N-File 8" (reg. $54.95) now **$23.95**

Beautiful/Functional Custom Computer Furniture From "Atlantic" & Toor"
CALL FOR PRICES

Reg. Trademarks • Limited Time Offer Limited Quantities • Prices subject to change without notice • Prices do not include state taxes

VISA **1 (800) 527-3475** master charge

Order by phone or by mail. We accept Visa, MasterCard, cashier's checks, certified checks, and money orders. With personal checks, allow additional time for bank clearance. Your bankcard will not be charged until your order is shipped. On orders over $1,000, we pay freight (surface only) and insurance, please add $3.00 shipping and handling under 50 lbs. Over 50 lbs., add $5.00 for orders under $1,000.00. Texas residents add 5% sales tax. Allow 2 to 4 weeks for delivery.

☐ Please send me a FREE catalog. I'm not ready to order at this time.

Name _____
Company Name _____
Address _____
City _____ State _____ Zip _____
Phone Number (_____) _____

Quantity	Item	Unit Price	Subtotal

Check one: State Sales Tax (Texas residents only)
☐ payment enclosed handling charge
☐ Visa ☐ MasterCard* Total

*If Master Card, numbers above name: ☐☐☐☐ Expiration Date: ☐☐ - ☐☐

Authorized signature, if charged

ACCESS UNLIMITED

DEPT. M1/401 N. Central Expwy. #600/Richardson, Texas 75080
Tel. 1-800/527-3475 214/340-5366
214/690-0207 — Sat. and Evenings Only ↙26

↙ See List of Advertisers on page 138

FLEX - OS-9 LEVEL ONE - UNIFLEX - OS-9 LEVEL TWO

ONLY GIMIX Systems can be configured to run any of these.

GIMIX systems utilize the most powerful 6809 operating systems: FLEX, UniFLEX, OS-9 LEVEL ONE and TWO -- the systems the PROs use. This means a wide selection of software to choose from as well the ability to develop sophisticated, multi-user/multi-tasking programs on your **GIMIX** System.

The GIMIX CLASSY CHASSIS™ consists of a heavy-weight aluminum mainframe cabinet which provides more than ample protection for the electronics and 1 or 2 optional 5¼" drives.

Backpanel connectors can be added for convenient connection of terminals, printers, drives and other peripherals.

A 3 position locking keyswitch enables users to disable the front panel reset button to prevent accidental or unauthorized tampering with the system.

The **GIMIX** system mother board provides fifteen 50 pin slots and eight 30 pin I/O slots -- the most room for expansion of any SS50 system available. The on board baud rate generator features 11 standard baud rates, 75 to 38.4K, for maximum versatility and compatibility with other systems. Extended address decoding allows the I/O block to be addressed anywhere in the 1 megabyte address space. All components feature Gold plated connectors for a lifetime of solid connections. All boards are fully buffered for maximum system expansion.

Each **GIMIX** Mainframe System is equipped with an industrial quality power supply featuring a **ferro-resonant constant voltage transformer** to insure against problems caused by adverse power input conditions such as A.C. line voltage fluctuations etc. The supply provides 8 volts at 30 amps and plus or minus 16 volts at 5 amps, more than enough capacity to power a fully loaded system and two internal drives.

The 2MHz GIMIX 6809 PLUS CPU board includes a time of day clock with battery back-up and 6840 programmable timer to provide the programmer with convenient, accurate time reference. Later addition of 9511 or 9512 arithmetic processors is provided for on the board. The unique **GIMIX** design enables software selection of either OS-9 or FLEX, both included in many complete **GIMIX** systems.

GIMIX STATIC RAM boards require no complicated refresh timing cycles or clocks for data retention. GIMIX memory boards are guaranteed for 2 MHz operation with no wait state or clock stretching required.

Our low power NMOS RAM requires less than 3/4 amp at 8V for a fully populated 64K board. For critical situations, our non-volatile 64K byte CMOS static RAM boards with built in battery back-up retain data even with system power removed. A fully charged battery will power this board for a minimum of 21 days. A write protect switch permits CMOS boards to be used for PROM/ROM emulation and software debugging.

The GIMIX DMA controller leaves the processor free to perform other tasks during disk transfers - an important feature for multi-user/multi-tasking systems where processor time allocation is critical. The DMA board will accomodate up to 4 drives 5¼" or 8" in any combination running single or double density single or double headed. Programmed I/O Disk Controllers are also available.

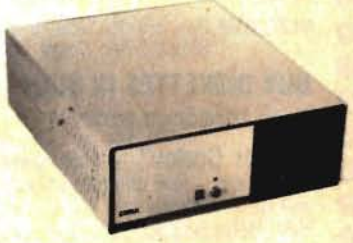
GIMIX systems are designed with ultimate **RELIABILITY** in mind. You can choose from the below featured systems or select from our wide variety of components to build a custom package to suit your needs.

GIMIX 2MHz 6809 System including: CLASSY CHASSIS, 6809 PLUS CPU BOARD, 56KB STATIC RAM, 2 SERIAL PORTS W/CABLES, GMXBUG MONITOR, FLEX, and OS-9 LEVEL 1 . . . . . **$3248.49**
FOR TWO 5¼" 40 TRACK DSDD DRIVES ADD . . . . . **$ 900.00**
GIMIX 128KB WINCHESTER SYSTEM including: CLASSY CHASSIS, 6809 PLUS CPU BOARD, 128KB STATIC RAM, 4 SERIAL PORTS W/CABLES, 5¼" 80 TRACK DSDD FLOPPY DISK DRIVE, 19MB 5¼" WINCHESTER HARD DISK, OS9 LEVEL 2, EDITOR AND ASSEMBLER **$8998.09**

50HZ Versions Available, 8" Drives Available — Contact GIMIX for Prices and Information.

The Sun Never Sets On A GIMIX!

GIMIX users are found on every continent, including Antarctica. A representative group of GIMIX users includes: **Government Research and Scientific Organizations** in Australia, Canada, U.K. and in the U.S.; NASA, Oak Ridge, White Plains, Fermilab, Argonne, Scripps, Sloan Kettering, Los Alamos National Labs, AURA. **Universities:** Carleton, Waterloo, Royal Military College, in Canada; Trier in Germany; and in the U.S.; Stanford, SUNY, Harvard, UCSD, Mississippi, Georgia Tech. **Industrial users** in Hong Kong, Malaysia, South Africa, Germany, Sweden, and in the U.S.; GTE, Becton Dickinson, American Hoechst, Monsanto, Allied, Honeywell, Perkin Elmer, Johnson Controls, Associated Press, Aydin, Newkirk Electric, Revere Sugar, HI-G/AMS Controls, Chevron. **Computer mainframe and peripheral manufacturers,** IBM, OKI, Computer Peripherals Inc., Qume, Floating Point Systems. **Software houses;** Microware, T.S.C., Lucidata, Norpak, Talbot, Stylo Systems, AAA, HHH, Frank Hogg Labs, Epstein Associates, Softwest, Dynasoft. Research Resources U.K.. Microworks. Meta Lab. Computerized Business Systems.



GIMIX Inc. reserves the right to change pricing and product speecifications at any time without further notice.

GIMIX® and GHOST® are registered trademarks of GIMIX Inc.
FLEX and UniFLEX are trademarks of Technical Systems Consultants Inc.
OS-9 is a trademark of Microware Inc.

1337 WEST 37th PLACE
CHICAGO, ILLINOIS 60609
(312) 927-5510
TWX 910-221-4055

✓54

GIMIX inc.

The Company that delivers

Quality Electronic products since 1975.

Computerware®
Proudly Presents...

from our long list of Color Computer software for home, work, business and programmers . . .

Your Lady Bug hussles thru an intricate maze of barriers & turnstiles, avoiding enemy bugs & skulls.
Cass $24.95 **Disk $29.95**

Turn your keyboard into a musical instrument with a digital synthesizer.
Cass $21.95 **Disk $26.95**

Centipedes & katerpillars are tame compared to the challenge & aggression in this great game!
Cass $21.95 **Disk $26.95**

You must dive thru shark infested waters to get the treasure. Timing & strategy are crucial . . .
Cass $21.95 **Disk $26.95**

New! Improved! The most realistic graphics arcade game ever!
Cass $24.95 **Disk $29.95**

Your Rail Runner must scurry over busy tracks dodging trains & handcars to rescue the hoboes!
Cass $21.95 **Disk $26.95**

Full feature modem software. Load & save from RAM Buffer, Macros, any duplex or parity, much more . . .
Cass $29.95 **Disk $39.95**

Complete editor & word processor with 51 x 24 upper & lower case display.
Disk $49.95

Modifies screen display to 51 x 24 for BASIC & your other software.
Cass $24.95 **Disk $29.95**

Add shipping of $2 surface or $5 air/Canada. Visa & MasterCard accepted. Dealer inquiries invited. Computerware® is a trademark of Computerware®

COMPUTERWARE™

369

P.O. Box 668, Encinitas, CA 92024 (619) 436-3512

Wake up your CoCo

Do you really care what this ad says, or are you just looking at the girl?

If you just bought your CoCo to play games, then read no further because I'm going to show you how to unleash the power that's in your CoCo. It's a little known fact that the CoCo is one of the fastest computers around. With the right software your CoCo can do everything that any other computer can do, and in most cases do it better and faster. The key is of course, the software. Without powerful software all you can do with your CoCo is play games. FHL is the largest supplier of software for the CoCo in the world! That's right, even more than Tandy. We have over 100 applications for the CoCo, and none of them are games. They are all high level software packages that have been used for years on bigger computers running the FLEX operating system. FLEX is the most popular operating system for 6809 computers (that is what the CoCo is) in the world.

Because of the power in the CoCo, it was possible for us to bring the FLEX operating system over to the CoCo, which we did a year and a half ago! Since then thousands of CoCo owners have run FLEX, and all the compatible software that we have, on their Color Computers.

These users range anywhere from hobbiests to businessmen, schools, universities, accountants, secretaries, and even NASA. The list of uses for FLEX is endless. FHL supports FLEX with more software than anyone else in the world and we have done so for almost THREE years!

Not only do we support our version of FLEX, but our version was the first one available for the CoCo. Our FLEX has more users than all the others combined, more capabilities, and last but not least, no one else supports FLEX like we do! We didn't get to be number one the easy way, it took hard work, quality products, and most of all, it took support.

Software is not the only way we enhance the CoCo. We have everything from complete systems to memory chips. We also have one of the best expansion systems for the CoCo available. It's called 'The SOLUTION,' and can be seen in the center of the picture, between the CoCo and the disk drive.

If you can't wait to get FLEX, then call or send $99 plus 3.50 S&H. We will also accept Visa, M/C, Diners' Club, or will ship COD. You will get FLEX, plus an Editor called TED, and an interactive assembler we call ISM. FLEX comes with a complete manual and supports any type of 5¼ disk system you may have. It requires a 64K CoCo and disk drive 0. Complete instructions are included for upgrading your CoCo to 64K. In addition, you will receive our complete 32 page catalog absolutely free!

The best way to find out what we can do for your CoCo is to send $3 for our catalog, the cost of which may be applied toward your first order. Not only does it list the hundreds of support products that we have but it also has several pages of reprinted articles which deal with increasing the memory size in the CoCo to 64K for free, and other useful info. As an extra bonus, and because we printed the entire catalog in the April issue of Color Computer News, we will include the magazine with every catalog we ship.

FHL FRANK HOGG LABORATORY

THE REGENCY TOWER • SUITE 215 • 770 JAMES ST. • SYRACUSE, NY 13203
PHONE (315)474-7856 • TELEX 646740